# Rules & Regulations

**B-001-1-1 (1) Authority to make "Radiocommunication Regulations" is derived from:**

**1. the Radiocommunication Act**

2. the General Radio Regulations

3. the Standards for the Operation of Radio Stations in the Amateur Radio Service

4. the ITU Radio Regulations

*> key word: AUTHORITY. Countries administer radio within their borders and territorial waters. The Canadian parliament enacted the 'Radiocommunication Act' (a law). This law grants authority to Industry-Canada to regulate radio communications. That department then issues 'Radiocommunication Regulations' where services such as the "maritime service", the "aeronautical service" and the "amateur radio service" are defined.*

**B-001-1-2 (2) Authority to make "Standards for the Operation of Radio Stations in the Amateur Radio Service" is derived from:**

1. the General Radio Regulations

**2. the Radiocommunication Act**

3. the Standards for the Operation of Radio Stations in the Amateur Radio Service

4. the ITU Radio Regulations

*> key word: AUTHORITY. Countries administer radio within their borders and territorial waters. The Canadian parliament enacted the 'Radiocommunication Act' (a law). This law grants authority to Industry-Canada to regulate radio communications. That department then issues 'Radiocommunication Regulations' where services such as the "maritime service", the "aeronautical service" and the "amateur radio service" are defined.*

**B-001-1-3 (2) The Department that is responsible for the administration of the Radiocommunication Act is:**

1. Transport Canada

**2. Industry Canada**

3. Communications Canada

4. National Defence

*> Transport-Canada [<1970] and Communications-Canada [1970-1993] HAVE looked after radio licences IN THE PAST. Countries administer radio within their borders and territorial waters. The Canadian parliament enacted the*

*'Radiocommunication Act' (a law). This law grants authority to Industry-Canada to regulate radio communications. That department then issues 'Radiocommunication Regulations' where services such as the "maritime service", the "aeronautical service" and the "amateur radio service" are defined.*

**B-001-1-4 (4) The "amateur radio service" is defined in:**

1. the Radiocommunication Act

2. the Standards for the Operation of Radio Stations in the Amateur Radio Service

3. the General Radio Regulations

**4. the Radiocommunication Regulations**

*> Countries administer radio within their borders and territorial waters. The Canadian parliament enacted the 'Radiocommunication Act' (a law). This law grants authority to Industry-Canada to regulate radio communications. That department then issues 'Radiocommunication Regulations' where services such as the "maritime service", the "aeronautical service" and the "amateur radio service" are defined.*

**B-001-2-1 (3) What must you do to notify your mailing address changes?**

1. Telephone your local club, and give them your new address

2. Contact an accredited examiner and provide details of your address change

**3. Contact Industry Canada and provide details of your address change**

4. Write amateur organizations advising them of your new address, enclosing your licence

*> Industry-Canada must be notified WITHIN 30 DAYS of a change of address. (RIC-2)*

**B-001-2-2 (4) An Amateur Radio Operator Certificate is valid for:**

1. five years

2. three years

3. one year

**4. for life**

*> Valid for life. No annual renewal. No yearly fees. Allows operating anywhere in Canada.*

**B-001-2-3 (3) Whenever a change of address is made:**

1. Industry Canada must be notified within 14 days of operation at the new address

2. the station shall not be operated until a change of address card is forwarded to Industry Canada

**3. Industry Canada must be advised of any change in postal address**

4. within the same province, there is no need to notify Industry Canada

*> Industry-Canada must be notified WITHIN 30 DAYS of a change of address. (RIC-2)*

**B-001-2-4 (3) The Amateur Radio Operator Certificate:**

1. must be put on file

2. must be kept in a safe place

**3. must be retained at the station**

4. must be kept on the person to whom it is issued

*> Station licenses used to be issued for a specific address. Keeping the Certificate at the address supplied to Industry-Canada is now the norm.*

**B-001-2-5 (1) The holder of a radio authorization shall, at the request of a duly appointed radio inspector, show the radio authorization, or a copy thereof, to the inspector, within ____ hours after the request:**

**1. 48 hours**

2. 12 hours

3. 24 hours

4. 72 hours

*> Holder of radio authorization has 48 HOURS to fulfill the request of a radio inspector. (Radio Regulations)*

**B-001-2-6 (1) The fee for an Amateur Radio Operator Certificate is:**

**1. free**

2. $32

3. $10

4. $24

*> The initial certificate is free. There are no yearly renewals.*

**B-001-2-7 (4) The Amateur Radio Operator Certificate should be:**

1. retained in a safety deposit box

2. retained on the radio amateur's person

3. retained in the radio amateur's vehicle

**4. retained at the address notified to Industry Canada**

*> Station licenses used to be issued for a specific address. Keeping the Certificate at the address supplied to Industry-Canada is now the norm.*

**B-001-3-1 (3) Out of amateur band transmissions:**

1. must be identified with your call sign

2. are permitted

**3. are prohibited - penalties could be assessed to the control operator**

4. are permitted for short tests only

*> Out of band transmissions contravene the regulations of the Amateur service.*

**B-001-3-2 (4) If an amateur pretends there is an emergency and transmits the word "MAYDAY," what is this called?**

1. A traditional greeting in May

2. An emergency test transmission

3. Nothing special: "MAYDAY" has no meaning in an emergency

**4. False or deceptive signals**

*> key word: PRETEND. This becomes a 'false or fraudulent' distress signal. It is an offence punishable under the Radiocommunication Act.*

**B-001-3-3 (1) A person found guilty of transmitting a false or fraudulent distress signal, or interfering with, or obstructing any radio communication, without lawful cause, may be liable, on summary conviction, to a penalty of:**

**1. a fine, not exceeding $25 000, or a prison term of one year, or both**

2. a fine of $10 000

3. a prison term of two years

4. a fine of $1 000

*> False distress signals and interference are punishable by a fine not exceeding $25000 and/or a prison term not exceeding one year. (Radiocommunication Act)*

**B-001-3-4 (3) Which of the following statements is NOT correct?**

1. No person shall decode an encrypted subscription programming signal without permission of the lawful distributor

2. No person shall, without lawful excuse, interfere with or obstruct any radiocommunication

**3. A person may decode an encrypted subscription programming signal, and retransmit it to the public**

4. No person shall send, transmit, or cause to be transmitted, any false or fraudulent distress signal

*> key word: NOT correct. 1, 2 and 4 are true. Decoding subscription programming (e.g., satellite TV) is unlawful. (Radiocommunication Act)*

**B-001-3-5 (3) Which of the following is NOT correct? The Minister may suspend a radio authorization:**

1. where the holder has contravened the Act, the Regulations, or the terms and conditions of the authorization

2. where the radio authorization was obtained through misrepresentation

**3. with no notice, or opportunity to make representation thereto**

4. where the holder has failed to comply with a request to pay fees or interest due

*> key word: NOT correct. 1, 2 and 4 are true. Except for failure to pay fees, license holders ARE given a chance to make representations. (Radiocommunication Act)*

**B-001-3-6 (2) Which of the following statements is NOT correct?**

1. Where entry is refused, and is necessary to perform his duties under the Act, a radio inspector may obtain a warrant

**2. A radio inspector may enter a dwelling without the consent of the occupant and without a warrant**

3. In executing a warrant, a radio inspector shall not use force, unless accompanied by a peace officer, and force is authorized

4. The person in charge of a place entered by a radio inspector shall give the inspector information that the inspector requests

*> key words: DWELLING, NOT correct. 1, 3 and 4 are true. A radio inspector may NOT enter a dwelling (house) without consent AND without a warrant. (Radiocommunication Act)*

**B-001-3-7 (4) The Minister may suspend or revoke a radio authorization WITHOUT NOTICE:**

1. where the radio authorization was obtained through misrepresentation

2. where the holder has contravened the Act or Regulations

3. where the holder has contravened the terms and conditions of the authorization

**4. where the holder has failed to comply with a request to pay fees or interest due**

*> key words: WITHOUT NOTICE. Failure to pay fees may lead to suspension WITHOUT a chance to make representations. (Radiocommunication Act)*

**B-001-4-1 (3) What age must you be to hold an Amateur Radio Operator Certificate with Basic Qualification?**

1. 70 years or younger

2. 18 years or older

**3. There are no age limits**

4. 14 years or older

*> No age or nationality restrictions. (RIC-3)*

**B-001-4-2 (1) Which examinations must be passed before an Amateur Radio Operator Certificate is issued?**

**1. Basic**

2. 12 w.p.m.

3. 5 w.p.m.

4. Advanced

*> The Basic Qualification is the only examination needed to obtain a Certificate ( and a call sign ). [ w.p.m. = words per minute, Morse speed ]*

**B-001-4-3 (2) The holder of an Amateur Digital Radio Operator's Certificate:**

1. has equivalency for the Basic qualification

**2. has equivalency for the Basic and Advanced qualifications**

3. has equivalency for the Basic and 12 w.p.m. qualifications

4. has equivalency for the Basic, Advanced and 12 w.p.m. qualifications

*> Pre-1990 "Digital" certificates were re-issued as Basic + Advanced. (Radio Regulations) [ w.p.m. = words per minute, Morse speed ]*

**B-001-4-4 (4) After an Amateur Radio Operator Certificate with Basic qualifications is issued, the holder may be examined for additional qualifications in the following order:**

1. 12 w.p.m. after passing the Advanced

2. 5 w.p.m. after passing the 12 w.p.m.

3. Advanced after the 5 w.p.m.

**4. any order**

*> After obtaining the Basic, the Morse or Advanced qualifications can be obtained in any sequence. [ w.p.m. = words per minute, Morse speed ]*

**B-001-4-5 (1) One Morse code qualification is available for the Amateur Radio Operator Certificate. It is:**

**1. 5 w.p.m.**

2. 7 w.p.m.

3. 15 w.p.m.

4. 12 w.p.m.

*> The 12 and 15 words per minute Morse tests have long been discontinued. [ 15 w.p.m. discontinued in the 1990 Restructuration, 12 w.p.m. discontinued in May 2001. ]*

**B-001-4-6 (4) The holder of an Amateur Radio Operator Certificate with the Basic Qualification is authorized to operate the following stations:**

1. a station authorized in the aeronautical service

2. a station authorized in the maritime service

3. any authorized station except stations authorized in the amateur, aeronautical or maritime services

**4. a station authorized in the amateur service**

*> Holder of radio authorization must limit his activities to services specified in the license. An Amateur Certificate is valid for Amateur bands only.*

**B-001-5-1 (1) Radio apparatus may be installed, placed in operation, repaired or maintained by the holder of an Amateur Radio Operator**

**Certificate with Advanced Qualification on behalf of another person:**

**1. if the other person is the holder of a radio authorization to operate in the amateur radio service**

2. pending the granting of a radio authorization, if the apparatus covers the amateur and commercial frequency bands

3. pending the granting of a radio authorization, if the apparatus covers the amateur frequency bands only
4. if the transmitter of a station, for which a radio authorization is to be applied for, is type approved and crystal controlled

*> key words: ON BEHALF OF ANOTHER PERSON. Installing and operating a radio station on behalf of someone else can only be done if the other person has an Amateur Certificate. Allusion to the 'Advanced' qualification is a misleading clue.*

**B-001-5-2 (1) The holder of an Amateur Radio Operator Certificate may build transmitting equipment for use in the amateur radio service provided that person has the:**

**1. Advanced qualification**

2. Morse code 12 w.p.m. qualification

3. Morse code 5 w.p.m. qualification

4. Basic qualification

*> key words: BUILD TRANSMITTING EQUIPMENT. Requires the 'Advanced' qualification. Morse has nothing to do with that. [ w.p.m. = words per minute, Morse speed ]*

**B-001-5-3 (4) Where a friend is not the holder of any type of radio operator certificate, you, as a holder of an Amateur Radio Operator Certificate with Basic Qualification, may, on behalf of your friend:**

1. install an amateur station, but not operate or permit the operation of the apparatus

2. install and operate the radio apparatus, using your own call sign

3. modify and repair the radio apparatus but not install it

**4. not install, place in operation, modify, repair, maintain, or permit the operation of the radio apparatus**

*> key words: FRIEND, NOT the holder of a certificate. Installing or operating a station on behalf of an unlicensed person is prohibited.*

**B-001-5-4 (1) A radio amateur with Basic and 5 w.p.m. Morse qualifications may install an amateur station for another person:**

**1. only if the other person is the holder of a valid Amateur Radio Operator Certificate**

2. only if the final power input does not exceed 100 watts

3. only if the station is for use on one of the VHF bands

4. only if the DC power input to the final stage does not exceed 200 watts

*> key words: FOR ANOTHER PERSON. Installing and operating a radio station on behalf of someone else can only be done if the other person has an Amateur Certificate. Allusions to qualification, power and bands are misleading clues.*

**B-001-22-1 (2) Which of these statements is NOT correct?**

1. The fee for taking an examination for an Amateur Radio Operator Certificate by an accredited volunteer examiner is to be negotiated

**2. The fee for taking an examination for an Amateur Radio Operator Certificate at an Industry Canada office is $5 per qualification**

3. An accredited volunteer examiner must hold an Amateur Radio Operator Certificate with Basic, Advanced, and 5 w.p.m. qualifications

4. The fee for taking an examination for an Amateur Radio Operator Certificate at an Industry Canada office is $20 per qualification

*> key words: NOT CORRECT. 1, 3 and 4 are true. "2" is wrong: the fee at an Industry-Canada office is $20 PER qualification.*

**B-001-22-2 (3) Which of the following statements is NOT correct?**

1. A disabled candidate, taking a Morse code sending test, may be allowed to recite the examination text in Morse code sounds

2. Examinations for disabled candidates may be given orally, or tailored to the candidate's ability to complete the examination

**3. A disabled candidate must pass a normal amateur radio certificate examination before being granted any qualification**

4. The fee for taking an amateur radio certificate examination from an accredited volunteer examiner is to be negotiated

*> key words: NOT CORRECT. 1, 2 and 4 are true. A disabled candidate must pass a test but some accommodation in the testing procedure is permitted. (RIC-3)*

**B-001-22-3 (1) The fee for taking examinations for amateur radio operator certificates by an accredited volunteer examiner is:**

**1. to be negotiated between examiner and candidate**

2. always $20 per qualification

3. always free of charge

4. always $20 per visit regardless of the number of examinations

*> Accredited examiners are free to negotiate the payment of a fee. (RIC-1)*

**B-001-22-4 (4) The fee for taking amateur radio certificate examinations at an Industry Canada office is:**

1. $20 per visit, regardless of the number of qualification examinations

2. no charge for qualification examinations

3. $5 per qualification examination

**4. $20 per qualification**

*> The Radiocommunication Regulations prescribe a fee of $20 for each examination conducted by Industry-Canada personnel. (RIC-1)*

**B-001-6-1 (1) An amateur station with a maximum input to the final stage of 2 watts:**

**1. must be licensed at all locations**

2. must be licensed in built-up areas only

3. must be licensed in isolated areas only

4. is exempt from licensing

*> Reference to power is misleading. ALL Amateur stations must be licensed.*

**B-001-6-2 (3) An amateur station may be used to communicate with:**

1. any stations which are identified for special contests

2. armed forces stations during special contests and training exercises

**3. similarly licensed stations**

4. any station transmitting in the amateur bands

*> This is a catch.  "any station transmitting in the amateur bands" seems reasonable until you think that this other station may be operating unlawfully without a license. "Similarly licensed stations" is a much better answer.  Amateurs are not allowed to knowingly conduct conversations with unlicensed stations.*

**B-001-6-3 (4) Which of the following statements is NOT correct?**

1. A radio amateur may not transmit superfluous signals

2. A radio amateur may not transmit profane or obscene language or messages

3. A radio amateur may not operate, or permit to be operated, a radio apparatus which he knows is not performing to the Radiocommunication Regulations

**4. A radio amateur may use his linear amplifier to amplify the output of a licence-exempt transmitter**

*> key words:  NOT CORRECT.  "1", "2" and "3" are true.  Using an amplifier on what is normally a license-exempt transmitter (e.g., a Citizens Band radio) is illegal.*

**B-001-6-4 (3) Which of the following statements is NOT correct?**

1. No person shall possess or operate any device, for the purpose of amplifying the output power of a licence-exempt radio apparatus

2. A person may operate or permit the operation of radio apparatus only where the apparatus is maintained to the Radiocommunication Regulations tolerances

**3. A person may operate radio apparatus on the amateur radio bands only to transmit superfluous signals**

4. A person may operate an amateur radio station when the person complies with the Standards for the Operation of Radio Stations in the Amateur Radio Service

*> key words:  NOT CORRECT.  "1", "2" and "4" are true.  Transmitting superfluous (unnecessary) signals is illegal.*

**B-001-6-5 (1) Which of the following statements is NOT correct? A person may operate radio apparatus, licensed in the amateur service:**

**1. on aeronautical, marine or land mobile frequencies**

2. only where the person complies with the Standards for the Operation of Radio Stations in the Amateur Radio Service

3. only where the apparatus is maintained within the performance standards set by Industry Canada regulations and policies

4. but not for the amplification of the output power of licence-exempt radio apparatus

*> key words:  NOT CORRECT.  "2", "3" and "4" are true.  Amateurs are only allowed on bands assigned to the Amateur Service.*

**B-001-7-1 (4) Which of the following CANNOT be discussed on an amateur club net?**

1. Recreation planning

2. Code practice planning

3. Emergency planning

**4. Business planning**

*> key word:  CANNOT.  Business-related communications are NOT allowed on amateur bands (except for relief operations in a disaster while regular services are overloaded or unavailable).*

**B-001-7-2 (1) When is a radio amateur allowed to broadcast information to the general public?**

**1. Never**

2. Only when the operator is being paid

3. Only when broadcasts last less than 1 hour

4. Only when broadcasts last longer than 15 minutes

*> key word:  BROADCAST.  Amateurs are not allowed to broadcast to the general public.*

**B-001-7-3 (1) When may false or deceptive amateur signals or communications be transmitted?**
**1. Never**

2. When operating a beacon transmitter in a "fox hunt" exercise

3. When playing a harmless "practical joke"

4. When you need to hide the meaning of a message for secrecy

*> key word:  DECEPTIVE.  False or fraudulent messages or distress signals are infractions to the Radiocommunications Act.*

**B-001-7-4 (1) Which of the following one-way communications may not be transmitted in the amateur service?**

**1. Broadcasts intended for the general public**

2. Radio control of model craft

3. Brief transmissions to make adjustments to the station

4. Morse code practice

*> key words: MAY NOT. Amateurs are not allowed to broadcast to the general public. Remote-Control, brief tests and code practice are allowed activities.*

**B-001-7-5 (1) When may you send indecent or profane words from your amateur station?**
**1. Never**

2. Only when they do not cause interference to other communications

3. Only when they are not retransmitted through a repeater

4. Any time, but there is an unwritten rule among amateurs that they should not be used on the air

*> Profane and obscene radiocommunications are specifically prohibited in the Radiocommunication Regulations.*

**B-001-7-6 (3) When may an amateur station in two-way communication transmit a message in a secret code in order to obscure the meaning of the communication?**

1. During a declared communications emergency

2. During contests

**3. Never**

4. When transmitting above 450 MHz

*> key words: SECRET, OBSCURE. Specifically prohibited in the Radiocommunication Regulations.*

**B-001-7-7 (4) What are the restrictions on the use of abbreviations or procedural signals in the amateur service?**

1. There are no restrictions

2. They are not permitted because they obscure the meaning of a message to government monitoring stations

3. Only "10 codes" are permitted

**4. They may be used if they do not obscure the meaning of a message**

*> key words: SECRET, OBSCURE. Specifically prohibited in the Radiocommunication Regulations.*

**B-001-7-8 (4) What should you do to keep your station from retransmitting music or signals from a non-amateur station?**

1. Turn up the volume of your transmitter

2. Speak closer to the microphone to increase your signal strength

3. Adjust your transceiver noise blanker

**4. Turn down the volume of background audio**

*> Retransmitting programming that originates from a broadcasting undertaking is specifically prohibited in the Radiocommunication Regulations.*

**B-001-7-9 (3) The transmission of a secret code by the operator of an amateur station:**

1. is permitted for contests

2. must be approved by Industry Canada

**3. is not permitted**

4. is permitted for third-party traffic

*> key words: SECRET, OBSCURE. Specifically prohibited in the Radiocommunication Regulations.*

**B-001-7-10 (2) A radio amateur may be engaged in communication which includes the transmission of:**

1. programming that originates from a broadcasting undertaking

**2. Q signals**

3. radiocommunication in support of industrial, business, or professional activities

4. commercially recorded material

*> key words: BROADCASTING, BUSINESS, COMMERCIALLY. Support of business/professional activities OR the retransmission of broadcasts are specifically prohibited in the Radiocommunication Regulations. "Q codes" are internationally recognized abbreviations used by Amateurs.*

**B-001-7-11 (4) An amateur station may transmit:**

1. profane or obscene words or language

2. music

3. secret codes or ciphers

**4. signals which are not superfluous**

*> key words:  NOT SUPERFLUOUS.  Profane and obscene, music or secret radiocommunications are all specifically prohibited in the Radiocommunication Regulations.*

**B-001-8-1 (1) Where may the holder of an Amateur Radio Operator Certificate operate an amateur radio station in Canada?**

**1. anywhere in Canada**

2. anywhere in Canada during times of emergency

3. only at the address shown on Industry Canada records

4. anywhere in your call sign prefix area

*> Yes, ANYWHERE in Canada but if you change your address permanently, you must notify Industry-Canada within 30 DAYS.*

**B-001-8-2 (1) Which type of station may transmit one-way communications?**

**1. Beacon station**

2. Repeater station

3. HF station

4. VHF station

*> Only three types of one-way communications are allowed:  1) Beacons (automated one-way stations used to assess propagation conditions), 2) remote control of model craft and 3) brief test transmissions.*

**B-001-8-3 (1) Amateur radio operators may install or operate radio apparatus:**

**1. at any location in Canada**

2. only at the address which is on record at Industry Canada

3. at the address which is on record at Industry Canada and at one other location

4. at the address which is on record at Industry Canada and in two mobiles

*> Yes, ANYWHERE in Canada but if you change your address permanently, you must notify Industry-Canada within 30 DAYS.*

**B-001-8-4 (2) In order to install any radio apparatus, to be used specifically for receiving and automatically retransmitting radiotelephone**

**communications within the same frequency band, a radio amateur must hold an Amateur Radio Operator Certificate, with a minimum of these qualifications:**

1. Basic and 12 w.p.m. Morse qualifications

**2. Basic and Advanced qualifications**

3. Basic Qualification

4. Basic and 5 w.p.m. Morse qualifications

*> key word:  RETRANSMITTING.  The Advanced Qualification grants 4 privileges:  1) install repeaters, 2) install club station, 3) build transmitters or amplifiers and 4) more output power.   Morse has nothing to do with such privileges.  [ w.p.m. = words per minute, Morse speed ]*

**B-001-8-5 (1) In order to install any radio apparatus, to be used specifically for an amateur radio club station, the radio amateur must hold an Amateur Radio Operator Certificate, with a minimum of the following qualifications:**

**1. Basic and Advanced**

2. Basic, Advanced and 5 w.p.m.

3. Basic

4. Basic, Advanced, and 12 w.p.m.

*> key words:  CLUB STATION.  The Advanced Qualification grants 4 privileges:  1) install repeaters, 2) install club station, 3) build transmitters or amplifiers and 4) more output power.   Morse has nothing to do with such privileges.  [ w.p.m. = words per minute, Morse speed ]*

**B-001-8-6 (4) In order to install or operate a transmitter or RF amplifier that is not commercially manufactured for use in the amateur service, a radio amateur must hold an Amateur Operator's Certificate, with a minimum of which qualifications?**

1. Basic, Advanced and 12 w.p.m.

2. Basic, and 12 w.p.m.

3. Basic, Advanced and 5 w.p.m.

**4. Basic and Advanced**

*> key words:  NOT COMMERCIALLY MANUFACTURED.  The Advanced Qualification grants 4 privileges:  1) install repeaters, 2) install club station, 3) build transmitters or amplifiers and 4) more output power.   Morse has nothing to do with such privileges.  [ w.p.m. = words per minute, Morse speed ]*

**B-001-9-1 (2) Who is responsible for the proper operation of an amateur station?**

1. Only the station owner who is the holder of an Amateur Radio Operator Certificate

**2. Both the control operator and the station licensee**

3. The person who owns the station equipment

4. Only the control operator

*> Both the licensee and the control operator ( a person other than the licensee who the owner may have left in charge of the station ) are responsible for proper operation of the station.*

**B-001-9-2 (2) If you transmit from another amateur's station, who is responsible for its proper operation?**

1. You, the control operator

**2. Both of you**

3. The station owner, unless the station records show that you were the control operator at the time

4. The station owner

*> Both the licensee and the control operator ( a person other than the licensee who the owner may have left in charge of the station ) are responsible for proper operation of the station.*

**B-001-9-3 (4) What is your responsibility as a station owner?**

1. You must allow another amateur to operate your station upon request

2. You must be present whenever the station is operated

3. You must notify Industry Canada if another amateur acts as the control operator

**4. You are responsible for the proper operation of the station in accordance with the regulations**

*> Both the licensee and the control operator ( a person other than the licensee who the owner may have left in charge of the station ) are responsible for proper operation of the station.*

**B-001-9-4 (2) Who may be the control operator of an amateur station?**

1. Any person over 21 years of age with a Basic Qualification

**2. Any qualified amateur chosen by the station owner**

3. Any person over 21 years of age with Basic and 12 w.p.m. qualifications

4. Any person over 21 years of age

*> The Control Operator must be a licensed Amateur.  [ w.p.m. = words per minute, Morse speed ]*

**B-001-9-5 (3) When must an amateur station have a control operator?**

1. A control operator is not needed

2. Whenever the station receiver is operated

**3. Whenever the station is transmitting**

4. Only when training another amateur

*> A licensed Amateur, the 'Control Operator', must be in charge of the station whenever it is on the air.*

**B-001-9-6 (4) When a station is transmitting, where must its control operator be?**

1. Anywhere in the same building as the transmitter

2. At the station's entrance, to control entry to the room

3. Anywhere within 50 km of the station location

**4. At the station's control point**

*> A licensed Amateur, the 'Control Operator', must be in charge of the station whenever it is on the air.*

**B-001-9-7 (4) Why can't family members without qualifications transmit using your amateur station if they are alone with your equipment?**

1. They must not use your equipment without your permission

2. They must first know how to use the right abbreviations and Q signals

3. They must first know the right frequencies and emissions for transmitting

**4. They must hold suitable amateur radio qualifications before they are allowed to be control operators**

*> A licensed Amateur, the 'Control Operator', must be in charge of the station whenever it is on the air.  Your license does not grant spouse, siblings or relatives privileges to be 'Control Operators' ( i.e., use the station in your absence ).*

**B-001-9-8 (3) The owner of an amateur station may:**

1. permit anyone to take part in communications only if prior written permission is received from Industry Canada

2. permit anyone to use the station without restrictions

**3. permit any person to operate the station under the supervision and in the presence of the holder of the amateur operator certificate**

4. permit anyone to use the station and take part in communications

*> A licensed Amateur, the 'Control Operator', must be in charge of the station whenever it is on the air.*

**B-001-9-9 (3) Which of the following statements is CORRECT?**

1. A person, holding only Basic Qualification, may operate another station on 14.2 MHz

2. A radio amateur may permit any person to operate the station without supervision

**3. Any person may operate an amateur station under supervision, and in the presence of, a person holding appropriate qualifications**

4. Any person may operate a station in the amateur radio service

*> "1": A Basic Qualification does not grant privileges below 30 MHz. "2" and "4": The 'Control Operator' must be a licensed Amateur*.

**B-001-10-1 (1) What is a transmission called that disturbs other communications?**

**1. Harmful interference**

2. Interrupted CW

3. Transponder signals

4. Unidentified transmissions

*> "Harmful Interference": "Adverse effect of electromagnetic energy...that endangers the use of a safety-related radiocommunication system... OR significantly degrades, or obstructs or repeatedly interrupts the use of radio apparatus or radio-sensitive equipment." (Radiocommunication Act)*

**B-001-10-2 (1) When may you deliberately interfere with another station's communications?**

**1. Never**

2. Only if the station is operating illegally

3. Only if the station begins transmitting on a frequency you are using

4. You may expect, and cause, deliberate interference because it can't be helped during crowded band conditions

*> Deliberate harmful interference is ALWAYS prohibited.*

**B-001-10-3 (1) If the regulations say that the amateur service is a secondary user of a frequency band, and another service is a primary user, what does this mean?**

**1. Amateurs are allowed to use the frequency band only if they do not cause interference to primary users**

2. Nothing special: all users of a frequency band have equal rights to operate

3. Amateurs are only allowed to use the frequency band during emergencies

4. Amateurs must increase transmitter power to overcome any interference caused by primary users

*> Primary User and Secondary User are statuses assigned to different services when frequency bands are allocated by Industry-Canada. "Stations of a secondary service: a) shall not cause harmful interference to stations of primary service, b) cannot claim protection from harmful interference from stations of a primary service". For example, on 430-450 MHz and 902-928 MHz, the Amateur Radio Service has secondary status behind other services.*

**B-001-10-4 (1) What rule applies if two amateur stations want to use the same frequency?**

**1. Both station operators have an equal right to operate on the frequency**

2. The station operator with a lesser class of licence must yield the frequency to a higher-class licensee

3. The station operator with a lower power output must yield the frequency to the station with a higher power output

4. Station operators in ITU Regions 1 and 3 must yield the frequency to stations in ITU Region 2

*> Common-sense and respect are expected out of amateurs in sharing radio spectrum. No organization, license class or activity can claim exclusive and priority use of a given frequency*.

**B-001-10-5 (4) What name is given to a form of interference that seriously degrades, obstructs or repeatedly interrupts a radiocommunication service?**

1. Intentional interference

2. Adjacent interference

3. Disruptive interference

**4. Harmful interference**

*> "Harmful Interference": "Adverse effect of electromagnetic energy...that endangers the use of a safety-related radiocommunication system... OR significantly degrades, or obstructs or repeatedly interrupts the use of radio apparatus or radio-sensitive equipment." (Radiocommunication Act)*

**B-001-10-6 (3) Where interference to the reception of radiocommunications is caused by the operation of an amateur station:**

1. the amateur station operator is not obligated to take any action

2. the amateur station operator may continue to operate without restrictions

**3. the Minister may require that the necessary steps for the prevention of the interference be taken by the radio amateur**

4. the amateur station operator may continue to operate and the necessary steps can be taken when the amateur operator can afford it

*> "The Department shall order the persons in control of the equipment to cease or modify operation until such time it can be operated without causing interference". (Radiocommunication Regulations)*

**B-001-10-7 (3) Radio amateur operation must not cause interference to other radio services operating in which of the following bands?**

1. 7.0 to 7.1 MHz

2. 144.0 to 148.0 MHz

**3. 430.0 to 450.0 MHz**

4. 14.0 to 14.2 MHz

*> Primary User and Secondary User are statuses assigned to different services when frequency bands are allocated by Industry-Canada. "Stations of a secondary service: a) shall not cause harmful interference to stations of primary service, b) cannot claim protection from harmful interference from stations of a primary service". For example, on 430-450 MHz and 902-928 MHz, the Amateur Radio Service has secondary status behind other services.*

**B-001-10-8 (4) Radio amateur operations are not protected from interference caused by another service operating in which of the following frequency bands?**

1. 144 to 148 MHz

2. 220 to 225 MHz

3. 50 to 54 MHz

**4. 902 to 928 MHz**

*> Primary User and Secondary User are statuses assigned to different services when frequency bands are allocated by Industry-Canada. "Stations of a secondary service: a) shall not cause harmful interference to stations of primary service, b) cannot claim protection from harmful interference from stations of a primary service". For example, on 430-450 MHz and 902-928 MHz, the Amateur Radio Service has secondary status behind other services.*

**B-001-10-9 (3) Which of the following is NOT correct? The operator of an amateur station:**

1. shall not cause harmful interference to a station in another service which has primary use of that band

2. may conduct technical experiments using the station apparatus

**3. may make trials or tests, even though there is a possibility of interfering with other stations**

4. may make trials or tests, except under circumstances that preclude the possibility of interference with other stations

*> key words: NOT CORRECT. "1", "2" and "3" are true. Conducting tests which result in 'harmful interference' is prohibited.*

**B-001-11-1 (4) Amateur radio stations may communicate:**

1. with anyone who uses international Morse code

2. with non amateur stations

3. with any station involved in a real or simulated emergency

**4. only with other amateur stations**

*> Amateurs can only communicate with properly licensed Amateur stations on Amateur bands. RIC-3, Issue 3, dated July 2005 states: "47. A person who operates radio apparatus in the amateur radio service may only (a) communicate with a radio station that operates in the amateur radio service" and further emphasizes: "48. In a real or simulated emergency, a person operating radio*

*apparatus in the amateur radio service may only communicate with a radio station that is in the amateur radio service". The word "any" invalidates Choice #3. The words "real or simulated emergency" are a catch.*

**B-001-11-2 (2) In the amateur radio service, business communications:**

1. Are permitted on some bands

**2. are not permitted under any circumstance**

3. are only permitted if they are for the safety of life or immediate protection of property

4. are not prohibited by regulation

*> Business-related communications are NOT allowed on amateur bands. RIC-3 states "47. A person who operates radio apparatus in the amateur radio service may only (c) be engaged in communication that does not include the transmission of i) music, (ii) commercially recorded material, (iii) programming that originates from a broadcasting undertaking, or (iv) radiocommunications in support of industrial, business or professional activities." [ Until July 2007, RIC-7 seemed to make an exception for relief operations in a disaster while regular services are overloaded or unavailable. Prior to 2000, an amateur could communicate any message in a real or simulated emergency. ]*

**B-001-11-3 (3) If you hear an unanswered distress signal on a amateur band where you do not have privileges to communicate:**

1. you may offer assistance using international Morse code only

2. you may offer assistance after contacting Industry Canada for permission to do so

**3. you should offer assistance**

4. you may not offer assistance

*> key word: UNANSWERED. You may exceed your normal privileges to help a station in distress.*

**B-001-11-4 (4) In the amateur radio service, it is permissible to broadcast:**

1. music

2. commercially recorded material

3. programming that originates from a broadcast undertaking

**4. radio communications required for the immediate safety of life of individuals or the immediate protection of property**

*> Music, commercially recorded material and broadcasts are not permitted. Amateur radio can be used for distress communications.*

**B-001-11-5 (3) An amateur radio station in distress may:**

1. only use radiocommunication bands for which the operator is qualified to use

2. use any means of radiocommunication, but only on internationally recognized emergency channels

**3. any means of radiocommunication**

4. only Morse code communications on internationally recognized emergency channels

*> You may exceed your normal privileges if you are in distress.*

**B-001-11-6 (2) During a disaster, when may an amateur station make transmissions necessary to meet essential communication needs and assist relief operations?**

1. Never: only official emergency stations may transmit in a disaster

**2. When normal communication systems are overloaded, damaged or disrupted**

3. When normal communication systems are working but are not convenient

4. Only when the local emergency net is activated

*> Amateurs have a long history of handling communication when normal systems (e.g., telephone) are unavailable. When communications systems are restored, amateurs must return to the "no business" rule.*

**B-001-11-7 (3) During an emergency, what power output limitations must be observed by a station in distress?**

1. 1000 watts PEP during daylight hours, reduced to 200 watts PEP during the night

2. 1500 watts PEP

**3. There are no limitations during an emergency**

4. 200 watts PEP

*> You may exceed your normal privileges if you are in distress.*

**B-001-11-8 (4) During a disaster:**

1. use only frequencies in the 80 metre band

2. use only frequencies in the 40 metre band

3. use any United Nations approved frequency

**4. most communications are handled by nets using predetermined frequencies in amateur bands. Operators not directly involved with disaster communications are requested to avoid making unnecessary transmissions on or near frequencies being used for disaster communications**

*> A 'net' (short for network) is a time and frequency where a given activity is conducted. Traffic is directed by a 'net control station'.*

**B-001-11-9 (4) Messages from recognized public service agencies may be handled by amateur radio stations:**

1. using Morse code only

2. when Industry Canada has issued a special authorization

3. only on the 7 and 14 MHz band

**4. during peace time and civil emergencies and exercises**

*> Messages from the Red Cross or Civil Protection can be handled by Amateurs at all times.*

**B-001-11-10 (4) It is permissible to interfere with the working of another station if:**

1. the other station is not operating according to the Radiocommunication Regulations

2. you both wish to contact the same station

3. the other station is interfering with your transmission

**4. your station is directly involved with a distress situation**

*> key words: DIRECTLY INVOLVED with distress. This is the only acceptable excuse for interference.*

**B-001-12-1 (3) What kind of payment is allowed for third-party messages sent by an amateur station?**

1. Donation of amateur equipment

2. Donation of equipment repairs

**3. No payment of any kind is allowed**

4. Any amount agreed upon in advance

*> "A person who operates in the Amateur Radio service shall do so without demanding or accepting remuneration in any form". (Radiocommunication Regulations)*

**B-001-12-2 (2) Radiocommunications transmitted by stations other than a broadcasting station may be divulged or used:**

1. if transmitted by any station using the international Morse code

**2. if it is transmitted by an amateur station**

3. if transmitted in English or French

4. during peacetime civil emergencies

*> "No person shall make use of or divulge a radio-based communication" except if it originates from a broadcaster ( e.g., the CBC) or an Amateur Radio station. (Radiocommunication Act)*

**B-001-12-3 (4) The operator of an amateur station:**

1. shall charge no less than $10 for each message that the person transmits or receives

2. shall charge no more than $10 for each message that the person transmits or receives

3. may accept a gift or gratuity in lieu of remuneration for any message that the person transmits or receives

**4. shall not demand or accept remuneration in any form, in respect of a radiocommunication that the person transmits or receives**

*> "A person who operates in the Amateur Radio service shall do so without demanding or accepting remuneration in any form". (Radiocommunication Regulations)*

**B-001-12-4 (1) Which of the following is NOT an exception from the penalties under the Act, for divulging, intercepting or using information obtained through radiocommunication, other than broadcasting?**

**1. Where it is to provide information for a journalist**

2. Where it is for the purpose of preserving or protecting property, or for the prevention of harm to a person

3. Where it is for the purpose of giving evidence in a criminal or civil proceeding in which persons are required to give evidence

4. Where it is on behalf of Canada, for the purpose of international or national defence or security

*> key words:  NOT AN EXCEPTION.  Protecting property, preventing harm, giving evidence and national security are valid exceptions to the privacy of communications.*

**B-001-13-1 (2) Which of the following call signs is a valid Canadian amateur radio callsign?**

1. SM2CAN

**2. VA3XYZ**

3. BY7HY

4. KA9OLS

*> Valid Canadian prefixes include VA, VE, VO (letter o) and VY.   [ VO1=Newfoundland, VO2=Labrador, VY1=Yukon, VY2=Nunavut ]*

**B-001-13-2 (1) How often must an amateur station be identified?**

**1. At least every thirty minutes, and at the beginning and at the end of a contact**

2. At the beginning of a contact and at least every thirty minutes after that

3. At least once during each transmission

4. At the beginning and end of each transmission

*> Station identification:  your call sign in English or French, at the START and the END of a contact or test transmission and  every 30 minutes at the most.  Only Remote-Control transmissions to model craft need not include station identification.*

**B-001-13-3 (4) What do you transmit to identify your amateur station?**

1. Your "handle"

2. Your first name and your location

3. Your full name

**4. Your call sign**

*> Station identification:  your call sign in English or French, at the START and the END of a contact or test transmission and  every 30 minutes at the most.  Only Remote-Control transmissions to model craft need not include station identification.*

**B-001-13-4 (2) What identification, if any, is required when two amateur stations begin communications?**

1. No identification is required

**2. Each station must transmit its own call sign**

3. Both stations must transmit both call signs

4. One of the stations must give both stations' call signs

*> Each station is required to identify itself.  Station identification:  your call sign in English or French, at the START and the END of a contact or test transmission and every 30 minutes at the most.  Only Remote-Control transmissions to model craft need not include station identification.*

**B-001-13-5 (1) What identification, if any, is required when two amateur stations end communications?**

**1. Each station must transmit its own call sign**

2. No identification is required

3. One of the stations must transmit both stations' call signs

4. Both stations must transmit both call signs

*> Each station is required to identify itself.  Station identification:  your call sign in English or French, at the START and the END of a contact or test transmission and every 30 minutes at the most.  Only Remote-Control transmissions to model craft need not include station identification.*

**B-001-13-6 (3) What is the longest period of time an amateur station can operate, without transmitting its call sign?**

1. 20 minutes

2. 15 minutes

**3. 30 minutes**

4. 10 minutes

*> Station identification:  your call sign in English or French, at the START and the END of a contact or test transmission and  every 30 minutes at the most.  Only Remote-Control transmissions to model craft need not include station identification. Only Remote-Control transmissions to model craft need not include station identification.*

**B-001-13-7 (4) When may an amateur transmit unidentified communications?**

1. Only for brief tests not meant as messages

2. Only if it does not interfere with others

3. Only for two-way or third-party communications

**4. Never, except to control a model craft**

*> key word:  UNINDENTIFIED.  Any test transmission must include station identification.  Only Remote-Control transmissions to model craft need not include station identification.  Station identification:  your call sign in English or French, at the START and the END of a contact or test transmission and  every 30 minutes at the most.*

**B-001-13-8 (1) What language may you use when identifying your station?**

**1. English or French**

2. Any language being used for a contact

3. Any language being used for a contact, providing Canada has a third-party communications agreement with that country

4. Any language of a country which is a member of the International Telecommunication Union

*> key word:  IDENTIFYING.  Contact may be conducted in any language but identification must be in one of the two official languages.  Station identification: your call sign in English or French, at the START and the END of a contact or test transmission and  every 30 minutes at the most.  Only Remote-Control transmissions to model craft need not include station identification.*

**B-001-13-9 (4) The call sign of an amateur station must be transmitted:**

1. at intervals not greater than three minutes when using voice communications

2. at intervals not greater than ten minutes when using Morse code

3. when requested to do so by the station being called

**4. at the beginning and at the end of each exchange of communications and at intervals not greater than 30 minutes**

*> Station identification:  your call sign in English or French, at the START and the END of a contact or test transmission and  every 30 minutes at the most.  Only Remote-Control transmissions to model craft need not include station identification. Only Remote-Control transmissions to model craft need not include station identification.*

**B-001-13-10 (3) The call sign of an amateur station must be sent:**

1. every minute

2. every 15 minutes

**3. at the beginning and end of each exchange of communications, and at least every 30 minutes, while in communications**

4. once after initial contact

*> Station identification:  your call sign in English or French, at the START and the END of a contact or test transmission and  every 30 minutes at the most.  Only Remote-Control transmissions to model craft need not include station identification.* *Only Remote-Control transmissions to model craft need not include station identification.*

**B-001-13-11 (1) The call sign of a Canadian amateur radio station would normally start with the letters:**

**1. VA, VE, VO or VY**

2. GA, GE, MO or VQ

3. A, K, N or W

4. EA, EI, RO or UY

*> Valid Canadian prefixes include VA, VE, VO (letter o) and VY.   [ VO1=Newfoundland, VO2=Labrador, VY1=Yukon, VY2=Nunavut ]*

## Routine operation

**B-002-1-1 (2) What is a good way to make contact on a repeater?**

1. Say the other operator's name, then your call sign three times

**2. Say the call sign of the station you want to contact, then your call sign**

3. Say, "Breaker, breaker"

4. Say the call sign of the station you want to contact three times

*> Say the call sign of the other station FIRST (to get his attention), the expression "THIS IS" and your call sign.*

**B-002-1-2 (2) What is the main purpose of a repeater?**

1. To link amateur stations with the telephone system

**2. To increase the range of portable and mobile stations**

3. To retransmit weather information during severe storm warnings

4. To make local information available 24 hours a day

*> A 'Repeater' is generally located on a hill or tall building. It is meant to extend the range of portables and mobiles.*

**B-002-1-3 (2) What is an autopatch?**

1. A device which connects a mobile station to the next repeater if it moves out of range of the first

**2. A device that allows repeater users to make telephone calls from their stations**

3. A device which locks other stations out of a repeater when there is an important conversation in progress

4. Something that automatically selects the strongest signal to be repeated

*> 'Autopatch' ( short for automated phone patch ). A device connecting a repeater to a telephone line.*

**B-002-1-4 (4) What is the purpose of a repeater time-out timer?**

1. It lets a repeater have a rest period after heavy use

2. It logs repeater transmit time to predict when a repeater will fail

3. It tells how long someone has been using a repeater

**4. It limits the amount of time someone can transmit on a repeater**

*> The 'Time-out Timer' takes a repeater off the air after a determined time of continuous transmission, either unintended or malicious. The timer enforces pauses between transmissions.*

**B-002-1-5 (2) What is a CTCSS (or PL) tone?**

1. A tone used by repeaters to mark the end of a transmission

**2. A sub-audible tone added to a carrier which may cause a receiver to accept a signal**

3. A special signal used for telemetry between amateur space stations and Earth stations

4. A special signal used for remote control of model craft

*> CTCSS -- "Continuous Tone-Controlled Squelch System". A receiver equipped with a CTCSS decoder will not reproduce a signal unless it carries a given sub-audible tone in the background, for example a continuous 100 Hz tone. To work with such receivers, a transmitter must be equipped with a CTCSS encoder [ Standard tones are in the range of 67 to 254 Hz, below the normal speech frequencies of 300 to 3000 Hz ]. [ PL (Private Line) is a trademark of Motorola ]*

**B-002-1-6 (1) How do you call another station on a repeater if you know the station's call sign?**

**1. Say the station's call sign, then identify your own station**

2. Say "break, break 79," then say the station's call sign

3. Say "CQ" three times, then say the station's call sign

4. Wait for the station to call "CQ", then answer it

*> Say the call sign of the other station FIRST (to get his attention), the expression "THIS IS" and your call sign. "CQ" is a general call to ANY station.*

**B-002-1-7 (4) Why should you pause briefly between transmissions when using a repeater?**

1. To check the SWR of the repeater

2. To reach for pencil and paper for third-party communications

3. To dial up the repeater's autopatch

**4. To listen for anyone else wanting to use the repeater**

*> Repeaters are meant primarily to extend the range of portables and mobiles. You never know when someone else might need the repeater. Be sure to leave pauses in between transmissions. Anyone wanting the repeater may signal his presence by* stating his call sign during one such pause. A station may have emergency traffic.

**B-002-1-8 (3) Why should you keep transmissions short when using a repeater?**

1. To keep long-distance charges down

2. To give any listening non-hams a chance to respond

**3. A long transmission may prevent someone with an emergency from using the repeater**

4. To see if the receiving station operator is still awake

*> Repeaters are meant primarily to extend the range of portables and mobiles. You never know when someone else might need the repeater. Be sure to leave pauses in between transmissions. Anyone wanting the repeater may signal his presence by stating his call sign during one such pause. A station may have emergency traffic*.

**B-002-1-9 (4) What is the proper way to break into a conversation on a repeater?**

1. Wait for the end of a transmission and start calling the desired party

2. Shout, "break, break!" to show that you're eager to join the conversation

3. Turn on an amplifier and override whoever is talking

**4. Say your call sign during a break between transmissions**

*> Repeaters are meant primarily to extend the range of portables and mobiles. You never know when someone else might need the repeater. Be sure to leave pauses in between transmissions. Anyone wanting the repeater may signal his presence by stating his call sign during one such pause. A station may have emergency traffic*.

**B-002-1-10 (2) What is the proper way to ask someone their location when using a repeater?**

1. What is your 20?

**2. Where are you?**

3. Locations are not normally told by radio

4. What is your 12?

*> Plain language is normally used on repeaters*.

**B-002-1-11 (2) FM repeater operation on the 2 metre band uses one frequency for transmission and one for reception. The difference in frequency between the transmit and receive frequency is normally:**

1. 800 kHz

**2. 600 kHz**

3. 1 000 kHz

4. 400 kHz

*> The difference between the OUTPUT and INPUT frequencies of a repeater is termed the 'Offset'. On 2m, the standard is "plus 600 kHz" or "minus 600 kHz".*

**B-002-2-1 (4) To make your call sign better understood when using voice transmissions, what should you do?**

1. Use any words which start with the same letters as your call sign for each letter of your call

2. Talk louder

3. Turn up your microphone gain

**4. Use Standard International Phonetics for each letter of your call sign**

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet: Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu.*

**B-002-2-2 (2) What can you use as an aid for correct station identification when using phone?**

1. Q signals

**2. The Standard International Phonetic Alphabet**

3. Unique words of your choice

4. A speech compressor

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet: Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu.*

**B-002-2-3 (1) What is the Standard International Phonetic for the letter A?**

**1. Alpha**

2. Able

3. Adam

4. America

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet:  Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu.*

**B-002-2-4 (2) What is the Standard International Phonetic for the letter B?**

1. Brazil

**2. Bravo**

3. Borneo

4. Baker

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet:  Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu.*

**B-002-2-5 (4) What is the Standard International Phonetic for the letter D?**

1. Dog

2. Denmark

3. David

**4. Delta**

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet:  Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu.*

**B-002-2-6 (4) What is the Standard International Phonetic for the letter E?**

1. Easy

2. Edward

3. England

**4. Echo**

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet:  Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu.*

**B-002-2-7 (1) What is the Standard International Phonetic for the letter G?**

**1. Golf**

2. George

3. Germany

4. Gibraltar

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet:  Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu.*

**B-002-2-8 (3) What is the Standard International Phonetic for the letter I?**

1. Iran

2. Italy

**3. India**

4. Item

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet:  Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu*.

**B-002-2-9 (4) What is the Standard International Phonetic for the letter L?**

1. Love

2. London

3. Luxembourg

**4. Lima**

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet:  Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu.*

**B-002-2-10 (2) What is the Standard International Phonetic for the letter P?**

1. Portugal

**2. Papa**

3. Paris

4. Peter

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet:  Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu.*

**B-002-2-11 (1) What is the Standard International Phonetic for the letter R?**

**1. Romeo**

2. Roger

3. Radio

4. Romania

*> To make a call sign clearer or spell some unusual word, use the International Phonetic Alphabet:  Alpha, Bravo, Charlie, Delta, Echo, Fox-Trot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whisky, X-Ray, Yankee, Zulu.*

**B-002-3-1 (1) What is the correct way to call "CQ" when using voice?**

**1. Say "CQ" three times, followed by "this is," followed by your call sign spoken three times**

2. Say "CQ" once, followed by "this is," followed by your call sign spoken three times

3. Say "CQ" at least five times, followed by "this is," followed by your call sign spoken once

4. Say "CQ" at least ten times, followed by "this is," followed by your call sign spoken once

*> A call to any station:  "CQ" three times, "THIS IS", your call sign three times.  Any word only spoken once might easily not get noticed.*

**B-002-3-2 (2) How should you answer a voice CQ call?**

1. Say the other station's call sign at least five times phonetically, followed by "this is," then your call sign twice

**2. Say the other station's call sign once, followed by "this is," then your call sign given phonetically**

3. Say the other station's call sign at least three times, followed by "this is," and your call sign at least five times phonetically

4. Say the other station's call sign at least ten times, followed by "this is," then your call sign at least twice

*> Anything spoken five or ten times is just overkill.*

**B-002-3-3 (4) What is simplex operation?**

1. Transmitting and receiving over a wide area

2. Transmitting on one frequency and receiving on another

3. Transmitting one-way communications

**4. Transmitting and receiving on the same frequency**

*> 'Simplex' ( also known as direct ) operation where two stations use one frequency in turns contrasts with repeater operation (duplex) where two frequencies are used simultaneously ( the repeater output frequency and the repeater input frequency ). Stations should avoid tying-up a repeater for long periods of time when within range of one another on a simplex frequency. Most receivers can be switched to the repeater input frequency at the press of a button (this is useful to verify if simplex operation is possible with a given station).*

**B-002-3-4 (1) When should you use simplex operation instead of a repeater?**

**1. When a contact is possible without using a repeater**

2. When the most reliable communications are needed

3. When an emergency telephone call is needed

4. When you are traveling and need some local information

*> 'Simplex' ( also known as direct ) operation where two stations use one frequency in turns contrasts with repeater operation (duplex) where two frequencies are used simultaneously ( the repeater output frequency and the repeater input frequency ). Stations should avoid tying-up a repeater for long periods of time when within range of one another on a simplex frequency. Most receivers can be switched to the repeater input frequency at the press of a button (this is useful to verify if simplex operation is possible with a given station).*

**B-002-3-5 (1) Why should local amateur communications use VHF and UHF frequencies instead of HF frequencies?**

**1. To minimize interference on HF bands capable of long-distance communication**

2. Because greater output power is permitted on VHF and UHF

3. Because HF transmissions are not propagated locally

4. Because signals are louder on VHF and UHF frequencies

*> Always choose a frequency with the least reach so the spectrum remains usable elsewhere.*

**B-002-3-6 (3) Why should simplex be used where possible, instead of using a repeater?**

1. Your antenna's effectiveness will be better tested

2. Long distance toll charges will be avoided

**3. The repeater will not be tied up unnecessarily**

4. Signal range will be increased

*> 'Simplex' ( also known as direct ) operation where two stations use one frequency in turns contrasts with repeater operation (duplex) where two frequencies are used simultaneously ( the repeater output frequency and the repeater input frequency ). Stations should avoid tying-up a repeater for long periods of time when within range of one another on a simplex frequency. Most receivers can be switched to the repeater input frequency at the press of a button (this is useful to verify if simplex operation is possible with a given station).*

**B-002-3-7 (3) If you are talking to a station using a repeater, how would you find out if you could communicate using simplex instead?**

1. See if a third station can clearly receive both of you

2. See if you can clearly receive a more distant repeater

**3. See if you can clearly receive the station on the repeater's input frequency**

4. See if you can clearly receive the station on a lower frequency band

*> 'Simplex' ( also known as direct ) operation where two stations use one frequency in turns contrasts with repeater operation (duplex) where two frequencies are used simultaneously ( the repeater output frequency and the repeater input frequency ). Stations should avoid tying-up a repeater for long periods of time when within range of one another on a simplex frequency. Most receivers can be switched to the*

*repeater input frequency at the press of a button (this is useful to verify if simplex operation is possible with a given station).*

**B-002-3-8 (1) If you are operating simplex on a repeater frequency, why would it be good amateur practice to change to another frequency?**

**1. Changing the repeater's frequency is not practical**

2. The repeater's output power may ruin your station's receiver

3. There are more repeater operators than simplex operators

4. Changing the repeater's frequency requires the authorization of Industry Canada

*> If you operate simplex on a repeater frequency, you are preventing others from using the repeater. Amateur organizations publish 'Band Plans' where segments reserved for simplex operation are recommended.*

**B-002-3-9 (1) Which sideband is commonly used for 20-metre phone operation?**

**1. Upper**

2. Lower

3. FM

4. Double

*> Choice of sideband: BELOW 10 MHZ ( 160m, 80m, 40m ), use Lower Sideband (LSB). Above 10 MHz ( 20m and up ), use Upper Sideband (USB).*

**B-002-3-10 (2) Which sideband is commonly used on 3755 kHz for phone operation?**

1. FM

**2. Lower**

3. Double

4. Upper

*> Choice of sideband: BELOW 10 MHZ ( 160m, 80m, 40m ), use Lower Sideband (LSB). Above 10 MHz ( 20m and up ), use Upper Sideband (USB).*

**B-002-3-11 (4) What is the best method to tell if a band is "open" for communication with a particular distant location?**

1. Ask others on your local 2 metre FM repeater

2. Telephone an experienced local amateur

3. Look at the propagation forecasts in an amateur radio magazine

**4. Listen for signals from that area from an amateur beacon station or a foreign broadcast or television station on a nearby frequency**

*> 'Beacons' are one-way automated stations maintained by amateurs which operate on known frequencies to permit evaluating propagation conditions.*

**B-002-4-1 (2) What should you do before you transmit on any frequency?**

1. Check your antenna for resonance at the selected frequency

**2. Listen to make sure others are not using the frequency**

3. Make sure the SWR on your antenna feed line is high enough

4. Listen to make sure that someone will be able to hear you

*> First, listen for a little while then ask "Is this frequency in use?" ( QRL? in Morse ).*

**B-002-4-2 (4) If you contact another station and your signal is extremely strong and perfectly readable, what adjustment might you make to your transmitter?**

1. Turn on your speech processor

2. Reduce your SWR

3. Continue with your contact, making no changes

**4. Turn down your power output to the minimum necessary**

*> Amateurs should always use the minimum power required.*

**B-002-4-3 (4) What is one way to shorten transmitter tune-up time on the air to cut down on interference?**

1. Use a random wire antenna

2. Tune up on 40 metres first, then switch to the desired band

3. Use twin lead instead of coaxial cable feed lines

**4. Tune the transmitter into a dummy load**

*> The 'Dummy Load' (a resistor with a high power rating) dissipates RF energy as heat without radiating the RF on the air.  Permits tests or adjustments without causing interference to other stations. The 'tuning process' (or 'loading') refers to a manual procedure necessary for equipment with vacuum tube final Power Amplifiers where variable capacitors needed to be adjusted.*

**B-002-4-4 (4) How can on-the-air interference be minimized during a lengthy transmitter testing or loading-up procedure?**

1. Choose an unoccupied frequency

2. Use a non-resonant antenna

3. Use a resonant antenna that requires no loading-up procedure

**4. Use a dummy load**

*> The 'Dummy Load' (a resistor with a high power rating) dissipates RF energy as heat without radiating the RF on the air.  Permits tests or adjustments without causing interference to other stations. The 'tuning process' (or 'loading') refers to a manual procedure necessary for equipment with vacuum tube final Power Amplifiers where variable capacitors needed to be adjusted.*

**B-002-4-5 (2) Why would you use a dummy antenna?**

1. To give comparative signal reports

**2. To allow antenna tuning without causing interference**

3. It is faster to tune

4. To reduce output power

*> The 'Dummy Load' (a resistor with a high power rating) dissipates RF energy as heat without radiating the RF on the air.  Permits tests or adjustments without causing interference to other stations. The 'tuning process' (or 'loading') refers to a manual procedure necessary for equipment with vacuum tube final Power Amplifiers where variable capacitors needed to be adjusted.*

**B-002-4-6 (1) If you are the net control station of a daily HF net, what should you do if the frequency on which you normally meet is in use just before the net begins?**

**1. Conduct the net on a frequency 3 to 5 kHz away from the regular net frequency**

2. Reduce your output power and start the net as usual

3. Increase your power output so that net participants will be able to hear you over the existing activity

4. Cancel the net for that day

*> A 'Net' is an activity carried on a given day and time at a known frequency where stations exchange information.  Although no given station is entitled to any specific frequency (regardless of license class, power or affiliation), stations would normally yield to an established daily net but if not, you need to move the net away.*

**B-002-4-7 (1) If a net is about to begin on a frequency which you and another station are using, what should you do?**

**1. As a courtesy to the net, move to a different frequency**

2. Increase your power output to ensure that all net participants can hear you

3. Transmit as long as possible on the frequency so that no other stations may use it

4. Turn off your radio

*> A 'Net' is an activity carried on a given day and time at a known frequency where stations exchange information. Although no given station is entitled to any specific frequency (regardless of license class, power or affiliation), stations would normally yield to an established daily net but if not, you need to move the net away.*

**B-002-4-8 (4) If propagation changes during your contact and you notice increasing interference from other activity on the same frequency, what should you do?**

1. Tell the interfering stations to change frequency, since you were there first

2. Report the interference to your local Amateur Auxiliary Coordinator

3. Increase the output power of your transmitter to overcome the interference

**4. Move your contact to another frequency**

*> No given station is entitled to any specific frequency (regardless of license class, power or affiliation).*

**B-002-4-9 (1) When selecting a single-sideband phone transmitting frequency, what minimum frequency separation from a contact in progress should you allow (between suppressed carriers) to minimize interference?**

**1. Approximately 3 kHz**

2. 150 to 500 Hz

3. Approximately 6 kHz

4. Approximately 10 kHz

*> In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz. Minimum frequency separation: CW = 150 to 500 Hz, RTTY = 250 to 500 Hz, SSB = 3 kHz to 5 kHz.*

**B-002-4-10 (2) What is a band plan?**

1. A plan of operating schedules within an amateur band published by Industry Canada

**2. A guideline for using different operating modes within an amateur band**

3. A plan devised by a club to best use a frequency band during a contest

4. A guideline for deviating from amateur frequency band allocations

*> "Band Plans" are published by Amateur organizations to suggest specific modes in specific segments of the band. The idea is to minimize interference and allow interest groups to find one another.*

**B-002-4-11 (4) Before transmitting, the first thing you should do is:**

1. ask if the frequency is occupied

2. make an announcement on the frequency indicating that you intend to make a call

3. decrease your receiver's volume

**4. listen carefully so as not to interrupt communications already in progress**

*> First, listen for a little while then ask "Is this frequency in use?" ( QRL? in Morse ).*

**B-002-5-1 (4) What is the correct way to call "CQ" when using Morse code?**

1. Send the letters "CQ" three times, followed by "DE", followed by your call sign sent once

2. Send the letters "CQ" ten times, followed by "DE", followed by your call sign sent once

3. Send the letters "CQ" over and over

**4. Send the letters "CQ" three times, followed by "DE", followed by your call sign sent three times**

*> "CQ" is a general call to any station. "DE" ( French for 'from' ) is the Morse abbreviation for "this is". Other abbreviations include: "K" (go ahead or over), "DX" (distant station) and "73" (best regards). [ "KN" is 'go station' ]*

**B-002-5-2 (4) How should you answer a Morse code "CQ" call?**

1. Send your call sign four times

2. Send the other station's call sign once, followed by "DE", followed by your call sign four times

3. Send your call sign followed by your name, station location and a signal report

**4. Send the other station's call sign twice, followed by "DE", followed by your call sign twice**

*> "CQ" is a general call to any station.  "DE" ( French for 'from' ) is the Morse abbreviation for "this is".  Other abbreviations include:  "K" (go ahead or over), "DX" (distant station) and "73" (best regards). [ "KN" is 'go station' ]*

**B-002-5-3 (1) At what speed should a Morse code CQ call be transmitted?**

**1. At any speed which you can reliably receive**

2. At any speed below 5 WPM

3. At the highest speed your keyer will operate

4. At the highest speed at which you can control the keyer

*> Any station which answers your call is likely to transmit at a speed similar to yours.  Operators frequently find it easier to transmit at higher speed than they can reliably copy.*

**B-002-5-4 (1) What is the meaning of the procedural signal "CQ"?**

**1. Calling any station**

2. Call on the quarter hour

3. An antenna is being tested

4. Only the station "CQ" should answer

*> "CQ" is a general call to any station.  "DE" ( French for 'from' ) is the Morse abbreviation for "this is".  Other abbreviations include:  "K" (go ahead or over), "DX" (distant station) and "73" (best regards). [ "KN" is 'go station' ]*

**B-002-5-5 (2) What is the meaning of the procedural signal "DE"?**

1. Received all correctly

**2. From**

3. Calling any station

4. Directional Emissions

*> "CQ" is a general call to any station.  "DE" ( French for 'from' ) is the Morse abbreviation for "this is".  Other abbreviations include:  "K" (go ahead or over), "DX" (distant station) and "73" (best regards). [ "KN" is 'go station' ]*

**B-002-5-6 (2) What is the meaning of the procedural signal "K"?**

1. End of message

**2. Any station transmit**

3. Called station only transmit

4. All received correctly

*> "CQ" is a general call to any station.  "DE" ( French for 'from' ) is the Morse abbreviation for "this is".  Other abbreviations include:  "K" (go ahead or over), "DX" (distant station) and "73" (best regards). [ "KN" is 'go station' ]*

**B-002-5-7 (2) What is meant by the term "DX"?**

1. Calling any station

**2. Distant station**

3. Go ahead

4. Best regards

*> "CQ" is a general call to any station.  "DE" ( French for 'from' ) is the Morse abbreviation for "this is".  Other abbreviations include:  "K" (go ahead or over), "DX" (distant station) and "73" (best regards). [ "KN" is 'go station' ]*

**B-002-5-8 (4) What is the meaning of the term "73"?**

1. Long distance

2. Love and kisses

3. Go ahead

**4. Best regards**

*> "CQ" is a general call to any station.  "DE" ( French for 'from' ) is the Morse abbreviation for "this is".  Other abbreviations include:  "K" (go ahead or over), "DX" (distant station) and "73" (best regards). [ "KN" is 'go station' ]*

**B-002-5-9 (2) Which of the following describes full break-in telegraphy ?**

1. Automatic keyers are used to send Morse code instead of hand keys

**2. Incoming signals are received between transmitted Morse dots**

3. An operator must activate a manual send/receive switch before and after every transmission

4. Breaking stations send the Morse code prosign "BK"

*> When a station operates "full break-in", the receiver becomes active IN BETWEEN the transmitted dots and dashes.  It permits the other station to interrupt (break-in), for example, when it failed to copy a word.*

**B-002-5-10 (1) When selecting a CW transmitting frequency, what minimum frequency separation from a contact in progress should you allow to minimize interference?**

**1. 150 to 500 Hz**

2. 5 to 50 Hz

3. 1 to 3 kHz

4. 3 to 6 kHz

*> In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz. Minimum frequency separation: CW = 150 to 500 Hz, RTTY = 250 to 500 Hz, SSB = 3 kHz to 5 kHz.*

**B-002-5-11 (2) Good Morse telegraphy operators:**

1. always give stations a good readability report

**2. listen to the frequency to make sure that it is not in use before transmitting**

3. save time by leaving out spaces between words

4. tune the transmitter using the operating antenna

*> First, listen for a little while then ask "Is this frequency in use?" ( QRL? in Morse ).*

**B-002-6-1 (2) What are "RST" signal reports?**

1. A short way to describe transmitter power

**2. A short way to describe signal reception**

3. A short way to describe sunspot activity

4. A short way to describe ionospheric conditions

*> "RST", A short way to describe signal reception ( Readability: 1 to 5, Signal Strength: 1 to 9, Tone Quality (for Morse): 1 to 9 ). For example, "11" unreadable, barely perceptible. "33" difficult to read, weak signal. "45" readable, fairly good. "57" perfectly readable, moderately strong.*

**B-002-6-2 (4) What does "RST" mean in a signal report?**

1. Recovery, signal strength, tempo

2. Recovery, signal speed, tone

3. Readability, signal speed, tempo

**4. Readability, signal strength, tone**

*> "RST", A short way to describe signal reception ( Readability: 1 to 5, Signal Strength: 1 to 9, Tone Quality (for Morse): 1 to 9 ). For example, "11" unreadable, barely perceptible. "33" difficult to read, weak signal. "45" readable, fairly good. "57" perfectly readable, moderately strong.*

**B-002-6-3 (2) What is the meaning of: "Your signal report is 5 7"?**

1. Your signal is readable with considerable difficulty

**2. Your signal is perfectly readable and moderately strong**

3. Your signal is perfectly readable with near pure tone

4. Your signal is perfectly readable, but weak

*> "RST", A short way to describe signal reception ( Readability: 1 to 5, Signal Strength: 1 to 9, Tone Quality (for Morse): 1 to 9 ). For example, "11" unreadable, barely perceptible. "33" difficult to read, weak signal. "45" readable, fairly good. "57" perfectly readable, moderately strong.*

**B-002-6-4 (3) What is the meaning of: "Your signal report is 3 3 "?**

1. Your signal is unreadable, very weak in strength

2. The station is located at latitude 33 degrees

**3. Your signal is readable with considerable difficulty and weak in strength**

4. The contact is serial number 33

*> "RST", A short way to describe signal reception ( Readability: 1 to 5, Signal Strength: 1 to 9, Tone Quality (for Morse): 1 to 9 ). For example, "11" unreadable, barely perceptible. "33" difficult to read, weak signal. "45" readable, fairly good. "57" perfectly readable, moderately strong.*

**B-002-6-5 (3) What is the meaning of: "Your signal report is 5 9 plus 20 dB"?**

1. The bandwidth of your signal is 20 decibels above linearity

2. Repeat your transmission on a frequency 20 kHz higher

**3. A relative signal-strength meter reading is 20 decibels greater than strength 9**

4. Your signal strength has increased by a factor of 100

*> The 'S-meter' on a receiver provides a relative indication of received signal strength. S-meters are calibrated at the low end in S units, from S1 to S9. One S unit represents about 6 decibels ( four times the power ). Above a signal strength of*

*S9, readings are in decibels: 10 dB over S9, 20 dB over S9, 30 dB over S9, etc.*

**B-002-6-6 (3) What is used to measure relative signal strength in a receiver?**

1. An SSB meter

2. A signal deviation meter

**3. An S meter**

4. An RST meter

*> The 'S-meter' on a receiver provides a relative indication of received signal strength. S-meters are calibrated at the low end in S units, from S1 to S9. One S unit represents about 6 decibels ( four times the power ). Above a signal strength of S9, readings are in decibels: 10 dB over S9, 20 dB over S9, 30 dB over S9, etc.*

**B-002-6-7 (2) If the power output of a transmitter is increased by four times, how might a nearby receiver's S-meter reading change?**

1. Increase by approximately four S units

**2. Increase by approximately one S unit**

3. Decrease by approximately four S units

4. Decrease by approximately one S unit

*> The 'S-meter' on a receiver provides a relative indication of received signal strength. S-meters are calibrated at the low end in S units, from S1 to S9. One S unit represents about 6 decibels ( four times the power ). Above a signal strength of S9, readings are in decibels: 10 dB over S9, 20 dB over S9, 30 dB over S9, etc.*

**B-002-6-8 (3) By how many times must the power output of a transmitter be increased to raise the S-meter reading on a nearby receiver from S8 to S9?**

1. Approximately 5 times

2. Approximately 3 times

**3. Approximately 4 times**

4. Approximately 2 times

*> The 'S-meter' on a receiver provides a relative indication of received signal strength. S-meters are calibrated at the low end in S units, from S1 to S9. One S unit represents about 6 decibels ( four times the power ). Above a signal strength of*

*S9, readings are in decibels: 10 dB over S9, 20 dB over S9, 30 dB over S9, etc.*

**B-002-6-9 (1) What does "RST 579" mean in a Morse code contact?**

**1. Your signal is perfectly readable, moderately strong, and with perfect tone**

2. Your signal is perfectly readable, weak strength, and with perfect tone

3. Your signal is fairly readable, fair strength, and with perfect tone

4. Your signal is barely readable, moderately strong, and with faint ripple

*> "RST", A short way to describe signal reception ( Readability: 1 to 5, Signal Strength: 1 to 9, Tone Quality (for Morse): 1 to 9 ). For example, "11" unreadable, barely perceptible. "33" difficult to read, weak signal. "45" readable, fairly good. "57" perfectly readable, moderately strong.*

**B-002-6-10 (4) What does "RST 459" mean in a Morse code contact?**

1. Your signal is very readable, very strong, and with perfect tone

2. Your signal is barely readable, very weak, and with perfect tone

3. Your signal is moderately readable, very weak, and with hum on the tone

**4. Your signal is quite readable, fair strength, and with perfect tone**

*> "RST", A short way to describe signal reception ( Readability: 1 to 5, Signal Strength: 1 to 9, Tone Quality (for Morse): 1 to 9 ). For example, "11" unreadable, barely perceptible. "33" difficult to read, weak signal. "45" readable, fairly good. "57" perfectly readable, moderately strong.*

**B-002-6-11 (1) What is the meaning of "Your signal report is 1 1"?**

**1. Your signal is unreadable, and barely perceptible**

2. Your signal is 11 dB over S9

3. Your signal is first class in readability and first class in strength

4. Your signal is very readable and very strong

*> "RST", A short way to describe signal reception ( Readability: 1 to 5, Signal Strength: 1 to 9, Tone Quality (for Morse): 1 to 9 ). For example, "11" unreadable, barely perceptible. "33" difficult to read, weak signal. "45" readable, fairly good. "57" perfectly readable, moderately strong.*

**B-002-7-1 (4) What is the meaning of the Q signal "QRS"?**

1. Interference from static

2. Send "RST" report

3. Radio station location is:

**4. Send more slowly**

*> Nine Q codes:  QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-7-2 (3) What is one meaning of the Q signal "QTH"?**

1. Stop sending

2. My name is

**3. My location is**

4. Time here is

*> Nine Q codes:  QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-7-3 (1) What is the proper Q signal to use to see if a frequency is in use before transmitting on CW?**

**1. QRL?**

2. QRV?

3. QRU?

4. QRZ?

*> Nine Q codes:  QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-7-4 (3) What is one meaning of the Q signal "QSY"?**

1. Use more power

2. Send faster

**3. Change frequency**

4. Send more slowly

*> Nine Q codes:  QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-7-5 (2) What is the meaning of the Q signal "QSO"?**

1. A contact is ending

**2. A contact is in progress**

3. A conversation is desired

4. A contact is confirmed

*> Nine Q codes: QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-7-6 (1) What is the proper Q signal to use to ask if someone is calling you on CW?**

**1. QRZ?**

2. QSL?

3. QRL?

4. QRT?

*> Nine Q codes: QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-7-7 (4) The signal "QRM" signifies:**

1. I am troubled by static

2. your signals are fading

3. is my transmission being interfered with

**4. I am being interfered with**

*> Nine Q codes: QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-7-8 (4) The signal "QRN" means:**

1. I am busy

2. are you troubled by static

3. I am being interfered with

**4. I am troubled by static**

*> Nine Q codes:  QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-7-9 (2) The "Q signal" indicating that you want the other station to send slower is:**

1. QRM

**2. QRS**

3. QRL

4. QRN

*> Nine Q codes:  QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-7-10 (3) "Who is calling me" is denoted by the "Q signal":**

1. QRK?

2. QRP?

**3. QRZ?**

4. QRM?

*> Nine Q codes:  QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-7-11 (1) The "Q signal" which signifies "I will call you again" is:**

**1. QRX**

2. QRZ

3. QRS

4. QRT

*> Nine Q codes:  QRL? frequency in use?, QRM interference, QRN static, QRS send more slowly, QRX will call you, QRZ? who is calling, QSO contact in progress, QSY change frequency, QTH location.*

**B-002-8-1 (4) When may you use your amateur station to transmit an "SOS" or "MAYDAY"?**

1. Never

2. Only at specific times (at 15 and 30 minutes after the hour)

3. Only in case of a severe weather watch

**4. In a life-threatening distress situation**

*> SOS (Morse) and MAYDAY (voice) are internationally recognized distress signals. Used to request help in a life-threatening situation. False or deceptive distress signals are punishable by law.*

**B-002-8-2 (1) If you are in contact with another station and you hear an emergency call for help on your frequency, what should you do?**

**1. Immediately stop your contact and take the emergency call**

2. Tell the calling station that the frequency is in use

3. Direct the calling station to the nearest emergency net frequency

4. Call your local police station and inform them of the emergency call

*> Stations in distress are priority number one, someone's life is at risk. The order of priority is 1) Distress, 2) Emergency and 3) Safety. Acknowledge the station immediately and see how it can be helped. If you cannot provide help, monitor the frequency to ensure help is forthcoming.*

**B-002-8-3 (3) What is the proper distress call to use when operating phone?**

1. Say "SOS" several times

2. Say "EMERGENCY" several times

**3. Say "MAYDAY" several times**

4. Say "HELP" several times

*> SOS (Morse) and MAYDAY (voice) are internationally recognized distress signals. Used to request help in a life-threatening situation. False or deceptive distress signals are punishable by law.*

**B-002-8-4 (3) What is the proper distress call to use when operating CW?**

1. CQD

2. QRRR

**3. SOS**

4. MAYDAY

*> SOS (Morse) and MAYDAY (voice) are internationally recognized distress signals. Used to request help in a life-threatening situation. False or deceptive distress signals are punishable by law.*

**B-002-8-5 (3) What is the proper way to interrupt a repeater conversation to signal a distress call?**

1. Say "EMERGENCY" three times

2. Say "SOS," then your call sign

**3. Say "BREAK" twice, then your call sign**

4. Say "HELP" as many times as it takes to get someone to answer

*> "Break, Break" and your call sign OR your call sign with the words "emergency traffic" inserted during a pause. Repeaters are meant primarily to extend the range of portables and mobiles. You never know when someone else might need the repeater. Be sure to leave pauses in between transmissions. Anyone wanting the repeater may signal his presence by stating his call sign during one such pause.*

**B-002-8-6 (3) Why is it a good idea to have a way to operate your amateur station without using commercial AC power lines?**

1. So you will comply with rules

2. So you may operate in contests where AC power is not allowed

**3. So you may provide communications in an emergency**

4. So you may use your station while mobile

*> Amateurs have a long history of providing emergency communications during disasters. Charged batteries and rapidly-deployable antennas are useful station accessories.*

**B-002-8-7 (1) What is the most important accessory to have for a hand-held radio in an emergency?**

**1. Several sets of charged batteries**

2. An extra antenna

3. A portable amplifier

4. A microphone headset for hands-free operation

*> Amateurs have a long history of providing emergency communications during disasters. Charged batteries and rapidly-deployable antennas are useful station accessories.*

**B-002-8-8 (3) Which type of antenna would be a good choice as part of a portable HF amateur station that could be set up in case of an emergency?**

1. A parabolic dish

2. A three-element Yagi

**3. A dipole**

4. A three-element quad

*> Amateurs have a long history of providing emergency communications during disasters. Charged batteries and rapidly-deployable antennas are useful station accessories.*

**B-002-8-9 (4) If you are communicating with another amateur station and hear a station in distress break in, what should you do**?

1. Continue your communication because you were on frequency first

2. Change to a different frequency so the station in distress may have a clear channel to call for assistance

3. Immediately cease all transmissions because stations in distress have emergency rights to the frequency

**4. Acknowledge the station in distress and determine its location and what assistance may be needed**

*> Stations in distress are priority number one, someone's life is at risk. The order of priority is 1) Distress, 2) Emergency and 3) Safety. Acknowledge the station immediately and se how it can be helped. If you cannot provide help, monitor the frequency to ensure help is forthcoming*.

**B-002-8-10 (3) In order of priority, a distress message comes before:**

1. no other messages

2. a government priority message

**3. an urgency message**

4. a safety message

*> Stations in distress are priority number one, someone's life is at risk. The order of priority is 1) Distress, 2) Emergency and 3) Safety. Acknowledge the station immediately and se how it can be helped. If you cannot provide help, monitor the frequency to ensure help is forthcoming.*

**B-002-8-11 (1) If you hear distress traffic and are unable to render assistance you should:**

**1. maintain watch until you are certain that assistance will be forthcoming**

2. enter the details in the log book and take no further action

3. take no action

4. tell all other stations to cease transmitting

*> Stations in distress are priority number one, someone's life is at risk. The order of priority is 1) Distress, 2) Emergency and 3) Safety. Acknowledge the station immediately and se how it can be helped. If you cannot provide help, monitor the frequency to ensure help is forthcoming.*

**B-002-9-1 (2) What is a "QSL card"?**

1. A Notice of Violation from Industry Canada

**2. A written proof of communication between two amateurs**

3. A postcard reminding you when your station license will expire

4. A letter or postcard from an amateur pen pal

*> A 'QSL Card' is a postcard-sized confirmation of a radio contact.*

**B-002-9-2 (4) What is an azimuthal map?**

1. A map projection centered on the North Pole

2. A map that shows the angle at which an amateur satellite crosses the equator

3. A map that shows the number of degrees longitude that an amateur satellite appears to move westward at the equator

**4. A map projection centered on a particular location, used to determine the shortest path between points on the earth's surface**

*> An 'Azimuthal Map' centered on your location is convenient to determine beam headings (i.e., where to orient a directional antenna) for the shortest distance to a given point on Earth ( the 'Short Path' ). The 'Long Path' is precisely 180 degrees in the opposite direction ( sometimes propagation conditions provide a path around the globe to a particular location ).*

**B-002-9-3 (4) What is the most useful type of map to use when orienting a directional HF antenna toward a distant station?**

1. Mercator

2. Polar projection

3. Topographical

**4. Azimuthal**

*> An 'Azimuthal Map' centered on your location is convenient to determine beam headings (i.e., where to orient a directional antenna) for the shortest distance to a given point on Earth ( the 'Short Path' ). The 'Long Path' is precisely 180 degrees in the opposite direction ( sometimes propagation conditions provide a path around the globe to a particular location ).*

**B-002-9-4 (4) A directional antenna pointed in the long-path direction to another station is generally oriented how many degrees from its short-path heading?**

1. 45 degrees

2. 90 degrees

3. 270 degrees

**4. 180 degrees**

*> An 'Azimuthal Map' centered on your location is convenient to determine beam headings (i.e., where to orient a directional antenna) for the shortest distance to a given point on Earth ( the 'Short Path' ). The 'Long Path' is precisely 180 degrees in the opposite direction ( sometimes propagation conditions provide a path around the globe to a particular location ).*

**B-002-9-5 (1) What method is used by radio amateurs to provide written proof of communication between two amateur stations?**

**1. A signed post card listing contact date, time, frequency, mode and power, called a "QSL card"**

2. A two-page letter containing a photograph of the operator

3. A radiogram sent over the CW traffic net

4. A packet message

*> A 'QSL Card' is a postcard-sized confirmation of a radio contact.*

**B-002-9-6 (3) You hear other local stations talking to radio amateurs in New Zealand but you don't hear those stations with your beam aimed on the normal compass bearing to New Zealand. What should you try?**

1. Point your antenna toward Newington, CT

2. Point your antenna to the north

**3. Point your beam 180 degrees away from that bearing and listen for the stations arriving on the "long-path"**

4. Point your antenna to the south

*> An 'Azimuthal Map' centered on your location is convenient to determine beam headings (i.e., where to orient a directional antenna) for the shortest distance to a given point on Earth ( the 'Short Path' ). The 'Long Path' is precisely 180 degrees in the opposite direction ( sometimes propagation conditions provide a path around the globe to a particular location ).*

**B-002-9-7 (2) Which statement about recording all contacts and unanswered "CQ calls" in a station logbook or computer log IS NOT correct?**

1. A log is important for recording contacts for operating awards

**2. A logbook is required by Industry Canada**

3. A well-kept log preserves your fondest amateur radio memories for years

4. A log is important for handling neighbour interference complaints

*> key words: NOT CORRECT. A logbook is no longer a legal requirement.*

**B-002-9-8 (1) Why would it be useful to have an azimuthal world map centred on the location of your station?**

**1. Because it shows the compass bearing from your station to any place on earth, for antenna planning and pointing**

2. Because it looks impressive

3. Because it shows the angle at which an amateur satellite crosses the equator

4. Because it shows the number of degrees longitude that an amateur satellite moves west

*> An 'Azimuthal Map' centered on your location is convenient to determine beam headings (i.e., where to orient a directional antenna) for the shortest distance to a given point on Earth ( the 'Short Path' ). The 'Long Path' is precisely 180 degrees in the opposite direction ( sometimes propagation conditions provide a path around the globe to a particular location ).*

**B-002-9-9 (1) Station logs and confirmation (QSL) cards are always kept in UTC (Universal Time Coordinated). Where is that time based?**

**1. Greenwich, England**

2. Geneva, Switzerland

3. Ottawa, Canada

4. Newington, CT

*> "Coordinated Universal Time", the international time standard. "UTC" is not a true acronym; it is a variant of Universal Time, UT, and has a modifier C (for "coordinated") appended to it. Has replaced Greenwich Mean Time (GMT). Greenwich Mean Time (GMT) is mean solar time at the Royal Greenwich Observatory in Greenwich, England, which by convention is at 0 degrees geographic longitude.*

**B-002-9-10 (1) When referring to contacts in the station log, what do the letters UTC mean?**

**1. Universal Time Coordinated (formerly Greenwich Mean Time - GMT)**

2. Universal Time Constant

3. Unlisted Telephone Call

4. Unlimited Time Capsule

*> "Coordinated Universal Time", the international time standard. "UTC" is not a true acronym; it is a variant of Universal Time, UT, and has a modifier C (for "coordinated") appended to it. Has replaced Greenwich Mean Time (GMT). Greenwich Mean Time (GMT) is mean solar time at the Royal Greenwich Observatory in Greenwich, England, which by convention is at 0 degrees geographic longitude.*

**B-002-9-11 (3) To set your station clock accurately to UTC, you could receive the most accurate time off the air from _______ ?**

1. A non-directional beacon station

2. Your local television station

**3. CHU, WWV or WWVH**

4. Your local radio station

*> CHU [Ottawa, Ontario], WWV [Fort Collins, CO] and WWVH [Kauai, HI] are stations continually broadcasting highly accurate time information.*

# Establishing and Equipping a Station

**B-003-1-1 (1) A low pass filter in an HF station is most effective when connected:**

**1. as close as possible to the transceiver output**

2. as close as possible to the antenna tuner output

3. as close as possible to the antenna

4. midway between the transceiver and antenna

*> A 'Low-Pass' filter serves to reduce 'Harmonics' which can be generated in overdriven, improperly adjusted or malfunctioning AMPLIFIER stages, either the actual Power Amplifier in a transmitter or an external Linear Power Amplifier. Consequently, it should be inserted as close as possible to the transceiver or amplifier if one is used. The HF Station block diagram begins with: Transceiver, Linear Amplifier, Low-Pass Filter, SWR Bridge, Antenna Switch...*

**B-003-1-2 (4) A low pass filter in an HF station is most effective when connected:**

1. as close as possible to the antenna

2. as close as possible to the antenna tuner output

3. as close as possible to the linear amplifier input

**4. as close as possible to the linear amplifier output**

*> A 'Low-Pass' filter serves to reduce 'Harmonics' which can be generated in overdriven, improperly adjusted or malfunctioning AMPLIFIER stages, either the actual Power Amplifier in a transmitter or an external Linear Power Amplifier. Consequently, it should be inserted as close as possible to the transceiver or amplifier if one is used. The HF Station block diagram begins with: Transceiver, Linear Amplifier, Low-Pass Filter, SWR Bridge, Antenna Switch...*

**B-003-1-3 (2) In designing an HF station, which component would you use to reduce the effects of harmonic radiation?**

1. Dummy load

**2. Low pass filter**

3. Antenna switch

4. SWR bridge

*> A 'Low-Pass' filter serves to reduce 'Harmonics' which can be generated in overdriven, improperly adjusted or malfunctioning AMPLIFIER stages, either the actual Power Amplifier in a transmitter or an external Linear Power Amplifier.*

*Consequently, it should be inserted as close as possible to the transceiver or amplifier if one is used.  The HF Station block diagram begins with:  Transceiver, Linear Amplifier, Low-Pass Filter, SWR Bridge, Antenna Switch...*

**B-003-1-4 (1) Which component in an HF station is the most useful for determining the effectiveness of the antenna system?**

**1. SWR bridge**

2. Antenna switch

3. Linear amplifier

4. Dummy load

*> The 'SWR Bridge' permits measuring the relative impedance match between the antenna system and the transceiver (SWR = Standing Wave Ratio).  The HF Station block diagram begins with:  Transceiver, Linear Amplifier, Low-Pass Filter, SWR Bridge, Antenna Switch...*

**B-003-1-5 (3) Of the components in an HF station, which component would normally be connected closest to the antenna, antenna tuner and dummy load?**

1. Transceiver

2. Low pass filter

**3. Antenna switch**

4. SWR bridge

*> The 'Antenna Switch' provides a convenient way to select a direct connection to an antenna, a connection through the 'Antenna Tuner' to other antennas or to the 'Dummy Load'.  The HF Station block diagram begins with:  Transceiver, Linear Amplifier, Low-Pass Filter, SWR Bridge, Antenna Switch, ...*

**B-003-1-6 (1) Of the components in an HF station, which component would be used to match impedances between the transceiver and antenna?**

**1. Antenna tuner**

2. Antenna switch

3. Dummy load

4. SWR bridge

*> The 'Antenna Tuner' provides variable impedance transformation:  it can adapt the impedance of the antenna system (which changes with antenna dimensions and operating frequency) to the design impedance of the transceiver.  The 'Antenna*

*Tuner' permits using an antenna on a frequency or band other than the one for which it was designed.*

**B-003-1-7 (4) In an HF station, which component is temporarily connected in the tuning process?**

1. SWR bridge

2. Low pass filter

3. Antenna tuner

**4. Dummy load**

*> The 'Dummy Load' (a resistor with a high power rating) dissipates RF energy as heat without radiating the RF on the air.  Permits tests or adjustments without causing interference to other stations. The 'tuning process' refers to a manual procedure necessary for equipment with vacuum tube final Power Amplifiers where variable capacitors needed to be adjusted with each frequency change.*

**B-003-1-8 (1) In an HF station, the antenna tuner is usually used for matching the transceiver with:**

**1. most antennas when operating below 14 MHz**

2. most antennas when operating above 14 MHz

3. mono-band Yagi type antennas

4. tri-band Yagi antennas

*> For example, on 160m band (1.8 MHz to 2.0 MHz), the band EDGES are 5% removed from the centre frequency of 1.9 MHz.  On 80m (3.5 MHz to 4.0 MHz), the edges are nearly 7% removed from the centre frequency of 3.75 MHz.  On 20m (14.0 MHz to 14.35 MHz), the edges are only 1.2% removed from the centre frequency of 14.175 MHz.  Antennas present an acceptable standing wave ratio over a limited range of frequencies, the Antenna Tuner circumvents that limitation.*

**B-003-1-9 (4) In an HF Station, the antenna tuner is commonly used:**

1. with most antennas when operating above 14 MHz

2. to tune into dummy loads

3. to tune low pass filters

**4. with most antennas when operating below 14 MHz**

*> For example, on 160m band (1.8 MHz to 2.0 MHz), the band EDGES are 5% removed from the centre frequency of 1.9 MHz.  On 80m (3.5 MHz to 4.0 MHz), the edges are nearly 7% removed from the centre frequency of 3.75 MHz.  On 20m (14.0 MHz to 14.35 MHz), the edges are only 1.2% removed from the centre*

*frequency of 14.175 MHz.  Antennas present an acceptable standing wave ratio over a limited range of frequencies, the Antenna Tuner circumvents that limitation.*

**B-003-7-1 (4) In a digital system, the ____________________is controlled by the computer.**

1. antenna

2. power supply

3. transceiver

**4. input/output**

*> The Digital Station block diagram:  Input/Output, Computer, MODEM, Transceiver, Antenna*.

**B-003-7-2 (2) In a digital system, the modem is connected to the _________.**

1. amplifier

**2. computer**

3. antenna

4. input/output

*> The Digital Station block diagram:  Input/Output, Computer, MODEM, Transceiver, Antenna.*

**B-003-7-3 (1) In a digital system, the transceiver is connected to the ____________.**

**1. modem**

2. computer

3. scanner

4. input/output

*> The Digital Station block diagram:  Input/Output, Computer, MODEM, Transceiver, Antenna.*

**B-003-7-4 (2) In a digital system, the modem is connected to the ____________.**

1. input/output

**2. transceiver**

3. scanner

4. antenna

*> The Digital Station block diagram:  Input/Output, Computer, MODEM, Transceiver, Antenna.*

**B-003-14-1 (1) What do many amateurs use to help form good Morse code characters?**

**1. An electronic keyer**

2. A key-operated on/off switch

3. A notch filter

4. A DTMF keypad

*> A 'Keyer' is an electronic circuit to which connects a 'Paddle'.  The 'Keyer' issues dots and dashes in response to contact closures on the 'Paddle' by the operator. Dots and dashes are uniformly timed and spaced.  The 'Paddle' relies on a side to side motion of the hand;  it does not lead to fatigue as the traditional hand key does after a while.*

**B-003-14-2 (1) Where would you connect a microphone for voice operation?**

**1. To a transceiver**

2. To a power supply

3. To an antenna switch

4. To an antenna

*> Remember your transmitter block diagrams:  the Microphone connects to the Speech Amplifier, the first stage in a voice transmitter.*

**B-003-14-3 (3) What would you connect to a transceiver for voice operation?**

1. A receiver audio filter

2. A terminal-voice controller

**3. A microphone**

4. A splatter filter

*> Remember your transmitter block diagrams:  the Microphone connects to the Speech Amplifier, the first stage in a voice transmitter.*

**B-003-14-4 (3) Why might a dummy antenna get warm when in use?**

1. Because it absorbs static electricity

2. Because it stores radio waves

**3. Because it changes RF energy into heat**

4. Because it stores electric current

*> The 'Dummy Load' (a resistor with a high power rating) dissipates RF energy as heat without radiating the RF on the air. Permits tests or adjustments without causing interference to other stations. The 'tuning process' (or 'loading') refers to a manual procedure necessary for equipment with vacuum tube final Power Amplifiers where variable capacitors needed to be adjusted.*

**B-003-14-5 (4) What is the circuit called which causes a transmitter to automatically transmit when an operator speaks into its microphone?**

1. VXO

2. VCO

3. VFO

**4. VOX**

*> VOX = "Voice Operated Transmit". VFO = "Variable Frequency Oscillator". [ the other two are beyond the scope of a Basic license. ]*

**B-003-14-6 (1) What is the reason for using a properly adjusted speech processor with a single-sideband phone transmitter?**

**1. It improves signal intelligibility at the receiver**

2. It reduces average transmitter power requirements

3. It reduces unwanted noise pickup from the microphone

4. It improves voice frequency fidelity

*> The 'Speech Processor' makes for more average power being packed in the transmitted sideband. 'Speech processing' is raising the average amplitude of the audio input from the microphone closer to an acceptable peak value: i.e., make every passage of the spoken words equally loud. THE AVERAGE can be increased but not the PEAK. Too much speech processing leads to distortion and possibly driving the Linear Power Amplifier with too large a signal (overdriving).*

**B-003-14-7 (1) If a single-sideband phone transmitter is 100% modulated, what will a speech processor do to the transmitter's power?**

**1. It will add nothing to the output PEP**

2. It will increase the output PEP

3. It will decrease the peak power output

4. It will decrease the average power output

*> The 'Speech Processor' makes for more average power being packed in the transmitted sideband. 'Speech processing' is raising the average amplitude of the audio input from the microphone closer to an acceptable peak value: i.e., make every passage of the spoken words equally loud. THE AVERAGE can be increased but not the PEAK. Too much speech processing leads to distortion and possibly driving the Linear Power Amplifier with too large a signal (overdriving).*

**B-003-14-8 (1) When switching from receive to transmit:**

**1. the receiver should be muted**

2. the transmit oscillator should be turned off

3. the receiving antenna should be connected

4. the power supply should be off

*> Switching from receive to transmit supposes FOUR actions: disconnect the antenna from the receiver, connect the antenna to the transmitter, silence the receiver and activate the Power Amplifier in the transmitter. A 'Relay' (a multiple-contact electrically-driven switch) frequently performs the antenna changeover an the enabling/disabling of the transceiver sections.*

**B-003-14-9 (2) A switching system to enable the use of one antenna for a transmitter and receiver should also:**

1. ground the antenna on receive

**2. disable the unit not being used**

3. switch between meters

4. disconnect the antenna tuner

*> Switching from receive to transmit supposes FOUR actions: disconnect the antenna from the receiver, connect the antenna to the transmitter, silence the receiver and activate the Power Amplifier in the transmitter. A 'Relay' (a multiple-contact electrically-driven switch) frequently performs the antenna changeover an the enabling/disabling of the transceiver sections.*

**B-003-14-10 (1) An antenna changeover switch in a transmitter-receiver combination is necessary:**

**1. so that one antenna can be used for transmitter and receiver**

2. to change antennas for operation on other frequencies

3. to prevent RF currents entering the receiver circuits

4. to allow more than one transmitter to be used

*> Switching from receive to transmit supposes FOUR actions: disconnect the antenna from the receiver, connect the antenna to the transmitter, silence the receiver and activate the Power Amplifier in the transmitter. A 'Relay' (a multiple-contact electrically-driven switch) frequently performs the antenna changeover an the enabling/disabling of the transceiver sections.*

**B-003-14-11 (3) Which of the following components could be used as a dynamic microphone?**

1. crystal earpiece

2. resistor

**3. loudspeaker**

4. capacitor

*> A 'Dynamic Microphone' is built around a membrane, a voice coil and a magnet: sound waves cause the membrane to vibrate, the voice coil, attached to the membrane, moves in and out of a magnetic field thus producing a tiny electrical signal corresponding to the voice. Loudspeaker employ the reverse principle: an audio signal applied to the voice coil moves the membrane to reproduce sound waves.*

**B-006-6-1 (1) What device might allow use of an antenna on a band it was not designed for?**

**1. An antenna tuner**

2. An SWR meter

3. A low pass filter

4. A high pass filter

*> The 'Antenna Tuner' permits using an antenna on a frequency or band other than the one for which it was designed. The 'SWR Meter' measures antenna system efficiency. The 'Low-Pass Filter' reduces 'Harmonic Radiation'. The 'High-Pass Filter' protects TV receivers from being overloaded by HF transmissions*.

**B-006-6-2 (1) What does an antenna matching unit do?**

**1. It matches a transceiver to a mismatched antenna system**

2. It helps a receiver automatically tune in stations that are far away

3. It switches an antenna system to a transmitter when sending, and to a receiver when listening

4. It switches a transceiver between different kinds of antennas connected to one feed line

*> The 'Antenna Tuner' provides variable impedance transformation:  it can adapt the impedance of a the antenna system (which changes with antenna dimensions and operating frequency) to the design impedance of the transceiver.  The 'Antenna Tuner' permits using an antenna on a frequency or band other than the one for which it was designed.*

# Modulation and Transmitters

**B-003-2-1 (1) In a frequency modulation transmitter, the input to the speech amplifier is connected to the:**

**1. microphone**

2. modulator

3. power amplifier

4. frequency multiplier

*> key words: INPUT to SPEECH AMPLIFIER. The Speech Amplifier serves to bring up the feeble microphone signal to a working level. The FM Transmitter block diagram: Microphone, Speech Amplifier, Modulator, Oscillator, Frequency Multiplier, Power Amplifier, Antenna.*

**B-003-2-2 (3) In a frequency modulation transmitter, the microphone is connected to the:**

1. modulator

2. power amplifier

**3. speech amplifier**

4. oscillator

*> The Speech Amplifier serves to bring up the feeble microphone signal to a working level. The FM Transmitter block diagram: Microphone, Speech Amplifier, Modulator, Oscillator, Frequency Multiplier, Power Amplifier, Antenna.*

**B-003-2-3 (1) In a frequency modulation transmitter, the ________is in between the speech amplifier and the oscillator**.

**1. modulator**

2. power amplifier

3. microphone

4. frequency multiplier

*> key words: FM TANSMITTER. Frequency Modulation depends on frequency deviation to carry the message. The obvious way to effect deviation is to use modulation to alter the Oscillator frequency. The FM Transmitter block diagram: Microphone, Speech Amplifier, Modulator, Oscillator, Frequency Multiplier, Power Amplifier, Antenna.*

**B-003-2-4 (2) In a frequency modulation transmitter, the __________ is located between the modulator and the frequency multiplier.**

1. speech amplifier

**2. oscillator**

3. power amplifier

4. microphone

*> The Oscillator frequency and the deviation impressed on it by the Modulator are brought up to the operating frequency through multiplication. The FM Transmitter block diagram: Microphone, Speech Amplifier, Modulator, Oscillator, Frequency Multiplier, Power Amplifier, Antenna*.

**B-003-2-5 (1) In a frequency modulation transmitter, the __________ is located between the oscillator and the power amplifier.**

**1. frequency multiplier**

2. microphone

3. speech amplifier

4. modulator

*> The Oscillator frequency and the deviation impressed on it by the Modulator are brought up to the operating frequency through multiplication. The FM Transmitter block diagram: Microphone, Speech Amplifier, Modulator, Oscillator, Frequency Multiplier, Power Amplifier, Antenna*.

**B-003-2-6 (2) In a frequency modulation transmitter, the __________ is located between the frequency multiplier and the antenna.**

1. modulator

**2. power amplifier**

3. speech amplifier

4. oscillator

*> In all transmitters, the last stage before the Antenna is a Power Amplifier which imparts the transmitted signal its actual power. The FM Transmitter block diagram: Microphone, Speech Amplifier, Modulator, Oscillator, Frequency Multiplier, Power Amplifier, Antenna.*

**B-003-2-7 (3) In a frequency modulation transmitter, the power amplifier output is connected to the:**

1. frequency multiplier

2. microphone

**3. antenna**

4. modulator

*> In all transmitters, the last stage before the Antenna is a Power Amplifier which imparts the transmitted signal its actual power.  The FM Transmitter block diagram: Microphone, Speech Amplifier, Modulator, Oscillator, Frequency Multiplier, Power Amplifier, Antenna.*

**B-003-4-1 (3) In a CW transmitter, the output from the ___________ is connected to the driver/buffer.**

1. power amplifier

2. telegraph key

**3. master oscillator**

4. power supply

*> To achieve stability (absence of frequency 'drift'), Master Oscillators are always low-power stages.  Amplification must follow;  that's the purpose of the Driver/Buffer.  The CW Transmitter block diagram:  Master Oscillator, Driver/Buffer, Power Amplifier, Antenna.  A Power Supply supplies DC to all stages.  A Telegraph Key activates the Driver and Power Amplifier when pressed.*

**B-003-4-2 (2) In a typical CW transmitter, the ____________ is the primary source of direct current.**

1. driver/buffer

**2. power supply**

3. power amplifier

4. master oscillator

*> ALL transmitters require a Power Supply, the primary source of Direct Current (DC), required by active devices such as transistors and vacuum tubes.  The CW Transmitter block diagram:  Master Oscillator, Driver/Buffer, Power Amplifier, Antenna.  A Power Supply supplies DC to all stages.  A Telegraph Key activates the Driver and Power Amplifier when pressed.*

**B-003-4-3 (2) In a CW transmitter, the__________ is between the master oscillator and the power amplifier.**

1. audio amplifier

**2. driver/buffer**

3. power supply

4. telegraph key

*> To achieve stability, Master Oscillators are always low-level stages.  Amplification must follow;  that's the purpose of the Driver/Buffer.  The CW Transmitter block diagram:  Master Oscillator, Driver/Buffer, Power Amplifier, Antenna.  A Power Supply supplies DC to all stages.  A Telegraph Key activates the Driver and Power Amplifier when pressed.*

**B-003-4-4 (3) In a CW transmitter, the______________ controls when RF energy is applied to the antenna.**

1. master oscillator

2. driver/buffer

**3. telegraph key**

4. power amplifier

*> Telegraphy is equivalent to 'on-off keying' ( an 'interrupted carrier').  The Telegraph Key allows the operator to send bursts of RF energy to the antenna per the rhythm of his hand movement on the key.  The CW Transmitter block diagram: Master Oscillator, Driver/Buffer, Power Amplifier, Antenna.  A Power Supply supplies DC to all stages.  A Telegraph Key activates the Driver and Power Amplifier when pressed.*

**B-003-4-5 (2) In a CW transmitter, the _______________ is in between the driver/buffer stage and the antenna.**

1. power supply

**2. power amplifier**

3. telegraph key

4. master oscillator

*> In all transmitters, the last stage before the Antenna is a Power Amplifier which imparts the transmitted signal its actual power.  The CW Transmitter block diagram: Master Oscillator, Driver/Buffer, Power Amplifier, Antenna.  A Power Supply supplies DC to all stages.  A Telegraph Key activates the Driver and Power Amplifier when pressed.*

**B-003-4-6 (1) In a CW transmitter, the output of the ______________ is transferred to the antenna.**

**1. power amplifier**

2. driver/buffer

3. power supply

4. master oscillator

*> In all transmitters, the last stage before the Antenna is a Power Amplifier which imparts the transmitted signal its actual power. The CW Transmitter block diagram: Master Oscillator, Driver/Buffer, Power Amplifier, Antenna. A Power Supply supplies DC to all stages. A Telegraph Key activates the Driver and Power Amplifier when pressed.*

**B-003-6-1 (1) In a single sideband transmitter, the output of the ________ is connected to the balanced modulator.**

**1. radio frequency oscillator**

2. variable frequency oscillator

3. linear amplifier

4. mixer

*> The Balanced Modulator receives two inputs: RF Oscillator, Speech Amplifier. The SSB Transmitter block diagram: The Balanced Modulator takes in two signals: fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier. Out of the Balanced Modulator, a Filter selects the desired sideband. This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer. Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power Amplifier.*

**B-003-6-2 (2) In a single sideband transmitter, the output of the _____________ is connected to the filter.**

1. microphone

**2. balanced modulator**

3. mixer

4. radio frequency oscillator

*> The Balanced Modulator produces a double-sideband suppressed-carrier signal. The Filter keeps one sideband. The SSB Transmitter block diagram: The Balanced Modulator takes in two signals: fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier. Out of the Balanced Modulator, a Filter selects the desired sideband. This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer. Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power*

*Amplifier.*

**B-003-6-3 (3) In a single sideband transmitter, the ______________ is in between the balanced modulator and the mixer.**

1. radio frequency oscillator

2. speech amplifier

**3. filter**

4. microphone

*> The Balanced Modulator produces a double-sideband suppressed-carrier signal. The Filter keeps one sideband. The SSB Transmitter block diagram: The Balanced Modulator takes in two signals: fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier. Out of the Balanced Modulator, a Filter selects the desired sideband. This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer. Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power Amplifier.*

**B-003-6-4 (4) In a single sideband transmitter, the _______________ is connected to the speech amplifier.**

1. radio frequency oscillator

2. filter

3. mixer

**4. microphone**

*> The Speech Amplifier serves to bring up the feeble microphone signal to a working level. The SSB Transmitter block diagram: The Balanced Modulator takes in two signals: fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier. Out of the Balanced Modulator, a Filter selects the desired sideband. This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer. Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power Amplifier.*

**B-003-6-5 (3) In a single sideband transmitter, the output of the ____________ is connected to the balanced modulator**.

1. filter

2. variable frequency oscillator

**3. speech amplifier**

4. linear amplifier

*> The Balanced Modulator receives two inputs: RF Oscillator, Speech Amplifier. The SSB Transmitter block diagram: The Balanced Modulator takes in two signals: fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier. Out of the Balanced Modulator, a Filter selects the desired sideband. This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer. Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power Amplifier.*

**B-003-6-6 (4) In a single sideband transmitter, the output of the variable frequency oscillator is connected to the __________.**

1. antenna

2. balanced modulator

3. linear amplifier

**4. mixer**

*> The Mixer takes in the SSB signal and the VFO output to bring up the SSB signal at the operating frequency. The SSB Transmitter block diagram: The Balanced Modulator takes in two signals: fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier. Out of the Balanced Modulator, a Filter selects the desired sideband. This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer. Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power Amplifier.*

**B-003-6-7 (1) In a single sideband transmitter, the output of the _________ is connected to the mixer.**

**1. variable frequency oscillator**

2. radio frequency oscillator

3. linear amplifier

4. antenna

*> The Mixer takes in the SSB signal and the VFO output to bring up the SSB signal at the operating frequency. The SSB Transmitter block diagram: The Balanced Modulator takes in two signals: fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier. Out of the Balanced Modulator, a Filter selects the desired sideband. This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer. Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power Amplifier.*

**B-003-6-8 (2) In an single sideband transmitter, the ____________ is in between the mixer and the antenna.**

1. variable frequency oscillator

**2. linear amplifier**

3. balanced modulator

4. radio frequency oscillator

*> In SSB, the Power Amplifier must be linear because it amplifies an amplitude modulated signal.  The SSB Transmitter block diagram:  The Balanced Modulator takes in two signals:  fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier.  Out of the Balanced Modulator, a Filter selects the desired sideband.  This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer.  Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power Amplifier.*

**B-003-6-9 (1) In a single sideband transmitter, the output of the linear amplifier is connected to the ______________.**

**1. antenna**

2. filter

3. variable frequency oscillator

4. speech amplifier

*> In SSB, the Power Amplifier must be linear because it amplifies an amplitude modulated signal.  The SSB Transmitter block diagram:  The Balanced Modulator takes in two signals:  fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier.  Out of the Balanced Modulator, a Filter selects the desired sideband.  This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer.  Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power Amplifier.*

**B-003-11-1 (2) What does chirp mean?**

1. A high-pitched tone which is received along with a CW signal

**2. A small change in a transmitter's frequency each time it is keyed**

3. A slow change in transmitter frequency as the circuit warms up

4. An overload in a receiver's audio circuit whenever CW is received

*> "Chirp":  Inadequate voltage regulation causes the Master Oscillator frequency to shift when the Telegraph Key is pressed.  Perceived at the receive location as a*

*change of pitch during each Morse element.  "3" is frequency 'drift', a lack of stability in the Master Oscillator.*

**B-003-11-2 (2) What can be done to keep a CW transmitter from chirping?**

1. Add a key-click filter

**2. Keep the power supply voltages very steady**

3. Keep the power supply current very steady

4. Add a low pass filter

*> "Chirp":  Inadequate voltage regulation causes the Master Oscillator frequency to shift when the Telegraph Key is pressed.  Perceived at the receive location as a change of pitch during each Morse element.  "3" Current varies as demand varies in a transmitter.  "4" Low-Pass filter reduces 'harmonics'.*

**B-003-11-3 (2) What circuit has a variable-frequency oscillator connected to a driver and a power amplifier?**

1. A crystal-controlled transmitter

**2. A VFO-controlled transmitter**

3. A single-sideband transmitter

4. A packet-radio transmitter

*> key words:  VFO, Variable Frequency Oscillator.  The CW Transmitter block diagram:  Master Oscillator, Driver/Buffer, Power Amplifier, Antenna.*

**B-003-11-4 (2) What type of modulation system changes the amplitude of an RF wave for the purpose of conveying information?**

1. Phase modulation

**2. Amplitude modulation**

3. Amplitude-rectification modulation

4. Frequency modulation

*> key word:  AMPLITUDE.  The instantaneous voltage of an AC waveform.  AM (Amplitude Modulation) impresses the message onto the RF carrier by varying its amplitude.*

**B-003-11-5 (3) In what emission type does the instantaneous amplitude (envelope) of the RF signal vary in accordance with the modulating audio?**

1. Frequency modulation

2. Pulse modulation

**3. Amplitude modulation**

4. Frequency shift keying

*> key word: AMPLITUDE. The instantaneous voltage of an AC waveform. AM (Amplitude Modulation) impresses the message onto the RF carrier by varying its amplitude.*

**B-003-11-6 (3) Morse code is usually transmitted by radio as:**

1. a series of key-clicks

2. a continuous carrier

**3. an interrupted carrier**

4. a voice-modulated carrier

*> Telegraphy is equivalent to 'on-off keying' (an 'interrupted carrier'). The Telegraph Key allows the operator to send bursts of RF energy to the antenna per the rhythm of his hand movement on the key. "1" Key-Clicks is a type of interference where a CW signal generates unwanted sidebands.*

**B-003-11-7 (3) A mismatched antenna or feedline may present an incorrect load to the transmitter. The result may be:**

1. loss of modulation in the transmitted signal

2. the driver stage will not deliver power to the final

**3. excessive heat produced in the final transmitter stage**

4. the output tank circuit breaks down

*> The 'Final' = the Power Amplifier. A serious impedance mismatch in the antenna system forces the Power Amplifier to operate in a load for which it was not designed. A significant mismatch causes high SWR (Standing Wave Ratio) which lead to voltage and current peaks which could damage the Power Amplifier.*

**B-003-11-8 (3) One result of a slight mismatch between the power amplifier of a transmitter and the antenna would be:**

1. smaller DC current drain

2. lower modulation percentage

**3. reduced antenna radiation**

4. radiated key-clicks

*> Impedance Match: maximum power transfer occurs when the impedance of the load matches the internal impedance of the source. A "slight mismatch" leads to reduced power being delivered to the antenna.*

**B-003-11-9 (3) An RF oscillator should be electrically and mechanically stable. This is to ensure that the oscillator does not:**

1. become over modulated

2. generate key-clicks

**3. drift in frequency**

4. cause undue distortion

*> key word: STABLE. Absence of frequency "drift". A good oscillator remains on frequency despite mechanical vibrations, voltage or temperature variations.*

**B-003-11-10 (1) The input power to the final stage of your transmitter is 200 watts and the output is 125 watts. What has happened to the remaining power?**

**1. It has been dissipated as heat loss**

2. It has been used to provide greater efficiency

3. It has been used to provide negative feedback

4. It has been used to provide positive feedback

*> Power Amplifiers have a certain 'efficiency', the ratio of DC power required to obtain an RF output. The difference goes up in heat. This is the reason for the 'heat sinks' on the back of transmitters.*

**B-003-11-11 (2) The difference between DC input power and RF output power of a transmitter RF amplifier:**

1. is lost in the feed line

**2. appears as heat dissipation**

3. is due to oscillating

4. radiates from the antenna

*> Power Amplifiers have a certain 'efficiency', the ratio of DC power required to obtain an RF output. The difference goes up in heat. This is the reason for the 'heat sinks' on the back of transmitters.*

**B-003-12-1 (3) What may happen if an SSB transmitter is operated with the microphone gain set too high?**

1. It may cause interference to other stations operating on a higher frequency band

2. It may cause atmospheric interference in the air around the antenna

**3. It may cause splatter interference to other stations operating near its frequency**

4. It may cause digital interference to computer equipment

*> key words: MICROPHONE GAIN SET TOO HIGH. This leads to 'overmodulation' evidenced by distorted speech plus using excessive bandwidth on the air (splatter) which interferes with stations using adjacent frequencies ('out-of-channel emissions').*

**B-003-12-2 (4) What may happen if an SSB transmitter is operated with too much speech processing?**

1. It may cause digital interference to computer equipment

2. It may cause atmospheric interference in the air around the antenna

3. It may cause interference to other stations operating on a higher frequency band

**4. It may cause splatter interference to other stations operating near its frequency**

*> key words: TOO MUCH SPEECH PROCESSING. 'Speech processing' is raising the average amplitude of the audio input from the microphone closer to an acceptable peak value: i.e., make every passage of the spoken words equally loud. Too much speech processing leads to distortion and possibly driving the Linear Power Amplifier with too large a signal (overdriving). This leads to 'overmodulation' evidenced by distorted speech plus occupying excessive bandwidth on the air (splatter) which interferes with stations using adjacent frequencies ('out-of-channel emissions').*

**B-003-12-3 (2) What is the term for the average power supplied to an antenna transmission line during one RF cycle, at the crest of the modulation envelope?**

1. Peak output power

**2. Peak envelope power**

3. Average radio-frequency power

4. Peak transmitter power

*> key word:  ENVELOPE.  PEP -- Peak Envelope Power ( a specification for SSB transmitter ):  the average power at the output of a transmitter during one cycle at a modulation peak.*

**B-003-12-4 (4) What is the usual bandwidth of a single-sideband amateur signal?**

1. 1 kHz

2. 2 kHz

3. Between 3 and 6 kHz

**4. Between 2 and 3 kHz**

*> By transposing the voice signal into the radio spectrum, the SSB transmitter manages to only use the approximate bandwidth of the original modulation ( speech frequencies important to communications span 300 Hertz to 3000 Hertz, a bandwidth of 2700 Hertz ).  SSB uses half the bandwidth of AM.*

**B-003-12-5 (2) In a typical single-sideband phone transmitter, what circuit processes signals from the balanced modulator and sends signals to the mixer?**

1. IF amplifier

**2. Filter**

3. RF amplifier

4. Carrier oscillator

*> The Balanced Modulator produces a double-sideband suppressed-carrier signal. The Filter keeps one sideband.  The SSB Transmitter block diagram:  The Balanced Modulator takes in two signals:  fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier.  Out of the Balanced Modulator, a Filter selects the desired sideband.  This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer.  Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power Amplifier.*

**B-003-12-6 (1) What is one advantage of carrier suppression in a double-sideband phone transmission?**

**1. More power can be put into the sidebands**

2. Only half the bandwidth is required for the same information content

3. Greater modulation percentage is obtainable with lower distortion

4. Simpler equipment can be used to receive a double-sideband suppressed-carrier signal

*> Plain AM (Amplitude Modulation) produces a radio Carrier, an upper sideband and a lower sideband. The sidebands are the ever-changing sum and differences of the modulating frequency (follows voice) and the carrier frequency (set at the operating frequency). The carrier by itself does NOT convey information. The message is in the sidebands. Suppressing the carrier permits using the full capacity of the Power Amplifier for the sidebands. Note: Suppressing the carrier an one sideband yields Single Sideband.*

**B-003-12-7 (4) What happens to the signal of an overmodulated single-sideband or double-sideband phone transmitter?**

1. It becomes louder with no other effects

2. It occupies less bandwidth with poor high-frequency response

3. It has higher fidelity and improved signal-to-noise ratio

**4. It becomes distorted and occupies more bandwidth**

*> key word: OVERMODULATED. 'Overmodulation' results in distorted speech plus using excessive bandwidth on the air (splatter) and interfering with stations using adjacent frequencies ('out-of-channel emissions').*

**B-003-12-8 (1) How should the microphone gain control be adjusted on a single-sideband phone transmitter?**

**1. For slight movement of the ALC meter on modulation peaks**

2. For full deflection of the ALC meter on modulation peaks

3. For 100% frequency deviation on modulation peaks

4. For a dip in plate current

*> ALC -- Automatic Level Control. A feedback circuit from the Linear Power Amplifier to an earlier amplifier stage which seeks to avoid overdriving the transmitter with too much audio. When the ALC acts, it is a corrective action. An infrequent ALC action on modulation peaks indicates that there is no overdriving. If the ALC needed to intervene constantly, this would indicate that the operator is trying to feed too much audio through the transmitter.*

**B-003-12-9 (4) The purpose of a balanced modulator in an SSB transmitter is to:**

1. make sure that the carrier and both sidebands are 180 degrees out of phase

2. ensure that the percentage of modulation is kept constant

3. make sure that the carrier and both sidebands are in phase

**4. suppress the carrier and pass on the two sidebands**

*> The Balanced Modulator produces a double-sideband suppressed-carrier signal. The Filter keeps one sideband. The SSB Transmitter block diagram: The Balanced Modulator takes in two signals: fixed frequency from an RF Oscillator and the microphone signal after it has passed through a Speech Amplifier. Out of the Balanced Modulator, a Filter selects the desired sideband. This SSB signal is mixed with a Variable Frequency Oscillator (VFO) signal by a Mixer. Out of the Mixer, the SSB signal is now at the operating frequency and is taken through a LINEAR Power Amplifier.*

**B-003-12-10 (2) In a SSB transmission, the carrier is:**

1. transmitted with one sideband

**2. reinserted at the receiver**

3. inserted at the transmitter

4. of no use at the receiver

*> In Amplitude Modulation, the position, along the radio spectrum, of a 'side frequency' within a sideband is the sum (or difference) of the modulating frequency and carrier frequency. The statement is also true with Single Sideband (SSB) where the carrier has been suppressed: the position of a 'side frequency' only has meaning in relation with the position of the phantom carrier. Suitable demodulation at the receiving end supposes that the "carrier is re-inserted" so that each side frequency (a great number of which form a sideband) can be rendered as an exact audio frequency.*

**B-003-12-11 (2) The automatic level control (ALC) in a SSB transmitter :**

1. eliminates the transmitter distortion

**2. controls the peak audio input so that the final amplifier is not overdriven**

3. increases the occupied bandwidth

4. reduces the system noise

*> ALC -- Automatic Level Control. A feedback circuit from the Linear Power Amplifier to an earlier amplifier stage which seeks to avoid overdriving the transmitter with too much audio. When the ALC acts, it is a corrective action. An infrequent ALC action on modulation peaks indicates that there is no overdriving. If the ALC needed to intervene constantly, this would indicate that the operator is trying to feed too much audio through the transmitter.*

**B-003-13-1 (4) What may happen if an FM transmitter is operated with the microphone gain or deviation control set too high?**

1. It may cause digital interference to computer equipment

2. It may cause atmospheric interference in the air around the antenna

3. It may cause interference to other stations operating on a higher frequency band

**4. It may cause interference to other stations operating near its frequency**

*> key words:  MICROPHONE GAIN, DEVIATION TOO HIGH.  'Overdeviation (FM)' or 'Overmodulation (AM,SSB)' results in distorted speech plus using excessive bandwidth on the air (splatter) and interfering with stations using adjacent frequencies ('out-of-channel emissions').*

**B-003-13-2 (1) What may your FM hand-held or mobile transceiver do if you shout into its microphone?**

**1. It may cause interference to other stations operating near its frequency**

2. It may cause digital interference to computer equipment

3. It may cause atmospheric interference in the air around the antenna

4. It may cause interference to other stations operating on a higher frequency band

*> key word:  SHOUT.  'Overdeviation (FM)' or 'Overmodulation (AM,SSB)' results in distorted speech plus using excessive bandwidth on the air (splatter) and interfering with stations using adjacent frequencies ('out-of-channel emissions').*

**B-003-13-3 (4) What can you do if you are told your FM hand-held or mobile transceiver is overdeviating?**

1. Talk louder into the microphone

2. Let the transceiver cool off

3. Change to a higher power level

**4. Talk farther away from the microphone**

*> key word:  OVERDEVIATION.    'Overdeviation (FM)' or 'Overmodulation (AM,SSB)' results in distorted speech plus using excessive bandwidth on the air (splatter) and interfering with stations using adjacent frequencies ('out-of-channel emissions').*

**B-003-13-4 (3) What kind of emission would your FM transmitter produce if its microphone failed to work?**

1. A frequency-modulated carrier

2. An amplitude-modulated carrier

**3. An unmodulated carrier**

4. A phase-modulated carrier

*> The concept here is that IF NO AUDIO is fed in an FM transmitter, the carrier put out at the Power Amplifier has full amplitude anyway. A carrier which conveys no message is an 'unmodulated carrier'.*

**B-003-13-5 (1) Why is FM voice best for local VHF/UHF radio communications?**

**1. It has high-fidelity audio which can be understood even when the signal is somewhat weak**

2. The carrier is not detectable

3. It is more resistant to distortion caused by reflected signals

4. Its RF carrier stays on frequency better than the AM modes

*> FM -- Frequency Modulation. Long recognized for fidelity and absence of noise. However, this comes at a the price of more transmitter bandwidth, 10 to 20 kilohertz in usual amateur communications.*

**B-003-13-6 (1) What is the usual bandwidth of a frequency-modulated amateur signal?**

**1. Between 10 and 20 kHz**

2. Less than 5 kHz

3. Between 5 and 10 kHz

4. Greater than 20 kHz

*> In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.*

**B-003-13-7 (1) What is the result of overdeviation in an FM transmitter?**

**1. Out-of-channel emissions**

2. Increased transmitter power

3. Increased transmitter range

4. Poor carrier suppression

*> 'Overdeviation (FM)' or 'Overmodulation (AM,SSB)' results in distorted speech plus using excessive bandwidth on the air (splatter) and interfering with stations using adjacent frequencies ('out-of-channel emissions').*

**B-003-13-8 (4) What emission is produced by a reactance modulator connected to an RF power amplifier?**

1. Multiplex modulation

2. Amplitude modulation

3. Pulse modulation

**4. Phase modulation**

*> Direct FM: Use a variable reactance element as one of the elements of an oscillator to cause frequency deviation. Indirect FM: apply the modulating voltage to a variable reactance element connected to a tuned circuit later in the transmit chain, where it will produce phase modulation rather than frequency modulation.*

**B-003-13-9 (4) Why isn't frequency modulated (FM) phone used below 29.5 MHz?**

1. The transmitter efficiency for this mode is low

2. Harmonics could not be attenuated to practical levels

3. The frequency stability would not be adequate

**4. The bandwidth would exceed limits in the Regulations**

*> The usual bandwidth of FM on amateur bands is between 10 to 20 kilohertz. This is much more than the allowed bandwidth on most HF bands per rules regulating the Amateur Radio service.*

**B-003-13-10 (1) You are transmitting FM on the 2 metre band. Several stations advise you that your transmission is distorted. A quick check with a frequency counter tells you that the transmitter is on the proper frequency. Which of the following is the most probable cause of the distortion?**

**1. The frequency deviation of your transmitter is set too high**

2. The power supply output voltage is low

3. The repeater is reversing your sidebands

4. The frequency counter is giving an incorrect reading and you are indeed off frequency

*> key word: DISTORTION. 'Overdeviation (FM)' or 'Overmodulation (AM,SSB)' results in distorted speech plus using excessive bandwidth on the air (splatter) and*

*interfering with stations using adjacent frequencies ('out-of-channel emissions').*

# Receivers

**B-003-3-1 (3) In a frequency modulation receiver, the __________ is connected to the input of the radio frequency amplifier.**

1. mixer

2. frequency discriminator

**3. antenna**

4. limiter

*> In a receiver, an RF amplifier is generally used to amplify the tiny signal (i.e., microvolts) arriving from the Antenna. Once amplified, the incoming signal is fed to the Mixer.*

**B-003-3-2 (4) In a frequency modulation receiver, the ___________ is in between the antenna and the mixer**.

1. audio frequency amplifier

2. high frequency oscillator

3. intermediate frequency amplifier

**4. radio frequency amplifier**

*> In a receiver, an RF amplifier is generally used to amplify the tiny signal (i.e., microvolts) arriving from the Antenna. Once amplified, the incoming signal is fed to the Mixer.*

**B-003-3-3 (4) In a frequency modulation receiver, the output of the high frequency oscillator is fed to the:**

1. radio frequency amplifier

2. limiter

3. antenna

**4. mixer**

*> The Mixer in a receiver takes in the incoming signal and mixes it with a local High Frequency Oscillator to transpose (usually down) the incoming signal to a fixed Intermediate Frequency (the Superheterodyne concept). Using a fixed and lower Intermediate Frequency regardless of operating frequency facilitates the achievement of high gain and selectivity.*

**B-003-3-4 (4) In a frequency modulation receiver, the output of the____________ is connected to the mixer.**

1. frequency discriminator

2. intermediate frequency amplifier

3. speaker and/or headphones

**4. high frequency oscillator**

*> The Mixer in a receiver takes in the incoming signal and mixes it with a local High Frequency Oscillator to transpose (usually down) the incoming signal to a fixed Intermediate Frequency (the Superheterodyne concept). Using a fixed and lower Intermediate Frequency regardless of operating frequency facilitates the achievement of high gain and selectivity.*

**B-003-3-5 (1) In a frequency modulation receiver, the__________ is in between the mixer and the intermediate frequency amplifier.**

**1. filter**

2. limiter

3. frequency discriminator

4. radio frequency amplifier

*> The Mixer accepts two inputs: the incoming signal and the local High Frequency Oscillator. Mixing returns two new products: the sum of the two inputs, the difference of the two inputs. The IF Filter seeks to let only one of the products into the Intermediate Frequency chain for amplification through the IF Amplifier.*

**B-003-3-6 (2) In a frequency modulation receiver, the _________ is located between the filter and the limiter.**

1. high frequency oscillator

**2. intermediate frequency amplifier**

3. mixer

4. radio frequency amplifier

*> The Mixer accepts two inputs: the incoming signal and the local High Frequency Oscillator. Mixing returns two new products: the sum of the two inputs, the difference of the two inputs. The IF Filter seeks to let only one of the products into the Intermediate Frequency chain for amplification through the IF Amplifier.*

**B-003-3-7 (3) In a frequency modulation receiver, the__________ is in between the intermediate frequency amplifier and the frequency discriminator.**

1. filter

2. high frequency oscillator

**3. limiter**

4. radio frequency amplifier

*> Detection (recovery of the original message) in a Frequency Modulation receiver is performed by the 'Discriminator'. The Discriminator translates frequency deviation back to audio. Early discriminators were sensitive to amplitude variations and needed to be preceded by a 'Limiter' to remove amplitude variations from the received signal. Limiters are integral part of an FM system as they cut down the influence of noise.*

**B-003-3-8 (4) In a frequency modulation receiver, the __________ is located between the limiter and the audio frequency amplifier.**

1. intermediate frequency amplifier

2. speaker and/or headphones

3. high frequency oscillator

**4. frequency discriminator**

*> Detection (recovery of the original message) in a Frequency Modulation receiver is performed by the 'Discriminator'. The Discriminator translates frequency deviation back to audio. Early discriminators were sensitive to amplitude variations and needed to be preceded by a 'Limiter' to remove amplitude variations from the received signal. Limiters are integral part of an FM system as they cut down the influence of noise.*

**B-003-3-9 (4) In a frequency modulation receiver, the _________ is located between the speaker and/or headphones and the frequency discriminator.**

1. limiter

2. intermediate frequency amplifier

3. radio frequency amplifier

**4. audio frequency amplifier**

*> Most receivers rely on an Audio Amplifier to provide sufficient volume from the loudspeaker.*

**B-003-3-10 (3) In a frequency modulation receiver, the ___________ connects to the audio frequency amplifier output.**

1. intermediate frequency amplifier

2. frequency discriminator

**3. speaker and/or headphones**

4. limiter

*> key words: "CONNECTS TO". The expected answer relies on the general concept of connecting something to a source: a hose to a tap, a house to the electrical grid or gas mains. In that sense, the loudspeaker CONNECTS to the Audio Amplifier. The Audio Amplifier connects to the Discriminator.*

**B-003-5-1 (4) In a single sideband and CW receiver, the antenna is connected to the _____________ .**

1. product detector

2. high frequency oscillator

3. intermediate frequency amplifier

**4. radio frequency amplifier**

*> In a receiver, an RF amplifier is generally used to amplify the tiny signal (i.e., microvolts) arriving from the Antenna. Once amplified, the incoming signal is fed to the Mixer.*

**B-003-5-2 (4) In a single sideband and CW receiver, the output of the ______________ is connected to the mixer.**

1. filter

2. intermediate frequency amplifier

3. audio frequency amplifier

**4. radio frequency amplifier**

*> The mixer accepts two inputs: the incoming signal and the local High Frequency Oscillator. Mixing returns two new products: the sum of the two inputs, the difference of the two inputs. The IF Filter seeks to let only one of the products into the Intermediate Frequency chain for amplification through the IF Amplifier.*

**B-003-5-3 (3) In a single sideband and CW receiver, the ___________ is connected to the radio frequency amplifier and the high frequency oscillator.**

1. beat frequency oscillator

2. product detector

**3. mixer**

4. filter

*> The mixer accepts two inputs:  the incoming signal and the local High Frequency Oscillator.  Mixing returns two new products:  the sum of the two inputs, the difference of the two inputs.  The IF Filter seeks to let only one of the products into the Intermediate Frequency chain for amplification through the IF Amplifier.*

**B-003-5-4 (2) In a single sideband and CW receiver, the output of the ____________ is connected to the mixer.**

1. intermediate frequency amplifier

**2. high frequency oscillator**

3. beat frequency oscillator

4. product detector

*> The mixer accepts two inputs:  the incoming signal and the local High Frequency Oscillator.  Mixing returns two new products:  the sum of the two inputs, the difference of the two inputs.  The IF Filter seeks to let only one of the products into the Intermediate Frequency chain for amplification through the IF Amplifier.*

**B-003-5-5 (1) In a single sideband and CW receiver, the ______________ is in between the mixer and intermediate frequency amplifier.**

**1. filter**

2. radio frequency amplifier

3. beat frequency oscillator

4. product detector

*> The mixer accepts two inputs:  the incoming signal and the local High Frequency Oscillator.  Mixing returns two new products:  the sum of the two inputs, the difference of the two inputs.  The IF Filter seeks to let only one of the products into the Intermediate Frequency chain for amplification through the IF Amplifier.*

**B-003-5-6 (1) In a single sideband and CW receiver, the ___________ is in between the filter and product detector.**

**1. intermediate frequency amplifier**

2. audio frequency amplifier

3. beat frequency oscillator

4. radio frequency amplifier

*> The mixer accepts two inputs:  the incoming signal and the local High Frequency Oscillator.  Mixing returns two new products:  the sum of the two inputs, the difference of the two inputs.  The IF Filter seeks to let only one of the products into the Intermediate Frequency chain for amplification through the IF Amplifier.*

**B-003-5-7 (1) In a single sideband and CW receiver, the ___________ output is connected to the audio frequency amplifier.**

**1. product detector**

2. high frequency oscillator

3. beat frequency oscillator

4. intermediate frequency amplifier

*> In an SSB/CW receiver, detection (recovery of the message) is performed by a 'Product Detector'.  The 'Product Detector' mixes the Intermediate Frequency signal with a Beat Frequency Oscillator to transpose the IF signal down to the audible range.  The demodulated signal is applied to an Audio Amplifier to provide sufficient drive for the loudspeaker.*

**B-003-5-8 (2) In a single sideband and CW receiver, the output of the ____________ is connected to the product detector.**

1. mixer

**2. beat frequency oscillator**

3. radio frequency amplifier

4. audio frequency amplifier

*> In an SSB/CW receiver, detection (recovery of the message) is performed by a 'Product Detector'.  The 'Product Detector' mixes the Intermediate Frequency signal with a Beat Frequency Oscillator to transpose the IF signal down to the audible range.  The demodulated signal is applied to an Audio Amplifier to provide sufficient drive for the loudspeaker.*

**B-003-5-9 (2) In a single sideband and CW receiver, the ___________ is connected to the output of the product detector.**

1. intermediate frequency amplifier

**2. audio frequency amplifier**

3. high frequency oscillator

4. radio frequency amplifier

*> In an SSB/CW receiver, detection (recovery of the message) is performed by a 'Product Detector'. The 'Product Detector' mixes the Intermediate Frequency signal with a Beat Frequency Oscillator to transpose the IF signal down to the audible range. The demodulated signal is applied to an Audio Amplifier to provide sufficient drive for the loudspeaker.*

**B-003-5-10 (1) In a single sideband and CW receiver, the __________ is connected to the output of the audio frequency amplifier.**

**1. speaker and/or headphones**

2. mixer

3. radio frequency amplifier

4. beat frequency oscillator

*> In an SSB/CW receiver, detection (recovery of the message) is performed by a 'Product Detector'. The 'Product Detector' mixes the Intermediate Frequency signal with a Beat Frequency Oscillator to transpose the IF signal down to the audible range. The demodulated signal is applied to an Audio Amplifier to provide sufficient drive for the loudspeaker.*

**B-003-10-1 (3) Which list of emission types is in order from the narrowest bandwidth to the widest bandwidth?**

1. CW, SSB voice, RTTY, FM voice

2. CW, FM voice, RTTY, SSB voice

**3. CW, RTTY, SSB voice, FM voice**

4. RTTY, CW, SSB voice, FM voice

*> In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.*

**B-003-10-2 (1) The figure in a receiver's specifications which indicates its sensitivity is the:**

**1. signal plus noise to noise ratio**

2. audio output in watts

3. bandwidth of the IF in kilohertz

4. number of RF amplifiers

*> Comparing 'Signal + Noise' to 'Noise alone' yields a measure of the sensitivity. A sensitive receiver will render more signal and little remaining noise (less background noise on the reproduced signal) when compared to the base noise in the receiver. "3" is an expression of Selectivity.*

**B-003-10-3 (3) If two receivers of different sensitivity are compared, the less sensitive receiver will produce:**

1. a steady oscillator drift

2. more than one signal

**3. less signal or more noise**

4. more signal or less noise

*> key words: LESS SENSITIVE. A sensitive receiver will render more signal and little remaining noise (less background noise on the reproduced signal) when compared to the base noise in the receiver. The better receiver can render weak signals with little noise.*

**B-003-10-4 (4) Which of the following modes of transmission is usually detected with a product detector?**

1. Double sideband full carrier

2. Frequency modulation

3. Pulse modulation

**4. Single sideband suppressed carrier**

*> In SSB, the FREQUENCY of the original modulating signal is conveyed by the POSITION of each side frequency within the sideband in relation to the phantom carrier (it has been suppressed). A sideband (a group of ever changing side frequencies) is formed by the sum (Upper Sideband) or difference (Lower Sideband) of the modulating frequencies and the carrier frequency. The original frequency can only be reproduced correctly by "re-inserting" a reference signal, the Beat Frequency Oscillator, and mixing it with the received signal. 'Beat' is synonym of mixing.*

**B-003-10-5 (3) A receiver designed for SSB reception must have a BFO (beat frequency oscillator) because:**

1. it beats with the received carrier to produce the other sideband

2. it reduces the passband of the IF stages

**3. the suppressed carrier must be replaced for detection**

4. it phases out the unwanted sideband signal

*> In SSB, the FREQUENCY of the original modulating signal is conveyed by the POSITION of each side frequency within the sideband in relation to the phantom carrier (it has been suppressed). A sideband (a group of ever changing side frequencies) is formed by the sum (Upper Sideband) or difference (Lower Sideband) of the modulating frequencies and the carrier frequency. The original frequency can only be reproduced correctly by "re-inserting" a reference signal, the Beat Frequency Oscillator, and mixing it with the received signal. 'Beat' is synonym of mixing.*

**B-003-10-6 (3) A receiver receives an incoming signal of 3.54 MHz, and the local oscillator produces a signal of 3.995 MHz. To which frequency should the IF be tuned?**

1. 7.435 MHz

2. 3.995 MHz

**3. 455 kHz**

4. 3.54 MHz

*> The mixer accepts two inputs: the incoming signal and the local High Frequency Oscillator. Mixing returns two new products: the sum of the two inputs, the difference of the two inputs. The IF Filter seeks to let only one of the products into the Intermediate Frequency chain for amplification through the IF Amplifier. In this example, 3995 kHz minus 3540 kHz yields 455 kHz.*

**B-003-10-7 (1) What kind of filter would you use to attenuate an interfering carrier signal while receiving an SSB transmission?**

**1. A notch filter**

2. A band pass filter

3. An all pass filter

4. A pi-network filter

*> The problem presented here is an offending signal within the receiver passband (the range of frequencies allowed though the Intermediate Frequency chain). A 'Notch Filter' which attenuates a very narrow range of frequencies can be used to remove the interfering carrier.*

**B-003-10-8 (4) The three main parameters against which the quality of a receiver is measured are:**

1. selectivity, stability and frequency range

2. sensitivity, stability and cross-modulation

3. sensitivity, selectivity and image rejection

**4. sensitivity, selectivity and stability**

*> Three times letter S:  Sensitivity, Selectivity and Stability.  Sensitivity:  render weak signals with less noise.  Selectivity: the ability to separate signals from adjacent ones.  Stability:  staying on frequency over time despite temperature or voltage variations.*

**B-003-10-9 (2) A communications receiver has four filters installed in it, one at 250 Hz, one at 500 Hz, one at 2.4 kHz, and one at 6 kHz. If you were listening to single sideband, which filter would you utilize?**

1. 250 Hz

**2. 2.4 kHz**

3. 6 kHz

4. 500 Hz

*> In order of bandwidth requirements:  CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.  A 2.4 kHz filter is just wide enough to accept an SSB signal.  Wider a filter, lets in more noise.  Too narrow a filter causes distortion.*

**B-003-10-10 (4) A communications receiver has four filters installed in it, one at 250 Hz, one at 500 Hz, one at 2.4 kHz and one at 6 kHz. You are copying a CW transmission and there is a great deal of interference. Which one of the filters would you choose?**

1. 500 Hz

2. 2.4 kHz

3. 6 kHz

**4. 250 Hz**

*> In order of bandwidth requirements:  CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.  A 250 Hz filter is best to isolate a CW signal.  Wider a filter, lets in more noise.  Too narrow a filter causes distortion.*

**B-003-10-11 (3) Selectivity can be placed in the audio stages of a receiver by the utilization of RC active or passive audio filters. If you were to copy CW, which of the following bandpasses would you choose?**

1. 2100 - 2300 Hz

2. 300 - 2700 Hz

**3. 750 - 850 Hz**

4. 100 - 1100 Hz

*> key words: AUDIO STAGES. After the 'Product Detector', an incoming CW signal is now an audible tone. Most receivers render CW as a note somewhere in the range of 750 Hz to 850 Hz. Additional band-pass filtering (allowing only a certain range of frequencies) can be useful to knock down adjacent stations finding their way into the receiver passband (the range of frequencies allowed though the Intermediate Frequency chain) and producing higher or lower notes, say at 250 or 1000 Hz.*

**B-003-13-11 (4) FM receivers perform in an unusual manner when two or more stations are present. The loudest signal, even though it is only two or three times as loud as the other signals, will be the only transmission demodulated. This is called:**

1. attach effect

2. interference effect

3. surrender effect

**4. capture effect**

*> The 'Capture Effect' is specific to FM receivers: only the stronger of two signals at or near the same frequency will be demodulated. The complete suppression of the weaker signal occurs at the receiver limiter. When both signals are nearly equal in strength, or are fading independently, the receiver may switch from one to the other. http://en.wikipedia.org/*

## Power Supplies

**B-003-8-1 (2) In a regulated power supply, the transformer connects to an external source which is referred to as _______________.**

1. regulator

**2. input**

3. filter

4. rectifier

*> The external source will frequently be a wall socket where 120 Volts AC is available. The blocks in a Regulated Power Supply: Input, Transformer, Rectifier, Filter, Regulator, Output.*

**B-003-8-2 (1) In a regulated power supply, the ________________ is between the input and the rectifier.**

**1. transformer**

2. output

3. regulator

4. filter

*> Prior to rectification with diodes, a transformer lowers or raises the voltage (to bring it closer to the desired output voltage). The blocks in a Regulated Power Supply: Input, Transformer, Rectifier, Filter, Regulator, Output.*

**B-003-8-3 (1) In a regulated power supply, the ________________ is between the transformer and the filter.**

**1. rectifier**

2. input

3. output

4. regulator

*> The 'Rectifier' (diodes) converts AC into 'pulsating DC' which is then smoothed out into pure DC by a 'Filter' (often simply a capacitor). The blocks in a Regulated Power Supply: Input, Transformer, Rectifier, Filter, Regulator, Output.*

**B-003-8-4 (1) In a regulated power supply, the output of the rectifier is connected to the _______________.**

**1. filter**

2. output

3. transformer

4. regulator

*> The 'Rectifier' (diodes) converts AC into 'pulsating DC' which is then smoothed out into pure DC by a 'Filter' (often simply a capacitor).  The blocks in a Regulated Power Supply:  Input, Transformer, Rectifier, Filter, Regulator, Output.*

**B-003-8-5 (1) In a regulated power supply, the output of the filter connects to the _______________________.**

**1. regulator**

2. transformer

3. rectifier

4. output

*> The pure DC available after the 'Filter' goes through the 'Regulator' which maintains a constant output voltage regardless of input variations or load changes. The blocks in a Regulated Power Supply:  Input, Transformer, Rectifier, Filter, Regulator, Output.*

**B-003-8-6 (1) In a regulated power supply, the _________________is connected to the regulator.**

**1. output**

2. rectifier

3. input

4. transformer

*> The 'Output' circuitry (fuses, meters) connect to the 'Regulator'.  The blocks in a Regulated Power Supply:  Input, Transformer, Rectifier, Filter, Regulator, Output.*

**B-003-17-1 (1) If your mobile transceiver works in your car but not in your home, what should you check first?**

**1. The power supply**

2. The speaker

3. The microphone

4. The SWR meter

*> In the car, the transceiver gets power from the car battery.  In the home, a power supply provides the 12 Volts DC necessary for the transceiver.  From the car to the home, the prime difference is the source of voltage.*

**B-003-17-2 (2) What device converts household current to 12 VDC?**

1. A low pass filter

**2. A power supply**

3. An RS-232 interface

4. A catalytic converter

*> A large percentage of modern transceivers are designed to work off 12 Volts DC which is readily available from a car battery.  To use a rig in the home, a 'Power Supply' is required:  a 'Power Supply' combines a transformer, rectifier and filter to convert 120 Volts AC down to 12 Volts DC.*

**B-003-17-3 (3) Which of these usually needs a heavy-duty power supply?**

1. An antenna switch

2. A receiver

**3. A transceiver**

4. An SWR meter

*> key words:  HEAVY-DUTY.  Receivers rarely draw more than 1 Ampere at 12 VDC.  A 100-Watt transceiver (while on transmit) can draw 20 Amperes at 12 VDC.*

**B-003-17-4 (1) What may cause a buzzing or hum in the signal of an AC-powered transmitter?**

**1. A bad filter capacitor in the transmitter's power supply**

2. Using an antenna which is the wrong length

3. Energy from another transmitter

4. Bad design of the transmitter's RF power output circuit

*> key word:  HUM.  Remember the 'Power Supply' block diagram:  a 'Rectifier' (diode) converts AC into 'pulsating DC'.  A 'Filter' then smoothes out the 'pulsating DC' into pure DC.  If the 'Filter' is deficient, hum or buzzing will appear on the transmitted signal.*

**B-003-17-5 (4) A power supply is to supply DC at 12 volts at 5 amperes. The power transformer should be rated higher than:**

1. 17 watts

2. 2.4 watts

3. 6 watts

**4. 60 watts**

*> Power, expressed in Watts = Voltage, in Volts, TIMES Current, in Amperes.  P = E * I.  Watts = Volts * Amperes.*

**B-003-17-6 (2) The diode is an important part of a simple power supply. It converts AC to DC, since it:**

1. has a high resistance to AC but not to DC

**2. allows electrons to flow in only one direction from cathode to anode**

3. has a high resistance to DC but not to AC

4. allows electrons to flow in only one direction from anode to cathode

*> A DIODE, vacuum tube or semiconductor, has two electrodes:  Anode and Cathode.  Electrons flow from Cathode to Anode in a forward-biased (i.e., a diode subjected to a voltage polarity which permits conduction) diode.*

**B-003-17-7 (3) To convert AC to pulsating DC, you could use a**:

1. transformer

2. capacitor

**3. diode**

4. resistor

*> A DIODE, vacuum tube or semiconductor, has two electrodes:  Anode and Cathode.  Electrons flow from Cathode to Anode in a forward-biased (i.e., a diode subjected to a voltage polarity which permits conduction) diode.*

**B-003-17-8 (1) Power-line voltages have been made standard over the years and the voltages generally supplied to homes are approximately:**

**1. 120 and 240 volts**

2. 110 and 220 volts

3. 100 and 200 volts

4. 130 and 260 volts

*> Nominal household voltages have slowly come up since the early 20th century from 110V, to 115V, to 117V, to 120V. The current standard is 120V and 240V. 240V is used for energy-hungry devices like water heaters, clothes dryers, electric ovens AND high-power linear amplifiers.*

**B-003-17-9 (4) So-called "transformerless" power supplies are used in some applications (notably tube-type radios and TV receivers). When working on such equipment, one should be very careful because**:

1. DC circuits are negative relative to the chassis

2. chassis connections are grounded by the centre pin of the power source's plug

3. the load across the power supply is variable

**4. one side of the line cord is connected to the chassis**

*> 120V AC household current is delivered over two wires: one 'neutral' at ground potential and a 'live' wire at 120 V AC above ground potential. If a fault occurs and YOU become part of the return path from a 'live' wire to ground, you could be electrocuted.*

**B-003-17-10 (2) If household voltages are consistently high or low at your location, this can be corrected by the use of:**

1. a full-wave bridge rectifier

**2. an autotransformer**

3. a variable voltmeter

4. a proper load resistance

*> An 'autotransformer': a transformer where primary and secondary are simply taps on a common winding. An autotransformer can efficiently provide small adjustments to voltage. A 'Rectifier' converts AC to 'pulsating DC'. A 'Voltmeter' measures voltage. A 'Resistance' opposes current flow.*

**B-003-17-11 (1) You have a very loud low-frequency hum appearing on your transmission. In what part of the transmitter would you first look for the trouble?**

**1. the power supply**

2. the variable-frequency oscillator

3. the driver circuit

4. the power amplifier circuit

*> key word:  HUM.  Remember the 'Power Supply' block diagram:  a 'Rectifier' (diode) converts AC into 'pulsating DC'.  A 'Filter' then smoothes out the 'pulsating DC' into pure DC.  If the 'Filter' is deficient, hum or buzzing will appear on the transmitted signal.*

# Antennas

**B-003-9-1 (4) In a Yagi-Uda 3 element directional antenna, the _____________ is primarily for mechanical purposes.**

1. reflector

2. driven element

3. director

**4. boom**

*> The 'boom' supports the elements of the Yagi.*

**B-003-9-2 (3) In a Yagi-Uda 3 element directional antenna, the _________ is the longest radiating element.**

1. director

2. driven element

**3. reflector**

4. boom

*> The 'boom' supports the elements of the Yagi.  Element dimensions on a Yagi;  the 'Driven' = a half-wave dipole, 95% of a half-wavelength in free space = (300 / MHz / 2) * 95%.  The 'Reflector', in back of the 'driven' = 5% longer than the 'driven'.  The 'Director', in front of the 'driven, = 5% shorter than the 'driven'.*

**B-003-9-3 (3) In a Yagi-Uda 3 element directional antenna, the _______________ is the shortest radiating element.**

1. boom

2. reflector

**3. director**

4. driven element

*> The 'boom' supports the elements of the Yagi.  Element dimensions on a Yagi;  the 'Driven' = a half-wave dipole, 95% of a half-wavelength in free space = (300 / MHz / 2) * 95%.  The 'Reflector', in back of the 'driven' = 5% longer than the 'driven'.  The 'Director', in front of the 'driven, = 5% shorter than the 'driven'.*

**B-003-9-4 (3) In a Yagi-Uda 3 element directional antenna, the _______________is not the longest nor the shortest radiating element.**

1. boom

2. director

**3. driven element**

4. reflector

*> The 'boom' supports the elements of the Yagi.  Element dimensions on a Yagi;  the 'Driven' = a half-wave dipole, 95% of a half-wavelength in free space = (300 / MHz / 2) * 95%.  The 'Reflector' (in back of the 'driven') = 5% longer than the 'driven'. The 'Director' (in front of the 'driven) = 5% shorter than the 'driven'.*

**B-006-7-1 (3) What does horizontal wave polarization mean?**

1. The electric and magnetic lines of force of a radio wave are perpendicular to the earth's surface

2. The electric lines of force of a radio wave are perpendicular to the earth's surface

*3. The electric lines of force of a radio wave are parallel to the earth's surface*

4. The magnetic lines of force of a radio wave are parallel to the earth's surface

*> An electromagnetic wave comprises an electrical field and a magnetic field.  Wave Polarization describes the position of the ELECTRIC field with respect to the earth's surface.  On a dipole antenna or on the 'driven' element of a Yagi, the electric field is developed between the tips of the radiating element.*

**B-006-7-2 (2) What does vertical wave polarization mean?**

1. The magnetic lines of force of a radio wave are perpendicular to the earth's surface

**2. The electric lines of force of a radio wave are perpendicular to the earth's surface**

3. The electric and magnetic lines of force of a radio wave are parallel to the earth's surface

4. The electric lines of force of a radio wave are parallel to the earth's surface

*> An electromagnetic wave comprises an electrical field and a magnetic field.  Wave Polarization describes the position of the ELECTRIC field with respect to the earth's surface.  On a dipole antenna or on the 'driven' element of a Yagi, the electric field is developed between the tips of the radiating element.*

**B-006-7-3 (2) What electromagnetic wave polarization does a Yagi antenna have when its elements are parallel to the earth's surface?**

1. Helical

**2. Horizontal**

3. Vertical

4. Circular

*> An electromagnetic wave comprises an electrical field and a magnetic field.  Wave Polarization describes the position of the ELECTRIC field with respect to the earth's surface.  On a dipole antenna or on the 'driven' element of a Yagi, the electric field is developed between the tips of the radiating element.*

**B-006-7-4 (4) What electromagnetic wave polarization does a half-wavelength antenna have when it is perpendicular to the earth's surface?**

1. Circular

2. Horizontal

3. Parabolical

**4. Vertical**

*> An electromagnetic wave comprises an electrical field and a magnetic field.  Wave Polarization describes the position of the ELECTRIC field with respect to the earth's surface.  On a dipole antenna or on the 'driven' element of a Yagi, the electric field is developed between the tips of the radiating element.*

**B-006-7-5 (2) Polarization of an antenna is determined by:**

1. the height of the antenna

**2. the electric field**

3. the type of antenna

4. the magnetic field

*> An electromagnetic wave comprises an electrical field and a magnetic field.  Wave Polarization describes the position of the ELECTRIC field with respect to the earth's surface.  On a dipole antenna or on the 'driven' element of a Yagi, the electric field is developed between the tips of the radiating element.*

**B-006-7-6 (1) An isotropic antenna is a:**

**1. hypothetical point source**

2. infinitely long piece of wire

3. dummy load

4. half-wave reference dipole

*> 'Isotropic' means "equal radiation in all directions". An 'isotropic antenna', also called 'isotropic radiator' is an HYPOTHETICAL point source. Plotting the pattern in all planes around the source would yield a 'sphere' as a pattern. The 'isotropic antenna' is used as a reference to compare the gain of real antennas.*

**B-006-7-7 (4) What is the antenna radiation pattern for an isotropic radiator?**

1. A parabola

2. A cardioid

3. A unidirectional cardioid

**4. A sphere**

*> 'Isotropic' means "equal radiation in all directions". An 'isotropic antenna', also called 'isotropic radiator' is an HYPOTHETICAL point source. Plotting the pattern in all planes around the source would yield a 'sphere' as a pattern. The 'isotropic antenna' is used as a reference to compare the gain of real antennas.*

**B-006-7-8 (3) VHF signals from a mobile station using a vertical whip antenna will normally be best received using a:**

1. random length of wire

2. horizontal ground-plane antenna

**3. vertical ground-plane antenna**

4. horizontal dipole antenna

*> key words: VHF, VERTICAL. On 'line of sight' propagation (common at Very High Frequencies) and with Ground Wave propagation (common at the low end of High Frequencies), a significant loss is incurred if the antennas on both extremities do NOT have the same polarization*.

**B-006-7-9 (4) A dipole antenna will emit a vertically polarized wave if it is:**

1. fed with the correct type of RF

2. too near to the ground

3. parallel with the ground

**4. mounted vertically**

*> An electromagnetic wave comprises an electrical field and a magnetic field. Wave Polarization describes the position of the ELECTRIC field with respect to the earth's surface. On a dipole antenna or on the 'driven' element of a Yagi, the electric field is developed between the tips of the radiating element.*

**B-006-7-10 (2) If an electromagnetic wave leaves an antenna vertically polarized, it will arrive at the receiving antenna, by ground wave:**

1. polarized at right angles to original

**2. vertically polarized**

3. horizontally polarized

4. polarized in any plane

*> key words: GROUND WAVE. On 'line of sight' propagation (common at Very High Frequencies) and with Ground Wave propagation (common at the low end of High Frequencies), a significant loss is incurred if the antennas on both extremities do NOT have the same polarization.*

**B-006-7-11 (4) Compared with a horizontal antenna, a vertical antenna will receive a vertically polarized radio wave:**

1. at weaker strength

2. without any comparative difference

3. if the antenna changes the polarization

**4. at greater strength**

*> On 'line of sight' propagation (common at Very High Frequencies) and with Ground Wave propagation (common at the low end of High Frequencies), a significant loss is incurred if the antennas on both extremities do NOT have the same polarization.*

**B-006-8-1 (1) If an antenna is made longer, what happens to its resonant frequency?**

**1. It decreases**

2. It increases

3. It stays the same

4. It disappears

*> Wavelength (lambda) in meters IN FREE SPACE is 300 divided by frequency in Megahertz. Wavelength and frequency have an inverse relationship. Antennas on the 80 metre HF (3.5 to 4.0 MHz) band are much longer than antennas on the 2 metre VHF band (144 to 148 MHz).*

**B-006-8-2 (2) If an antenna is made shorter, what happens to its resonant frequency?**

1. It stays the same

**2. It increases**

3. It disappears

4. It decreases

*> Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz.  Wavelength and frequency have an inverse relationship.  Antennas on the 2 metre VHF band (144 to 148 MHz) are much shorter than antennas on the 80 metre HF band (3.5 to 4.0 MHz).*

**B-006-8-3 (3) The wavelength for a frequency of 25 MHz is:**

1. 15 metres (49.2 ft)

2. 4 metres (13.1 ft)

**3. 12 metres (39.4 ft)**

4. 32 metres (105 ft)

*> Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz.  In this example, 300 / 25 = 12 m.*

**B-006-8-4 (1) The velocity of propagation of radio frequency energy in free space is:**

**1. 300 000 kilometres per second**

2. 3000 kilometres per second

3. 150 kilometres per second

4. 186 000 kilometres per second

*> Radio waves in free space travel at the speed of light:  300000 kilometres per second.*

**B-006-8-5 (3) Adding a series inductance to an antenna would:**

1. increase the resonant frequency

2. have little effect

**3. decrease the resonant frequency**

4. have no change on the resonant frequency

*> A series inductance in an antenna is termed a "loading coil". It makes the antenna appear LONGER electrically than its physical size. Making the antenna longer brings down the resonant frequency.*

**B-006-8-6 (3) The resonant frequency of an antenna may be increased by:**

1. lowering the radiating element

2. increasing the height of the radiating element

**3. shortening the radiating element**

4. lengthening the radiating element

*> Wavelength and frequency have an inverse relationship. Increasing the resonant frequency (shorter wavelength) can be achieved by shortening the radiating element.*

**B-006-8-7 (2) The speed of a radio wave:**

1. is infinite in space

**2. is the same as the speed of light**

3. is always less than half speed of light

4. varies directly with frequency

*> Radio waves in free space travel at the speed of light: 300000 kilometres per second.*

**B-006-8-8 (1) At the end of suspended antenna wire, insulators are used. These act to:**

**1. limit the electrical length of the antenna**

2. increase the effective antenna length

3. allow the antenna to be more easily held vertically

4. prevent any loss of radio waves by the antenna

*> Insulators mark the end of the antenna. Thus, wet support ropes or metallic support wires do not become part of the antenna.*

**B-006-8-9 (2) To lower the resonant frequency of an antenna, the operator should:**

1. shorten it

**2. lengthen it**

3. ground one end

4. centre feed it with TV ribbon feeder

*> Wavelength and frequency have an inverse relationship.  Decreasing the resonant frequency (longer wavelength) can be achieved by lengthening the radiating element.*

**B-006-8-10 (2) One solution to multiband operation with a shortened radiator is the "trap dipole" or trap vertical. These "traps" are actually:**

1. large wire-wound resistors

**2. a coil and capacitor in parallel**

3. coils wrapped around a ferrite rod

4. hollow metal cans

*> "Antenna traps" are parallel resonant circuits which exhibit high impedance at resonance.  Electrically speaking, they cut-off the antenna at the trap position when operated at the resonant frequency of the trap.*

**B-006-8-11 (2) The wavelength corresponding to a frequency of 2 MHz is:**

1. 360 m (1181 ft)

**2. 150 m (492 ft)**

3. 1500 m (4921 ft)

4. 30 m (98 ft)

*> Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz.  In this example,  300 / 2 = 150 m*.

**B-006-9-1 (3) What is a parasitic beam antenna?**

1. An antenna where the driven element obtains its radio energy by induction or radiation from director elements

2. An antenna where all elements are driven by direct connection to the feed line

**3. An antenna where some elements obtain their radio energy by induction or radiation from a driven element**

4. An antenna where wave traps are used to magnetically couple the elements

*> The term 'parasite' means "feeding off something else". For instance, in a Yagi, there is only one 'driven' element where the transmission line attaches. The 'reflector' and 'director' capture energy off the 'driven' and re-radiate it.*

**B-006-9-2 (2) How can the bandwidth of a parasitic beam antenna be increased?**

1. Use traps on the elements

**2. Use larger diameter elements**

3. Use tapered-diameter elements

4. Use closer element spacing

*> 'Antenna bandwidth' is the range of frequencies over which an antenna is usable. Larger-diameter elements means "ticker" elements. With "fatter" elements, resonance isn't as sharp. Antenna 'bandwidth' is increased.*

**B-006-9-3 (2) If a slightly shorter parasitic element is placed 0.1 wavelength away from an HF dipole antenna, what effect will this have on the antenna's radiation pattern?**

1. A major lobe will develop in the horizontal plane, parallel to the two elements

**2. A major lobe will develop in the horizontal plane, toward the parasitic element**

3. A major lobe will develop in the vertical plane, away from the ground

4. The radiation pattern will not be affected

*> key words: PARASITIC, SHORTER. A 'slightly shorter parasitic' element is the description of a 'Director'. A dipole and a 'director' in front of it make up a two-element Yagi. Radiation will be enhanced toward the 'director' at the expense of the back.*

**B-006-9-4 (3) If a slightly longer parasitic element is placed 0.1 wavelength away from an HF dipole antenna, what effect will this have on the antenna's radiation pattern?**

1. A major lobe will develop in the horizontal plane, parallel to the two elements

2. A major lobe will develop in the vertical plane, away from the ground

**3. A major lobe will develop in the horizontal plane, away from the parasitic element, toward the dipole**

4. The radiation pattern will not be affected

*> key words: PARASITIC, LONGER. A 'slightly longer parasitic' element is the description of a 'reflector'. A dipole and a 'reflector' behind it make up a two-element Yagi. Radiation will be enhanced away from the 'reflector', towards the radiating element (the dipole, the 'driven').*

**B-006-9-5 (1) The property of an antenna, which defines the range of frequencies to which it will respond, is called its:**

**1. bandwidth**

2. front-to-back ratio

3. impedance

4. polarization

*> 'Antenna Bandwidth' is the range of frequencies over which Standing Wave Ratio (SWR) is acceptable*.

**B-006-9-6 (4) Approximately how much gain does a half-wave dipole have over an isotropic radiator?**

1. 1.5 dB

2. 3.0 dB

3. 6.0 dB

**4. 2.1 dB**

*> An 'isotropic radiator' radiates equally well in ALL directions ( radiation pattern is a 'sphere'). A dipole in free space has a radiation pattern similar to a donut ( maximum radiation broadside from the antenna, none towards the ends ). This concentration of radiation produce a gain of 2.1 dB over an isotropic antenna.*

**B-006-9-7 (4) What is meant by antenna gain?**

1. The numerical ratio of the signal in the forward direction to the signal in the back direction

2. The numerical ratio of the amount of power radiated by an antenna compared to the transmitter output power

3. The final amplifier gain minus the transmission line losses

**4. The numerical ratio relating the radiated signal strength of an antenna to that of another antenna**

*> Antenna Gain is a ratio, expressed in decibel, of the radiation of a given antenna against some reference antenna. For example, the expression 'dBi' means decibel over an isotropic radiator.*

**B-006-9-8 (4) What is meant by antenna bandwidth?**

1. Antenna length divided by the number of elements

2. The angle between the half-power radiation points

3. The angle formed between two imaginary lines drawn through the ends of the elements

**4. The frequency range over which the antenna may be expected to perform well**

*> 'Antenna Bandwidth' is the range of frequencies over which Standing Wave Ratio (SWR) is acceptable.*

**B-006-9-9 (1) In free space, what is the radiation characteristic of a half-wave dipole?**

**1. Minimum radiation from the ends, maximum broadside**

2. Maximum radiation from the ends, minimum broadside

3. Omnidirectional

4. Maximum radiation at 45 degrees to the plane of the antenna

*> A dipole in free space has a radiation pattern similar to a donut ( maximum radiation broadside from the antenna, none towards the ends ). This concentration of radiation produce a gain of 2.1 dB over an isotropic antenna.*

**B-006-9-10 (1) The gain of an antenna, especially on VHF and above, is quoted in dBi. The "i" in this expression stands for:**

**1. isotropic**

2. ideal

3. ionosphere

4. interpolated

*> Antenna Gain is a ratio, expressed in decibel, of the radiation of a given antenna against some reference antenna. For example, the expression 'dBi' means decibel over an isotropic radiator.*

**B-006-9-11 (2) The front-to-back ratio of a beam antenna is:**

1. the forward power of the major lobe to the power in the backward direction both being measured at the 3 dB points

**2. the ratio of the maximum forward power in the major lobe to the maximum backward power radiation**

3. undefined

4. the ratio of the forward power at the 3 dB points to the power radiated in the backward direction

*> 'Beam antenna' is another name for a Yagi.  'Front to back' is a ratio in decibels of the power radiated in the most favoured direction (front) to the power radiated towards the back of the antenna.*

**B-006-10-1 (3) How do you calculate the length in metres (feet) of a quarter-wavelength vertical antenna?**

1. Divide 468 (1532) by the antenna's operating frequency (in MHz)

2. Divide 300 (982) by the antenna's operating frequency (in MHz)

**3. Divide 71.5 (234) by the antenna's operating frequency (in MHz)**

4. Divide 150 (491) by the antenna's operating frequency (in MHz)

*> key words: QUARTER-wavelength.  Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz.  Answer:  95 % of one quarter wavelength in free space = '300 / 4 * 0.95' divided by frequency in Megahertz = 71.3 divided by frequency in Megahertz.*

**B-006-10-2 (2) If you made a quarter-wavelength vertical antenna for 21.125 MHz, how long would it be?**

1. 3.6 metres (11.8 ft)

**2. 3.36 metres (11.0 ft)**

3. 7.2 metres (23.6 ft)

4. 6.76 metres (22.2 ft)

*> key words: QUARTER-wavelength.  Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz.  Answer:  95 % of one quarter wavelength in free space = '300 / 4 * 0.95' divided by frequency in Megahertz = 71.3 divided by frequency in Megahertz.  In this example, '300 / 21.125 MHz / 4 * 0.95' = 3.37m*

**B-006-10-3 (1) If you made a half-wavelength vertical antenna for 223 MHz, how long would it be?**

**1. 64 cm (25.2 in)**

2. 128 cm (50.4 in)

3. 105 cm (41.3 in)

4. 134.6 cm (53 in)

*> key words:  HALF-wavelength.  Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz.  Answer:  95 % of one half wavelength in free space = '300 / 2 * 0.95' divided by frequency in Megahertz = 143 divided by frequency in Megahertz.  In this example, '300 / 223 MHz / 2 * 0.95' = 0.64m*

**B-006-10-4 (2) Why is a 5/8-wavelength vertical antenna better than a 1/4-wavelength vertical antenna for VHF or UHF mobile operations?**

1. A 5/8-wavelength antenna has less corona loss

**2. A 5/8-wavelength antenna has more gain**

3. A 5/8-wavelength antenna is easier to install on a car

4. A 5/8-wavelength antenna can handle more power

*> The 'five eights' wavelength antenna focuses energy somewhat better towards the horizon (lower radiation angle) than a regular quarter-wave antenna.*

**B-006-10-5 (3) If a magnetic-base whip antenna is placed on the roof of a car, in what direction does it send out radio energy?**

1. Most of it is aimed high into the sky

2. Most of it goes equally in two opposite directions

**3. It goes out equally well in all horizontal directions**

4. Most of it goes in one direction

*> An upright antenna element radiates equally well all around it in the horizontal plane.*

**B-006-10-6 (3) What is an advantage of downward sloping radials on a ground plane antenna?**

1. It increases the radiation angle

2. It brings the feed point impedance closer to 300 ohms

**3. It brings the feed point impedance closer to 50 ohms**

4. It lowers the radiation angle

*> Radials are the three or four elements simulating ground at the base of an elevated vertical antenna (ground plane antenna). Sloping radials (lower than 90 degrees) BRING up the impedance from about 30 ohms to 50 ohms for a better direct match to coaxial cable.*

**B-006-10-7 (1) What happens to the feed point impedance of a ground-plane antenna when its radials are changed from horizontal to downward-sloping?**

**1. It increases**

2. It decreases

3. It stays the same

4. It approaches zero

*> Radials are the three or four elements simulating ground at the base of an elevated vertical antenna (ground plane antenna). Sloping radials (lower than 90 degrees) BRING up the impedance from about 30 ohms to 50 ohms for a better direct match to coaxial cable.*

**B-006-10-8 (4) Which of the following transmission lines will give the best match to the base of a quarter-wave ground-plane antenna?**

1. 300 ohms balanced feed line

2. 75 ohms balanced feed line

3. 300 ohms coaxial cable

**4. 50 ohms coaxial cable**

*> A quarter-wave ground plane antenna exhibits a feedpoint impedance fairly close to 50 ohms.*

**B-006-10-9 (1) The main characteristic of a vertical antenna is that it will:**

**1. receive signals equally well from all compass points around it**

2. be very sensitive to signals coming from horizontal antennas

3. require few insulators

4. be easy to feed with TV ribbon feeder

*> An upright antenna element radiates equally well all around it in the horizontal plane. It is termed 'omni-directional'.*

**B-006-10-10 (1) Why is a loading coil often used with an HF mobile vertical antenna?**

**1. To tune out capacitive reactance**

2. To lower the losses

3. To lower the Q

4. To improve reception

*> Short answer: a coil (inductor) has a behaviour totally opposite to capacitors; 'cancelling reactive capacitance' makes sense. A short antenna (e.g., 2.5m) operated on HF frequencies (wavelengths of 10 to 80 metres) looks like an antenna operated well below its natural resonant frequency. If you think of an ideal antenna as a resonant circuit where capacitive and inductive reactances cancel each other, you'll note that CAPACITIVE reactance ( XC = 1 over '2 * PI * f * C' ) grows below the resonant frequency. A "loading coil" cancels out that capacitive reactance.*

**B-006-10-11 (2) What is the main reason why so many VHF base and mobile antennas are 5/8 of a wavelength?**

1. The angle of radiation is high giving excellent local coverage

**2. The angle of radiation is low**

3. It is easy to match the antenna to the transmitter

4. It's a convenient length on VHF

*> The 'five eights' wavelength antenna focuses energy somewhat better towards the horizon (lower radiation angle) than a regular quarter-wave antenna.*

**B-006-11-1 (4) How many directly driven elements do most Yagi antennas have?**

1. None

2. Two

3. Three

**4. One**

*> Generally speaking, a parasitic beam antenna has one 'driven' element where the transmission line attaches.*

**B-006-11-2 (4) Approximately how long is the driven element of a Yagi antenna for 14.0 MHz?**

1. 5.21 metres (17 feet)

2. 10.67 metres (35 feet)

3. 20.12 metres (66 feet)

**4. 10.21 metres (33 feet and 6 inches)**

*> key word: DRIVEN. Same approximate length as a HALF-WAVE dipole. Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz. Answer: 95 % of one half wavelength in free space = '(300 / 2) * 0.95' divided by frequency in Megahertz = 143 divided by frequency in Megahertz. In this example, '(300 / 14 MHz / 2) * 0.95' = 10.18m .*

**B-006-11-3 (2) Approximately how long is the director element of a Yagi antenna for 21.1 MHz?**

1. 5.18 metres (17 feet)

**2. 6.4 metres (21 feet)**

3. 3.2 metres (10.5 feet)

4. 12.8 metres (42 feet)

*> key word: DIRECTOR. About 5% SHORTER than the 'driven' which is itself the approximate length of a HALF-WAVE dipole. Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz. The 'driven' would be 95 % of one half wavelength in free space = '(300 / 2) * 0.95' divided by frequency in Megahertz. The DIRECTOR is another 95% of the length of the 'driven'. In this example, the director becomes (300 / 21.1 MHz / 2) * 0.95 * 0.95 = 6.42 m*

**B-006-11-4 (2) Approximately how long is the reflector element of a Yagi antenna for 28.1 MHz?**

1. 4.88 metres (16 feet)

**2. 5.33 metres (17.5 feet)**

3. 10.67 metres (35 feet)

4. 2.66 metres (8.75 feet)

*> key word: REFLECTOR. About 5% LONGER than the 'driven' which is itself the approximate length of a HALF-WAVE dipole. Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz. The 'driven' would be 95 % of one half wavelength in free space = '(300 / 2) * 0.95' divided by frequency in Megahertz. The REFLECTOR is 1.05 times the length of the 'driven'. In this example, the reflector becomes (300 / 28.1 MHz / 2) * 0.95 * 1.05 = 5.32 m*

**B-006-11-5 (4) What is one effect of increasing the boom length and adding directors to a Yagi antenna?**

1. SWR increases

2. Weight decreases

3. Wind load decreases

**4. Gain increases**

*> More directors is the primary means of augmenting gain.  [ Weight and 'wind load' certainly increase then. ]*

**B-006-11-6 (1) What are some advantages of a Yagi with wide element spacing?**

**1. High gain, less critical tuning and wider bandwidth**

2. High gain, lower loss and a low SWR

3. High front-to-back ratio and lower input resistance

4. Shorter boom length, lower weight and wind resistance

*> 'lower loss', 'lower input resistance' and 'shorter boom length' are all misleading clues.*

**B-006-11-7 (4) Why is a Yagi antenna often used for radiocommunications on the 20-metre band?**

1. It provides excellent omnidirectional coverage in the horizontal plane

2. It is smaller, less expensive and easier to erect than a dipole or vertical antenna

3. It provides the highest possible angle of radiation for the HF bands

**4. It helps reduce interference from other stations off to the side or behind**

*> 20-metre is an amateur band with global reach.  It is open during day time even during solar cycle lows.  The directive antenna pattern of a Yagi permits reducing interference by focusing energy in one direction only.*

**B-006-11-8 (2) What does "antenna front-to-back ratio" mean in reference to a Yagi antenna?**

1. The relative position of the driven element with respect to the reflectors and directors

**2. The power radiated in the major radiation lobe compared to the power radiated in exactly the opposite direction**

3. The power radiated in the major radiation lobe compared to the power radiated 90 degrees away from that direction

4. The number of directors versus the number of reflectors

*> 'Front to back' is a ratio in decibels of the power radiated in the most favoured direction (front) to the power radiated towards the back of the antenna.*

**B-006-11-9 (1) What is a good way to get maximum performance from a Yagi antenna?**

**1. Optimize the lengths and spacing of the elements**

2. Use RG-58 feed line

3. Use a reactance bridge to measure the antenna performance from each direction around the antenna

4. Avoid using towers higher than 9 metres (30 feet) above the ground

*> All dimensions in Yagis must be optimized: the lengths and positions of each elements influence final performance. [ Center frequency, feedpoint impedance, forward gain, antenna bandwidth and front-to-back ratio all change with changing physical dimensions. ]*

**B-006-11-10 (4) The spacing between the elements on a three-element Yagi antenna, representing the best overall choice, is _____ of a wavelength.**

1. 0.15

2. 0.5

3. 0.75

**4. 0.2**

*> Two tenths of a wavelength is reputed to be an optimum choice on a 3-element beam.*

**B-006-11-11 (2) If the forward gain of a six-element Yagi is about 10 dB, what would the gain of two of these antennas be if they were "stacked"?**

1. 7 dB

**2. 13 dB**

3. 20 dB

4. 10 dB

*> This is a trick question.  Two identical antennas side by side doubles the radiated power.  An increase of 2 in power is a gain of +3 dB.  The gain of the array becomes 10 dB + 3 dB = 13 dB.*

**B-006-12-1 (3) If you made a half-wavelength dipole antenna for 28.550 MHz, how long would it be?**

1. 10.5 metres (34.37 ft)

2. 28.55 metres (93.45 ft)

**3. 5.01 metres (16.39 ft)**

4. 10.16 metres (33.26 ft)

*> key words: half-wavelength DIPOLE.  Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz.  A 'dipole' is approximately 95 % of one half wavelength in free space = '(300 / 2) * 0.95' divided by frequency in Megahertz.  In this example, the dipole must be (300 / 28.55 MHz / 2) * 0.95 = 4.99 m .  The frequency is in the 10-metre band of 28.0 to 29.7 MHz, a dipole there must be 5 metres long.*

**B-006-12-2 (3) What is one disadvantage of a random wire antenna?**

1. It usually produces vertically polarized radiation

2. It must be longer than 1 wavelength

**3. You may experience RF feedback in your station**

4. You must use an inverted T matching network for multi-band operation

*> Because the 'random wire antenna' frequently originates right at the back of the antenna tuner in your station.  "Stray Radio-Frequency" can be a problem*.

**B-006-12-3 (1) What is the low angle radiation pattern of an ideal half-wavelength dipole HF antenna installed parallel to the earth?**

**1. It is a figure-eight, perpendicular to the antenna**

2. It is a circle (equal radiation in all directions)

3. It is two smaller lobes on one side of the antenna, and one larger lobe on the other side

4. It is a figure-eight, off both ends of the antenna

*> Picture an horizontal dipole viewed from above.  If you plotted radiation all around it, the plot would look like a "number eight":  peak radiation at 90 degrees (broadside) from the antenna, negligible radiation from the ends.*

**B-006-12-4 (2) The impedances in ohms at the feed point of the dipole and folded dipole are, respectively:**

1. 73 and 150

**2. 73 and 300**

3. 52 and 100

4. 52 and 200

*> Feedpoint impedance of a dipole in free space: 73 ohms. Feedpoint impedance of a Folded Dipole: 300 ohms.*

**B-006-12-5 (4) A dipole transmitting antenna, placed so that the ends are pointing North/South, radiates:**

1. mostly to the South and North

2. mostly to the South

3. equally in all directions

**4. mostly to the East and West**

*> Picture an horizontal dipole viewed from above, if you plotted radiation all around it, the plot would look like a "number eight": peak radiation at 90 degrees (broadside) from the antenna, negligible radiation from the ends.*

**B-006-12-6 (4) How does the bandwidth of a folded dipole antenna compare with that of a simple dipole antenna?**

1. It is essentially the same

2. It is less than 50%

3. It is 0.707 times the bandwidth

**4. It is greater**

*> 'Antenna Bandwidth' is the range of frequencies over which Standing Wave Ratio (SWR) is acceptable. The Folded Dipole can be operated over a wider range of frequencies than a regular dipole.*

**B-006-12-7 (2) What is a disadvantage of using an antenna equipped with traps?**

1. It is too sharply directional at lower frequencies

**2. It will radiate harmonics**

3. It must be neutralized

4. It can only be used for one band

*> An antenna with traps is a multi-band antenna (i.e., resonant at more than one frequency).  If the transmitter leaks harmonic energy (multiples of the operating energy), this harmonic energy may be more readily radiated by a multi-band antenna.  For example, traps are inserted in an antenna for 80-metre to permit operation on 40-metre;  if your transmitter puts out 'harmonics' while you operate on 80-m ( say, 3.5 MHz ), the second harmonic falls in the 40-m band.  The antenna is also resonant at that frequency and would freely radiate the harmonics.*

**B-006-12-8 (1) What is an advantage of using a trap antenna?**

**1. It may be used for multi-band operation**

2. It has high directivity at the higher frequencies

3. It has high gain

4. It minimizes harmonic radiation

*> The only reason why antenna traps (parallel resonant circuits) are useful is to permit operation on more than one band from the same physical antenna.  Through their high impedance at resonance, traps shorten the antenna by making the antenna sections beyond them inaccessible.*

**B-006-12-9 (1) The "doublet antenna" is the most common in the amateur service. If you were to cut this antenna for 3.75 MHz, what would be its approximate length?**

**1. 38 meters (125 ft.)**

2. 32 meters (105 ft.)

3. 45 meters (145 ft.)

4. 75 meters (245 ft.)

*> key word: DOUBLET.  A synonym for DIPOLE.  Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz.  The dipole is approximately 95 % of one half wavelength in free space = '(300 / 2) * 0.95' divided by frequency in Megahertz.  In this example, the dipole must be cut to (300 / 3.75 MHz / 2) * 0.95 = 38 m .  [ 3.75 MHz is in the 80-metre band of 3.5 to 4.0 MHz, a DIPOLE there must be below 40 metres long ].*

**B-006-13-1 (3) What is a cubical quad antenna?**

1. A center-fed wire 1/2-electrical wavelength long

2. A vertical conductor 1/4-electrical wavelength high, fed at the bottom

**3. Two or more parallel four-sided wire loops, each approximately one-electrical wavelength long**

4. Four straight, parallel elements in line with each other, each approximately 1/2-electrical wavelength long

*> Only number 3 properly describes a parasitic array made of one-wavelength LOOPS. [ "1" is a dipole, "2" a vertical and "4" is Yagi-like. ]*

**B-006-13-2 (1) What is a delta loop antenna?**

**1. A type of cubical quad antenna, except with triangular elements rather than square**

2. A large copper ring or wire loop, used in direction finding

3. An antenna system made of three vertical antennas, arranged in a triangular shape

4. An antenna made from several triangular coils of wire on an insulating form

*> A 'delta' is a triangular shape. Number "1" describes a parasitic array made of one-wavelength LOOPS.*

**B-006-13-3 (1) Approximately how long is each side of a cubical quad antenna driven element for 21.4 MHz?**

**1. 3.54 metres (11.7 feet)**

2. 0.36 metres (1.17 feet)

3. 14.33 metres (47 feet)

4. 143 metres (469 feet)

*> key word: CUBICAL QUAD. A four-sided loop. Loop antennas are roughly 1 wavelength long. Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz. The 'driven' element in a LOOP is 2% longer than a full wavelength in free space = '300 * 1.02' divided by frequency in Megahertz. In this example, ONE side of the quad becomes (300 * 1.02) / 21.4 MHz / 4 = 3.57 m .*

**B-006-13-4 (2) Approximately how long is each side of a cubical quad antenna driven element for 14.3 MHz?**

1. 21.43 metres (70.3 feet)

**2. 5.36 metres (17.6 feet)**

3. 53.34 metres (175 feet)

4. 7.13 metres (23.4 feet)

*> key word: CUBICAL QUAD. A four-sided loop. Loop antennas are roughly 1 wavelength long. Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz. The 'driven' element in a LOOP is 2% longer than a full wavelength in free space = '300 * 1.02' divided by frequency in Megahertz. In this example, ONE side of the quad becomes (300 * 1.02) / 14.3 MHz / 4 = 5.35 m .*

**B-006-13-5 (4) Approximately how long is each leg of a symmetrical delta loop antenna driven element for 28.7 MHz?**

1. 2.67 metres (8.75 feet)

2. 7.13 metres (23.4 feet)

3. 10.67 metres (35 feet)

**4. 3.5 metres (11.5 feet)**

*> key word: DELTA LOOP. A three-sided loop. Loop antennas are roughly 1 wavelength long. Wavelength (lambda) in metres IN FREE SPACE is 300 divided by frequency in Megahertz. The 'driven' element in a LOOP is 2% longer than a full wavelength in free space = '300 * 1.02' divided by frequency in Megahertz. In this example, ONE side of the DELTA becomes (300 * 1.02) / 28.7 MHz / 3 = 3.55 m .*

**B-006-13-6 (2) Which statement about two-element delta loops and quad antennas is true?**

1. They perform very well only at HF

**2. They compare favourably with a three-element Yagi**

3. They are effective only when constructed using insulated wire

4. They perform poorly above HF

*> Because quads and deltas focus energy in both planes, horizontal and vertical, the two-element quad performs similarly to a three-element Yagi.*

**B-006-13-7 (1) Compared to a dipole antenna, what are the directional radiation characteristics of a cubical quad antenna?**

**1. The quad has more directivity in both horizontal and vertical planes**

2. The quad has more directivity in the horizontal plane but less directivity in the vertical plane

3. The quad has less directivity in the horizontal plane but more directivity in the vertical plane

4. The quad has less directivity in both horizontal and vertical planes

*> A quad with its four-sided architecture focuses energy in the vertical (up and down) AND horizontal (left to right) planes.*

**B-006-13-8 (3) Moving the feed point of a multi-element quad antenna from a side parallel to the ground to a side perpendicular to the ground will have what effect?**

1. It will change the antenna polarization from vertical to horizontal

2. It will significantly decrease the antenna feed point impedance

**3. It will change the antenna polarization from horizontal to vertical**

4. It will significantly increase the antenna feed point impedance

*> In your head, squish the quad from the top down, it now looks like a Folded Dipole. If the Folded dipole is horizontal, it is polarized horizontally. Flip it 90 degrees and it is now has a vertical polarization.*

**B-006-13-9 (2) What does the term "antenna front-to-back ratio" mean in reference to a delta loop antenna?**

1. The relative position of the driven element with respect to the reflectors and directors

**2. The power radiated in the major radiation lobe compared to the power radiated in exactly the opposite direction**

3. The power radiated in the major radiation lobe compared to the power radiated 90 degrees away from that direction

4. The number of directors versus the number of reflectors

*> Same as a Yagi. 'Front to back' is a ratio in decibels of the power radiated in the most favoured direction (front) to the power radiated towards the back of the antenna.*

**B-006-13-10 (2) The cubical "quad" or "quad" antenna consists of two or more square loops of wire. The driven element has an approximate overall length of:**

1. three-quarters of a wavelength

**2. one wavelength**

3. two wavelengths

4. one-half wavelength

*> key words:  LOOP, OVERALL length.  A loop antenna is a little over 1 wavelength long (1.02 wavelength to be precise).*

**B-006-13-11 (2) The delta loop antenna consists of two or more triangular structures mounted on a boom. The overall length of the driven element is approximately:**

1. one-quarter of a wavelength

**2. one wavelength**

3. two wavelengths

4. one-half of a wavelength

*> key words:  LOOP, OVERALL length.  A loop antenna is a little over 1 wavelength long (1.02 wavelength to be precise).*

# Digital Modes

**B-003-15-1 (4) What does "connected" mean in a packet-radio link?**

1. A telephone link is working between two stations

2. A message has reached an amateur station for local delivery

3. A transmitting and receiving station are using a digipeater, so no other contacts can take place until they are finished

**4. A transmitting station is sending data to only one receiving station; it replies that the data is being received correctly**

*> When two PACKET stations are "connected", the receiving station acknowledges each received packet as valid.  A "connection" involves only two stations;  each acknowledging the packets from the other.  Concurrent "connections" can share the same frequency.  A 'Terminal-Node Controller' (TNC) is the key component in a packet station.  The TNC is a specialized MODEM which assembles/de-assembles data packets and performs error checking.*

**B-003-15-2 (2) What does "monitoring" mean on a packet-radio frequency?**

1. A member of the Amateur Auxiliary is copying all messages

**2. A receiving station is displaying messages that may not be sent to it, and is not replying to any message**

3. A receiving station is displaying all messages sent to it, and replying that the messages are being received correctly

4. Industry Canada is monitoring all messages

*> A 'Terminal-Node Controller' (TNC) is the key component in a packet station.  The TNC is a specialized MODEM which assembles/de-assembles data packets and performs error checking.  A TNC in "Monitor" mode will display the packets heard but not attempt to acknowledge any.*

**B-003-15-3 (3) What is a digipeater?**

1. A repeater built using only digital electronics parts

2. A repeater that changes audio signals to digital data

**3. A packet-radio station that retransmits only data that is marked to be retransmitted**

4. A packet-radio station that retransmits any data that it receives

*> A 'Digipeater' (contraction of 'digital repeater') only repeats packets specifically addressed for routing through that digipeater:  i.e., marked with its call sign.  Unlike duplex voice repeaters using two frequencies, the digipeater receives, temporarily stores and retransmits the data packets on a single frequency.*

**B-003-15-4 (1) What does "network" mean in packet radio?**

**1. A way of connecting packet-radio stations so data can be sent over long distances**

2. A way of connecting terminal-node controllers by telephone so data can be sent over long distances

3. The connections on terminal-node controllers

4. The programming in a terminal-node controller that rejects other callers if a station is already connected

*> In packet radio operation, a 'network' is a succession of digipeaters (or normal packet stations which can also 'digipeat') used to connect to a station normally not within range of the originating station.*

**B-003-15-5 (4) In packet-radio operation, what equipment connects to a terminal-node controller?**

1. A transceiver and a modem

2. A DTMF keypad, a monitor and a transceiver

3. A DTMF microphone, a monitor and a transceiver

**4. A transceiver and a terminal or computer system**

*> The Digital Station block diagram: Input/Output, Computer, MODEM, Transceiver, Antenna. In a packet station, the TNC is the specialized modem (i.e., it incorporates a modem) used to assemble/disassemble data packets. A 'terminal' (sometimes called a 'dumb terminal') does not need to be a computer but can be a simple display and keyboard.*

**B-003-15-6 (1) How would you modulate a 2 meter FM transceiver to produce packet-radio emissions?**

**1. Connect a terminal-node controller to the transceiver's microphone input**

2. Connect a terminal-node controller to interrupt the transceiver's carrier wave

3. Connect a keyboard to the transceiver's microphone input

4. Connect a DTMF key pad to the transceiver's microphone input

*> The Digital Station block diagram: Input/Output, Computer, MODEM, Transceiver, Antenna. In a packet station, the TNC is the specialized modem (i.e., it incorporates a modem) used to assemble/disassemble data packets.*

**B-003-15-7 (3) When selecting a RTTY transmitting frequency, what minimum frequency separation from a contact in progress should you allow (center to center) to minimize interference?**

1. Approximately 6 kHz

2. Approximately 3 kHz

**3. 250 to 500 Hz**

4. 60 Hz

*> In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz. Minimum frequency separation: CW = 150 to 500 Hz, RTTY = 250 to 500 Hz, SSB = 3 kHz to 5 kHz. [ The 'Mark' and 'Space' states are represented by two discrete frequencies normally 170 Hz apart from one another. ]*

**B-003-15-8 (3) Digital transmissions use signals called ___________ to transmit the states 1 and 0**

1. packet and AMTOR

2. baudot and ASCII

**3. mark and space**

4. dot and dash

*> The terms 'Mark' (on) and 'Space' (off) date back to the days of land-line telegraph where dots and dashes corresponding to the incoming pulses were inked or embossed on paper ribbon. When the telegraph circuit was energized, the receiving machine would mark the paper, otherwise blank space appeared on the paper. [ Samuel F. B. Morse perfected a "Telegraph Register" which could mark dots and dashes on a moving strip of paper in the years 1832 to 1844. US Patent 000006420 ]*

**B-003-15-9 (2) Which of the following terms does not apply to packet?**

1. ASCII

**2. Baudot**

3. Terminal-Node Controller (TNC)

4. AX.25

*> key word: NOT. 'Baudot' is the encoding used for RTTY (RadioTeletype). On packet, the computer exchanges ASCII (American Standard Code for Information Interchange) with the TNC. The TNC packages packets per the AX.25 protocol.*

**B-003-15-10 (3) When using AMTOR transmissions, there are two modes that may be utilized. Mode A uses Automatic Repeat Request (ARQ) protocol and is normally used:**

1. at all times. Mode B is for test purposes only

2. only when communications have been completed

**3. for communications after contact has been established**

4. when making a general call

*> AMTOR (Amateur Teleprinting Over Radio).  Mode 'B' [Forward Error Correction, groups of 5 characters are sent twice] used for CQ (call to any station), bulletins or nets where no acknowledgements are exchanged.  Mode 'A' [Automatic Repeat Request, characters sent by groups of three must be acknowledged] used when two stations are in contact (similar to the "connection" in packet).*

**B-003-15-11 (4) What is the most common data rate used for VHF packet communications?**

1. 300 baud

2. 9600 baud

3. 2400 baud

**4. 1200 baud**

*> The most COMMON data rate for VHF packet is 1200 baud.  A 'baud': the reciprocal of the shortest element (in seconds) in the data-encoding scheme.  1200 baud corresponds to 1200 elements per second ( the signalling rate ).  Each 'signalling element' can convey one or more bits of data ( the information transfer rate in bits per second ). [ 300 baud is a common rate on HF ]*

{L15} Regulations, Part III

**B-001-14-1 (2) If a non-amateur friend is using your station to talk to someone in Canada, and a foreign station breaks in to talk to your friend, what should you do?**

1. Since you can talk to foreign amateurs, your friend may keep talking as long as you are the control operator

**2. Have your friend wait until you find out if Canada has a third-party agreement with the foreign station's government**

3. Report the incident to the foreign amateur's government

4. Stop all discussions and quickly sign off

*> 'Third-Party communication': a message originating from or intended for a person other than the two amateurs in a radio contact. Originally, countries needed to sign agreements permitting exchanges of messages on behalf of third parties. Nowadays, each country states its position: "Any foreign administration may permit its amateur stations to communicate on behalf of third parties without having to enter into any special arrangements with Canada. Canada does not prohibit international communications on behalf of third parties. (RIC-2)"*

**B-001-14-2 (3) If you let an unqualified third party use your amateur station, what must you do at your station's control point?**

1. You must key the transmitter and make the station identification

2. You must monitor and supervise the communication only if contacts are made on frequencies below 30 MHz

**3. You must continuously monitor and supervise the third party's participation**

4. You must monitor and supervise the communication only if contacts are made in countries which have no third party communications

*> This is a catch. The requirement for a 'Control Operator' comes first before the question of 'Third Party communications'.*

**B-001-14-3 (3) Radio amateurs may use their stations to transmit international communications on behalf of a third party only if:**

1. the amateur station has received written authorization from Industry Canada to pass third party traffic

2. the communication is transmitted by secret code

**3. such communications have been authorized by the countries concerned**

4. prior remuneration has been received

*> 'Third-Party communication': a message originating from or intended for a person other than the two amateurs in a radio contact. Originally, countries needed to sign agreements permitting exchanges of messages on behalf of third parties. Nowadays, each country states its position: "Any foreign administration may permit its amateur stations to communicate on behalf of third parties without having to enter into any special arrangements with Canada. Canada does not prohibit international communications on behalf of third parties. (RIC-2)"*

**B-001-14-4 (1) A person operating a Canadian amateur station is forbidden to communicate with amateur stations of another country:**

**1. when that country has notified the International Telecommunication Union that it objects to such communications**

2. without written permission from Industry Canada

3. until he has properly identified his station

4. unless he is passing third-party traffic

*> key word: FORBIDDEN. Certain countries do not allow amateur communications with their borders; they must notify the ITU that they forbid such communications.*

**B-001-14-5 (2) International communications on behalf of third parties may be transmitted by an amateur station only if:**

1. English or French is used to identify the station at the end of each transmission

**2. the countries concerned have authorized such communications**

3. the countries for which the traffic is intended have registered their consent to such communications with the ITU

4. radiotelegraphy is used

*> 'Third-Party communication': a message originating from or intended for a person other than the two amateurs in a radio contact. Originally, countries needed to sign agreements permitting exchanges of messages on behalf of third parties. Nowadays, each country states its position: "Any foreign administration may permit its amateur stations to communicate on behalf of third parties without having to enter into any special arrangements with Canada. Canada does not prohibit international communications on behalf of third parties. (RIC-2)"*

**B-001-14-6 (4) Amateur third party communications is:**

1. the transmission of commercial or secret messages

2. a simultaneous communication between three operators

3. none of these answers

**4. the transmission of non-commercial or personal messages to or on behalf of a third party**

*> 'Third-Party communication': a message originating from or intended for a person other than the two amateurs in a radio contact. Originally, countries needed to sign agreements permitting exchanges of messages on behalf of third parties. Nowadays, each country states its position: "Any foreign administration may permit its amateur stations to communicate on behalf of third parties without having to enter into any special arrangements with Canada. Canada does not prohibit international communications on behalf of third parties. (RIC-2)"*

**B-001-14-7 (3) Third-party traffic is:**

1. any message passed by an amateur station

2. coded communications of any type

**3. a message sent to a non-amateur via an amateur station**

4. any communication between two amateur operators

*> 'Third-Party communication': a message originating from or intended for a person other than the two amateurs in a radio contact.  Originally, countries needed to sign agreements permitting exchanges of messages on behalf of third parties.  Nowadays, each country states its position:  "Any foreign administration may permit its amateur stations to communicate on behalf of third parties without having to enter into any special arrangements with Canada.  Canada does not prohibit international communications on behalf of third parties. (RIC-2)"*

**B-001-14-8 (3) One of the following is not considered to be communications on behalf of a third party, even though the message is originated by, or addressed to, a non-amateur:**

1. messages that are handled within a local network

2. messages addressed to points within Canada

**3. messages originated from Canadian Forces Affiliate Radio Service (CFARS)**

4. all messages received from Canadian stations

*> key word:  NOT.  CFARS (Canadian Forces Affiliate Radio Service) and MARS (United States Military Affiliate Radio System) are not considered 'Third Party communications'.  [ MARS has been renamed Military Auxiliary Radio System on 2009 12 23 by the US Department of Defence. ]*

**B-001-14-9 (1) One of the following is not considered to be communications on behalf of a third party, even though the message may be originated by, or addressed to, a non-amateur:**

**1. messages that originate from the United States Military Affiliate Radio System (MARS)**

2. all messages originated by Canadian amateur stations

3. messages addressed to points within Canada from the United States

4. messages that are handled within local networks during a simulated emergency exercise

*> key word:  NOT.  CFARS (Canadian Forces Affiliate Radio Service) and MARS (United States Military Affiliate Radio System) are not considered 'Third Party communications'.  [ MARS has been renamed Military Auxiliary Radio System on*

*2009 12 23 by the US Department of Defence. ]*

**B-001-14-10 (3) Which of the following is NOT correct? While in Canada, the operator of a station licensed by the Government of the United States, shall identify the station using three of these identifiers:**

1. by adding to the call sign the Canadian call sign prefix for the geographic location of the station

2. by radiotelephone, adding to the call sign the word "mobile" or "portable" or by radiotelegraph adding the oblique character "/"

**3. US radio amateurs must obtain a Canadian amateur station licence before operating in Canada**

4. by transmitting the call sign assigned by the FCC

*> key word: NOT. Canada and the US have a reciprocal agreement which permits amateurs from one country to operate in the other country. While in Canada, the US amateur identifies with his call sign, the qualifier "mobile" or "portable" and the prefix of the Canadian province/territory. [ In the US, the Federal Communications Commission (FCC) regulates radio ]*

**B-001-14-11 (1) Which of the following statements is NOT correct? A Canadian radio amateur may:**

**1. pass third-party traffic with all duly licensed amateur stations in any country which is a member of the ITU**

2. pass messages originating from or destined to the United States Military Affiliate Radio System (MARS)

3. pass messages originating from or destined to the Canadian Forces Affiliate Radio Service (CFARS)

4. communicate with a similar station of a country which has not notified ITU that it objects to such communications

*> key word: NOT. 'Third-Party communication': a message originating from or intended for a person other than the two amateurs in a radio contact. Third party communications can only be exchanged with countries which permit such communication. CFARS (Canadian Forces Affiliate Radio Service) and MARS (United States Military Affiliate Radio System) are not considered 'Third Party communications'. [ MARS has been renamed Military Auxiliary Radio System on 2009 12 23 by the US Department of Defence. ]*

**B-001-15-1 (1) If you let another amateur with additional qualifications than yours control your station, what operating privileges are allowed?**

**1. Only the privileges allowed by your qualifications**

2. Any privileges allowed by the additional qualifications

3. All the emission privileges of the additional qualifications, but only the frequency privileges of your qualifications

4. All the frequency privileges of the additional qualifications, but only the emission privileges of your qualifications

*> Quoted from a 1980 TRC-25: "57) a licensee may permit another certificate holder to operate his station using only such frequencies and emission modes as the licensee is qualified to use or, if the person is not as qualified as the licensee, only such frequencies and emission modes as the person is qualified to use". Interpretation: a licensed visiting operator may only operate the station within your or his privileges, whichever are lower.*

**B-001-15-2 (4) If you are the control operator at the station of another amateur who has additional qualifications to yours, what operating privileges are you allowed?**

1. Any privileges allowed by the additional qualifications

2. All the emission privileges of the additional qualifications, but only the frequency privileges of your qualifications

3. All the frequency privileges of the additional qualifications, but only the emission privileges of your qualifications

**4. Only the privileges allowed by your qualifications**

*> Quoted from a 1980 TRC-25: "57) a licensee may permit another certificate holder to operate his station using only such frequencies and emission modes as the licensee is qualified to use or, if the person is not as qualified as the licensee, only such frequencies and emission modes as the person is qualified to use". Interpretation: a licensed visiting operator may only operate the station within your or his privileges, whichever are lower.*

**B-001-15-3 (4) In addition to passing the Basic written examination, what must you do before you are allowed to use amateur frequencies below 30 MHz?**

1. You must notify Industry Canada that you intend to operate on the HF bands

2. You must pass a Morse code test

3. You must attend a class to learn about HF communications

**4. You must pass a Morse code or Advanced test or attain a mark of 80% on the Basic exam**

*> Until July 2003, it was an ITU regulation that amateurs needed to demonstrate Morse proficiency before being allowed BELOW 30 MHz. In July 2005, Canada added alternatives to the Morse qualification; namely, an 80% mark on the Basic qualification or an Advanced qualification.*

**B-001-15-4 (2) The licensee of an amateur station may operate radio controlled models:**

1. if the control transmitter does not exceed 15 kHz of occupied bandwidth

**2. on all frequencies above 30 MHz**

3. if the frequency used is below 30 MHz

4. if only pulse modulation is used

*> "Frequencies for Radio Control of Models: The frequency for the radio control of a model is limited to any frequency within the amateur bands above 30 MHz" (RIC-2)*

**B-001-15-5 (4) In Canada, the 75/80 metre amateur band corresponds in frequency to:**

1. 3.0 to 3.5 MHz

2. 4.0 to 4.5 MHz

3. 4.5 to 5.0 MHz

**4. 3.5 to 4.0 MHz**

*> 80-metre: 3.5 to 4.0 MHz. Some amateurs refer to the upper part, say 3.8 MHz and up, as 75 metre. With wavelength in metres being 300 divided by frequency in megahertz: the band covers 86 metres to 75 metres*.

**B-001-15-6 (1) In Canada, the 160 metre amateur band corresponds in frequency to:**

**1. 1.8 to 2.0 MHz**

2. 1.5 to 2.0 MHz

3. 2.0 to 2.25 MHz

4. 2.25 to 2.5 MHz

*> 160-metre: 1.8 to 2.0 MHz. With wavelength in metres being 300 divided by frequency in megahertz: the band covers 167 metres to 150 metres.*

**B-001-15-7 (4) In Canada, the 40 metre amateur band corresponds in frequency to:**

1. 6.5 to 6.8 MHz

2. 6.0 to 6.3 MHz

3. 7.7 to 8.0 MHz

**4. 7.0 to 7.3 MHz**

*> 40-metre:  7.0 to 7.3 MHz.  With wavelength in metres being 300 divided by frequency in megahertz:  the band covers 43 metres to 41 metres.*

**B-001-15-8 (1) In Canada, the 20 meter amateur band corresponds in frequency to:**

**1. 14.000 to 14.350 MHz**

2. 13.500 to 14.000 MHz

3. 15.000 to 15.750 MHz

4. 16.350 to 16.830 MHz

*> 20-metre:  14.00 to 14.35 MHz.  With wavelength in metres being 300 divided by frequency in megahertz:  the band covers 21.4 metres to 20.9 metres.*

**B-001-15-9 (4) In Canada, the 15 metre amateur band corresponds in frequency to:**

1. 18.068 to 18.168 MHz

2. 14.000 to 14.350 MHz

3. 28.000 to 29.700 MHz

**4. 21.000 to 21.450 MHz**

*> 15-metre:  21.00 to 21.45 MHz.  With wavelength in metres being 300 divided by frequency in megahertz:  the band covers 14.3 metres to 14.0 metres.*

**B-001-15-10 (1) In Canada, the 10 metre amateur band corresponds in frequency to:**

**1. 28.000 to 29.700 MHz**

2. 24.890 to 24.990 MHz

3. 21.000 to 21.450 MHz

4. 50.000 to 54.000 MHz

*> 10-metre:  28.0 to 29.7 MHz.  NOTE:  FM is not allowed below 29.5 MHz.  Signal from Basic operator cannot be retransmitted below 29.5 MHz.  With wavelength in metres being 300 divided by frequency in megahertz:  the band covers 10.7 metres to 10.1 metres.*

**B-001-15-11 (3) In Canada, radio amateurs may use which of the following for radio control of models:**

1. 50 to 54 MHz only

2. all amateur frequency bands

**3. all amateur frequency bands above 30 MHz**

4. 50 to 54, 144 to 148, and 220 to 225 MHz only

*> "Frequencies for Radio Control of Models:  The frequency for the radio control of a model is limited to any frequency within the amateur bands above 30 MHz" (RIC-2)*

**B-001-16-1 (4) What is the maximum authorized bandwidth within the frequency range of 50 to 148 MHz?**

1. 20 kHz

2. The total bandwidth shall not exceed that of a single-sideband phone emission

3. The total bandwidth shall not exceed 10 times that of a CW emission

**4. 30 kHz**

*> Allowed bandwidths: with the exception of 30m (10.1 to 10.15 MHz) where 1 kHz is allowed, 6 kHz is allowed on bands below 28 MHz, 20 kHz is allowed on 10m (28.0 to 29.7 MHz), 30 kHz is allowed on 6m (50 to 54 MHz) and 2m (144 to 148 MHz), Fast-scan Amateur Television only becomes permissible on 430 to 450 MHz [where 12 MHz of bandwidth is allowed].  In order of bandwidth requirements:  CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.*

**B-001-16-2 (2) The maximum bandwidth of an amateur station's transmission allowed in the band 28 to 29.7 MHz is:**

1. 6 kHz

**2. 20 kHz**

3. 30 kHz

4. 15 kHz

*> Allowed bandwidths: with the exception of 30m (10.1 to 10.15 MHz) where 1 kHz is allowed, 6 kHz is allowed on bands below 28 MHz, 20 kHz is allowed on 10m (28.0 to 29.7 MHz), 30 kHz is allowed on 6m (50 to 54 MHz) and 2m (144 to 148 MHz), Fast-scan Amateur Television only becomes permissible on 430 to 450 MHz [where 12 MHz of bandwidth is allowed].  In order of bandwidth requirements:  CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.*

**B-001-16-3 (1) Except for one band, the maximum bandwidth of an amateur station's transmission allowed below 28 MHz is:**

**1. 6 kHz**

2. 15 kHz

3. 20 kHz

4. 30 kHz

*> Allowed bandwidths: with the exception of 30m (10.1 to 10.15 MHz) where 1 kHz is allowed, 6 kHz is allowed on bands below 28 MHz, 20 kHz is allowed on 10m (28.0 to 29.7 MHz), 30 kHz is allowed on 6m (50 to 54 MHz) and 2m (144 to 148 MHz), Fast-scan Amateur Television only becomes permissible on 430 to 450 MHz [where 12 MHz of bandwidth is allowed]. In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz*.

**B-001-16-4 (3) The maximum bandwidth of an amateur station's transmission allowed in the band 144 to 148 MHz is:**

1. 6 kHz

2. 20 kHz

**3. 30 kHz**

4. 15 kHz

*> Allowed bandwidths: with the exception of 30m (10.1 to 10.15 MHz) where 1 kHz is allowed, 6 kHz is allowed on bands below 28 MHz, 20 kHz is allowed on 10m (28.0 to 29.7 MHz), 30 kHz is allowed on 6m (50 to 54 MHz) and 2m (144 to 148 MHz), Fast-scan Amateur Television only becomes permissible on 430 to 450 MHz [where 12 MHz of bandwidth is allowed]. In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.*

**B-001-16-5 (2) The maximum bandwidth of an amateur station's transmission allowed in the band 50 to 54 MHz is:**

1. 20 kHz

**2. 30 kHz**

3. 6 kHz

4. 15 kHz

*> Allowed bandwidths: with the exception of 30m (10.1 to 10.15 MHz) where 1 kHz is allowed, 6 kHz is allowed on bands below 28 MHz, 20 kHz is allowed on 10m (28.0 to 29.7 MHz), 30 kHz is allowed on 6m (50 to 54 MHz) and 2m (144 to 148 MHz), Fast-scan Amateur Television only becomes permissible on 430 to 450 MHz [where 12 MHz of bandwidth is allowed]. In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz*.

**B-001-16-6 (2) Only one band of amateur frequencies has a maximum allowed bandwidth of less than 6 kHz. That band is:**

1. 18.068 to 18.168 MHz

**2. 10.1 to 10.15 MHz**

3. 24.89 to 24.99 MHz

4. 1.8 to 2.0 MHz

*> Allowed bandwidths: with the exception of 30m (10.1 to 10.15 MHz) where 1 kHz is allowed, 6 kHz is allowed on bands below 28 MHz, 20 kHz is allowed on 10m (28.0 to 29.7 MHz), 30 kHz is allowed on 6m (50 to 54 MHz) and 2m (144 to 148 MHz), Fast-scan Amateur Television only becomes permissible on 430 to 450 MHz [where 12 MHz of bandwidth is allowed]. In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.*

**B-001-16-7 (2) Single sideband is not permitted in the band:**

1. 18.068 to 18.168 MHz

**2. 10.1 to 10.15 MHz**

3. 24.89 to 24.99 MHz

4. 7.0 to 7.3 MHz

*> key word: NOT. SSB is too wide for 30m. Allowed bandwidths: with the exception of 30m (10.1 to 10.15 MHz) where 1 kHz is allowed, 6 kHz is allowed on bands below 28 MHz, 20 kHz is allowed on 10m (28.0 to 29.7 MHz), 30 kHz is allowed on 6m (50 to 54 MHz) and 2m (144 to 148 MHz), Fast-scan Amateur Television only becomes permissible on 430 to 450 MHz [where 12 MHz of bandwidth is allowed]. In order of bandwidth requirements: CW* = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.

**B-001-16-8 (4) The bandwidth of an amateur station shall be determined by measuring the frequency band occupied by that signal at a level of ____ dB below the maximum amplitude of that signal**:

1. 3

2. 6

3. 36

**4. 26**

*> "The bandwidth of a signal shall be determined by measuring the frequency band occupied by that signal at a level that is 26 dB below the maximum amplitude of that signal." (RIC-2)*

**B-001-16-9 (3) Which of the following answers is NOT correct? Based on the bandwidth required, the following modes may be transmitted on these frequencies:**

1. AMTOR on 14.08 MHz

2. packet on 10.145 MHz

**3. fast-scan television (ATV) on 145 MHz**

4. fast-scan television (ATV) on 440 MHz

**> key word: NOT. ATV is too wide for 2m. Allowed bandwidths: with the exception of 30m (10.1 to 10.15 MHz) where 1 kHz is allowed, 6 kHz is allowed on bands below 28 MHz, 20 kHz is allowed on 10m (28.0 to 29.7 MHz), 30 kHz is allowed on 6m (50 to 54 MHz) and 2m (144 to 148 MHz), Fast-scan Amateur Television only becomes permissible on 430 to 450 MHz [where 12 MHz of bandwidth is allowed]. In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.**

**B-001-16-10 (1) Which of the following answers is NOT correct? Based on the bandwidth required, the following modes may be transmitted on these frequencies:**

**1. fast-scan television (ATV) on 14.23 MHz**

2. slow-scan television (SSTV) on 14.23 MHz

3. frequency modulation (FM) on 29.6 MHz

4. single-sideband (SSB) on 3.76 MHz

*> key word: NOT. ATV is too wide for 20m. Allowed bandwidths: with the exception of 30m (10.1 to 10.15 MHz) where 1 kHz is allowed, 6 kHz is allowed on bands below 28 MHz, 20 kHz is allowed on 10m (28.0 to 29.7 MHz), 30 kHz is allowed on 6m (50 to 54 MHz) and 2m (144 to 148 MHz), Fast-scan Amateur Television only becomes permissible on 430 to 450 MHz [where 12 MHz of bandwidth is allowed]. In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.*

**B-001-16-11 (1) Which of the following answers is NOT correct? Based on the bandwidth required, the following modes may be transmitted on these frequencies:**

**1. single-sideband (SSB) on 10.12 MHz**

2. frequency modulation (FM) on 29.6 MHz

3. Morse radiotelegraphy (CW) on 10.11 MHz

4. packet on 10.148 MHz

*> key word: NOT. SSB is too wide for 30m. Allowed bandwidths: with the exception of 30m (10.1 to 10.15 MHz) where 1 kHz is allowed, 6 kHz is allowed on bands below 28 MHz, 20 kHz is allowed on 10m (28.0 to 29.7 MHz), 30 kHz is allowed on 6m (50 to 54 MHz) and 2m (144 to 148 MHz), Fast-scan Amateur Television only becomes permissible on 430 to 450 MHz [where 12 MHz of bandwidth is allowed]. In order of bandwidth requirements: CW = about 100 Hz, RTTY = about 600 Hz, SSB = 2 to 3 kHz, FM = 10 to 20 kHz.*

**B-001-17-1 (1) What amount of transmitter power must radio amateurs use at all times?**

**1. The minimum legal power necessary to communicate**

2. 25 watts PEP output

3. 250 watts PEP output

4. 2000 watts PEP output

*> Amateurs shall use the minimum legal power necessary to communicate within these restrictions: BASIC Qualification = 250 Watts DC input or 560 Watts PEP ("where expressed as radio frequency output power measured across an impedance-matched load"). ADVANCED Qualification: 1000 Watts DC input. The Morse Qualification has no bearing on the allowed power.*

**B-001-17-2 (3) What is the most FM transmitter power a holder of only Basic Qualification may use on 147 MHz?**

1. 1000 watts DC input

2. 200 watts PEP output

**3. 250 W DC input**

4. 25 watts PEP output

*> key word: BASIC. Amateurs shall use the minimum legal power necessary to communicate within these restrictions: BASIC Qualification = 250 Watts DC input or 560 Watts PEP ("where expressed as radio frequency output power measured across an impedance-matched load"). ADVANCED Qualification: 1000 Watts DC input. The Morse Qualification has no bearing on the allowed power.*

**B-001-17-3 (2) At what point in your station is transceiver power measured?**

1. At the final amplifier input terminals inside the transmitter or amplifier

**2. At the antenna terminals of the transmitter or amplifier**

3. On the antenna itself, after the feed line

4. At the power supply terminals inside the transmitter or amplifier

*> Amateurs shall use the minimum legal power necessary to communicate within these restrictions:  BASIC Qualification = 250 Watts DC input or 560 Watts PEP ("where expressed as radio frequency output power measured across an impedance-matched load").  ADVANCED Qualification:  1000 Watts DC input.  The Morse Qualification has no bearing on the allowed power.*

**B-001-17-4 (4) What is the maximum transmitting output power an amateur station may use on 3750 kHz, if the operator has Basic and 5 w.p.m. qualifications?**

1. 1000 watts PEP output for SSB operation

2. 1500 watts PEP output for SSB operation

3. 2000 watts PEP output for SSB operation

**4. 560 watts PEP output for SSB operation**

*> key word:  BASIC.  Amateurs shall use the minimum legal power necessary to communicate within these restrictions:  BASIC Qualification = 250 Watts DC input or 560 Watts PEP ("where expressed as radio frequency output power measured across an impedance-matched load").  ADVANCED Qualification:  1000 Watts DC input.  The Morse Qualification has no bearing on the allowed power*.

**B-001-17-5 (2) What is the maximum transmitting power an amateur station may use for SSB operation on 7055 kHz, if the operator has Basic and 5 w.p.m. qualifications?**

1. 1000 watts PEP output

**2. 560 watts PEP output**

3. 2000 watts PEP output

4. 200 watts PEP output

*> key word:  BASIC.  Amateurs shall use the minimum legal power necessary to communicate within these restrictions:  BASIC Qualification = 250 Watts DC input or 560 Watts PEP ("where expressed as radio frequency output power measured across an impedance-matched load").  ADVANCED Qualification:  1000 Watts DC input.  The Morse Qualification has no bearing on the allowed power.*

**B-001-17-6 (3) The DC power input to the anode or collector circuit of the final RF stage of a transmitter, used by a holder of an Amateur Radio**

**Operator Certificate with Advanced Qualification, shall not exceed:**

1. 250 watts

2. 500 watts

**3. 1000 watts**

4. 750 watts

*> key word: ADVANCED. Amateurs shall use the minimum legal power necessary to communicate within these restrictions: BASIC Qualification = 250 Watts DC input or 560 Watts PEP ("where expressed as radio frequency output power measured across an impedance-matched load"). ADVANCED Qualification: 1000 Watts DC input. The Morse Qualification has no bearing on the allowed power.*

**B-001-17-7 (2) The maximum DC input to the final stage of an amateur transmitter, when the operator is the holder of both the Basic and Advanced qualifications, is:**

1. 250 watts

**2. 1000 watts**

3. 1500 watts

4. 500 watts

*> key word: ADVANCED. Amateurs shall use the minimum legal power necessary to communicate within these restrictions: BASIC Qualification = 250 Watts DC input or 560 Watts PEP ("where expressed as radio frequency output power measured across an impedance-matched load"). ADVANCED Qualification: 1000 Watts DC input. The Morse Qualification has no bearing on the allowed power.*

**B-001-17-8 (3) The operator of an amateur station, who is the holder of a Basic Qualification, shall ensure that the station power, when expressed as RF output power measured across an impedance matched load, does not exceed:**

1. 2500 watts peak power

2. 1000 watts carrier power for transmitters producing other emissions

**3. 560 watts peak-envelope power, for transmitters producing any type of single sideband emission**

4. 150 watts peak power

*> key word: BASIC. Amateurs shall use the minimum legal power necessary to communicate within these restrictions: BASIC Qualification = 250 Watts DC input or*

*560 Watts PEP ("where expressed as radio frequency output power measured across an impedance-matched load"). ADVANCED Qualification: 1000 Watts DC input. The Morse Qualification has no bearing on the allowed power.*

**B-001-17-9 (3) The holder of an Amateur Radio Operator Certificate with Basic Qualification is limited to a maximum of _______ watts when expressed as direct current input power to the anode or collector circuit of the transmitter stage supplying radio frequency energy to the antenna :**

1. 1000

2. 750

**3. 250**

4. 100

*> key word: BASIC. Amateurs shall use the minimum legal power necessary to communicate within these restrictions: BASIC Qualification = 250 Watts DC input or 560 Watts PEP ("where expressed as radio frequency output power measured across an impedance-matched load"). ADVANCED Qualification: 1000 Watts DC input. The Morse Qualification has no bearing on the allowed power.*

**B-001-18-1 (1) What kind of amateur station automatically retransmits the signals of other stations?**

**1. Repeater station**

2. Space station

3. Remote-controlled station

4. Beacon station

*> A 'Repeater' is generally located on a hill or tall building. It is meant to extend the range of portables and mobiles. 'Beacons' are one-way automated stations maintained by amateurs which operate on known frequencies to permit evaluating propagation conditions.*

**B-001-18-2 (2) An unmodulated carrier may be transmitted only:**

1. if the output to the final RF amplifier is kept under 5W

**2. for brief tests on frequencies below 30 MHz**

3. when transmitting SSB

4. in frequency bands below 30 MHz

*> "An unmodulated carrier in a frequency band below 30 MHz may be transmitted for brief tests."  (RIC-2)*

**B-001-18-3 (4) Radiotelephone signals in a frequency band below ____ MHz cannot be automatically retransmitted, unless these signals are received from a station operated by a person qualified to transmit on frequencies below the above frequency:**

1. 29.7 MHz

2. 50 MHz

3. 144 MHz

**4. 29.5 MHz**

*> "Radiotelephone signals in a frequency band below 29.50 MHz cannot be automatically retransmitted unless these signals are received from a station operated by a person qualified to transmit on frequencies below 29.50 MHz." (RIC-2)*

**B-001-18-4 (4) Which of the following statements is NOT correct? Radiotelephone signals may be retransmitted:**

1. in the 29.5-29.7 MHz band, when received in a VHF band,  from a station operated by a person with only Basic Qualification.

2. in the 50-54 MHz frequency band, when received from a station operated by a person with only Basic Qualification

3. in the 144-148 MHz frequency band, when received from a station operated by a person with only Basic Qualification

**4. in the 21 MHz band, when received in a VHF band, from a station operated by a person with only Basic Qualification**

*> key word:  NOT.  "Radiotelephone signals in a frequency band below 29.50 MHz cannot be automatically retransmitted unless these signals are received from a station operated by a person qualified to transmit on frequencies below 29.50 MHz." (RIC-2)*

**B-001-19-1 (3) When operating on frequencies below 148 MHz:**

1. the bandwidth for any emission must not exceed 3 kHz

2. the frequency stability of the transmitter must be at least two parts per million over a period of one hour

**3. the frequency stability must be comparable to crystal control**

4. an overmodulation indicator must be used

*> "The frequency stability of an amateur station in a frequency band below 148.000 MHz shall be equal to or greater than that which is obtainable using crystal control." (RIC-2)*

**B-001-19-2 (1) A reliable means to prevent or indicate overmodulation must be employed at an amateur station if:**

**1. radiotelephony is used**

2. DC input power to the anode or collector circuit of the final RF stage is in excess of 250 watts

3. radiotelegraphy is used

4. persons other than the licensee use the station

*> key word: OVERMODULATION. Supposes voice operation. "An amateur station shall be equipped with a means of: (a) determining the transmit frequency to the same degree of accuracy as would a crystal calibrator; and (b) indicating or preventing overmodulation of the transmitter in the case of a radiotelephone transmitter." (RIC-2)*

**B-001-19-3 (4) An amateur station using radiotelephony must install a device for indicating or preventing:**

1. resonance

2. antenna power

3. plate voltage

**4. overmodulation**

*> key word: RADIOTELEPHONY. Voice operation runs the risk of overmodulation. "An amateur station shall be equipped with a means of: (a) determining the transmit frequency to the same degree of accuracy as would a crystal calibrator; and (b) indicating or preventing overmodulation of the transmitter in the case of a radiotelephone transmitter." (RIC-2)*

**B-001-19-4 (2) The maximum percentage of modulation permitted in the use of radiotelephony by an amateur station is:**

1. 75 percent

**2. 100 percent**

3. 50 percent

4. 90 percent

*> "An amateur station transmitting amplitude modulation is limited to 100 per cent modulation." (RIC-2)*

**B-001-19-5 (3) All amateur stations, regardless of the mode of transmission used, must be equipped with:**

1. a DC power meter

2. an overmodulation indicating device

**3. a reliable means of determining the operating radio frequency**

4. a dummy antenna

*> key words: REGARDLESS OF THE MODE. "Determining the frequency" applies to all modes. "Indication or prevention of overmodulation" applies to voice operation. "An amateur station shall be equipped with a means of: (a) determining the transmit frequency to the same degree of accuracy as would a crystal calibrator; and (b) indicating or preventing overmodulation of the transmitter in the case of a radiotelephone transmitter." (RIC-2)*

**B-001-19-6 (4) The maximum percentage of modulation permitted in the use of radiotelephony by an amateur station is:**

1. 90 percent

2. 75 percent

3. 50 percent

**4. 100 percent**

*> "An amateur station transmitting amplitude modulation is limited to 100 per cent modulation." (RIC-2)*

**B-001-20-1 (3) What type of messages may be transmitted to an amateur station in a foreign country?**

1. Messages of any type, if the foreign country allows third-party communications with Canada

2. Messages that are not religious, political, or patriotic in nature

**3. Messages of a technical nature or personal remarks of relative unimportance**

4. Messages of any type

*> Regulations do not permit just "any type" of message. Messages need be "of a technical nature or remarks of a personal character of relative unimportance".*

**B-001-20-2 (4) The operator of an amateur station shall ensure that:**

1. communications are exchanged only with commercial stations

2. all communications are conducted in secret code

3. charges are properly applied to all third-party communications

**4. communications are limited to messages of a technical or personal nature**

*> Regulations do not permit just "any type" of message. Messages need be "of a technical nature or remarks of a personal character of relative unimportance".*

**B-001-20-3 (3) Which of the following is NOT a provision of the ITU Radio Regulations which apply to Canadian radio amateurs?**

1. It is forbidden to transmit international messages on behalf of third parties, unless those countries make special arrangements

2. Radiocommunications between countries shall be forbidden, if the administration of one of the countries objects

**3. Transmissions between countries shall not include any messages of a technical nature, or remarks of a personal character**

4. Administrations shall take such measures as they judge necessary to verify the operational and technical qualifications of amateurs

*> key word: NOT. Amateur Radio is precisely the exchange of messages of a technical or personal nature.*

**B-001-20-4 (4) The ITU Radio Regulations limit those radio amateurs, who have not demonstrated proficiency in Morse code, to frequencies above:**

1. 1.8 MHz

2. 3.5 MHz

3. 28 MHz

**4. none of the above**

*> Until July 2003, it was an ITU regulation that amateurs needed to demonstrate Morse proficiency before being allowed BELOW 30 MHz. In July 2005, Canada added alternatives to the Morse qualification; namely, an 80% mark on the Basic qualification or an Advanced qualification.*

**B-001-20-5 (2) In addition to complying with the Act and Radiocommunication Regulations, Canadian radio amateurs must also comply with the regulations of the:**

1. American Radio Relay League

**2. International Telecommunication Union**

3. Radio Amateurs of Canada Inc.

4. International Amateur Radio Union

*> The ITU ( an agency of the United Nations ) edicts global rules to which Canada adheres.*

**B-001-21-1 (3) In which International Telecommunication Union Region is Canada?**

1. Region 4

2. Region 3

**3. Region 2**

4. Region 1

*> The Americas are in ITU Region 2.  Australia and Southeast Asia are in ITU Region 3.*

**B-001-21-2 (1) A Canadian radio amateur, operating his station in the state of Florida, is subject to which frequency band limits?**

**1. Those applicable to US radio amateurs**

2. ITU Region 2

3. ITU Region 3

4. ITU Region 1

*> When operating within a country or within territorial waters (generally, 12 nautical miles or 22 kilometres from the shore), the regulations of the specific country apply.*

**B-001-21-3 (3) A Canadian radio amateur, operating his station 7 kilometres (4 miles) offshore from the coast of Florida, is subject to which frequency band limits?**

1. Those applicable to Canadian radio amateurs

2. ITU Region 1

**3. Those applicable to US radio amateurs**

4. ITU Region 2

*> key words:  SEVEN KILOMETRES FROM THE COAST.  This close to the shore is not yet considered "international waters".  When operating within a country or within territorial waters (generally, 12 nautical miles or 22 kilometres from the shore), the regulations of the specific country apply*.

**B-001-21-4 (3) Australia, Japan, and Southeast Asia are in which ITU Region?**

1. Region 4

2. Region 2

**3. Region 3**

4. Region 1

*> The Americas are in ITU Region 2.  Australia and Southeast Asia are in ITU Region 3.*

B-001-21-5 (2) Canada is located in ITU Region:

1. region 1

**2. region 2**

3. region 3

4. region 4

*> The Americas are in ITU Region 2.  Australia and Southeast Asia are in ITU Region 3.*

**B-001-21-6 (1) Which of the following answers is NOT correct? Canadian radio amateurs may apply for a CEPT international radio amateur licence for operation in any of the 32 CEPT countries, and:**

**1. foreign radio amateurs, holding CEPT Class 2 licences, receive the same privileges in Canada as Canadians with Basic and 5 WPM qualifications**

2. Canadian radio amateurs, holding Basic and 5 w.p.m. qualifications, will be granted CEPT Class 1 recognition

3. Canadian radio amateurs, holding Basic Qualification only, will be granted CEPT Class 2 recognition (operation only above 30 MHz)

4. foreign radio amateurs, holding CEPT Class 1 licences, receive the same privileges in Canada as Canadians with Basic and 5  w.p.m. qualifications

*> key word:  NOT.  CEPT Class 1 permits HF privileges ( think 'First Class' as in all privileges ).  CEPT Class 2 is Basic only (operation above 30 MHz).  [ Conférence Européenne des Administrations des Postes et des Télécommunications, agreement which allows amateurs to operate while temporarily visiting certain countries. ]*

**B-001-21-7 (3) Which of the following answers is NOT correct? Canadian radio amateurs may apply for CEPT international radio licences for operation in any of the 32 CEPT member countries, and:**

1. foreign radio amateurs, holding CEPT Class 1 licences, will receive recognition in Canada equal to Basic and 5 w.p.m.

2. Canadian radio amateurs, holding Basic Qualification only, will be granted CEPT Class 2 recognition (operation above 30 MHz)

**3. foreign radio amateurs, holding CEPT Class 1 licences, will receive recognition in Canada equal to Basic Qualification only**

4. Canadian radio amateurs, holding Basic and 5 w.p.m. qualifications, will be granted CEPT Class 1 recognition

*> key word: NOT. CEPT Class 1 permits HF privileges ( think 'First Class' as in 'all privileges' ). CEPT Class 2 is Basic only (operation above 30 MHz). [ Conférence Européenne des Administrations des Postes et des Télécommunications, agreement which allows amateurs to operate while temporarily visiting certain countries. ]*

**B-001-23-1 (2) Which of these statements about erection of an antenna structure is NOT correct?**

1. There is no requirement to receive the prior approval from Industry Canada to construct an antenna or its structure

**2. A radio amateur may erect any size antenna structure without consulting neighbours or the local land-use authority**

3. Industry Canada expects radio amateurs to address community concerns in a responsible manner

4. Prior to an installation, for which community concerns could be raised, radio amateurs must consult with their land-use authority

*> key word: NOT. Type 2 Stations that do NOT require a site specific authorization, e.g., amateur, general radio service (GRS) and satellite receiving stations - non-site-specific. Owners must comply with Safety Code 6. Prior to the installation of an antenna structure for which it is felt that community concerns could be raised, owners must consult with their land-use authority. Industry Canada expects owners to address the concerns of the community in a responsible manner, and to consider seriously all requests put forward by the land-use authority. (CPC-2-0-03)*

**B-001-23-2 (3) Which of these statements is NOT correct?**

1. If a radio amateur erects an antenna structure without consulting the land-use authority, he must accept any consequences

2. For the purposes of environmental filing, amateur stations are considered to be Type 2 (non-site-specific)

**3. For the purposes of environmental filing, amateur stations are considered to be Type 1 (site-specific)**

4. Before installing an antenna structure which could raise community concerns, radio amateurs must consult with the land-use authority

*> key word: NOT. Type 2 Stations that do NOT require a site specific authorization, e.g., amateur, general radio service (GRS) and satellite receiving stations - non-site-specific. Owners must comply with Safety Code 6. Prior to the installation of an antenna structure for which it is felt that community concerns could be raised, owners must consult with their land-use authority. Industry Canada expects owners to address the concerns of the community in a responsible manner, and to consider seriously all requests put forward by the land-use authority. (CPC-2-0-03)*

**B-001-23-3 (2) Which of the following statements is NOT correct?**

1. Prior to installing an antenna structure, for which concerns could be raised, radio amateurs must consult their land-use authority

**2. Radio amateurs must secure written permission of Industry Canada before installing an antenna structure**

3. Should an antenna structure be installed without consulting the land-use authority, it must be with the acceptance of consequences

4. Industry Canada expects radio amateurs to responsibly address any community concerns, and to consider land-use authority requests

*> key word: NOT. Type 2 Stations that do NOT require a site specific authorization, e.g., amateur, general radio service (GRS) and satellite receiving stations - non-site-specific. Owners must comply with Safety Code 6. Prior to the installation of an antenna structure for which it is felt that community concerns could be raised, owners must consult with their land-use authority. Industry Canada expects owners to address the concerns of the community in a responsible manner, and to consider seriously all requests put forward by the land-use authority. (CPC-2-0-03)*

**B-001-23-4 (2) Before erecting an antenna structure, for which community concerns could be raised, a radio amateur must consult with:**

1. Industry Canada only

**2. the land-use authority, and possibly the neighbours**

3. Industry Canada and Transport Canada

4. Industry Canada and the neighbours

*> Type 2 Stations that do NOT require a site specific authorization, e.g., amateur, general radio service (GRS) and satellite receiving stations - non-site-specific. Owners must comply with Safety Code 6. Prior to the installation of an antenna structure for which it is felt that community concerns could be raised, owners must consult with their land-use authority. Industry Canada expects owners to address*

*the concerns of the community in a responsible manner, and to consider seriously all requests put forward by the land-use authority. (CPC-2-0-03)*

**B-001-24-1 (4) What organization has published safety guidelines for the maximum limits of RF energy near the human body?**

1. Canadian Standards Association

2. Environment Canada

3. Transport Canada

**4. Health Canada**

*> Health-Canada publishes 'Safety Code 6' (Limits of Human Exposure to Radiofrequency Electromagnetic Fields) to protect workers and general public from adverse health effects. The lowest exposure limit is set to '28 Volts per metre' for the range of 10 MHz to 300 MHz. This range is presumed to be the one over which the human body most readily absorbs RF energy. Limits on either side of that range are higher. Since 1999, a previous exemption for portable transmitters has been removed (i.e., handhelds are no longer exempt from code requirements).*

**B-001-24-2 (1) What is the purpose of the Safety Code 6?**

**1. It gives RF exposure limits for the human body**

2. It lists all RF frequency allocations for interference protection

3. It sets transmitter power limits for interference protection

4. It sets antenna height limits for aircraft protection

*> Health-Canada publishes 'Safety Code 6' (Limits of Human Exposure to Radiofrequency Electromagnetic Fields) to protect workers and general public from adverse health effects. The lowest exposure limit is set to '28 Volts per metre' for the range of 10 MHz to 300 MHz. This range is presumed to be the one over which the human body most readily absorbs RF energy. Limits on either side of that range are higher. Since 1999, a previous exemption for portable transmitters has been removed (i.e., handhelds are no longer exempt from code requirements).*

**B-001-24-3 (2) According to Safety Code 6, what frequencies cause us the greatest risk from RF energy?**

1. 300 to 3000 MHz

**2. 30 to 300 MHz**

3. Above 1500 MHz

4. 3 to 30 MHz

*> Health-Canada publishes 'Safety Code 6' (Limits of Human Exposure to Radiofrequency Electromagnetic Fields) to protect workers and general public from adverse health effects. The lowest exposure limit is set to '28 Volts per metre' for the range of 10 MHz to 300 MHz. This range is presumed to be the one over which the human body most readily absorbs RF energy. Limits on either side of that range are higher. Since 1999, a previous exemption for portable transmitters has been removed (i.e., handhelds are no longer exempt from code requirements).*

**B-001-24-4 (4) Why is the limit of exposure to RF the lowest in the frequency range of 30 MHz to 300 MHz, according to Safety Code 6?**

1. There are more transmitters operating in this range

2. There are fewer transmitters operating in this range

3. Most transmissions in this range are for a longer time

**4. The human body absorbs RF energy the most in this range**

*> Health-Canada publishes 'Safety Code 6' (Limits of Human Exposure to Radiofrequency Electromagnetic Fields) to protect workers and general public from adverse health effects. The lowest exposure limit is set to '28 Volts per metre' for the range of 10 MHz to 300 MHz. This range is presumed to be the one over which the human body most readily absorbs RF energy. Limits on either side of that range are higher. Since 1999, a previous exemption for portable transmitters has been removed (i.e., handhelds are no longer exempt from code requirements).*

**B-001-24-5 (2) According to Safety Code 6, what is the maximum safe power output to the antenna of a hand-held VHF or UHF radio?**

1. 10 watts

**2. not specified - the exemption for portable equipment was withdrawn in 1999**

3. 25 watts

4. 125 milliwatts

*> Health-Canada publishes 'Safety Code 6' (Limits of Human Exposure to Radiofrequency Electromagnetic Fields) to protect workers and general public from adverse health effects. The lowest exposure limit is set to '28 Volts per metre' for the range of 10 MHz to 300 MHz. This range is presumed to be the one over which the human body most readily absorbs RF energy. Limits on either side of that range are higher. Since 1999, a previous exemption for portable transmitters has been removed (i.e., handhelds are no longer exempt from code requirements).*

**B-001-24-6 (4) Which of the following statements is NOT correct?**

1. Maximum exposure levels of RF fields to the general population, in the frequency range 10 to 300 MHz, is 28 V RMS/metre (E-field)

2. Permissible exposure levels of RF fields increases as frequency is increased above 300 MHz

3. Permissible exposure levels of RF fields increases as frequency is decreased below 10 MHz

**4. Permissible exposure levels of RF fields decreases as frequency is decreased below 10 MHz**

*> key word:  NOT.  Health-Canada publishes 'Safety Code 6' (Limits of Human Exposure to Radiofrequency Electromagnetic Fields) to protect workers and general public from adverse health effects. The lowest exposure limit is set to '28 Volts per metre' for the range of 10 MHz to 300 MHz.  This range is presumed to be the one over which the human body most readily absorbs RF energy.   Limits on either side of that range are higher.  Since 1999, a previous exemption for portable transmitters has been removed (i.e., handhelds are no longer exempt from code requirements).*

**B-001-24-7 (2) The permissible exposure levels of RF fields:**

1. decreases, as frequency is decreased below 10 MHz

**2. increases, as frequency is increased above 300 MHz**

3. increases, as frequency is increased from 10 MHz to 300 MHz

4. decreases, as frequency is increased above 300 MHz

*> Health-Canada publishes 'Safety Code 6' (Limits of Human Exposure to Radiofrequency Electromagnetic Fields) to protect workers and general public from adverse health effects. The lowest exposure limit is set to '28 Volts per metre' for the range of 10 MHz to 300 MHz.  This range is presumed to be the one over which the human body most readily absorbs RF energy.   Limits on either side of that range are higher.  Since 1999, a previous exemption for portable transmitters has been removed (i.e., handhelds are no longer exempt from code requirements).*

**B-001-24-8 (2) Which statement is NOT correct:**

1. maximum exposure level of RF fields for general population, in the range 10 to 300 MHz, is 28 V RMS per metre (E-field)

**2. portable transmitters, operating below 1 GHz with a power output up to 7 watts, are excluded from Safety Code 6 requirements**

3. maximum exposure level of RF fields for general population, in the range 30 to 300 MHz, is 0.073 A RMS per metre (H-field)

4. the exemption of portable transmitters, operating below 1 GHz with a power output up to 7 watts was removed from Safety Code 6 in 1999

*> key word:  NOT.  Health-Canada publishes 'Safety Code 6' (Limits of Human Exposure to Radiofrequency Electromagnetic Fields) to protect workers and general public from adverse health effects. The lowest exposure limit is set to '28 Volts per metre' for the range of 10 MHz to 300 MHz.  This range is presumed to be the one*

*over which the human body most readily absorbs RF energy. Limits on either side of that range are higher. Since 1999, a previous exemption for portable transmitters has been removed (i.e., handhelds are no longer exempt from code requirements).*

**B-001-24-9 (4) Which statement is correct?**

1. Safety Code 6 regulates the operation of receivers only

2. the operation of portable transmitting equipment is of no concern in Safety Code 6

3. portable transmitters, operating below 1 GHz, with an output power equal to, or less than 7 watts, are exempt from the requirements of Safety Code 6

**4. the exemption for portable transmitters was eliminated in Safety Code 6 in 1999**

*> Health-Canada publishes 'Safety Code 6' (Limits of Human Exposure to Radiofrequency Electromagnetic Fields) to protect workers and general public from adverse health effects. The lowest exposure limit is set to '28 Volts per metre' for the range of 10 MHz to 300 MHz. This range is presumed to be the one over which the human body most readily absorbs RF energy. Limits on either side of that range are higher. Since 1999, a previous exemption for portable transmitters has been removed (i.e., handhelds are no longer exempt from code requirements).*

**B-001-24-10 (4) The maximum exposure level of RF fields for general population, in the frequency range 10 to 300 MHz is ___ V RMS per metre (E-field):**

1. 7

2. 37

3. 0.073

**4. 28**

*> Health-Canada publishes 'Safety Code 6' (Limits of Human Exposure to Radiofrequency Electromagnetic Fields) to protect workers and general public from adverse health effects. The lowest exposure limit is set to '28 Volts per metre' for the range of 10 MHz to 300 MHz. This range is presumed to be the one over which the human body most readily absorbs RF energy. Limits on either side of that range are higher. Since 1999, a previous exemption for portable transmitters has been removed (i.e., handhelds are no longer exempt from code requirements).*

**B-001-25-1 (3) In the event of interference to a neighbour's FM receiver and stereo system, if the field strength of the amateur station signal is below ____ volts per metre, it will be deemed that the affected equipment's lack of immunity is the cause:**

1. 2.8

2. 7.9

**3. 1.83**

4. 3.16

*> Field Strength Criterion for 'Broadcast Receivers' (equipment for the reception of broadcast sound and television signals): 1.83 Volts per metre. The "Criteria for Resolution of Immunity Complaints involving Fundamental Emissions of Radiocommunications Transmitters" considers 3 categories of electronic equipment: 'Broadcast Receivers', 'Associated Equipment' (recorders, players, amplifiers, converters, etc.) and 'Radio-Sensitive Equipment' (all other non-radio electronic equipment). (EMCAB-2)*

**B-001-25-2 (2) In the event of interference to a neighbour's television receiver, if the field strength of the amateur station signal exceeds _____volts per metre, it will be deemed that the transmission is the cause of the problem:**

1. 14.2

**2. 1.83**

3. 28

4. 3.75

*> Field Strength Criterion for 'Broadcast Receivers' (equipment for the reception of broadcast sound and television signals): 1.83 Volts per metre. The "Criteria for Resolution of Immunity Complaints involving Fundamental Emissions of Radiocommunications Transmitters" considers 3 categories of electronic equipment: 'Broadcast Receivers', 'Associated Equipment' (recorders, players, amplifiers, converters, etc.) and 'Radio-Sensitive Equipment' (all other non-radio electronic equipment). (EMCAB-2)*

**B-001-25-3 (3) Which of the following is defined as "any device, machinery or equipment, other than radio apparatus, the use or functioning of which is, or can be, adversely affected by radiocommunication emissions"?**

1. cable television converters

2. audio and video recorders

**3. radio-sensitive equipment**

4. broadcast receivers

*> Field Strength Criterion for 'Broadcast Receivers' (equipment for the reception of broadcast sound and television signals): 1.83 Volts per metre. The "Criteria for Resolution of Immunity Complaints involving Fundamental Emissions of Radiocommunications Transmitters" considers 3 categories of electronic equipment: 'Broadcast Receivers', 'Associated Equipment' (recorders, players, amplifiers, converters, etc.) and 'Radio-Sensitive Equipment' (all other non-radio electronic equipment). (EMCAB-2)*

**B-001-25-4 (1) Which of the following types of equipment is NOT included in the list of field strength criteria for resolution of immunity complaints?**

**1. broadcast transmitters**

2. broadcast receivers

3. associated equipment

4. radio-sensitive equipment

*> key word: NOT. Field Strength Criterion for 'Broadcast Receivers' (equipment for the reception of broadcast sound and television signals): 1.83 Volts per metre. The "Criteria for Resolution of Immunity Complaints involving Fundamental Emissions of Radiocommunications Transmitters" considers 3 categories of electronic equipment: 'Broadcast Receivers', 'Associated Equipment' (recorders, players, amplifiers, converters, etc.) and 'Radio-Sensitive Equipment' (all other non-radio electronic equipment). (EMCAB-2)*

# Basic Electronics

**B-003-16-1 (3) How much voltage does a standard automobile battery usually supply ?**

1. About 240 volts

2. About 120 volts

**3. About 12 volts**

4. About 9 volts

*> Also known as a 'storage cell', the common Lead-Acid battery has a nominal voltage of 12 Volts [ 12.6 to be exact ]*

**B-003-16-2 (4) Which component has a positive and a negative side?**

1. A potentiometer

2. A fuse

3. A resistor

**4. A battery**

*> Fuses, resistors and potentiometers are not 'polarized' (current can flow through them either way). The battery, however, has a positive terminal and a negative terminal.*

**B-003-16-3 (3) A cell, that can be repeatedly recharged by supplying it with electrical energy, is known as a:**

1. low leakage cell

2. memory cell

**3. storage cell**

4. primary cell

*> A 'storage cell' can be recharged repeatedly. A 'primary cell', such as a common Zinc-Carbon flashlight cell, can only be used once.*

**B-003-16-4 (2) Which of the following is a source of EMF?**

1. germanium diode

**2. lead acid battery**

3. P channel FET

4. carbon resistor

*> EMF = Electromotive Force or voltage.  Lead-Acid batteries are commonly used in vehicles.  The car battery has a nominal voltage of 12 Volts.*

**B-003-16-5 (2) An important difference between a conventional flashlight battery and a lead acid battery is that only the lead acid battery:**

1. has two terminals

**2. can be repeatedly recharged**

3. can be completely discharged

4. contains an electrolyte

*> The 'conventional' Zinc-Carbon or Alkaline flashlight battery CANNOT be recharged while a 'storage cell' like a car battery can be recharged numerous times.*

**B-003-16-6 (2) A dry cell has a nominal voltage of 1.5 volt. When supplying a great deal of current, the voltage may drop to 1.2 volt. This is due to the cell's:**

1. electrolyte becoming dry

**2. internal resistance**

3. current capacity

4. voltage capacity

*> An ideal battery would supply precisely the same voltage regardless of the current drawn.  Real-life batteries exhibit 'internal resistance' which causes a drop in voltage when current is drawn.  Ever noticed the headlights dim when the starter is cranked on a cold winter day ?*

**B-003-16-7 (1) The most common primary cell in use today is the carbon-zinc or flashlight cell. This cell can be recharged:**

**1. never**

2. twice

3. many times

4. once

*> The 'conventional' Zinc-Carbon or Alkaline flashlight battery CANNOT be recharged while a 'storage cell' like a car battery can be recharged numerous times.*

**B-003-16-8 (4) All storage batteries have discharge limits, and nickel-cadmium, the type most used in hand-held portables, should not be discharged to less than:**

1. 0.5 volt per cell

2. 1.5 volt per cell

3. 0.2 volt per cell

**4. 1.0 volt per cell**

*> At 1 Volt per cell, a Nickel-Cadmium cell is 99% spent*.

**B-003-16-9 (1) To increase the current capacity of a cell, several cells should be connected in**:

**1. parallel**

2. series

3. parallel resonant

4. series resonant

*> key word: CURRENT. A parallel combination of batteries will permit supplying more current at a given voltage.*

**B-003-16-10 (4) To increase the voltage output, several cells are connected in:**

1. parallel

2. series-parallel

3. resonance

**4. series**

*> key word: VOLTAGE. Adding cells in series brings up the available voltage. However, the total current available from the string remains limited to what a single cell can supply.*

**B-003-16-11 (1) A nickel-cadmium battery should never be:**

**1. short-circuited**

2. recharged

3. left disconnected

4. left overnight at room temperature

*> Nickel-Cadmium cells have very low 'internal resistance'.  Hence, they can supply potentially dangerous currents in a short-circuit.*

**B-004-6-1 (2) How do you find a resistor's tolerance rating?**

1. By using Thevenin's theorem for resistors

**2. By reading the resistor's color code**

3. By reading its Baudot code

4. By using a voltmeter

*> The last band in a resistor's colour code identify 'tolerance':  an allowed variance in percentage from the nominal value.  For example, a GOLD band means 5%.*

**B-004-6-2 (3) What do the first three-color bands on a resistor indicate?**

1. The resistance material

2. The power rating in watts

**3. The value of the resistor in ohms**

4. The resistance tolerance in percent

*> The first two bands are significant digits, the third band is a multiplier.  The fourth band is tolerance.*

**B-004-6-3 (4) What does the fourth color band on a resistor mean?**

1. The value of the resistor in ohms

2. The power rating in watts

3. The resistance material

**4. The resistance tolerance in percent**

*> The last band in a resistor's colour code identify 'tolerance':  an allowed variance in percentage from the nominal value.  For example, a GOLD band means 5%.*

**B-004-6-4 (1) What are the possible values of a 100 ohm resistor with a 10% tolerance?**

**1. 90 to 110 ohms**

2. 90 to 100 ohms

3. 10 to 100 ohms

4. 80 to 120 ohms

*> 100 ohms minus 10% is 90 ohms, 100 ohms plus 10 % is 110 ohms.*

**B-004-6-5 (1) How do you find a resistor's value?**

**1. By using the resistor's color code**

2. By using a voltmeter

3. By using Thevenin's theorem for resistors

4. By using the Baudot code

*> The first two bands are significant digits, the third band is a multiplier. The last band is tolerance.*

**B-004-6-6 (4) Which tolerance rating would a high-quality resistor have?**

1. 5%

2. 10%

3. 20%

**4. 0.1%**

*> key words: HIGH-QUALITY. The actual value would be within a very small range of the nominal value: a small tolerance.*

**B-004-6-7 (1) Which tolerance rating would a low-quality resistor have?**

**1. 20%**

2. 0.1%

3. 5%

4. 10%

*> key words: LOW-QUALITY. The actual value could vary wildly from the nominal value: a wide tolerance.*

**B-004-6-8 (2) If a carbon resistor's temperature is increased, what will happen to the resistance?**

1. It will stay the same

**2. It will change depending on the resistor's temperature coefficient rating**

3. It will become time dependent

4. It will increase by 20% for every 10 degrees centigrade

*> Temperature affects all components and conductors.*

**B-004-6-9 (3) A gold band on a resistor indicates the tolerance is:**

1. 20%

2. 10%

**3. 5%**

4. 1%

*> 'gold' means 5%.*

**B-004-6-10 (1) A resistor with a colour code of brown, black, and red, would have a value of:**

**1. 1000 ohms**

2. 100 ohms

3. 10 ohms

4. 10 000 ohms

*> Brown = 1, Black = 0, Red = 2: ("1","0") * 100 = 1000 ohms (Black 0, Brown 1, Red 2, Orange 3, Yellow 4, Green 5, Blue 6, Violet 7, Gray 8, White 9).*

**B-004-6-11 (4) A resistor is marked with the colours red, violet and yellow. This resistor has a value of:**

1. 274

2. 72 k

3. 27 M

**4. 270 k**

*> Red = 2, Violet = 7, Yellow = 4:  ("2","7") * 10000 = 270000 ohms = 270 kilohms (Black 0, Brown 1, Red 2, Orange 3, Yellow 4, Green 5, Blue 6, Violet 7, Gray 8, White 9).*

**B-005-1-2 (1) If an ammeter marked in amperes is used to measure a 3000 milliampere current, what reading would it show?**

**1. 3 amperes**

2. 0.003 ampere

3. 0.3 ampere

4. 3 000 000 amperes

*> Milli is a thousandth.  A thousand milliamperes is one Ampere.  Converting from milliamperes to amperes:  from small units to larger units, requires fewer digits, decimal point moves to the left by three positions, a thousand times less.*

**B-005-1-3 (1) If a voltmeter marked in volts is used to measure a 3500 millivolt potential, what reading would it show?**

**1. 3.5 volts**

2. 0.35 volt

3. 35 volts

4. 350 volts

*> Milli is a thousandth.  A thousand millivolts is one Volt.  Converting from millivolts to volts:  from small units to larger units, requires fewer digits, decimal point moves to the left by three positions, a thousand times less.*

**B-005-1-6 (4)   A kilohm is:**

1. 0.1 ohm

2. 0.001 ohm

3. 10 ohms

**4. 1000 ohms**

*> Kilohm is a thousand ohms.  Converting from kilohm to ohms:  from large units to smaller units, requires more digits, decimal point moves to the right by three positions, a thousand times more.*

**B-005-1-7 (1)    6.6 kilovolts is equal to:**

**1. 6600 volts**

2. 660 volts

3. 66 volts

4. 66 000 volts

*> Kilovolt is a thousand volts. Converting from kilovolts to volts: from large units to smaller units, requires more digits, decimal point moves to the right by three positions, a thousand times more.*

**B-005-1-8 (4) A current of one quarter ampere may be written as:**

1. 0.5 amperes

2. 0.25 milliampere

3. 250 microampere

**4. 250 milliamperes**

*> One quarter ampere is 0.25 Ampere. Milli is one thousandth. One Ampere is a thousand milliamperes. Converting from ampere to milliampere: from large units to smaller units, requires more digits, decimal point moves to the right by three positions, a thousand times more.*

**B-005-1-9 (2) How many millivolts are equivalent to two volts?**

1. 0.000002

**2. 2 000**

3. 2 000 000

4. 0.002

*> A millivolt is a thousandth of a Volt. A Volt is one thousand millivolts. Converting from volts to millivolts: from large units to smaller units, requires more digits, decimal point moves to the right by three positions, a thousand times more.*

**B-005-2-1 (2) Name three good electrical conductors.**

1. Gold, silver, wood

**2. Gold, silver, aluminum**

3. Copper, aluminum, paper

4. Copper, gold, mica

*> Wood, paper and mica do NOT conduct electricity.  The best conductors, in descending order, are:  Silver, Copper, Gold and Aluminum.*

**B-005-2-2 (3) Name four good electrical insulators.**

1. Plastic, rubber, wood, carbon

2. Paper, glass, air, aluminum

**3. Glass, air, plastic, porcelain**

4. Glass, wood, copper, porcelain

*> Copper and aluminum are CONDUCTORS.  Carbon is a poor conductor, it is used to fabricate resistors*.

**B-005-2-3 (4) Why do resistors sometimes get hot when in use?**

1. Their reactance makes them heat up

2. Hotter circuit components nearby heat them up

3. They absorb magnetic energy which makes them hot

**4. Some electrical energy passing through them is lost as heat**

*> Power is Voltage times Current, P = E * I.  When current flows through a resistor, a 'voltage drop' ensues.  Volts times Amperes become Watts.  Power is dissipated as heat.*

**B-005-2-4 (4) What is the best conductor among the following materials?**

1. carbon

2. silicon

3. aluminium

**4. copper**

*> The best conductors, in descending order, are:  Silver, Copper, Gold and Aluminum.  Carbon is a poor conductor, it is used to fabricate resistors.  Silicon is used to make 'semiconductors'.*

**B-005-2-5 (1) The material listed, which will most readily allow an electric current to flow, is called?**

**1. a conductor**

2. an insulator

3. a resistor

4. a dielectric

*> As the name implies, a 'conductor' readily passes electrical current. An Insulator ( synonym = dielectric ) does not let current flow. A resistor conducts but badly.*

**B-005-2-6 (4) A length of metal is connected in a circuit and is found to conduct electricity very well. It would be best described as having a:**

1. high resistance

2. high wattage

3. low wattage

**4. low resistance**

*> Conductors have LOW resistance. They do not oppose current flow.*

**B-005-2-7 (2) The letter "R" is the symbol for:**

1. impedance

**2. resistance**

3. reluctance

4. reactance

*> R = Resistance, Z = Impedance, X = Reactance.*

**B-005-2-8 (1) The reciprocal of resistance is:**

**1. conductance**

2. reactance

3. reluctance

4. permeability

*> Reciprocal = 'the inverse of something'. 1 over resistance yields CONDUCTANCE. Low resistance implies high conductance. High resistance implies little conductance.*

**B-005-2-9 (1) Voltage drop means**:

**1. voltage developed across the terminals of a component**

2. any point in a radio circuit which has zero voltage

3. difference in voltage at output terminals of a transformer

4. the voltage which is dissipated before useful work is accomplished

*> As current flows through electronic components, some voltage is 'lost'. Remember voltage as 'pressure', there is more 'pressure' before a resistor than after it: this represents a 'voltage drop'.*

**B-005-2-10 (2) The resistance of a conductor changes with:**

1. voltage

**2. temperature**

3. current

4. humidity

*> Temperature affects components and conductors.*

**B-005-2-11 (1) The most common material used to make a resistor is:**

**1. carbon**

2. gold

3. mica

4. lead

*> Carbon is a poor conductor. Gold and Lead are conductors. Mica is an insulator.*

**B-005-3-4 (2) Which electrical circuit will have no current?**

1. A short circuit

**2. An open circuit**

3. A complete circuit

4. A closed circuit

*> 'Open' circuit = no current ( a loop from one side of the voltage source to the other side does NOT exist, the loop is open ). 'Closed' circuit = current ( a path exists from one side of the voltage source to the other side, current flows, the loop is closed ). 'Short circuit' = heavy current ( a very low resistance path exists between*

*from one side of the voltage source to the other side, large current ensues ).*

**B-005-3-5 (2) Which electrical circuit uses too much current?**

1. A dead circuit

**2. A short circuit**

3. A closed circuit

4. An open circuit

*> 'Open' circuit = no current ( a loop from one side of the voltage source to the other side does NOT exist, the loop is open ). 'Closed' circuit = current ( a path exists from one side of the voltage source to the other side, current flows, the loop is closed ). 'Short circuit' = heavy current ( a very low resistance path exists between from one side of the voltage source to the other side, large current ensues ).*

**B-005-7-1 (3) What term means the number of times per second that an alternating current flows back and forth?**

1. Speed

2. Pulse rate

**3. Frequency**

4. Inductance

*> Frequency is the number of cycles per second of an Alternating Current (AC). Frequency is expressed in Hertz (Hz). One Hertz is one cycle per second.*

**B-005-7-2 (3) Approximately what frequency range can most humans hear?**

1. 20 000 - 30 000 Hz

2. 200 - 200 000 Hz

**3. 20 - 20 000 Hz**

4. 0 - 20 Hz

*> Hz = Hertz = cycles per second. Frequencies audible to humans range from 20 Hz to 20000 Hz. Speech frequencies important to intelligibility in communications range from 300 Hz to 3000 Hz*.

**B-005-7-3 (4) Why do we call signals in the range 20 Hz to 20 000 Hz audio frequencies?**

1. Because the human ear cannot sense anything in this range

2. Because this range is too low for radio energy

3. Because the human ear can sense radio waves in this range

**4. Because the human ear can sense sounds in this range**

*> Hz = Hertz = cycles per second. Frequencies audible to humans range from 20 Hz to 20000 Hz. Speech frequencies important to intelligibility in communications range from 300 Hz to 3000 Hz.*

**B-005-7-8 (2) What does 60 hertz (Hz) mean?**

1. 6000 metres per second

**2. 60 cycles per second**

3. 60 metres per second

4. 6000 cycles per second

*> Hz = Hertz = cycles per second. Frequency is the number of cycles per second of an Alternating Current (AC). Frequency is expressed in Hertz (Hz). One Hertz is one cycle per second.*

**B-005-7-9 (3) If the frequency of the waveform is 100 Hz, the time for one cycle is:**

1. 10 seconds

2. 0.0001 second

**3. 0.01 second**

4. 1 second

*> 100 Hz = 100 Hertz = 100 cycles per second. The duration of ONE cycle, the "period", is 1 / frequency. In this example, 1 / 100 Hz yields 0.01 second.*

**B-005-7-10 (1) Current in an AC circuit goes through a complete cycle in 0.1 second. This means the AC has a frequency of:**

**1. 10 Hz**

2. 1 Hz

3. 100 Hz

4. 1000 Hz

*> One cycle in 0.1 second, how many cycles in a second ?  The duration of ONE cycle, the "period", and frequency have an inverse relation:  Frequency is 1 / period. In this example, 1 / 0.1 second yields 10 Hertz.*

**B-005-7-11 (4) A signal is composed of a fundamental frequency of 2 kHz and another of 4 kHz. This 4 kHz signal is referred to as:**

1. a fundamental of the 2 kHz signal

2. the DC component of the main signal

3. a dielectric signal of the main signal

**4. a harmonic of the 2 kHz signal**

*> 'Harmonics' are integer MULTIPLES (e.g., 2x, 3x, 4x, 5x,...) of a given frequency. The base frequency is referred to as the 'fundamental'.*

**B-005-11-9 (4) A force of repulsion exists between two __________ magnetic poles.**

1. unlike

2. positive

3. negative

**4. like**

*> key word:  REPULSION.  'Like' magnetic poles repulse each other.  'Unlike' magnetic poles attract one another.*

**B-005-11-10 (4) A permanent magnet would most likely be made from:**

1. copper

2. aluminum

3. brass

**4. steel**

*> Copper, aluminum and brass are impervious to magnetic fields.*

**B-005-13-1 (4) How is a voltmeter usually connected to a circuit under test?**

1. In series with the circuit

2. In quadrature with the circuit

3. In phase with the circuit

**4. In parallel with the circuit**

*> key word: VOLTMETER. An instrument to measure voltage. The voltmeter is always connected in parallel to measure a difference of potential between two points, across a component, etc.*

**B-005-13-2 (2) How is an ammeter usually connected to a circuit under test?**

1. In quadrature with the circuit

**2. In series with the circuit**

3. In phase with the circuit

4. In parallel with the circuit

*> key word: AMMETER. Ammeter comes from the words Ampere + meter, it is used to measure current. Current flow THROUGH a circuit. The circuit must be 'broken' and the ammeter inserted in series with the circuit to measure current. Ammeters have very low resistance and, thus, have little effect once inserted in the circuit.*

**B-005-13-3 (2) What does a multimeter measure?**

1. Resistance, capacitance and inductance

**2. Voltage, current and resistance**

3. Resistance and reactance

4. SWR and power

*> Common multimeters can measure the three basic electrical units: Voltage (E), Current (I) and Resistance (R).*

**B-005-13-4 (3) The correct instrument to measure plate current or collector current of a transmitter is:**

1. an ohmmeter

2. a wattmeter

**3. an ammeter**

4. a voltmeter

*> key word: CURRENT. Ammeter comes from the words Ampere + meter, it is used to measure current.*

**B-005-13-5 (1) Which of the following meters would you use to measure the power supply current drawn by a small hand-held transistorized receiver?**

**1. a DC ammeter**

2. an RF ammeter

3. an RF power meter

4. an electrostatic voltmeter

*> key word: CURRENT. Ammeter comes from the words Ampere + meter, it is used to measure current.*

**B-005-13-6 (2) When measuring current drawn from a DC power supply, it is true to say that the meter will act in circuit as:**

1. a perfect conductor

2**. a low value resistance**

3. an extra current drain

4. an insulator

*> This is a bit of a catch. A PERFECT conductor would exhibit ZERO resistance. An ammeter actually has a very low resistance. [ For example, a 10A ammeter can have a resistance of 0.005 ohms, a 1A ammeter can have 0.05 ohms and a 500mA ammeter can introduce 0.2 ohms of resistance in the circuit. ]*

**B-005-13-7 (2) When measuring the current drawn by a receiver from a power supply, the current meter should be placed:**

1. in series with both receiver power leads

**2. in series with one of the receiver power leads**

3. in parallel with both receiver power supply leads

4. in parallel with one of the receiver power leads

*> Ammeter comes from the words Ampere + meter, it is used to measure current. Current flow THROUGH a circuit. The circuit must be 'broken' and the ammeter inserted in series with the circuit to measure current. Ammeters have very low resistance and, thus, have little effect once inserted in the circuit.*

**B-005-13-8 (3) Potential difference is measured by means of:**

1. a wattmeter

2. an ohmmeter

**3. a voltmeter**

4. an ammeter

*> The voltmeter is always connected in parallel to measure a difference of potential between two points, across a component, etc.*

**B-005-13-9 (3) Voltage drop means:**

1. the voltage which is dissipated before useful work is accomplished

2. difference in voltage at output terminals of a transformer

**3. voltage between the terminals of a component**

4. any point in a radio circuit which has zero voltage

*> As current flows through electronic components, some voltage is 'lost'. Remember voltage as 'pressure', there is more 'pressure' before a resistor than after it: this represents a 'voltage drop'.*

**B-005-13-10 (3) The instrument used for measuring the flow of electrical current is the:**

1. faradmeter

2. wattmeter

**3. ammeter**

4. voltmeter

*> Ammeter comes from the words Ampere + meter, it is used to measure current. Current flow THROUGH a circuit. The circuit must be 'broken' and the ammeter inserted in series with the circuit to measure current. Ammeters have very low resistance and, thus, have little effect once inserted in the circuit.*

**B-005-13-11 (2) In measuring volts and amperes, the connections should be made with:**

1. the voltmeter in series and ammeter in parallel

**2. the voltmeter in parallel and ammeter in series**

3. both voltmeter and ammeter in series

4. both voltmeter and ammeter in parallel

*> The voltmeter is always connected in parallel to measure a difference of potential between two points, across a component, etc.  Ammeter comes from the words Ampere + meter, it is used to measure current.  Current flow THROUGH a circuit. The circuit must be 'broken' and the ammeter inserted in series with the circuit to measure current.  Ammeters have very low resistance and, thus, have little effect once inserted in the circuit.*

## Safety

**B-003-18-1 (1) How could you best keep unauthorized persons from using your amateur station at home?**

**1. Use a key-operated on/off switch in the main power line**

2. Use a carrier-operated relay in the main power line

3. Put a "Danger - High Voltage" sign in the station

4. Put fuses in the main power line

*> key word: UNAUTHORIZED. A locked switch in line with the electrical circuit feeding the station would prevent unauthorized operation of the station.*

**B-003-18-2 (3) How could you best keep unauthorized persons from using a mobile amateur station in your car?**

1. Tune the radio to an unused frequency when you are done using it

2. Turn the radio off when you are not using it

**3. Disconnect the microphone when you are not using it**

4. Put a "Do not touch" sign on the radio

*> key word: UNAUTHORIZED. Locking away or taking away the microphone would prevent unauthorized use of the transmitter.*

**B-003-18-3 (4) Why would you use a key-operated on/off switch in the main power line of your station?**

1. For safety, in case the main fuses fail

2. To keep the power company from turning off your electricity during an emergency

3. For safety, to turn off the station in the event of an emergency

**4. To keep unauthorized persons from using your station**

*> key word: UNAUTHORIZED. A locked switch in line with the electrical circuit feeding the station would prevent unauthorized operation of the station.*

**B-003-18-4 (1) Why would there be a switch in a high-voltage power supply to turn off the power if its cabinet is opened?**

**1. To keep anyone opening the cabinet from getting shocked by dangerous high voltages**

2. To keep dangerous RF radiation from leaking out through an open cabinet

3. To keep dangerous RF radiation from coming in through an open cabinet

4. To turn the power supply off when it is not being used

*> key words: HIGH-VOLTAGE. Devices operating with high voltage should always include an 'interlock' switch so they power down when cabinets are open to prevent electrocution.*

**B-003-18-5 (4) How little electrical current flowing through the human body can be fatal?**

1. Approximately 10 amperes

2. More than 20 amperes

3. Current flow through the human body is never fatal

**4. As little as 1/10 of an ampere**

*> If the human heart is part of the electrocution path, even one tenth of an Ampere can lead to cardiac arrest.*

**B-003-18-6 (1) Which body organ can be fatally affected by a very small amount of electrical current?**

**1. The heart**

2. The brain

3. The liver

4. The lungs

*> If the human heart is part of the electrocution path, even one tenth of an Ampere can lead to cardiac arrest.*

**B-003-18-7 (4) What is the minimum voltage which is usually dangerous to humans?**

1. 100 volts

2. 1000 volts

3. 2000 volts

**4. 30 volts**

*> Under certain circumstances, even 30 VOLTS can be dangerous. If the human heart is part of the electrocution path, even one tenth of an Ampere can lead to*

*cardiac arrest. Wet skin or cuts to the skin and the exact path of the current are all factors that determine the severity of electrocution.*

**B-003-18-8 (3) What should you do if you discover someone who is being burned by high voltage?**

1. Wait for a few minutes to see if the person can get away from the high voltage on their own, then try to help

2. Immediately drag the person away from the high voltage

**3. Turn off the power, call for emergency help and give CPR if needed**

4. Run from the area so you won't be burned too

*> Step number One: turn off the power. Do not risk electrocuting yourself and become a second victim. [ CPR is Cardiopulmonary Resuscitation ]*

**B-003-18-9 (1) What is the safest method to remove an unconscious person from contact with a high voltage source?**

**1. Turn off the high voltage switch before removing the person from contact with the source**

2. Wrap the person in a blanket and pull him to a safe area

3. Call an electrician

4. Remove the person by pulling an arm or a leg

*> Step number One: turn off the power. Do not risk electrocuting yourself and become a second victim. [ CPR is Cardiopulmonary Resuscitation ]*

**B-003-18-10 (1) Before checking a fault in a mains operated power supply unit, it would be safest to FIRST:**

**1. turn off the power and remove power plug**

2. short out leads of filter capacitor

3. check action of capacitor bleeder resistance

4. remove and check fuse from power supply

*> key words: "MAINS" OPERATED. This refers to 'Household' current which runs at 120 Volts and can supply hundreds of Amperes (for a brief time) before a fuse or breaker interrupts the circuit after a fault. 30 VOLTS is considered potentially dangerous to humans and less than A TENTH of an AMPERE can lead to cardiac arrest.*

**B-003-18-11 (1) Fault finding in a power supply of an amateur transmitter while the supply is operating is not a recommended technique because of**

**the risk of**:

**1. electric shock**

2. damaging the transmitter

3. overmodulation

4. blowing the fuse

*> This was especially true of transmitters using vacuum tubes. Plate voltages ran into the hundreds of Volts with current capacities of hundreds of milliamperes. 30 VOLTS is considered potentially dangerous to humans and less than A TENTH of an AMPERE can lead to cardiac arrest.*

**B-003-19-1 (2) For best protection from electrical shock, what should be grounded in an amateur station?**

1. The antenna feed line

**2. All station equipment**

3. The AC power line

4. The power supply primary

*> An external ground connection on each cabinet serves as a backup to the normal electrical outlet ground ( the 'green' wire in a three-lead power cord ).*

**B-003-19-2 (1) If a separate ground system is not possible for your amateur station, an alternative indoor grounding point could be:**

**1. a metallic cold water pipe**

2. a plastic cold water pipe

3. a window screen

4. a metallic natural gas pipe

*> A 'metallic cold water pipe' normally offers the most direct solid conduction to earth ground*.

**B-003-19-3 (1) To protect you against electrical shock, the chassis of each piece of your station equipment should be connected to:**

**1. a good ground connection**

2. a dummy load

3. insulated shock mounts

4. the antenna

*> An external ground connection on each cabinet serves as a backup to the normal electrical outlet ground ( the 'green' wire in a three-lead power cord ).*

**B-003-19-4 (4) Which of these materials is best for a ground rod driven into the earth?**

1. Hard plastic

2. Iron or steel

3. Fiberglass

**4. Copper-clad steel**

*> 'Copper-Clad' ( steel core, copper plating ) offers rigidity (when hammering the rod into the ground) and conductivity (for best ground connection).*

**B-003-19-5 (4) If you ground your station equipment to a ground rod driven into the earth, what is the shortest length the rod should be?**

1. 1.25 metre (4 ft)

2. 2 metres (6 ft)

3. 3.25 metres (10 ft)

**4. 2.5 metres (8 ft)**

*> Electrical safety regulations recommend 2.5 metres ( 8 feet ).*

**B-003-19-6 (3) Where should the green wire in a three-wire AC line cord be connected in a power supply?**

1. To the white wire

2. To the "hot" side of the power switch

**3. To the chassis**

4. To the fuse

*> The 'green wire' in a three-wire AC line cord is a ground connection. Securing the 'green wire' to the chassis (and outside cabinet) keeps the chassis at ground potential if a fault ever caused the 'live' side (120 Volts) of the AC line to contact the chassis.*

**B-003-19-7 (3) If your third-floor amateur station has a ground wire running 10.05 metres (33 feet) down to a ground rod, why might you get an**

**RF burn if you touch the front panel of your HF transceiver?**

1. Because of a bad antenna connection, allowing the RF energy to take an easier path out of the transceiver through you

2. Because the transceiver's heat-sensing circuit is not working to start the cooling fan

**3. Because the ground wire is a resonant length on several HF bands and acts more like an antenna than an RF ground connection**

4. Because the ground rod is not making good contact with moist earth

*> key word:  10 METRES.  RF 'hot spots' and RF 'burns' are symptoms of 'Stray RF'. This is relatively long in comparison with some of the wavelengths in the HF (High Frequency) spectrum.  For example, 10 metres is a quarter wavelength on the 40-metre band.  A wire this long looks like an antenna and will not provide a low impedance ground connection necessary to evacuate 'Stray RF'*.

**B-003-19-8 (3) What is one good way to avoid stray RF energy in your amateur station?**

1. Make a couple of loops in the ground wire where it connects to your station

2. Drive the ground rod at least 420 cm (14 feet) into the ground

**3. Keep the station's ground wire as short as possible**

4. Use a beryllium ground wire for best conductivity

*> RF 'hot spots' and RF 'burns' are symptoms of 'Stray RF'.  To eliminate 'Stray RF', a low impedance path to ground must be provided.  Only SHORT and WIDE ground conductors can provide low impedance.*

**B-003-19-9 (3) Which statement about station grounding is true?**

1. A ground loop is an effective way to ground station equipment

2. If the chassis of all station equipment is connected with a good conductor, there is no need to tie them to an earth ground

**3. RF hot spots can occur in a station located above the ground floor if the equipment is grounded by a long ground wire**

4. The chassis of each piece of station equipment should be tied together with high-impedance conductors

*> RF 'hot spots' and RF 'burns' are symptoms of 'Stray RF'.  To eliminate 'Stray RF', a low impedance path to ground must be provided.  Only SHORT and WIDE ground conductors can provide low impedance.*

**B-003-19-10 (4) On mains operated power supplies, the ground wire should be connected to the metal chassis of the power supply. This ensures, in case there is a fault in the power supply, that the chassis:**

1. does not become conductive to prevent electric shock

2. becomes conductive to prevent electric shock

3. develops a high voltage compared to the ground

**4. does not develop a high voltage with respect to the ground**

*> The 'green wire' in a three-wire AC line cord is a ground connection. Securing the 'green wire' to the chassis (and outside cabinet) keeps the chassis at ground potential if a fault ever caused the 'live' side (120 Volts) of the AC line to contact the chassis.*

**B-003-19-11 (2) The purpose of using a three-wire power cord and plug on amateur radio equipment is to:**

1. prevent the plug from being reversed in the wall outlet

**2. prevent the chassis from becoming live in case of an internal short to the chassis**

3. prevent short circuits

4. make it inconvenient to use

*> The 'green wire' in a three-wire AC line cord is a ground connection. Securing the 'green wire' to the chassis (and outside cabinet) keeps the chassis at ground potential if a fault ever caused the 'live' side (120 Volts) of the AC line to contact the chassis.*

**B-003-20-1 (2) Why should you ground all antenna and rotator cables when your amateur station is not in use?**

1. To lock the antenna system in one position

**2. To protect the station and building from lightning damage**

3. To avoid radio frequency interference

4. To make sure everything will stay in place

*> Grounding antenna and rotator cables help direct an eventual lightning strike as directly to ground as possible*.

**B-003-20-2 (4) How can an antenna system be protected from lightning damage?**

1. Install a balun at the antenna feed point

2. Install an RF choke in the antenna feed line

3. Install a fuse in the antenna feed line

**4. Ground all antennas when they are not in use**

*> Grounding antenna and rotator cables help direct an eventual lightning strike as directly to ground as possible.*

**B-003-20-3 (1) How can amateur station equipment best be protected from lightning damage**?

**1. Disconnect all equipment from the power lines and antenna cables**

2. Use heavy insulation on the wiring

3. Never turn off the equipment

4. Disconnect the ground system from all radios

*> If station equipment is totally disconnected from external circuits (power and antenna), damage to station equipment from lightning or voltage surges become impossible.*

**B-003-20-4 (2) What equipment should be worn for working on an antenna tower?**

1. A reflective vest of approved color

**2. Approved equipment in accordance with provincial safety standards concerning climbing**

3. A flashing red, yellow or white light

4. A grounding chain

*> In Canada, worker safety is a provincial responsibility. A 'safety harness' and 'hard hat' are minimum requirements.*

**B-003-20-5 (3) Why should you wear a safety belt if you are working on an antenna tower?**

1. To safely bring any tools you might use up and down the tower

2. To keep the tower from becoming unbalanced while you are working

**3. To prevent you from accidentally falling**

4. To safely hold your tools so they don't fall and injure someone on the ground

*> 'Fall prevention' is a serious matter.  In Canada, worker safety is a provincial responsibility.  A 'safety harness' and 'hard hat' are minimum requirements.*

**B-003-20-6 (3) For safety, how high should you place a horizontal wire antenna?**

1. Above high-voltage electrical lines

2. Just high enough so you can easily reach it for adjustments or repairs

**3. High enough so that no one can touch any part of it from the ground**

4. As close to the ground as possible

*> Even at modest power, touching a radiating antenna or open-wire line can lead to 'RF burns'.  Voltage is not the only factor, radio-frequency reaches deep into the skin, potentially causing nasty burns.  "1" would be a dangerous mistake:  if the antenna dropped, lethal voltages would be carried back to the station.  "4" is not what we usually want to do with our antennas.*

**B-003-20-7 (4) Why should you wear a hard hat if you are on the ground helping someone work on an antenna tower?**

1. So you won't be hurt if the tower should accidentally fall

2. To keep RF energy away from your head during antenna testing

3. So someone passing by will know that work is being done on the tower and will stay away

**4. To protect your head from something dropped from the tower**

*> Think for a second about a screwdriver, wrench or a heavy bolt falling on your head from a height of 14 metres (48 feet).*

**B-003-20-8 (3) Why should your outside antennas be high enough so that no one can touch them while you are transmitting?**

1. Touching the antenna might reflect the signal back to the transmitter and cause damage

2. Touching the antenna might radiate harmonics

**3. Touching the antenna might cause RF burns**

4. Touching the antenna might cause television interference

*> Even at modest power, touching a radiating antenna or open-wire line can lead to 'RF burns'.  Voltage is not the only factor, radio-frequency reaches deep into the skin, potentially causing nasty burns.*

**B-003-20-9 (2) Why should you make sure that no one can touch an open-wire feed line while you are transmitting with it?**

1. Because contact might break the feed line

**2. Because high-voltage radio energy might burn the person**

3. Because contact might cause spurious emissions

4. Because contact might cause a short circuit and damage the transmitter

*> Even at modest power, touching a radiating antenna or open-wire line can lead to 'RF burns'. Voltage is not the only factor, radio-frequency reaches deep into the skin, potentially causing nasty burns.*

**B-003-20-10 (1) What safety precautions should you take before beginning repairs on an antenna?**

**1. Be sure to turn off the transmitter and disconnect the feed line**

2. Be sure you and the antenna structure are grounded

3. Inform your neighbours so they are aware of your intentions

4. Turn off the main power switch in your house

*> "Disconnecting the transmission line", that is an important precaution to ensure that no RF is ever sent to the antenna. This is especially important if there are several parties in the work crew: an operator could return to the station, turn-on a transmitter and put someone outside at risk.*

**B-003-20-11 (3) What precaution should you take when installing a ground-mounted antenna?**

1. It should be painted so people or animals do not accidentally run into it

2. It should not be installed in a wet area

**3. It should be installed so no one can come in contact with it**

4. It should not be installed higher than you can reach

*> Even at modest power, touching a radiating antenna or open-wire line can lead to 'RF burns'. Voltage is not the only factor, radio-frequency reaches deep into the skin, potentially causing nasty burns.*

**B-003-21-1 (1) What should you do for safety when operating at 1270 MHz?**

**1. Keep antenna away from your eyes when RF is applied**

2. Make sure that an RF leakage filter is installed at the antenna feed point

3. Make sure the standing wave ratio is low before you conduct a test

4. Never use a horizontally polarized antenna

*> RF energy can heat body tissue. 1000 MHz is generally considered to be the low end of the MICROWAVE spectrum. Microwave energy has long been known for its 'heating' effect ( think "microwave oven" ). Never point antennas at anyone. Never look into antennas. Disconnect transmission lines before working on antennas (to further reduce the odds of an error at the station exposing to RF).*

**B-003-21-2 (2) What should you do for safety if you put up a UHF transmitting antenna?**

1. Make sure the antenna is near the ground to keep its RF energy pointing in the correct direction

**2. Make sure the antenna will be in a place where no one can get near it when you are transmitting**

3. Make sure you connect an RF leakage filter at the antenna feed point

4. Make sure that RF field screens are in place

*> RF energy can heat body tissue. VHF and UHF frequencies present the greatest risk. Never point antennas at anyone. Never look into antennas. Disconnect transmission lines before working on antennas (to further reduce the odds of an error at the station exposing to RF).*

**B-003-21-3 (3) What should you do for safety, before removing the shielding on a UHF power amplifier?**

1. Make sure that RF leakage filters are connected

2. Make sure the antenna feed line is properly grounded

**3. Make sure the amplifier cannot accidentally be turned on**

4. Make sure all RF screens are in place at the antenna feed line

*> RF energy can heat body tissue. VHF and UHF frequencies present the greatest risk.*

**B-003-21-4 (2) Why should you make sure the antenna of a hand-held transceiver is not close to your head when transmitting?**

1. To use your body to reflect the signal in one direction

**2. To reduce your exposure to the radio-frequency energy**

3. To keep static charges from building up

4. To help the antenna radiate energy equally in all directions

*> RF energy can heat body tissue.  VHF and UHF frequencies present the greatest risk.  30 MHz to 300 MHz is the range of radio-frequencies over which Health-Canada's "Safety Code 6" recommends the lowest exposure level.*

**B-003-21-5 (4) How should you position the antenna of a hand-held transceiver while you are transmitting?**

1. Pointed towards the station you are contacting

2. Pointed away from the station you are contacting

3. Pointed down to bounce the signal off the ground

**4. Away from your head and away from others**

*> RF energy can heat body tissue.  VHF and UHF frequencies present the greatest risk.  30 MHz to 300 MHz is the range of radio-frequencies over which Health-Canada's "Safety Code 6" recommends the lowest exposure level.*

**B-003-21-6 (4) How can exposure to a large amount of RF energy affect body tissue**?

1. It causes radiation poisoning

2. It paralyzes the tissue

3. It produces genetic changes in the tissue

**4. It heats the tissue**

*> RF energy can heat body tissue.  VHF and UHF frequencies present the greatest risk.  30 MHz to 300 MHz is the range of radio-frequencies over which Health-Canada's "Safety Code 6" recommends the lowest exposure level.*

**B-003-21-7 (2) Which body organ is the most likely to be damaged from the heating effects of RF radiation?**

1. Heart

**2. Eyes**

3. Liver

4. Hands

*> The inside of the eye is mostly liquid.  Ever seen a cup of water brought to a boil in a microwave oven ?   RF energy can heat body tissue.  VHF and UHF frequencies present the greatest risk.  30 MHz to 300 MHz is the range of radio-frequencies over*

*which Health-Canada's "Safety Code 6" recommends the lowest exposure level. Keep antennas away from your head.*

**B-003-21-8 (4) Depending on the wavelength of the signal, the energy density of the RF field, and other factors, in what way can RF energy affect body tissue?**

1. It causes radiation poisoning

2. It causes blood flow to stop

3. It produces genetic changes in the tissue

**4. It heats the tissue**

*> RF energy can heat body tissue. VHF and UHF frequencies present the greatest risk. 30 MHz to 300 MHz is the range of radio-frequencies over which Health-Canada's "Safety Code 6" recommends the lowest exposure level.*

**B-003-21-9 (3) If you operate your amateur station with indoor antennas, what precautions should you take when you install them?**

1. Position the antennas parallel to electrical power wires to take advantage of parasitic effects

2. Position the antennas along the edge of a wall where it meets the floor or ceiling to reduce parasitic radiation

**3. Locate the antennas as far away as possible from living spaces that will be occupied while you are operating**

4. Locate the antennas close to your operating position to minimize feed-line length

*> RF energy can heat body tissue. Keep the antennas away from people and use as little power as possible.*

**B-003-21-10 (1) Why should directional high-gain antennas be mounted higher than nearby structures?**

**1. So they will not direct RF energy toward people in nearby structures**

2. So they will be dried by the wind after a heavy rain storm

3. So they will not damage nearby structures with RF energy

4. So they will receive more sky waves and fewer ground waves

*> RF energy can heat body tissue. VHF and UHF frequencies present the greatest risk. Never point antennas at anyone. Never look into antennas. Disconnect transmission lines before working on antennas (to further reduce the odds of an*

*error at the station exposing to RF).*

**B-003-21-11 (1) For best RF safety, where should the ends and center of a dipole antenna be located?**

**1. As high as possible to prevent people from coming in contact with the antenna**

2. Near or over moist ground so RF energy will be radiated away from the ground

3. As close to the transmitter as possible so RF energy will be concentrated near the transmitter

4. Close to the ground so simple adjustments can be easily made without climbing a ladder

*> Even at modest power, touching a radiating antenna or open-wire line can lead to 'RF burns'.  Voltage is not the only factor, radio-frequency reaches deep into the skin, potentially causing nasty burns.*

# Active Devices: Diodes, Transistors and Tubes

**B-004-1-1 (1) A circuit designed to increase the level of its input signal is called:**

**1. an amplifier**

2. a modulator

3. an oscillator

4. a receiver

> key word:  INCREASE.  An amplifier reproduces its input signal into a larger output signal ( more voltage, more current, more power).

**B-004-1-2 (1) If an amplifier becomes non-linear, the output signal would:**

**1. become distorted**

2. be saturated

3. cause oscillations

4. overload the power supply

*> If an amplifier is 'linear', amplification, as a ratio of output versus input, will be constant regardless of frequency or amplitude of he input signal.  Linearity is synonym with 'absence of distortion'.  'Non-linear' implies distortion.*

**B-004-1-3 (3) To increase the level of very weak radio signals from an antenna, you would use:**

1. an RF oscillator

2. an audio oscillator

**3. an RF amplifier**

4. an audio amplifier

> key words:  INCREASE WEAK RADIO signals.  A Radio-Frequency (RF) amplifier must be used.

**B-004-1-4 (3) To increase the level of very weak signals from a microphone you would use:**

1. an RF oscillator

2. an RF amplifier

**3. an audio amplifier**

4. an audio oscillator

*> key words: INCREASE WEAK microphone signal. An 'audio amplifier'. Frequently called a 'speech amplifier' or 'microphone amplifier' for this particular application.*

**B-004-1-5 (4) The range of frequencies to be amplified by a speech amplifier is typically:**

1. 3 to 300 Hz

2. 300 to 1000 Hz

3. 40 to 40 000 Hz

**4. 300 to 3400 Hz**

*> Frequencies audible to humans range from 20 Hz to 20000 Hz. Speech frequencies important to intelligibility in communications range from 300 Hz to 3000 Hz.*

**B-004-1-6 (2) Which of the following IS NOT amplified by an amplifier?**

1. current

**2. resistance**

3. power

4. voltage

*> key word: NOT. Amplifiers work on voltage, current and power.*

**B-004-1-7 (4) The increase in signal level by an amplifier is called:**

1. attenuation

2. amplitude

3. modulation

4. gain

*> Gain (synonymous with amplification) is an increase in signal voltage/current/power. 'Attenuation' is a loss (opposite to gain). 'Amplitude' is the*

*instantaneous value of a signal. 'Modulation' is the impression of a message onto another signal.*

**B-004-1-8 (4) A device with gain has the property of:**

1. attenuation

2. oscillation

3. modulation

**4. amplification**

*> Gain and Amplification are synonymous. 'Attenuation' is a loss (opposite to gain). 'Oscillation' is the production of an Alternating Current (AC) signal. 'Modulation' is the impression of a message onto another signal.*

**B-004-1-9 (4) A device labelled "Gain = 10 dB" is likely to be an:**

1. attenuator

2. oscillator

3. audio fader

**4. amplifier**

*> Gain and Amplification are synonymous. 'Attenuation' is a loss (opposite to gain). 'Oscillation' is the production of an Alternating Current (AC) signal. 'Modulation' is the impression of a message onto another signal.*

**B-004-1-10 (2) Amplifiers can amplify:**

1. current, power, or inductance

**2. voltage, current, or power**

3. voltage, power, or inductance

4. voltage, current, or inductance

*> Recall that Inductance, a property of coils, is influenced by "The core material, the core diameter, the length of the coil and the number of turns of wire used to wind the coil".*

**B-004-1-11 (4) Which of the following is not a property of an amplifier?**

1. gain

2. linearity

3. distortion

**4. loss**

*> key word:  NOT.  Gain and Amplification are synonymous.  Linearity (or lack of distortion) is a specification of amplifiers.  Loss has nothing to do with amplifiers.*

**B-004-2-1 (2) Zener diodes are used as:**

1. current regulators

**2. voltage regulators**

3. RF detectors

4. AF detectors

*> ZENER diodes maintain a constant voltage across their terminals.  Hence, they are used for voltage regulation.*

**B-004-2-2 (4) One important application for diodes is recovering information from transmitted signals. This is referred to as:**

1. regeneration

2. ionization

3. biasing

**4. demodulation**

*> Detection = DEmodulation = Recovery of the message carried on radio signal*.

B-004-2-3 (2) The primary purpose of a Zener diode is to:

1. provide a voltage phase shift

**2. regulate or maintain a constant voltage**

3. to boost the power supply voltage

4. provide a path through which current can flow

*> ZENER diodes maintain a constant voltage across their terminals.  Hence, they are used for voltage regulation.*

**B-004-2-4 (2) The action of changing alternating current to direct current is called:**

1. amplification

**2. rectification**

3. transformation

4. modulation

*> Changing AC to DC is called 'Rectification'. AC is turned into 'pulsating DC' (it flows in one direction only) after going through a diode. In Power Supply circuits, diodes are called 'Rectifiers'. Diodes have two electrodes: Cathode and Anode. Electrons flow from Cathode to Anode in a forward-biased (i.e., a diode subjected to a voltage polarity which permits conduction) diode.*

**B-004-2-5 (2) The electrodes of a semi-conductor diode are known as:**

1. gate and source

**2. anode and cathode**

3. collector and base

4. cathode and drain

*> A DIODE, vacuum tube or semiconductor, has two electrodes: Anode and Cathode. Electrons flow from Cathode to Anode in a forward-biased (i.e., a diode subjected to a voltage polarity which permits conduction) diode. Cathode/Grid/Anode(plate) are electrodes in a vacuum triode. Source/Gate/Drain are electrodes in a Field Effect Transistor (FET, N-Channel or P-Channel). Emitter/Base/Collector are electrodes in a Bipolar Transistor ( type PNP or NPN ).*

**B-004-2-6 (3) If alternating current is applied to the anode of a diode, what would you expect to see at the cathode?**

1. No signal

2. Steady direct current

**3. Pulsating direct current**

4. Pulsating alternating current

*> Changing AC to DC is called 'Rectification'. AC is turned into 'pulsating DC' (it flows in one direction only) after going through a diode. In Power Supply circuits, diodes are called 'Rectifiers'. Diodes have two electrodes: Cathode and Anode. Electrons flow from Cathode to Anode in a forward-biased (i.e., a diode subjected to a voltage polarity which permits conduction) diode.*

**B-004-2-7 (4) In a semi-conductor diode, electrons flow from:**

1. anode to cathode

2. cathode to grid

3. grid to anode

**4. cathode to anode**

*> A DIODE, vacuum tube or semiconductor, has two electrodes: Anode and Cathode. Electrons flow from Cathode to Anode in a forward-biased (i.e., a diode subjected to a voltage polarity which permits conduction) diode. Cathode/Grid/Anode(plate) are electrodes in a vacuum triode. Source/Gate/Drain are electrodes in a Field Effect Transistor (FET, N-Channel or P-Channel). Emitter/Base/Collector are electrodes in a Bipolar Transistor ( type PNP or NPN ).*

**B-004-2-8 (1) What semi-conductor device glows red, yellow, or green, depending upon its chemical composition?**

**1. A light-emitting diode**

2. A fluorescent bulb

3. A neon bulb

4. A vacuum diode

*> key word: SEMI-CONDUCTOR. "LED", a Light-Emitting Diode.*

**B-004-2-9 (4) Voltage regulation is the principal application of the:**

1. junction diode

2. light-emitting diode

3. vacuum diode

**4. Zener diode**

> ZENER diodes maintain a constant voltage across their terminals. Hence, they are used for voltage regulation.

**B-004-2-10 (2) In order for a diode to conduct, it must be:**

1. close coupled

**2. forward-biased**

3. enhanced

4. reverse-biased

*> A DIODE, vacuum tube or semiconductor, has two electrodes: Anode and Cathode. Electrons flow from Cathode to Anode in a forward-biased (i.e., a diode*

*subjected to a voltage polarity which permits conduction) diode. Cathode/Grid/Anode(plate) are electrodes in a vacuum triode. Source/Gate/Drain are electrodes in a Field Effect Transistor (FET, N-Channel or P-Channel). Emitter/Base/Collector are electrodes in a Bipolar Transistor ( type PNP or NPN ).*

**B-004-3-1 (4) Which component can amplify a small signal using low voltages?**

1. A variable resistor

2. An electrolytic capacitor

3. A multiple-cell battery

**4. A PNP transistor**

*> key words: AMPLIFY, LOW VOLTAGE. A transistor amplifies signals and can work at a low voltage. Bipolar Transistors ( type PNP or NPN ) as well as Field Effect Transistor (FET, N-Channel or P-Channel) can amplify signals.*

**B-004-3-2 (3) The basic semi-conductor amplifying device is the:**

1. tube

2. P-N junction

**3. transistor**

4. diode

*> key words: SEMICONDUCTOR, AMPLIFY. A transistor amplifies signals. Bipolar Transistors ( type PNP or NPN ) as well as Field Effect Transistor (FET, N-Channel or P-Channel) can amplify signals. A 'single P-N junction' is a diode. Diodes have two main uses: 'Rectification' and 'Detection'.*

**B-004-3-3 (2) The three leads from a PNP transistor are named:**

1. drain, base and source

**2. collector, emitter and base**

3. collector, source and drain

4. gate, source and drain

*> Emitter/Base/Collector are electrodes in a Bipolar Transistor ( type PNP or NPN ). Source/Gate/Drain are electrodes in a Field Effect Transistor (FET, N-Channel or P-Channel). Cathode/Grid/Anode(plate) are electrodes in a vacuum triode.*

**B-004-3-4 (4) If a low level signal is placed at the input to a transistor, a higher level of signal is produced at the output lead. This effect is know as:**

1. detection

2. modulation

3. rectification

**4. amplification**

*> Detection = DEmodulation = Recovery of the message carried on radio signal. 'Modulation' is the impression of a message onto another signal. 'Rectification' turns AC into 'pulsating DC' (it flows in one direction only) after going through a diode.*

**B-004-3-5 (2) Bipolar transistors usually have:**

1. 2 leads

**2. 3 leads**

3. 1 lead

4. 4 leads

*> Emitter/Base/Collector are electrodes in a Bipolar Transistor ( type PNP or NPN ). Source/Gate/Drain are electrodes in a Field Effect Transistor (FET, N-Channel or P-Channel). Cathode/Grid/Anode(plate) are electrodes in a vacuum triode.*

**B-004-3-6 (1) A semi-conductor is described as a "general purpose audio NPN device". This would be:**

**1. a bipolar transistor**

2. a silicon diode

3. a triode

4. an audio detector

*> key word: NPN. The only choice in the group comprising a sandwich of N-semiconductor and P-semiconductor is the 'Bipolar Transistor'*.

**B-004-3-7 (2) The two basic types of bipolar transistors are:**

1. diode and triode types

2. NPN and PNP types

3. varicap and zener types

4. P and N channel types

*> key word: BIPOLAR TRANSISTOR. It is constructed with a sandwich of N-semiconductor and P-semiconductor: NPN or PNP type.*

**B-004-3-8 (1) A transistor can be destroyed in a circuit by:**

**1. excessive heat**

2. excessive light

3. saturation

4. cut-off

*> Extreme operating temperatures can rapidly destroy transistors.*

**B-004-3-9 (2) In a bipolar transistor, the ______________compares closest to the control grid of a triode vacuum tube**.

1. emitter

**2. base**

3. source

4. collector

*> Comparing Triode/Bipolar Transistor/FET in terms of their RESPECTIVE electrodes: Origin of charge carriers = Cathode/Emitter/Source. Control electrode = Grid/Base/Gate. Destination of charge carriers = Anode(plate)/Collector/Drain.*

**B-004-3-10 (3) In a bipolar transistor, the ______________compares closest to the plate of a triode vacuum tube.**

1. gate

2. emitter

**3. collector**

4. base

*> Comparing Triode/Bipolar Transistor/FET in terms of their RESPECTIVE electrodes: Origin of charge carriers = Cathode/Emitter/Source. Control electrode = Grid/Base/Gate. Destination of charge carriers = Anode(plate)/Collector/Drain.*

**B-004-3-11 (4) In a bipolar transistor, the _____________ compares closest to the cathode of a triode vacuum tube.**

1. collector

2. base

3. drain

**4. emitter**

*> Comparing Triode/Bipolar Transistor/FET in terms of their RESPECTIVE electrodes: Origin of charge carriers = Cathode/Emitter/Source. Control electrode = Grid/Base/Gate. Destination of charge carriers = Anode(plate)/Collector/Drain.*

**B-004-4-1 (4) The two basic types of field effect transistors (FET) are:**

1. NPN and PNP

2. germanium and silicon

3. inductive and capacitive

**4. N and P channel**

*> In a field effect transistor, Source and Drain are the two extremities of a 'channel' made of a single semi-conductor type. NPN and PNP are the two type of BIPOLAR Transistors.*

**B-004-4-2 (2) A semi-conductor having its leads labeled gate, drain, and source is best described as a:**

1. gated transistor

**2. field-effect transistor**

3. bipolar transistor

4. silicon diode

*> Source/Gate/Drain are electrodes in a Field Effect Transistor (FET, N-Channel or P-Channel). Emitter/Base/Collector are electrodes in a Bipolar Transistor ( type PNP or NPN ). Cathode/Grid/Anode(plate) are electrodes in a vacuum triode.*

**B-004-4-3 (1) In a field effect transistor, the ___________ is the terminal that controls the conductance of the channel.**

**1. gate**

2. drain

3. source

4. collector

*> Comparing Triode/Bipolar Transistor/FET in terms of their RESPECTIVE electrodes: Origin of charge carriers = Cathode/Emitter/Source. Control electrode = Grid/Base/Gate. Destination of charge carriers = Anode(plate)/Collector/Drain.*

**B-004-4-4 (1) In a field effect transistor, the ____________is the terminal where the charge carriers enter the channel.**

**1. source**

2. gate

3. drain

4. emitter

*> Comparing Triode/Bipolar Transistor/FET in terms of their RESPECTIVE electrodes: Origin of charge carriers = Cathode/Emitter/Source. Control electrode = Grid/Base/Gate. Destination of charge carriers = Anode(plate)/Collector/Drain.*

**B-004-4-5 (3) In a field effect transistor, the ___________ is the terminal where the charge carriers leave the channel.**

1. collector

2. source

**3. drain**

4. gate

*> Comparing Triode/Bipolar Transistor/FET in terms of their RESPECTIVE electrodes: Origin of charge carriers = Cathode/Emitter/Source. Control electrode = Grid/Base/Gate. Destination of charge carriers = Anode(plate)/Collector/Drain.*

**B-004-4-6 (3) Which semi-conductor device has characteristics most similar to a triode vacuum tube?**

1. Junction diode

2. Zener diode

**3. Field effect transistor**

4. Bipolar transistor

*> The triode and the FET both rely on a reverse voltage on their control electrodes to affect the current through the device.*

**B-004-4-7 (1) The control element in the field effect transistor is the:**

**1. gate**

2. source

3. drain

4. base

*> Comparing Triode/Bipolar Transistor/FET in terms of their RESPECTIVE electrodes: Origin of charge carriers = Cathode/Emitter/Source.  Control electrode = Grid/Base/Gate.  Destination of charge carriers = Anode(plate)/Collector/Drain.*

**B-004-4-8 (1) If you wish to reduce the current flowing in a field effect transistor, you could:**

**1. increase the reverse bias voltage**

2. decrease the reverse bias voltage

3. increase the forward bias voltage

4. increase the forward bias gain

*> The triode and the FET both rely on a reverse voltage on their control electrodes to affect the current through the device.*

**B-004-4-9 (2) The source of a field effect transistor corresponds to the ________ of a bipolar transistor.**

1. base

**2. emitter**

3. drain

4. collector

*> Comparing Triode/Bipolar Transistor/FET in terms of their RESPECTIVE electrodes: Origin of charge carriers = Cathode/Emitter/Source.  Control electrode = Grid/Base/Gate.  Destination of charge carriers = Anode(plate)/Collector/Drain*.

**B-004-4-10 (2) The drain of a field effect transistor corresponds to the ________ of a bipolar transistor.**

1. base

**2. collector**

3. source

4. emitter

*> Comparing Triode/Bipolar Transistor/FET in terms of their RESPECTIVE electrodes: Origin of charge carriers = Cathode/Emitter/Source.  Control electrode = Grid/Base/Gate.  Destination of charge carriers = Anode(plate)/Collector/Drain.*

**B-004-4-11 (4) Which two elements in a field effect transistor exhibit fairly similar characteristics?**

1. Source and gate

2. Gate and drain

3. Source and base

**4. Source and drain**

*> Source and Drain are the two ends of the same block of semiconductor material, the 'Channel'.  Only the control electrode, the Gate, is made of the opposite type of material.*

**B-004-5-1 (2) What is one reason a triode vacuum tube might be used instead of a transistor in a circuit?**

1. It uses less current

**2. It may be able to handle higher power**

3. It is much smaller

4. It uses lower voltages

*> Vacuum triodes are larger, use current just to heat the filament and require higher voltages than transistors BUT they remain simpler to use in HIGH-POWER amplifiers.*

**B-004-5-2 (1) Which component can amplify a small signal but must use high voltages?**

**1. A vacuum tube**

2. A transistor

3. An electrolytic capacitor

4. A multiple-cell battery

*> key words:  AMPLIFY, HIGH VOLTAGE.  Vacuum tubes amplify signals but work at higher voltages than transistors (generally low-voltage devices).*

**B-004-5-3 (2) A feature common to tubes and transistors is that both:**

1. have electrons drifting through a vacuum

**2. can amplify signals**

3. convert electrical energy to radio waves

4. use heat to cause electron movement

*> Only vacuum tubes use heat to facilitate electron movement within an envelope free of air.  "3" is the function of a transmitting antenna.*

**B-004-5-4 (2) In a vacuum tube, the electrode that is operated with the highest positive potential is the __________.**

1. filament (heater)

**2. plate**

3. cathode

4. grid

*> The 'Plate' (or Anode) attracts electrons with a high positive voltage.  The Cathode emits electrons.  The Grid encircles the Cathode and controls the flow of electrons.*

**B-004-5-5 (2) In a vacuum tube, the electrode that is usually a cylinder of wire mesh is the ________.**

1. filament (heater)

**2. grid**

3. cathode

4. plate

*> The 'Grid' is a wire mesh (looking like a fence, so to speak) around the Cathode. The 'Plate' (or Anode) attracts electrons with a high positive voltage.  The Cathode emits electrons.  The Grid encircles the Cathode and controls the flow of electrons.*

**B-004-5-6 (4) In a vacuum tube, the element that is furthest away from the plate is the ___________.**

1. grid

2. emitter

3. cathode

**4. filament (heater)**

*> key words: ELEMENT, FURTHEST. A "directly-heated triode" comprises a filament (serving as a cathode, emitting electrons), a grid and a plate (or anode). An "indirectly-heated triode" comprises a heater (heating the cathode), a cathode (emitting electrons), a grid and a plate (or anode).*

**B-004-5-7 (1) In a vacuum tube, the electrode that emits electrons is the ___________.**

**1. cathode**

2. grid

3. collector

4. plate

*> The 'Plate' (or Anode) attracts electrons with a high positive voltage. The Cathode emits electrons. The Grid encircles the Cathode and controls the flow of electrons.*

**B-004-5-8 (2) What is inside the envelope of a triode tube?**

1. argon

2. a vacuum

3. air

4. neon

*> A 'vacuum' is the absence of air. Air is pumped out of vacuum tubes (like light bulbs) to prevent the filament from burning up.*

**B-004-5-9 (4) How many grids are there in a triode vacuum tube?**

1. two

2. three

3. three plus a filament

**4. one**

*> key words: GRID, TRIODE. A triode is a 3-electrode device: a cathode, a single GRID and a plate (or anode).*

**B-004-5-10 (2) If you do not wish to have current flowing in the grid circuit of a vacuum tube, the grid should be:**

1. positive with respect to the anode

**2. negative with respect to the cathode**

3. positive with respect to both cathode and anode

4. positive with respect to the cathode

*> A negative grid repulses the negatively-charged electrons arriving from the cathode. The triode and the FET both rely on a reverse voltage on their control electrodes to affect the current through the device.*

**B-004-5-11 (2) The negative DC control voltage applied to the control grid of a vacuum tube is called:**

1. suppression voltage

**2. bias voltage**

3. repulsion voltage

4. excitation voltage

*> Bias voltage: the voltage set on the control electrode of an amplifying device when it is at rest.*

# Waves, Wavelength, Frequency and Bands

**B-005-1-1 (2) If a dial marked in megahertz shows a reading of 3.525 MHz, what would it show if it were marked in kilohertz?**

1. 35.25 kHz

**2. 3525 kHz**

3. 3 525 000 kHz

4. 0.003525 kHz

*> Mega is a million, kilo is a thousand.  A Megahertz is a thousand kilohertz. Converting from Megahertz to kilohertz, from large units to smaller, requires more digits, decimal point moves to the right by three positions, a thousand times more.*

**B-005-1-10 (1) One megahertz is equal to:**

**1. 1 000 kHz**

2. 100 kHz

3. 0.001 Hz

4. 10 Hz

*> Mega is a million, kilo is a thousand.  Converting from Megahertz to kilohertz, from large units to smaller, requires more digits, decimal point moves to the right by three positions, a thousand times more.*

**B-005-7-4 (1) Electrical energy at a frequency of 7125 kHz is in what frequency range?**

**1. Radio**

2. Audio

3. Hyper

4. Super-high

*> Frequencies audible to humans range from 20 Hz to 20000 Hz (AUDIO).  Speech frequencies important to intelligibility in communications range from 300 Hz to 3000 Hz.  Radio frequencies can reach up to 300 GHz ( 300000 MHz ):  Medium Frequencies 300 kHz - 3000 kHz, High Frequencies 3 MHz - 30 MHz, Very High Frequencies 30 MHz - 300 MHz, Ultra High Frequencies 300 MHz - 3000 MHz, Super High Frequencies 3 GHz - 30 GHz, Extremely High Frequencies 30 GHz - 300 GHz.*

**B-005-7-5 (1) What is the name for the distance an AC signal travels during one complete cycle?**

**1. Wavelength**

2. Wave speed

3. Waveform

4. Wave spread

*> Wavelength: the distance between successive points of equal amplitude and phase on a wave (for example, crest to crest or trough to trough).*

**B-005-7-6 (4) What happens to a signal's wavelength as its frequency increases?**

1. It gets longer

2. It stays the same

3. It disappears

**4. It gets shorter**

*> Wavelength (lambda) in metres is 300 divided by frequency in Megahertz ( i.e., the speed of light divided by the frequency in Hertz ). Wavelength and frequency have an inverse relationship.*

**B-005-7-7 (3) What happens to a signal's frequency as its wavelength gets longer?**

1. It disappears

2. It stays the same

**3. It goes down**

4. It goes up

*> Wavelength (lambda) in metres is 300 divided by frequency in Megahertz ( i.e., the speed of light divided by the frequency in Hertz ). Wavelength and frequency have an inverse relationship*.

## Inductors and Capacitors

**B-005-1-4 (3) How many microfarads is 1 000 000 picofarads?**

1. 1 000 000 000 microfarads

2. 1000 microfarads

**3. 1 microfarad**

4. 0.001 microfarad

*> Pico is a millionth of a millionth, micro is a millionth.  Converting from picofarads to microfarads:  from small units to larger units, requires fewer digits, decimal point moves to the left by SIX positions, a MILLION times less.*

**B-005-1-11 (4) An inductance of 10 000 microhenrys may be stated correctly as:**

1. 100 millihenrys

2. 10 henrys

3. 1 000 henrys

**4. 10 millihenrys**

*> Micro is a millionth, milli is a thousandth.  Converting from microhenrys to millihenrys:  from small units to larger units, requires fewer digits, decimal point moves to the left by three positions, a thousand times less.*

**B-005-9-1 (4) If two equal-value inductors are connected in series, what is their total inductance?**

1. Half the value of one inductor

2. The same as the value of either inductor

3. The value of one inductor times the value of the other

**4. Twice the value of one inductor**

*> key words:  SERIES INDUCTORS.  Inductors (coils) in combinations obey rules similar to resistors.  In SERIES, the total value is the sum of the values.  In PARALLEL combination with components of IDENTICAL values, the total value is the value of one component divided by the number in the circuit.*

**B-005-9-2 (4) If two equal-value inductors are connected in parallel, what is their total inductance?**

1. Twice the value of one inductor

2. The same as the value of either inductor

3. The value of one inductor times the value of the other

**4. Half the value of one inductor**

*> key words:  PARALLEL INDUCTORS.  Inductors (coils) in combinations obey rules similar to resistors.  In PARALLEL combination with components of IDENTICAL values, the total value is the value of one component divided by the number in the circuit.  In SERIES, the total value is the sum of the values.*

**B-005-9-3 (4) If two equal-value capacitors are connected in series, what is their total capacitance?**

1. Twice the value of one capacitor

2. The same as the value of either capacitor

3. The value of one capacitor times the value of the other

**4. Half the value of either capacitor**

*> key words:  SERIES CAPACITORS.  Capacitors behave OPPOSITE TO INDUCTORS. Capacitors add up in parallel combinations BUT the total value is less than the smallest in a series combination.  With identical CAPACITORS in SERIES, the total value is the value of one component divided by the number in the circuit.*

**B-005-9-4 (2) If two equal-value capacitors are connected in parallel, what is their total capacitance?**

1. The same as the value of either capacitor

**2. Twice the value of one capacitor**

3. The value of one capacitor times the value of the other

4. Half the value of one capacitor

*> key words:  PARALLEL CAPACITORS.  Capacitors behave OPPOSITE TO INDUCTORS.  With CAPACITORS in PARALLEL, the total value is the sum of the values.  Picture in your head, the area of the plates growing as more and more capacitors are added in parallel.  More plate area, more capacity.*

**B-005-9-5 (3) What determines the inductance of a coil?**

1. The core material, the number of turns used to wind the core and the frequency of the current through the coil

2. The core diameter, the number of turns of wire used to wind the coil and the type of metal used for the wire

**3. The core material, the core diameter, the length of the coil and the number of turns of wire used to wind the coil**

4. The core material, the core diameter, the length of the coil and whether the coil is mounted horizontally or vertically

> Inductance in a coil is due to the interaction of the magnetic fields from one turn to the others. The ease of setting up a magnetic field through a suitable core material, the relative position of the turns (diameter and length) and the number of turns all contribute to inductance.

**B-005-9-6 (1) What determines the capacitance of a capacitor?**

**1. The material between the plates, the area of one side of one plate, the number of plates and the spacing between the plates**

2. The material between the plates, the number of plates and the size of the wires connected to the plates

3. The number of plates, the spacing between the plates and whether the dielectric material is N type or P type

4. The material between the plates, the area of one plate, the number of plates and the material used for the protective coating

*> A simple capacitor is two plates next to one another. The material used as a dielectric to insulate the two plates and the distance between the plates influence the importance of the electric field that can be set-up. The area and number of plates multiply the capacitance effect.*

**B-005-9-7 (4) If two equal-value capacitors are connected in parallel, what is their capacitance?**

1. The same value of either capacitor

2. The value of one capacitor times the value of the other

3. Half the value of either capacitor

**4. Twice the value of either capacitor**

*> key words: PARALLEL CAPACITORS. Capacitors behave OPPOSITE TO INDUCTORS. With CAPACITORS in PARALLEL, the total value is the sum of the values. Picture in your head, the area of the plates growing as more and more capacitors are added in parallel. More plate area, more capacity*.

**B-005-9-8 (2) To replace a faulty 10 millihenry choke, you could use two:**

1. Two 20 millihenry chokes in series

**2. Two 5 millihenry chokes in series**

3. Two 30 millihenry chokes in parallel

4. Two 5 millihenry chokes in parallel

*> key words:  SERIES INDUCTORS.  Inductors (coils) in combinations obey rules similar to resistors.  In SERIES, the total value is the sum of the values.*

**B-005-9-9 (3) Three 15 microfarad capacitors are wired in series. The total capacitance of this arrangement is:**

1. 45 microfarads

2. 12 microfarads

**3. 5 microfarads**

4. 18 microfarads

*> key words:  SERIES CAPACITORS.  Capacitors behave OPPOSITE TO INDUCTORS.  Capacitors add up in parallel combinations BUT the total value is less than the smallest in a series combination.  With identical CAPACITORS in SERIES, the total value is the value of one component divided by the number in the circuit.*

**B-005-9-10 (2) Which series combinations of capacitors would best replace a faulty 10 microfarad capacitor?**

1. two 10 microfarad capacitors

**2. two 20 microfarad capacitors**

3. twenty 2 microfarad capacitors

4. ten 2 microfarad capacitors

*> key words:  SERIES CAPACITORS.  Capacitors behave OPPOSITE TO INDUCTORS.  Capacitors add up in parallel combinations BUT the total value is less than the smallest in a series combination.  With identical CAPACITORS in SERIES, the total value is the value of one component divided by the number in the circuit.  [ capacitors in series might be useful to augment the overall voltage rating ]*

**B-005-9-11 (3) The total capacitance of two or more capacitors in series is:**

1. found by adding each of the capacitors together and dividing by the total number of capacitors

2. found by adding each of the capacitors together

**3. always less than the smallest capacitor**

4. always greater than the largest capacitor

*> key words: SERIES CAPACITORS. Capacitors behave OPPOSITE TO INDUCTORS. Capacitors add up in parallel combinations BUT the total value is less than the smallest in a series combination. With identical CAPACITORS in SERIES, the total value is the value of one component divided by the number in the circuit.*

**B-005-10-1 (3) How does a coil react to AC?**

1. As the amplitude of the applied AC increases, the reactance decreases

2. As the amplitude of the applied AC increases, the reactance increases

**3. As the frequency of the applied AC increases, the reactance increases**

4. As the frequency of the applied AC increases, the reactance decreases

*> Reactance is opposition. XL = 2 * PI * f * L. Inductive reactance = two times PI (i.e., 3.14) times frequency in Hertz times inductance in Henrys. Reactance (opposition) is not influenced by the amplitude of the applied voltage. If frequency goes up, inductive reactance goes up. Intuitively, the higher the frequency (i.e., rate of change), the more significant become the counter-currents induced in adjacent turns.*

**B-005-10-2 (1) How does a capacitor react to AC?**

**1. As the frequency of the applied AC increases, the reactance decreases**

2. As the frequency of the applied AC increases, the reactance increases

3. As the amplitude of the applied AC increases, the reactance increases

4. As the amplitude of the applied AC increases, the reactance decreases

*> Reactance is opposition. XC = 1 over ( 2 * PI * f * C ). Capacitive Reactance = 1 over the product of 'two times PI (i.e., 3.14) times frequency in Hertz times capacitance in Farads'. A behaviour opposite to inductors. Reactance (opposition) is not influenced by the amplitude of the applied voltage. If frequency goes up, capacitive reactance goes down. Intuitively, the more frequent the change of polarity (AC changes polarity every half-cycle), the more incessant becomes the charge/discharge current, current never seems to stop, less apparent opposition to current flow.*

**B-005-10-3 (2) The reactance of capacitors increases as:**

1. applied voltage increases

**2. AC frequency decreases**

3. applied voltage decreases

4. AC frequency increases

*> Reactance is opposition.  XC = 1 over ( 2 * PI * f * C ).  Capacitive Reactance = 1 over the product of 'two times PI (i.e., 3.14) times frequency in Hertz times capacitance in Farads'.  A behaviour opposite to inductors.  Reactance (opposition) is not influenced by the amplitude of the applied voltage.  If frequency goes up, capacitive reactance goes down.  Intuitively, the more frequent the change of polarity (AC changes polarity every half-cycle), the more incessant becomes the charge/discharge current, current never seems to stop, less apparent opposition to current flow.*

**B-005-10-4 (3) In inductances, AC may be opposed by both resistance of winding wire and reactance due to inductive effect. The term which includes resistance and reactance is:**

1. resonance

2. inductance

**3. impedance**

4. capacitance

*> Impedance is measured in ohms.  It is the combined effect of reactance(s) and resistance.  Resistance affects DC and AC equally.  Reactance is a property only present under AC. [ DC = direct current, AC = alternating current ]*

**B-005-10-5 (1) Capacitive reactance:**

**1. decreases as frequency increases**

2. applies only to series RLC circuits

3. increases as frequency increases

4. increases with the time constant

*> Reactance is opposition.  XC = 1 over ( 2 * PI * f * C ).  Capacitive Reactance = 1 over the product of 'two times PI (i.e., 3.14) times frequency in Hertz times capacitance in Farads'.  A behaviour opposite to inductors.  Reactance (opposition) is not influenced by the amplitude of the applied voltage.  If frequency goes up, capacitive reactance goes down.  Intuitively, the more frequent the change of polarity (AC changes polarity every half-cycle), the more incessant becomes the charge/discharge current, current never seems to stop, less apparent opposition to current flow.*

**B-005-10-6 (4) Inductive reactance may be increased by:**

1. a decrease in the applied frequency

2. a decrease in the supplied current

3. an increase in the applied voltage

**4. an increase in the applied frequency**

*> Reactance is opposition. XL = 2 * PI * f * L. Inductive reactance = two times PI (i.e., 3.14) times frequency in Hertz times inductance in Henrys. Reactance (opposition) is not influenced by the amplitude of the applied voltage. If frequency goes up, inductive reactance goes up. Intuitively, the higher the frequency (i.e., rate of change), the more significant become the counter-currents induced in adjacent turns.*

**B-005-10-7 (2) A choke coil of 4.25 microhenrys is used in a circuit at a frequency of 200 MHz. Its reactance is approximately:**

1. 5 740 ohms

**2. 5 340 ohms**

3. 7 540 ohms

4. 4 750 ohms

*> Reactance is opposition. XL = 2 * PI * f * L. Inductive reactance = two times PI (i.e., 3.14) times frequency in Hertz times inductance in Henrys. XL = 2 * 3.14 * 200000000 Hz * 0.00000425 H = 2 * 3.14 * 200 Hz * 4.25 uH = 5338*

**B-005-10-8 (1) The capacitive reactance of a 25 microfarad capacitor connected to a 60 hertz line is:**

**1. 106.1 ohms**

2. 9 420 ohms

3. 2.4 ohms

4. 1 500 ohms

*> Reactance is opposition. XC = 1 over ( 2 * PI * f * C ). Capacitive Reactance = 1 over the product of 'two times PI times frequency in Hertz times capacitance in Farads'. XC = 1 / ( 2 * 3.14 * 60 Hz * 0.000025 F ) = 1 / ( 0.00942 ) = 106.16*

**B-005-10-9 (4) A power-supply filter has a capacitor of 10 microfarad. What is the capacitive reactance of this capacitor to a frequency of 60 hertz?**

1. 200 ohms

2. 100 ohms

3. 500 ohms

**4. 265 ohms**

*> Reactance is opposition.  XC = 1 over ( 2 * PI * f * C ).  Capacitive Reactance = 1 over the product of 'two times PI times frequency in Hertz times capacitance in Farads'.  XC  =  1 / ( 2 * 3.14 * 60 Hz * 0.000010 F )  =  1 / ( 0.003768 )  = 265.39*

**B-005-10-10 (1) What is the approximate inductive reactance of a 1 henry choke coil used in a 60 hertz circuit?**

**1. 376 ohms**

2. 3760 ohms

3. 188 ohms

4. 1888 ohms

*> Reactance is opposition.  XL = 2 * PI * f * L.  Inductive reactance = two times PI (i.e., 3.14) times frequency in Hertz times inductance in Henrys.  XL  =  2 * 3.14 * 60 Hz * 1 H   =  376.8*

**B-005-10-11 (1) In general, the reactance of inductors increases with:**

**1. increasing AC frequency**

2. decreasing AC frequency

3. decreasing applied voltage

4. increasing applied voltage

*> Reactance is opposition.  XL = 2 * PI * f * L.  Inductive reactance = two times PI (i.e., 3.14) times frequency in Hertz times inductance in Henrys.  Reactance (opposition) is not influenced by the amplitude of the applied voltage.  If frequency goes up, inductive reactance goes up.  Intuitively, the higher the frequency (i.e., rate of change), the more significant become the counter-currents induced in adjacent turns.*

**B-005-11-1 (1) If no load is attached to the secondary winding of a transformer, what is current in the primary winding called?**

**1. Magnetizing current**

2. Direct current

3. Excitation current

4. Stabilizing current

*> Even if no current is drawn from the secondary of the transformer, the primary winding remains an inductor.  It lets some AC current through despite its reactance. This minimal current is called "Magnetizing Current".*

**B-005-11-2 (1) A transformer operates a 6.3 volt 2 ampere light bulb from its secondary winding. The power consumed by the primary winding is approximately:**

**1. 13 watts**

2. 6 watts

3. 8 watts

4. 3 watts

*> The Power Law:  P = E * I, Power is Voltage times Current.  6.3 Volts * 2 Amperes = 12.6 Watts*

**B-005-11-3 (4) A transformer has a 240 volt primary that draws a current of 250 mA from the mains supply. Assuming no losses, what current would be available from a 12 volt secondary?**

1. 215 amperes

2. 25 amperes

3. 50 amperes

**4. 5 amperes**

*> As work is performed at a lower voltage on the secondary side, current on the secondary is larger.  The turns ratio is '20 to 1' ( 240 Volts to 12 Volts ), the current ratio follows the inverse of that ratio:  20 * 0.25 Amperes = 5 Amperes.  Method B: Primary consumes 60 Watts  ( 240 Volts * 0.25 Amperes ),  secondary must draw that same power (discounting losses).  What is the secondary current for 60 Watts at 12 Volts ?  I = P / E (derived from P = E * I), I = 60 Watts / 12 Volts = 5 Amperes.*

**B-005-11-4 (2) In a mains power transformer, the primary winding has 250 turns, and the secondary has 500. If the input voltage is 110 volts, the likely secondary voltage is:**

1. 440 V

**2. 220 V**

3. 560 V

4. 24 V

*> A 'step-up' transformer, the secondary uses twice as many turns as the primary, voltage is doubled ( exactly per the turns ratio ).*

**B-005-11-5 (3) The strength of the magnetic field around a conductor in air is:**

1. inversely proportional to the diameter of the conductor

2. directly proportional to the diameter of the conductor

**3. directly proportional to the current in the conductor**

4. inversely proportional to the voltage on the conductor

*> Current and magnetism are closely related: current in a conductor sets up a magnetic field, dropping a conductor through magnetic lines of force creates a current. "1" and "2" allude to the conductor's diameter which has no influence. "4" alludes to voltage which would only be of concern for an electrical field.*

**B-005-11-6 (1) Maximum induced voltage in a coil occurs when:**

**1. current is going through its greatest rate of change**

2. the current through the coil is of a DC nature

3. current is going through its least rate of change

4. the magnetic field around the coil is not changing

*> For induction to take place in a wire, a conductor must be subjected to a moving magnetic field (no movement, no induction). Either the conductor must move in the magnetic field OR the magnetic field must move if the conductor is immobile. If current changes drastically within a short period of time ('rate of change'), the magnetic field around the conductor changes rapidly, induction is maximized.*

**B-005-11-7 (3) The voltage induced in a conductor moving in a magnetic field is at a maximum when the movement is:**

1. made in a counterclockwise direction

2. parallel to the lines of force

**3. perpendicular to the lines of force**

4. made in a clockwise direction

*> For induction to be maximum, the conductor must "cut" through the lines of magnetic force. Dropping through perpendicularly (at 90 degrees) through the magnetic field maximizes induction.*

**B-005-11-8 (3) A 100% efficient transformer has a turns ratio of 1/5. If the secondary current is 50 mA, the primary current is:**

1. 2 500 mA

2. 0.01 A

**3. 0.25 A**

4. 0.25 mA

*> A turns ratio of '1 to 5' indicates a 'step-up' transformer, primary current will be larger than the secondary current by the inverse of that ratio. In this example, primary current is 5 * times 50 mA = 250 milliamperes = 0.25 Amperes. Transformers do not "create" power out of nothing, the power ( E * I ) flowing into the primary equals the power drawn by the secondary plus losses (which are ignored for the sake of simplicity). For power to remain "comparable" on both sides of the transformer, current goes up if voltage increases and vice-versa.*

**B-005-11-11 (3) The fact that energy transfer from primary to secondary windings in a power transformer is not perfect is indicated by:**

1. electrostatic shielding

2. large secondary currents

**3. warm iron laminations**

4. high primary voltages

*> Heating of the core laminations is a symptom of one of the losses in a real-life transformer.*

**B-005-12-1 (1) Resonance is the condition that exists when:**

**1. inductive reactance and capacitive reactance are equal**

2. inductive reactance is the only opposition in the circuit

3. the circuit contains no resistance

4. resistance is equal to the reactance

*> Resonance is the condition where Inductive Reactance (XL) is equal in value to Capacitive Reactance (XC). For a given Inductance (L, a coil or inductor) and Capacitance (C, a capacitor), resonance happens at one frequency: the resonant frequency. At resonance, the two reactances cancel each other, only resistance is left in the circuit.*

**B-005-12-2 (4) Parallel tuned circuits offer:**

1. low impedance at resonance

2. zero impedance at resonance

3. an impedance equal to resistance of the circuit

**4. very high impedance at resonance**

*> key words: PARALLEL, TUNED. Question refers to Resonance. The one frequency at which Inductive Reactance cancels Capacitive Reactance. In a PARALLEL circuit, Impedance (Z) at resonance is HIGH ( series circuit will be the opposite ). As a memory aid, try to visualize the PARALLEL circuit as a tub or tank, signals get trapped at resonance. Try to visualize the SERIES circuit as a slim tube, signals slip right through at resonance.*

**B-005-12-3 (4) Resonance is an electrical property used to describe:**

1. an inductor

2. a set of parallel inductors

3. the results of tuning a varicap (varactor)

**4. the frequency characteristic of a coil and capacitor circuit**

*> Resonance is the condition where Inductive Reactance (XL) is equal in value to Capacitive Reactance (XC). For a given Inductance (L, a coil or inductor) and Capacitance (C, a capacitor), resonance happens at one frequency: the resonant frequency. At resonance, the two reactances cancel each other, only resistance is left in the circuit.*

**B-005-12-4 (4) A tuned circuit is formed from two basic components. These are:**

1. resistors and transistors

2. directors and reflectors

3. diodes and transistors

**4. inductors and capacitors**

*> A 'tuned' circuit is a synonym for a 'resonant' circuit. Resonance is the condition where Inductive Reactance (XL) is equal in value to Capacitive Reactance (XC). Inductors and Capacitors alone determine the resonant frequency of a circuit.*

**B-005-12-5 (1) When a parallel coil-capacitor combination is supplied with AC of different frequencies, there will be one frequency where the impedance will be highest. This is the:**

**1. resonant frequency**

2. impedance frequency

3. inductive frequency

4. reactive frequency

*> key words:  COIL, CAPACITOR.  A 'tuned' circuit.  Question refers to Resonance. The one frequency at which Inductive Reactance cancels Capacitive Reactance.  In a PARALLEL circuit, Impedance (Z) at resonance is HIGH ( series circuit will be the opposite ).  As a memory aid, try to visualize the PARALLEL circuit as a tub or tank, signals get trapped at resonance.  Try to visualize the SERIES circuit as a slim tube, signals slip right through at resonance.*

**B-005-12-6 (4) In a parallel-resonant circuit at resonance, the circuit has a:**

1. low impedance

2. low mutual inductance

3. high mutual inductance

**4. high impedance**

*> key words:  PARALLEL, RESONANT.  Question refers to Resonance.  The one frequency at which Inductive Reactance cancels Capacitive Reactance.  In a PARALLEL circuit, Impedance (Z) at resonance is HIGH ( series circuit will be the opposite ).  As a memory aid, try to visualize the PARALLEL circuit as a tub or tank, signals get trapped at resonance.  Try to visualize the SERIES circuit as a slim tube, signals slip right through at resonance.*

**B-005-12-7 (1) In a series resonant circuit at resonance, the circuit has:**

**1. low impedance**

2. high impedance

3. low mutual inductance

4. high mutual inductance

*> key words:  SERIES, RESONANT.  Question refers to Resonance.  The one frequency at which Inductive Reactance cancels Capacitive Reactance.  In a SERIES circuit, Impedance (Z) at resonance is LOW ( parallel circuit will be the opposite ).  If Impedance is low (little total opposition), current will be high.  As a memory aid, try to visualize the SERIES circuit as a slim tube, signals slip right through at resonance. Try to visualize the PARALLEL circuit as a tub or tank, signals get trapped at resonance.*

**B-005-12-8 (4) A coil and an air-spaced capacitor are arranged to form a resonant circuit. The resonant frequency will remain the same if we:**

1. increase the area of plates in the capacitor

2. replace the air dielectric with oil in the capacitor

3. wind more turns on the coil

**4. add a resistor to the circuit**

*> Resonance is affected exclusively by Inductance (L in Henrys for inductors) and Capacitance ( C in Farads for capacitors ). "1" and "2" affect C. "3" affects L. Only "4" has no impact on L nor C.*

**B-005-12-9 (2) Resonant circuits in a receiver are used to:**

1. filter direct current

**2. select signal frequencies**

3. increase power

4. adjust voltage levels

*> Resonance is about choosing a frequency (or narrow range of frequencies) over others, either to eliminate it or favour it.*

**B-005-12-10 (1) Resonance is the condition that exists when:**

**1. inductive reactance and capacitive reactance are equal and opposite in sign**

2. inductive reactance is the only opposition in the circuit

3. the circuit contains no resistance

4. resistance is equal to the reactance

*> Resonance is the condition where Inductive Reactance (XL) is equal in value to Capacitive Reactance (XC). For a given Inductance (L, a coil or inductor) and Capacitance (C, a capacitor), resonance happens at one frequency: the resonant frequency. At resonance, the two reactances cancel each other, only resistance is left in the circuit.*

**B-005-12-11 (3) When a series LCR circuit is tuned to the frequency of the source, the:**

1. line current lags the applied voltage

2. line current leads the applied voltage

**3. line current reaches maximum**

4. impedance is maximum

*> key words: SERIES, TUNED. Question refers to Resonance. The one frequency at which Inductive Reactance cancels Capacitive Reactance. In a SERIES circuit, Impedance (Z) at resonance is LOW ( parallel circuit will be the opposite ). If Impedance is low (little total opposition), current will be high. As a memory aid, try to visualize the SERIES circuit as a slim tube, signals slip right through at resonance. Try to visualize the PARALLEL circuit as a tub or tank, signals get trapped at resonance.*

**B-006-6-4 (3) When will a power source deliver maximum output to the load?**

1. When air wound transformers are used instead of iron-core transformers

2. When the power-supply fuse rating equals the primary winding current

**3. When the impedance of the load is equal to the impedance of the source**

4. When the load resistance is infinite

*> Impedance Match: maximum power transfer occurs when the impedance of the load matches the internal impedance of the source. For example, a transmitter designed to work into an impedance of 50 ohms, will delivered maximum power if the antenna system offers an impedance of 50 ohms.*

**B-006-6-5 (2) What happens when the impedance of an electrical load is equal to the internal impedance of the power source?**

1. The electrical load is shorted

**2. The source delivers maximum power to the load**

3. No current can flow through the circuit

4. The source delivers minimum power to the load

*> Impedance Match: maximum power transfer occurs when the impedance of the load matches the internal impedance of the source. For example, a transmitter designed to work into an impedance of 50 ohms, will delivered maximum power if the antenna system offers an impedance of 50 ohms.*

**B-006-6-6 (4) Why is impedance matching important?**

1. So the load will draw minimum power from the source

2. To ensure that there is less resistance than reactance in the circuit

3. To ensure that the resistance and reactance in the circuit are equal

**4. So the source can deliver maximum power to the load**

*> Impedance Match:  maximum power transfer occurs when the impedance of the load matches the internal impedance of the source.  For example, a transmitter designed to work into an impedance of 50 ohms, will delivered maximum power if the antenna system offers an impedance of 50 ohms.*

# Ohm's Law and Power

**B-005-1-5 (2) If you have a hand-held transceiver which puts out 500 milliwatts, how many watts would this be?**

1. 5

**2. 0.5**

3. 50

4. 0.02

*> A thousand milliwatts is one Watt.  Converting from milliwatts to watts:  from small units to larger units, requires fewer digits, decimal point moves to the left by three positions, a thousand times less.*

**B-005-3-1 (2) What is the word used to describe how fast electrical energy is used?**

1. Current

**2. Power**

3. Voltage

4. Resistance

*> The Watt is the unit used to measure the rate of energy use.*

**B-005-3-2 (3) If you have light bulbs marked 40 watts, 60 watts and 100 watts, which one will use electrical energy the fastest?**

1. They will all be the same

2. The 40 watt bulb

**3. The 100 watt bulb**

4. The 60 watt bulb

*> How fast does each one make the electrical utility meter on the side of your house spin ?  The device with the highest wattage spins it the fastest.*

**B-005-3-3 (3) What is the basic unit of electrical power?**

1. The ampere

2. The volt

**3. The watt**

4. The ohm

*> Power, expressed in Watts = Voltage, in Volts, TIMES Current, in Amperes.  P = E * I.  Watts = Volts * Amperes.  The Watt describe how fast electrical energy is used.*

**B-005-3-6 (3) Power is expressed in:**

1. volts

2. amperes

**3. watts**

4. ohms

*> Power, expressed in Watts = Voltage, in Volts, TIMES Current, in Amperes.  P = E * I.  Watts = Volts * Amperes.  The Watt describe how fast electrical energy is used.*

**B-005-3-7 (3) Which of the following two quantities should be multiplied together to find power?**

1. Inductance and capacitance

2. Voltage and inductance

**3. Voltage and current**

4. Resistance and capacitance

*> Power, expressed in Watts = Voltage, in Volts, TIMES Current, in Amperes.  P = E * I.  Watts = Volts * Amperes.  The Watt describe how fast electrical energy is used.*

**B-005-3-8 (4) Which two electrical units multiplied together give the unit "watts"?**

1. Volts and farads

2. Farads and henrys

3. Amperes and henrys

**4. Volts and amperes**

*> Power, expressed in Watts = Voltage, in Volts, TIMES Current, in Amperes.  P = E * I.  Watts = Volts * Amperes.  The Watt describe how fast electrical energy is used.*

**B-005-3-9 (4) A resistor in a circuit becomes very hot and starts to burn. This is because the resistor is dissipating too much:**

1. voltage

2. resistance

3. current

**4. power**

*> Power is Voltage times Current, P = E * I.  When current flows through a resistor, a 'voltage drop' ensues.  Volts times Amperes become Watts.  Power is dissipated as heat.*

**B-005-3-10 (3) High power resistors are usually large with heavy leads. The size aids the operation of the resistor by:**

1. allowing higher voltage to be handled

2. increasing the effective resistance of the resistor

**3. allowing heat to dissipate more readily**

4. making it shock proof

*> Resistors are rated for Resistance in ohms and safe power dissipation in Watts*.

**B-005-3-11 (3) The resistor that could dissipate the most heat would be marked:**

1. 100 ohms

2. 2 ohms

**3. 20 watts**

4. 0.5 watt

*> Resistors are rated for Resistance in ohms and safe power dissipation in Watts.*

**B-005-4-1 (3) If a current of 2 amperes flows through a 50-ohm resistor, what is the voltage across the resistor?**

1. 48 volts

2. 52 volts

**3. 100 volts**

4. 25 volts

> Ohm's Law ( I = E / R ) becomes E = R*I when solving for E.  Voltage = Resistance times Current.  Volts = Ohms * Amperes.  50 ohms * 2 Amperes = 100 Volts.

**B-005-4-2 (1) How is the current in a DC circuit calculated when the voltage and resistance are known?**

**1. Current equals voltage divided by resistance**

2. Current equals resistance multiplied by voltage

3. Current equals resistance divided by voltage

4. Current equals power divided by voltage

> Ohm's Law is I = E / R, current is voltage divided by resistance.  Amperes = Volts / ohms.

**B-005-4-3 (2) How is the resistance in a DC circuit calculated when the voltage and current are known?**

1. Resistance equals current multiplied by voltage

**2. Resistance equals voltage divided by current**

3. Resistance equals power divided by voltage

4. Resistance equals current divided by voltage

> Ohm's Law ( I = E / R ) becomes R = E / I when solving for R.  Resistance is Voltage divided by Current.  Ohms = Volts / Amperes.

**B-005-4-4 (4) How is the voltage in a DC circuit calculated when the current and resistance are known?**

1. Voltage equals current divided by resistance

2. Voltage equals resistance divided by current

3. Voltage equals power divided by current

**4. Voltage equals current multiplied by resistance**

> Ohm's Law ( I = E / R ) becomes E = R*I when solving for E.  Voltage is Resistance times Current.  Volts = Ohms * Amperes.

**B-005-4-5 (2) If a 12-volt battery supplies 0.25 ampere to a circuit, what is the circuit's resistance?**

1. 3 ohms

**2. 48 ohms**

3. 12 ohms

4. 0.25 ohm

*> Ohm's Law ( I = E / R ) becomes R = E / I when solving for R. Resistance is Voltage divided by current. Ohms = Volts / Amperes. 12 Volts / 0.25 Amperes = 48 ohms.*

**B-005-4-6 (1) Calculate the value of resistance necessary to drop 100 volts with current flow of 0.8 milliamperes:**

**1. 125 kilohms**

2. 125 ohms

3. 1250 ohms

4. 1.25 kilohms

*> Ohm's Law ( I = E / R ) becomes R = E / I when solving for R. Resistance is Voltage divided by current. Ohms = Volts / Amperes. 100 Volts / 0.0008 Amperes = 125000 ohms = 125 kilohms. [ Note that Volts divided by milliamperes is kilohm ]*

**B-005-4-7 (1) The voltage required to force a current of 4.4 amperes through a resistance of 50 ohms is:**

**1. 220 volts**

2. 2220 volts

3. 22.0 volts

4. 0.220 volt

*> Ohm's Law ( I = E / R ) becomes E = R*I when solving for E. Voltage is Resistance times current. Volts = Ohms * Amperes. 50 ohms * 4.4 Amperes = 220 Volts.*

**B-005-4-8 (4) A lamp has a resistance of 30 ohms and a 6 volt battery is connected. The current flow will be:**

1. 2 amperes

2. 0.5 ampere

3. 0.005 ampere

**4. 0.2 ampere**

*> Ohm's Law ( I = E / R ). Current is Voltage divided by Resistance. Amperes = Volts / ohms. 6 Volts / 30 ohms = 0.2 Amperes.*

**B-005-4-9 (1) What voltage would be needed to supply a current of 200 mA, to operate an electric lamp which has a resistance of 25 ohms?**

**1. 5 volts**

2. 8 volts

3. 175 volts

4. 225 volts

*> Ohm's Law ( I = E / R ) becomes E = R*I when solving for E. Voltage is Resistance times current. Volts = Ohms * Amperes. 25 ohms * 0.200 Amperes = 5 Volts.*

**B-005-4-10 (1) The resistance of a circuit can be found by using one of the following:**

**1. R = E/I**

2. R = I/E

3. R = E/R

4. R = E X I

*> Ohm's Law ( I = E / R ) becomes R = E / I when solving for R. Resistance is Voltage divided by current. Ohms = Volts / Amperes.*

**B-005-4-11 (1) If a 3 volt battery supplies 300 mA to a circuit, the circuit resistance is:**

**1. 10 ohms**

2. 9 ohms

3. 5 ohms

4. 3 ohms

*> Ohm's Law ( I = E / R ) becomes R = E / I when solving for R.  Resistance is Voltage divided by Current.  Ohms = Volts / Amperes.  3 Volts / 0.300 Amperes = 10 ohms.*

**B-005-5-1 (1) In a parallel circuit with a voltage source and several branch resistors, how is the total current related to the current in the branch resistors?**

**1. It equals the sum of the branch current through each resistor**

2. It equals the average of the branch current through each resistor

3. It decreases as more parallel resistors are added to the circuit

4. It is the sum of each resistor's voltage drop multiplied by the total number of resistors

*> Each resistor added in parallel to the source draws some current ( in accordance with Ohm's Law, I = E / R ).  The total current that the source must supply becomes the SUM of all these individual currents.  Just like in your house, the total current drawn from the utility company is the sum of all the devices turned-on.*

**B-005-5-2 (1) A 6 volt battery is connected across three resistances of 10 ohms, 15 ohms and 20 ohms connected in parallel.**

**1. The current through the separate resistances, when added together, equals the total current drawn from the battery**

2. The current flowing through the 10 ohm resistance is less than that flowing through the 20 ohm resistance

3. The voltage drop across each resistance added together equals 6 volts

4. The voltage drop across the 20 ohm resistance is greater than the voltage across the 10 ohm resistance

*> key word:  PARALLEL.  In a parallel circuit, the total current is the sum of the currents.  3 and 4 are false because all resistors are subjected to the same voltage in a PARALLEL circuit.  2 is incorrect:  Ohm's Law tells us that the smaller resistor will draw more current than the others.*

**B-005-5-3 (1) Total resistance in a parallel circuit:**

**1. is always less than the smallest resistance**

2. depends upon the IR drop across each branch

3. could be equal to the resistance of one branch

4. depends upon the applied voltage

*> key word:  PARALLEL.  In a parallel circuit, each added resistor adds to the current drawn from the source.  If more and more current is drawn, the total resistance must be going down.  In PARALLEL, the total resistance is less than the smallest.*

**B-005-5-4 (1) Two resistors are connected in parallel and are connected across a 40 volt battery. If each resistor is 1000 ohms, the total current is:**

**1. 80 milliamperes**

2. 40 milliamperes

3. 80 amperes

4. 40 amperes

*> Ohm's Law ( I = E / R ).  Each resistor draws this much current:  40 Volts divided by 1000 ohms = 0.040 Amperes = 40 milliamperes.  In PARALLEL, total current is the sum of the currents.  Method B:  identical resistors in parallel, total resistance is value divided by number.  In this case, 1000 / 2 = 500 ohms.  40 Volts / 500 ohms = 0.08 Amperes = 80 milliamperes.*

**B-005-5-5 (1) The total resistance of resistors connected in series is:**

**1. greater than the resistance of any one resistor**

2. less than the resistance of any one resistor

3. equal to the highest resistance present

4. equal to the lowest resistance present

*> key word: SERIES.  In a series circuit, there is only one current.  This current must wrestle with each resistor one after the other.  In SERIES, total resistance is the sum of the resistances.  The same current flows through all of them.*

**B-005-5-6 (1) Five 10 ohm resistors connected in series equals:**

**1. 50 ohms**

2. 5 ohms

3. 10 ohms

4. 1 ohm

*> key word: SERIES.  In SERIES, total resistance is the sum of the resistances.*

**B-005-5-7 (4) Which series combination of resistors would replace a single 120 ohm resistor?**

1. six 22 ohm

2. two 62 ohm

3. five 100 ohm

**4. five 24 ohm**

*> key word: SERIES.  In SERIES, total resistance is the sum of the resistances.  Five times twenty-four = 120.*

**B-005-5-8 (2) If ten resistors of equal value were wired in parallel, the total resistance would be:**

1.  10 / R

**2.  R / 10**

3.  10 x R

4.  10 + R

*> key word: PARALLEL.  In a parallel circuit with IDENTICAL resistors, total resistance is value divided by number.  In this example, the value of one R divided by 10.*

**B-005-5-9 (4) The total resistance of four 68 ohm resistors wired in parallel is:**

1. 12 ohms

2. 34 ohms

3. 272 ohms

**4. 17 ohms**

*> key word: PARALLEL.  In a parallel circuit with IDENTICAL resistors, total resistance is value divided by number.  In this example, 68 / 4 yields 17.*

**B-005-5-10 (3) Two resistors are in parallel. Resistor A carries twice the current of resistor B, which means that:**

1. the voltage across B is twice that across A

2. the voltage across A is twice that across B

**3. A has half the resistance of B**

4. B has half the resistance of A

*> key word: PARALLEL.  1 and 2 are wrong because all resistors in a parallel circuit are subjected to the same voltage.  Per Ohm's Law ( I = E / R, Current = Voltage divided by Resistance ), if resistor A draws twice the current of resistor B, it must*

*have half the resistance of Resistor B.*

**B-005-5-11 (2) The total current in a parallel circuit is equal to the:**

1. source voltage divided by the value of one of the resistive elements

**2. sum of the currents through all the parallel branches**

3. source voltage divided by the sum of the resistive elements

4. current in any one of the parallel branches

*> key word: PARALLEL. In a parallel circuit, the total current is the sum of the currents. 1 and 4 only address the current in ONE resistor, not the total current. 3 is wrong because it relates to a series circuit.*

**B-005-6-1 (4) Why would a large size resistor be used instead of a smaller one of the same resistance?**

1. For better response time

2. For a higher current gain

3. For less impedance in the circuit

**4. For greater power dissipation**

*> Remember that Power is Voltage times Current, P = E * I. A resistor dissipates power into heat. A resistor can only dissipate so much power without burning up: i.e., its power rating. Larger resistors can dissipate more heat.*

**B-005-6-2 (1) How many watts of electrical power are used by a 12-VDC light bulb that draws 0.2 ampere?**

**1. 2.4 watts**

2. 60 watts

3. 24 watts

4. 6 watts

*> P = E * I, Power is Voltage times Current, Watts = Volts * Amperes. 12 Volts * 0.2 Amperes = 2.4 Watts [ VDC = Volts in a Direct Current circuit ]*

**B-005-6-3 (2) The DC input power of a transmitter operating at 12 volts and drawing 500 milliamps would be:**

1. 20 watts

**2. 6 watts**

3. 500 watts

4. 12 watts

*> P = E * I, Power is Voltage times Current, Watts = Volts * Amperes. 12 Volts * 0.5 Amperes = 6 Watts [ milliamps is short for milliamperes ]*

**B-005-6-4 (2) When two 500 ohm 1 watt resistors are connected in series, the maximum total power that can be dissipated by the resistors is:**

1. 1 watt

**2. 2 watts**

3. 1/2 watt

4. 4 watts

*> This is about POWER RATING, not resistance. Two identical resistors can safely dissipate TWICE as much power as only one. [ Yes, total resistance will be twice as much, but that is immaterial here ]*

**B-005-6-5 (3) When two 500 ohm 1 watt resistors are connected in parallel, they can dissipate a maximum total power of:**

1. 1/2 watt

2. 1 watt

3. 2 watts

**4. 4 watts**

*> This is about POWER RATING, not resistance. Two identical resistors can safely dissipate TWICE as much power as only one. [ Yes, total resistance will be half, but that is immaterial here ]*

**B-005-6-6 (1) If the voltage applied to two resistors in series is doubled, how much will the total power change?**

**1. increase four times**

2. decrease to half

3. double

4. no change

*> P = E * I, Power is Voltage times Current, Watts = Volts * Amperes. Given the proportional relation of Current versus Voltage stated by Ohm's Law, if you double*

*Voltage in a circuit, current will double.  Power is Voltage times Current, if both double, power has quadrupled ( 4 times more ).*

**B-005-6-7 (4) If the power is 500 watts and the resistance is 20 ohms, the current is:**

1. 2.5 amps

2. 10 amps

3. 25 amps

**4. 5 amps**

*> The Power Law:  P = E * I, Power is Voltage times Current.  Ohm's Law ( I = E / R ) can be transformed to read E = R*I.  If we insert this expression of E as R*I as a substitute for E in the Power Law, P in Watts can now be computed as "( R * I ) * I" or "R times I squared".  Transforming this last equation for an unknown current yields: I squared = Watts / Resistance, thus I = Square Root of (Watts / Resistance). Sqrt(500/20) = 5.*

**B-005-6-8 (1) A 12 volt light bulb is rated at a power of 30 watts. The current drawn would be:**

**1. 30/12 amps**

2. 18 amps

3. 360 amps

4. 12/30 amps

*> The Power Law:  P = E * I, Power is Voltage times Current.  Transformed to solve for I, it becomes I = P / E.  In this example, I = 30 Watts / 12 Volts.  [ Amps is short for Amperes ]*

**B-005-6-9 (1) If two 10 ohm resistors are connected in series with a 10 volt battery, the power consumption would be:**

**1. 5 watts**

2. 10 watts

3. 20 watts

4. 100 watts

*> Two 10 ohm resistors in series present a total resistance of 20 ohms.  Use Ohm's Law ( I = E / R ) to compute current as 10 Volts divided by 20 ohms = 0.5 Amperes. The Power Law:  P = E * I, Power is Voltage times Current.  Power for this example becomes 10 Volts times 0.5 Amperes = 5 Watts*.

**B-005-6-10 (3) One advantage of replacing a 50 ohm resistor with a parallel combination of two similarly rated 100 ohm resistors is that the parallel combination will have:**

1. the same resistance but lesser power rating

2. greater resistance and similar power rating

**3. the same resistance but greater power rating**

4. lesser resistance and similar power rating

*> This is about POWER RATING, not resistance. Two identical resistors can safely dissipate TWICE as much power as only one. Two resistors of 100 ohms in PARALLEL yield a total resistance of 50 ohms ( In a parallel circuit with IDENTICAL resistors, total resistance is value divided by number ).*

**B-005-6-11 (3) Resistor wattage ratings are:**

1. calculated according to physical size

2. expressed in joules per second

**3. determined by heat dissipation qualities**

4. variable in steps of one hundred

*> Materials, shape, construction all interact to determine heat dissipation capabilities. Answer 1 might be a distant second best. [ Choice # 1 in the French Question Bank includes an allusion to tolerance, obviously false ]*

# Decibels

**B-005-8-1 (2) A two-times increase in power results in a change of how many dB?**

1. 6 dB higher

**2. 3 dB higher**

3. 12 dB higher

4. 1 dB higher

*> GAINS in power: +3dB = twice, +6dB = four times (2x2), +9dB = eight times (2x2x2), +10dB = ten times, +20dB = one hundred times (10x10), +30dB = one thousand times (10x10x10). LOSSES: -3dB = half, -6dB = one quarter (0.5 x 0.5), -9dB = one eighth (0.5 x 0.5 x 0.5), -10dB = one tenth, -20dB = one hundredth (0.1 x 0.1), -30dB = one thousandth (0.1 x 0.1 x 0.1).*

**B-005-8-2 (4) How can you decrease your transmitter's power by 3 dB?**

1. Divide the original power by 1.5

2. Divide the original power by 3

3. Divide the original power by 4

**4. Divide the original power by 2**

*> GAINS in power: +3dB = twice, +6dB = four times (2x2), +9dB = eight times (2x2x2), +10dB = ten times, +20dB = one hundred times (10x10), +30dB = one thousand times (10x10x10). LOSSES: -3dB = half, -6dB = one quarter (0.5 x 0.5), -9dB = one eighth (0.5 x 0.5 x 0.5), -10dB = one tenth, -20dB = one hundredth (0.1 x 0.1), -30dB = one thousandth (0.1 x 0.1 x 0.1).*

**B-005-8-3 (3) How can you increase your transmitter's power by 6 dB?**

1. Multiply the original power by 3

2. Multiply the original power by 2

**3. Multiply the original power by 4**

4. Multiply the original power by 1.5

*> GAINS in power: +3dB = twice, +6dB = four times (2x2), +9dB = eight times (2x2x2), +10dB = ten times, +20dB = one hundred times (10x10), +30dB = one thousand times (10x10x10). LOSSES: -3dB = half, -6dB = one quarter (0.5 x 0.5), -9dB = one eighth (0.5 x 0.5 x 0.5), -10dB = one tenth, -20dB = one hundredth*

*(0.1 x 0.1), -30dB = one thousandth (0.1 x 0.1 x 0.1).*

**B-005-8-4 (4) If a signal-strength report is "10 dB over S9", what should the report be if the transmitter power is reduced from 1500 watts to 150 watts?**

1. S9 plus 3 dB

2. S9 minus 10 dB

3. S9 plus 5 dB

**4. S9**

*> A reduction at the transmitting station from 1500 Watts to 150 Watts is a drop of -10dB (one tenth). The received signal strength which read '10 dB OVER Nine S units' will drop -10dB to simply 'Nine S units'.*

**B-005-8-5 (1) If a signal-strength report is "20 dB over S9", what should the report be if the transmitter power is reduced from 1500 watts to 150 watts?**

**1. S9 plus 10 dB**

2. S9 plus 5 dB

3. S9 plus 3 dB

4. S9

*> A reduction at the transmitting station from 1500 Watts to 150 Watts is a drop of -10dB (one tenth). The received signal strength which reads '20 dB OVER Nine S units' will drop -10dB to simply '10 dB over Nine S units'*.

**B-005-8-6 (2) The unit "decibel" is used to indicate:**

1. an oscilloscope wave form

**2. a mathematical ratio**

3. certain radio waves

4. a single side band signal

*The DECIBEL: "A unit used in the COMPARISON of two power levels relating to electrical signals". GAINS in power: +3dB = twice, +6dB = four times (2x2), +9dB = eight times (2x2x2), +10dB = ten times, +20dB = one hundred times (10x10), +30dB = one thousand times (10x10x10). LOSSES: -3dB = half, -6dB = one quarter (0.5 x 0.5), -9dB = one eighth (0.5 x 0.5 x 0.5), -10dB = one tenth, -20dB = one hundredth (0.1 x 0.1), -30dB = one thousandth (0.1 x 0.1 x 0.1).*

**B-005-8-7 (3) The power output from a transmitter increases from 1 watt to 2 watts. This is a db increase of:**

1. 30

2. 6

**3. 3**

4. 1

*> GAINS in power: +3dB = twice, +6dB = four times (2x2), +9dB = eight times (2x2x2), +10dB = ten times, +20dB = one hundred times (10x10), +30dB = one thousand times (10x10x10). LOSSES: -3dB = half, -6dB = one quarter (0.5 x 0.5), -9dB = one eighth (0.5 x 0.5 x 0.5), -10dB = one tenth, -20dB = one hundredth (0.1 x 0.1), -30dB = one thousandth (0.1 x 0.1 x 0.1).*

**B-005-8-8 (2) The power of a transmitter is increased from 5 watts to 50 watts by a linear amplifier. The power gain, expressed in dB, is:**

1. 30 dB

**2. 10 dB**

3. 40 dB

4. 20 dB

*> GAINS in power: +3dB = twice, +6dB = four times (2x2), +9dB = eight times (2x2x2), +10dB = ten times, +20dB = one hundred times (10x10), +30dB = one thousand times (10x10x10). LOSSES: -3dB = half, -6dB = one quarter (0.5 x 0.5), -9dB = one eighth (0.5 x 0.5 x 0.5), -10dB = one tenth, -20dB = one hundredth (0.1 x 0.1), -30dB = one thousandth (0.1 x 0.1 x 0.1).*

**B-005-8-9 (2) You add a 9 dB gain amplifier to your 2 watt handheld. What is the power output of the combination?**

1. 11 watts

**2. 16 watts**

3. 20 watts

4. 18 watts

*> GAINS in power: +3dB = twice, +6dB = four times (2x2), +9dB = eight times (2x2x2), +10dB = ten times, +20dB = one hundred times (10x10), +30dB = one thousand times (10x10x10). LOSSES: -3dB = half, -6dB = one quarter (0.5 x 0.5), -9dB = one eighth (0.5 x 0.5 x 0.5), -10dB = one tenth, -20dB = one hundredth*

*(0.1 x 0.1), -30dB = one thousandth (0.1 x 0.1 x 0.1).*

**B-005-8-10 (1) The power of a transmitter is increased from 2 watts to 8 watts. This is a power gain of ___________ dB.**

**1. 6 dB**

2. 3 dB

3. 8 dB

4. 9 dB

*> GAINS in power: +3dB = twice, +6dB = four times (2x2), +9dB = eight times (2x2x2), +10dB = ten times, +20dB = one hundred times (10x10), +30dB = one thousand times (10x10x10). LOSSES: -3dB = half, -6dB = one quarter (0.5 x 0.5), -9dB = one eighth (0.5 x 0.5 x 0.5), -10dB = one tenth, -20dB = one hundredth (0.1 x 0.1), -30dB = one thousandth (0.1 x 0.1 x 0.1).*

**B-005-8-11 (4) A local amateur reports your 100W 2M simplex VHF transmission as 30 dB over S9. To reduce your signal to S9, you would reduce your power to _______ watts.**

1. 1 W

2. 10 W

3. 33.3 W

**4. 100 mW**

*> To bring a received signal strength of '30 dB OVER Nine S units' down to 'Nine S units' supposes a drop of -30dB, i.e., one thousandth of the original power. In this example, 100 Watts would need to be brought down to 0.1 Watt.*

## Transmission Lines

**B-006-1-1 (3) What connects your transceiver to your antenna?**

1. The power cord

2. A ground wire

**3. A feed line**

4. A dummy load

*> "Feed line" is synonym for "transmission line".*

**B-006-1-2 (2) The characteristic impedance of a transmission line is determined by the:**

1. length of the line

**2. physical dimensions and relative positions of the conductors**

3. frequency at which the line is operated

4. load placed on the line

*> Characteristic Impedance is determined by the physical dimensions of the line. Length, frequency or load have nothing to do with it.*

**B-006-1-3 (1) The characteristic impedance of a 20 metre piece of transmission line is 52 ohms. If 10 metres were cut off, the impedance would be:**

**1. 52 ohms**

2. 26 ohms

3. 39 ohms

4. 13 ohms

*> This is a catch.  Characteristic Impedance does NOT change with line length. Length, frequency or load have nothing to do with it.*

**B-006-1-4 (1) The impedance of a coaxial line:**

**1. can be the same for different diameter line**

2. changes with the frequency of the energy it carries

3. is correct for only one size of line

4. is greater for larger diameter line

*> The Characteristic Impedance of coaxial cable is determined by the ratio of the outer conductor to the inner conductor.  Different diameters of lines can have the same Characteristic Impedance as long as the RATIO is preserved.*

**B-006-1-5 (4) What commonly available antenna feed line can be buried directly in the ground for some distance without adverse effects?**

1. 300 ohm twin-lead

2. 600 ohm open-wire

3. 75 ohm twin-lead

**4. coaxial cable**

*> Because the outer conductor of a coaxial cable is operated at ground potential, it can be buried.  Parallel lines operate differently with both conductors at some voltage above ground.*

**B-006-1-6 (4) The characteristic impedance of a transmission line is:**

1. the impedance of a section of the line one wavelength long

2. the dynamic impedance of the line at the operating frequency

3. the ratio of the power supplied to the line to the power delivered to the termination

**4. equal to the pure resistance which, if connected to the end of the line, will absorb all the power arriving along it**

*> If a resistor of the same value as the Characteristic Impedance of a given line is placed at the end of that line, no energy is reflected.  100% of the incoming energy is dissipated in the terminating load.*

**B-006-1-7 (3) A transmission line differs from an ordinary circuit or network in communications or signaling devices in one very important way. That important aspect is:**

1. capacitive reactance

2. inductive reactance

**3. propagation delay**

4. resistance

*> Radio signals propagate (travel) slower in a transmission line than they do in space. 'Propagation Delay' is specific to transmission lines. Resistance and reactance can be found in many other components or circuits.*

**B-006-1-8 (1) The characteristic impedance of a parallel wire transmission line does not depend on the:**

**1. velocity of energy on the line**

2. radius of the conductors

3. centre to centre distance between conductors

4. dielectric

*> Physical dimensions (radius and centre to centre distance) and dielectric influence Characteristic Impedance. The speed at which waves travel on the line (velocity) is another characteristic altogether.*

**B-006-1-9 (1) Any length of transmission line may be made to appear as an infinitely long line by:**

**1. terminating the line in its characteristic impedance**

2. leaving the line open at the end

3. shorting the line at the end

4. increasing the standing wave ratio above unity

*> Characteristic Impedance is the impedance of a line which would be infinitely long: i.e., no energy would ever be reflected from the end. If a resistor of the same value as the Characteristic Impedance of a given line is placed at the end of that line, 100% of the energy is absorbed by a load of an adequate value. It makes the line APPEAR infinitely long because no energy is ever reflected back from the terminating load.*

**B-006-1-10 (1) What factors determine the characteristic impedance of a parallel-conductor antenna feed line?**

**1. The distance between the centres of the conductors and the radius of the conductors**

2. The distance between the centres of the conductors and the length of the line

3. The radius of the conductors and the frequency of the signal

4. The frequency of the signal and the length of the line

*> Physical dimensions (radius and centre to centre distance) influence Characteristic Impedance. It is independent of line length or operating frequency.*

**B-006-1-11 (1) What factors determine the characteristic impedance of a coaxial antenna feed line?**

**1. The ratio of the diameter of the inner conductor to the diameter of the braid**

2. The diameter of the braid and the length of the line

3. The diameter of the braid and the frequency of the signal

4. The frequency of the signal and the length of the line

*> The Characteristic Impedance of coaxial cable is determined by the ratio of the outer conductor to the inner conductor. It is independent of line length or operating frequency.*

**B-006-2-1 (4) What is a coaxial cable?**

1. Two wires side-by-side in a plastic ribbon

2. Two wires side-by-side held apart by insulating rods

3. Two wires twisted around each other in a spiral

**4. A center wire inside an insulating material which is covered by a metal sleeve or shield**

*> Coaxial: two concentric conductors, an inner conductor, a dielectric (insulator) and an outer conductor (braided or solid). "1" is 'twin lead' (a type of parallel line). "2" is 'open wire line' or 'ladder line' (a type of parallel line). [ "3" is 'twisted pair' (very rarely used in radio work). ]*

**B-006-2-2 (4) What is parallel-conductor feed line?**

1. Two wires twisted around each other in a spiral

2. A center wire inside an insulating material which is covered by a metal sleeve or shield

3. A metal pipe which is as wide or slightly wider than a wavelength of the signal it carries

**4. Two wires side-by-side held apart by insulating rods**

*> 'Feed line' is synonym for transmission line. "Two wires held apart by insulating rods (spacers or 'spreaders')" is also known as 'open wire line' or 'ladder line'. "2" is coaxial cable. [ "3" is a waveguide. ]*

**B-006-2-3 (1) What kind of antenna feed line is made of two conductors held apart by insulated rods?**

**1. Open-conductor ladder line**

2. Coaxial cable

3. Twin lead in a plastic ribbon

4. Twisted pair

*> 'Feed line' is synonym for transmission line. "Two wires held apart by insulating rods (spacers or 'spreaders')" is also known as 'open wire line' or 'ladder line'.*

**B-006-2-4 (2) What does the term "balun" mean?**

1. Balanced unloader

**2. Balanced to unbalanced**

3. Balanced unmodulator

4. Balanced antenna network

*> "Balun" is the contraction of "BALanced to UNbalanced". Dipole ("doublet") antennas and parallel lines operate in a BALanced mode (two conductors float above ground potential). A quarter-wave antenna, a ground-plane antenna and coaxial cable operate in an UNbalanced mode (with one side grounded). A BALUN interfaces balanced antenna to unbalanced transmission line OR balanced line to unbalanced line. A BALUN can also include impedance transformation*.

**B-006-2-5 (1) Where would you install a balun to feed a dipole antenna with 50-ohm coaxial cable?**

**1. Between the coaxial cable and the antenna**

2. Between the transmitter and the coaxial cable

3. Between the antenna and the ground

4. Between the coaxial cable and the ground

*> "Balun" is the contraction of "BALanced to UNbalanced". Dipole ("doublet") antennas and parallel lines operate in a BALanced mode (two conductors float above ground potential. A quarter-wave antenna, a ground-plane antenna and coaxial cable operate in an UNbalanced mode (with one side grounded). A BALUN interfaces balanced antenna to unbalanced transmission line OR balanced line to unbalanced line. A BALUN can also include impedance transformation.*

**B-006-2-6 (4) What is an unbalanced line?**

1. Feed line with neither conductor connected to ground

2. Feed line with both conductors connected to ground

3. Feed line with both conductors connected to each other

**4. Feed line with one conductor connected to ground**

*> key word: UNBALANCED. An 'UNbalanced' transmission line functions with one conductor connected to ground (like coaxial cable or 'coax' for short). A 'balanced' transmission line operates with both conductors floating above ground potential (like all types of parallel lines: twin-lead, open-wire line).*

**B-006-2-7 (2) What device can be installed to feed a balanced antenna with an unbalanced feed line?**

1. A triaxial transformer

**2. A balun**

3. A wavetrap

4. A loading coil

*> "Balun" is the contraction of "BALanced to UNbalanced". Dipole ("doublet") antennas and parallel lines operate in a BALanced mode (two conductors float above ground potential. A quarter-wave antenna, a ground-plane antenna and coaxial cable operate in an UNbalanced mode (with one side grounded). A BALUN interfaces balanced antenna to unbalanced transmission line OR balanced line to unbalanced line. A BALUN can also include impedance transformation.*

**B-006-2-8 (3) A flexible coaxial line contains:**

1. four or more conductors running parallel

2. only one conductor

**3. braid and insulation around a central conductor**

4. two parallel conductors separated by spacers

*> Coaxial: two concentric conductors, an inner conductor, a dielectric (insulator) and an outer conductor (braided or solid). "Two parallel conductors separated by spacers" are also known as 'open wire line' or 'ladder line'.*

**B-006-2-9 (1) A balanced transmission line:**

**1. is made of two parallel wires**

2. has one conductor inside the other

3. carries RF current on one wire only

4. is made of one conductor only

*> key word:  BALANCED.  A 'balanced' transmission line operates with both conductors floating above ground potential (like all types of parallel lines: twin-lead, open-wire line).  An 'UNbalanced' transmission line functions with one conductor connected to ground (like coaxial cable or 'coax' for short).*

**B-006-2-10 (2)   A 75 ohm transmission line could be matched to the 300 ohm feedpoint of an antenna:**

1. with an extra 250 ohm resistor

**2. by using a 4 to 1 balun**

3. by using a 4 to 1 trigatron

4. by inserting a diode in one leg of the antenna

> "Balun" is the contraction of "BALanced to UNbalanced".  Dipole ("doublet") antennas and parallel lines operate in a BALanced mode (two conductors float above ground potential.  A quarter-wave antenna, a ground-plane antenna and coaxial cable operate in an UNbalanced mode (with one side grounded).  A BALUN interfaces balanced antenna to unbalanced transmission line  OR  balanced line to unbalanced line.  A BALUN can also include impedance transformation.  In this example, a '4 to 1' balun.

**B-006-2-11 (3)   What kind of antenna feed line can be constructed using two conductors which are maintained a uniform distance apart using insulated spreaders?**

1. Coaxial cable

2. 75 ohm twin-lead

**3. 600 ohm open-wire**

4. 300 ohm twin-lead

*> "Two wires held apart by insulating rods (spacers or 'spreaders')" is also known as 'open wire line' or 'ladder line'.  'Twin-lead' is two conductors held apart in a plastic ribbon.  Coaxial cable is two concentric conductors, an inner conductor, a dielectric (insulator) and an outer conductor (braided or solid).*

**B-006-3-1 (2) Why does coaxial cable make a good antenna feed line?**

1. It is weatherproof, and its impedance is higher than that of most amateur antennas

**2. It is weatherproof, and its impedance matches most amateur antennas**

3. It can be used near metal objects, and its impedance is higher than that of most amateur antennas

4. You can make it at home, and its impedance matches most amateur antennas

*> Parallel lines generally have Characteristic Impedances in the range of 300 to 600 ohms.  Common coaxial cable have Characteristic Impedances of 50 or 75 ohms. Such an impedance is a direct match to transmitters and common antennas*.

**B-006-3-2 (3) What is the best antenna feed line to use, if it must be put near grounded metal objects?**

1. Ladder-line

2. Twisted pair

**3. Coaxial cable**

4. Twin lead

*> Coaxial cable, with its shielded and grounded outer conductor, is not affected by nearby metallic objects.*

**B-006-3-3 (3) What are some reasons not to use parallel-conductor feed line?**

1. You must use an impedance-matching device with your transceiver, and it does not work very well with a high SWR

2. It does not work well when tied down to metal objects, and it cannot operate under high power

**3. It does not work well when tied down to metal objects, and you must use an impedance-matching device with your transceiver**

4. It is difficult to make at home, and it does not work very well with a high SWR

*> key word:  NOT.  The high Characteristic Impedances and greater separation of the conductors in parallel lines DO permit high power and high Standing Wave Ratio (SWR)  BUT  nearby metallic objects can affect them and impedance matching is most often necessary at the transmitter end.  Their high Characteristic Impedance permits carrying power with less current (P = R * I squared), less current implies less losses due to resistance.*

**B-006-3-4 (1) What common connector usually joins RG-213 coaxial cable to an HF transceiver?**

**1. A PL-259 connector**

2. An F-type cable connector

3. A banana plug connector

4. A binding post connector

*> 'RG-213' is the catalogue designation of common 10mm (0.405 in.) coaxial cable. 'PL-259' is the catalogue designation of the male connector which matches the output connector found on MF/HF (Medium Frequency/High Frequency) transceivers. The 'BNC' connector is found on larger size handheld transceivers. The 'Type-N' connector is the connector of choice above 300 MHz.*

**B-006-3-5 (1) What common connector usually joins a hand-held transceiver to its antenna?**

**1. A BNC connector**

2. A PL-259 connector

3. An F-type cable connector

4. A binding post connector

*> The 'BNC' connector is found on larger size handheld transceivers. 'PL-259' is the catalogue designation of the male connector which matches the output connector found on MF/HF (Medium Frequency/High Frequency) transceivers. The PL-259 connector fits on 10mm (0.405 in.) coaxial cable such as RG-213. The 'Type-N' connector is the connector of choice above 300 MHz.*

**B-006-3-6 (4) Which of these common connectors has the lowest loss at UHF?**

1. An F-type cable connector

2. A BNC connector

3. A PL-259 connector

**4. A type-N connector**
*> The 'Type-N' connector is the connector of choice above 300 MHz. The 'BNC' connector is found on larger size handheld transceivers. 'PL-259' is the catalogue designation of the male connector which matches the output connector found on MF/HF (Medium Frequency/High Frequency) transceivers.*

**B-006-3-7 (3) If you install a 6 metre Yagi antenna on a tower 50 metres from your transmitter, which of the following feed lines is best?**

1. RG-174

2. RG-59

**3. RG-213**

4. RG-58

*> 'RG-213' is the coaxial with the largest diameter (10mm or 0.405 in.) in this group. It has the lowest loss per 30m length.*

**B-006-3-8 (1) Why should you regularly clean, tighten and re-solder all antenna connectors?**

**1. To help keep their resistance at a minimum**

2. To keep them looking nice

3. To keep them from getting stuck in place

4. To increase their capacitance

*> Poor connections can also lead to intermittent electrical contact (evidenced by an erratic or 'jumpy' Standing Wave Ratio (SWR) reading at the station).*

**B-006-3-9 (3) What commonly available antenna feed line can be buried directly in the ground for some distance without adverse effects?**

1. 75 ohm twin-lead

2. 600 ohm open-wire

**3. Coaxial cable**

4. 300 ohm twin-lead

*> Coaxial cable, with its shielded and grounded outer conductor, is not affected by conductive soil. It is also not affected by nearby metallic objects.*

**B-006-3-10 (4) When antenna feed lines must be placed near grounded metal objects, which of the following feed lines should be used?**

1. 300 ohm twin-lead

2. 600 ohm open-wire

3. 75 ohm twin-lead

**4. Coaxial cable**

*> Coaxial cable, with its grounded outer conductor, is not affected by nearby metallic objects.*

**B-006-3-11 (3) TV twin-lead feed line can be used for a feed line in an amateur station. The impedance of this line is approximately:**

1. 600 ohms

2. 50 ohms

**3. 300 ohms**

4. 70 ohms

*> 50 ohms is the common Characteristic Impedance of coaxial cable. 600 ohms is the common Characteristic Impedance of 'open-wire line' (a.k.a. ladder line). 300 ohms is the Characteristic Impedance of twin-lead transmission line used with yesteryear outside television antennas.*

**B-006-4-1 (4) Why should you use only good quality coaxial cable and connectors for a UHF antenna system?**

1. To keep television interference high

2. To keep the power going to your antenna system from getting too high

3. To keep the standing wave ratio of your antenna system high

**4. To keep RF loss low**

*> Losses in transmission lines increase with length and operating frequencies. At Ultra High Frequencies (UHF, 300 MHz to 3000 MHz), keeping losses low is paramount.*

**B-006-4-2 (1) What are some reasons to use parallel-conductor feed line?**

**1. It will operate with a high SWR, and has less loss than coaxial cable**

2. It has low impedance, and will operate with a high SWR

3. It will operate with a high SWR, and it works well when tied down to metal objects

4. It has a low impedance, and has less loss than coaxial cable

*> The high Characteristic Impedances and greater separation of the conductors in parallel lines DO permit high power and high Standing Wave Ratio (SWR) BUT nearby metallic objects can affect them and impedance matching is most often necessary at the transmitter end. Their high Characteristic Impedance permits carrying power with less current (P = R * I squared), less current implies less losses due to resistance*.

**B-006-4-3 (2) If your transmitter and antenna are 15 metres apart, but are connected by 65 metres of RG-58 coaxial cable, what should be done to reduce feed line loss?**

1. Shorten the excess cable so the feed line is an odd number of wavelengths long

**2. Shorten the excess cable**

3. Roll the excess cable into a coil which is as small as possible

4. Shorten the excess cable so the feed line is an even number of wavelengths long

*> key words: 65 METRES of RG-58. Fifty extra meters (164 ft.) of unnecessary RG-58 (diameter = 5mm or 0.195 in.) introduce 4 dB of loss at 30 MHz, that's the problem here. [ References to multiples of the wavelength only tap into urban legends. ]*

**B-006-4-4 (2) As the length of a feed line is changed, what happens to signal loss?**

1. Signal loss decreases as length increases

**2. Signal loss increases as length increases**

3. Signal loss is the least when the length is the same as the signal's wavelength

4. Signal loss is the same for any length of feed line

*> Signal loss in a given transmission line AUGMENT with increased length or increased operating frequency. For example, 30m of RG-58 introduce a loss of -3 dB at 50 MHz. Doubling the length, double the loss: 60m of RG-58 lose -6 dB at 50 MHz. The original 30m of RG-58 waste -10 dB at 450 MHz.*

**B-006-4-5 (2) As the frequency of a signal is changed, what happens to signal loss in a feed line?**

1. Signal loss increases with decreasing frequency

**2. Signal loss increases with increasing frequency**

3. Signal loss is the least when the signal's wavelength is the same as the feed line's length

4. Signal loss is the same for any frequency

*> Signal loss in a given transmission line AUGMENT with increased length or increased operating frequency. For example, 30m of RG-58 introduce a loss of -3 dB at 50 MHz. Doubling the length, double the loss: 60m of RG-58 lose -6 dB at 50 MHz. The original 30m of RG-58 waste -10 dB at 450 MHz.*

**B-006-4-6 (2) Losses occurring on a transmission line between transmitter and antenna results in:**

1. an SWR reading of 1:1

**2. less RF power being radiated**

3. reflections occurring in the line

4. the wire radiating RF energy

*> Losses in the line are merely transmit energy that does not get to the antenna to be radiated OR received signal which does not reach the receiver to be detected. "1" The SWR reading is primarily dependent on the adequacy of the match between the load placed at the end of the line and the Characteristic Impedance of the line. "3" Reflections, measured by SWR, are caused by an improper match at the end of the line.*

**B-006-4-7 (1) The lowest loss feed line on HF is:**

**1. open-wire**

2. 75 ohm twin-lead

3. coaxial cable

4. 300 ohm twin-lead

*> 300 ohms is the Characteristic Impedance of TV twin-lead transmission line. The high Characteristic Impedances and greater separation of the conductors in parallel lines DO permit high power and high Standing Wave Ratio (SWR) BUT nearby metallic objects can affect them and impedance matching is most often necessary at the transmitter end. Their high Characteristic Impedance permits carrying power with less current (P = R * I squared), less current implies less losses due to resistance.*

**B-006-4-8 (4) In what values are RF feed line losses expressed?**

1. ohms per MHz

2. dB per MHz

3. ohms per metre

**4. dB per unit length**

*> "Decibels per unit length". In North America, typically 'dB per 100 ft' or 'dB per 30m' at a given frequency. Loss rises proportionally with length. Loss goes up as frequency goes up.*

**B-006-4-9 (1) If the length of coaxial feed line is increased from 20 metres (65.6 ft) to 40 metres (131.2 ft), how would this affect the line loss?**

**1. It would be increased by 100%**

2. It would be reduced by 10%

3. It would be increased by 10%

4. It would be reduced to 50%

*> If line length is doubled, the incurred signal loss is doubled. Loss for transmission lines is specified as "decibels per 100 feet (30m)" at a certain frequency. Signal loss in a given transmission line AUGMENT with increased length or increased operating frequency. For example, 30m of RG-58 introduce a loss of -3 dB at 50 MHz. Doubling the length, double the loss: 60m of RG-58 lose -6 dB at 50 MHz. The original 30m of RG-58 waste -10 dB at 450 MHz.*

**B-006-4-10 (2) If the frequency is increased, how would this affect the loss on a transmission line?**

1. It is independent of frequency

**2. It would increase**

3. It depends on the line length

4. It would decrease

*> The higher the frequency, the higher the loss. Larger diameter coaxial cables are recommended at VHF (Very High Frequency) and UHF (Ultra High Frequency) to minimize losses. Signal loss in a given transmission line AUGMENT with increased length or increased operating frequency. For example, 30m of RG-58 introduce a loss of -3 dB at 50 MHz. Doubling the length, double the loss: 60m of RG-58 lose -6 dB at 50 MHz. The original 30m of RG-58 waste -10 dB at 450 MHz.*

**B-006-5-1 (1) What does an SWR reading of 1:1 mean?**

**1. The best impedance match has been attained**

2. An antenna for another frequency band is probably connected

3. No power is going to the antenna

4. The SWR meter is broken

*> SWR is a measure of the impedance match in the antenna system. A Standing Wave Ratio (SWR) of '1 to 1' is an ideal condition indicating no reflected energy. The impedance of the load at the end of the transmission line matches the Characteristic Impedance of the line. Impedance Match has been achieved. A Standing Wave Ratio (SWR) of '1.5 to 1' would indicate a fairly good match while a very high SWR would indicate a short-circuit or an open-circuit somewhere along the transmission line.*

**B-006-5-2 (1) What does an SWR reading of less than 1.5:1 mean?**

**1. A fairly good impedance match**

2. An impedance match which is too low

3. An impedance mismatch; something may be wrong with the antenna system

4. An antenna gain of 1.5

*> SWR is a measure of the impedance match in the antenna system.  A Standing Wave Ratio (SWR) of '1.5 to 1' is a totally acceptable condition indicating little reflected energy.  A '1 to 1' ratio would indicate a perfect match while a very high SWR would indicate a short-circuit or an open-circuit somewhere along the transmission line.*

**B-006-5-3 (3) What kind of SWR reading may mean poor electrical contact between parts of an antenna system?**

1. A negative reading

2. No reading at all

**3. A jumpy reading**

4. A very low reading

*> SWR is a measure of the impedance match in the antenna system.  A 'jumpy' (erratic) reading resulting from the sometimes on, sometimes off electrical contact would indicate a loose connection in the antenna system.*

**B-006-5-4 (2) What does a very high SWR reading mean?**

1. The transmitter is putting out more power than normal, showing that it is about to go bad

**2. The antenna is the wrong length, or there may be an open or shorted connection somewhere in the feed line**

3. There is a large amount of solar radiation, which means very poor radio conditions

4. The signals coming from the antenna are unusually strong, which means very good radio conditions

*> SWR is a measure of the impedance match in the antenna system.  A very high SWR, indicating that most if not all energy sent up the line is reflected back indicates that the antenna is cut for a totally different frequency  OR  that a short-circuit or open-circuit exists somewhere along the line.*

**B-006-5-5 (1) What does standing-wave ratio mean?**

**1. The ratio of maximum to minimum voltages on a feed line**

2. The ratio of maximum to minimum inductances on a feed line

3. The ratio of maximum to minimum resistances on a feed line

4. The ratio of maximum to minimum impedances on a feed line

*> 'Standing Waves' result from the interaction of the forward power sent from the transmitter towards the antenna and the reverse power reflected back by an improper impedance match. The interaction produces a repeating pattern of voltage peaks and troughs along the line. SWR is also known as 'Voltage Standing Wave Ratio (VSWR)': it is a measure of the peak voltage to the minimum voltage on the standing wave.*

**B-006-5-6 (4) If your antenna feed line gets hot when you are transmitting, what might this mean?**

1. You should transmit using less power

2. The conductors in the feed line are not insulated very well

3. The feed line is too long

**4. The SWR may be too high, or the feed line loss may be high**

*> Line losses, possibly compounded by high Standing Wave Ratio (SWR), waste energy as heat.*

**B-006-5-7 (4) If the characteristic impedance of the feedline does not match the antenna input impedance then**:

1. heat is produced at the junction

2. the SWR reading falls to 1:1

3. the antenna will not radiate any signal

**4. standing waves are produced in the feedline**

*> 'Standing Waves' result from the interaction of the forward power sent from the transmitter towards the antenna and the reverse power reflected back by an improper impedance match. The interaction produces a repeating pattern of voltage peaks and troughs along the line. SWR is also known as 'Voltage Standing Wave Ratio (VSWR)': it is a measure of the peak voltage to the minimum voltage on the standing wave.*

**B-006-5-8 (4) The result of the presence of standing waves on a transmission line is:**

1. perfect impedance match between transmitter and feedline

2. maximum transfer of energy to the antenna from the transmitter

3. lack of radiation from the transmission line

**4. reduced transfer of RF energy to the antenna**

*> High SWR add to line losses and lead to energy wasted as heat.*

**B-006-5-9 (1) An SWR meter measures the degree of match between transmission line and antenna by:**

**1. comparing forward and reflected voltage**

2. measuring radiated RF energy

3. measuring the conductor temperature

4. inserting a diode in the feed line

*> 'Standing Waves' result from the interaction of the forward power sent from the transmitter towards the antenna and the reverse power reflected back by an improper impedance match. The interaction produces a repeating pattern of voltage peaks and troughs along the line. SWR is also known as 'Voltage Standing Wave Ratio (VSWR)': it is a measure of the peak voltage to the minimum voltage on the standing wave.*

**B-006-5-10 (3) A resonant antenna having a feed point impedance of 200 ohms is connected to a feed line and transmitter which have an impedance of 50 ohms. What will the standing wave ratio of this system be?**

1. 6:1

2. 3:1

**3. 4:1**

4. 5:1

*> key word: RESONANT. A resonant antenna (reactances cancel each other at resonance) does not present any reactance (X) but only a 'radiation resistance'. In such a situation, SWR can be computed as the ratio of the impedances. In this example, 200 / 50 yields a ratio of '4 to 1'. SWR is normally a ratio of maximum to minimum voltage on the standing wave.*

**B-006-5-11 (2) The type of feed line best suited to operating at a high standing wave ratio is:**

1. 75 ohm twin-lead

**2. 600 ohm open-wire**

3. coaxial line

4. 300 ohm twin-lead

*> The high Characteristic Impedances and greater separation of the conductors in parallel lines DO permit high power and high Standing Wave Ratio (SWR) BUT nearby metallic objects can affect them and impedance matching is most often necessary at the transmitter end. Their high Characteristic Impedance permits carrying power with less current (P = R * I squared), less current implies less losses due to resistance.*

**B-006-6-3 (2) What would you use to connect a coaxial cable of 50 ohms impedance to an antenna of 35 ohms impedance?**

1. An SWR meter

**2. An impedance-matching device**

3. A low pass filter

4. A terminating resistor

*> The impedance mismatch ( line with a Characteristic Impedance of 50 ohms to a load impedance of 35 ohms ) could be corrected by an 'impedance-matching device'*.

**B-006-6-7 (3) To obtain efficient power transmission from a transmitter to an antenna requires:**

1. high load impedance

2. low ohmic resistance

**3. matching of impedances**

4. inductive impedance

*> Impedance Match: maximum power transfer occurs when the impedance of the load matches the internal impedance of the source. For example, A transmitter designed to work into an impedance of 50 ohms, will delivered maximum power if the antenna system offers an impedance of 50 ohms.*

**B-006-6-8 (2) To obtain efficient transfer of power from a transmitter to an antenna, it is important that there is a:**

1. high load impedance

**2. matching of impedance**

3. proper method of balance

4. low ohmic resistance

*> Impedance Match: maximum power transfer occurs when the impedance of the load matches the internal impedance of the source. For example, A transmitter designed to work into an impedance of 50 ohms, will delivered maximum power if the antenna system offers an impedance of 50 ohms.*

**B-006-6-9 (4) If an antenna is correctly matched to a transmitter, the length of transmission line:**

1. must be a full wavelength long

2. must be an odd number of quarter-wave

3. must be an even number of half-waves

**4. will have no effect on the matching**

*> IF a mismatch is present at the end of the transmission lines, certain lengths may introduce an 'impedance transformation' effect. With a correctly matched antenna, line length is immaterial except for line losses if the line is unnecessarily long.*

**B-006-6-10 (2) The reason that an RF transmission line should be matched at the transmitter end is to:**

1. ensure that the radiated signal has the intended polarization

**2. transfer the maximum amount of power to the antenna**

3. prevent frequency drift

4. overcome fading of the transmitted signal

*> Impedance Match: maximum power transfer occurs when the impedance of the load matches the internal impedance of the source. For example, A transmitter designed to work into an impedance of 50 ohms, will delivered maximum power if the antenna system offers an impedance of 50 ohms.*

**B-006-6-11 (4) If the centre impedance of a folded dipole is approximately 300 ohms, and you are using RG8U (50 ohms) coaxial lines, what is the ratio required to have the line and the antenna matched?**

1. 2:1

2. 4:1

3. 10:1

**4. 6:1**

*> Impedance transformation of 300 to 50 ohms is required. 300 / 50 = '6 to 1'.*

# Propagation

**B-007-1-1 (4) What type of propagation usually occurs from one hand-held VHF transceiver to another nearby?**

1. Tunnel propagation

2. Sky-wave propagation

3. Auroral propagation

**4. Line-of-sight propagation**

*> key words: VHF, NEARBY. The two antennas "see" one another. 'Line-of-sight' is also known as 'direct waves' in contrast with 'sky wave'.*

**B-007-1-2 (4) How does the range of sky-wave propagation compare to ground-wave propagation?**

1. It is much shorter

2. It is about the same

3. It depends on the weather

**4. It is much longer**

*> Ground Wave propagation present on long wavelengths (e.g., 160m and 80m) is of the order of 200 km. One hop via the E layer of the ionosphere can reach to 2000 km. One hop via the F2 layer can reach to 4000 km.*

**B-007-1-3 (3) When a signal is returned to earth by the ionosphere, what is this called?**

1. Tropospheric propagation

2. Ground-wave propagation

**3. Sky-wave propagation**

4. Earth-moon-earth propagation

*> Sky Waves or 'ionospheric waves' rely on refraction in layers of the ionosphere.*

**B-007-1-4 (1) How are VHF signals propagated within the range of the visible horizon?**

**1. By direct wave**

2. By sky wave

3. By plane wave

4. By geometric wave

*> key words: HORIZON. The two antennas "see" one another. 'Line-of-sight' is also known as 'direct waves' in contrast with 'sky wave'.*

**B-007-1-5 (1) Skywave is another name for:**

**1. ionospheric wave**

2. tropospheric wave

3. ground wave

4. inverted wave

*> Sky Waves or 'ionospheric waves' rely on refraction in layers of the ionosphere.*

**B-007-1-6 (4) That portion of the radiation which is directly affected by the surface of the earth is called:**

1. tropospheric wave

2. ionospheric wave

3. inverted wave

**4. ground wave**

*> key words: SURFACE OF THE EARTH. "A special form of diffraction. Bending results when the lower part of the wave front loses energy due to currents induced in the ground (ARRL Handbook)". Ground Wave propagation present on long wavelengths (e.g., 160m and 80m) is of the order of 200 km.*

**B-007-1-7 (4) At HF frequencies, line-of-sight transmission between two stations uses mainly the:**

1. troposphere

2. skip wave

3. ionosphere

**4. ground wave**

*> This question is ambiguous. Yes, until you reach the radio horizon (1.15 times the visible horizon), both the ground wave and the direct wave are undistinguishable. However, while neither are significantly enhanced by conditions in the troposphere, both travel through the troposphere. Line-of-sight generally refers to VHF and up. Ground Wave (about 200 km) is most apparent on 160m and 80m. "The term ground wave is often mistakenly applied to any short-distance communication, but the actual mechanism is unique to longer wavelengths (ARRL Handbook)".*

**B-007-1-8 (3) The distance travelled by ground waves:**

1. depends on the maximum usable frequency

2. is more at higher frequencies

**3. is less at higher frequencies**

4. is the same for all frequencies

*> "The actual mechanism is unique to longer wavelengths (ARRL Handbook)". Ground Wave (about 200 km) is most apparent on 160m and 80m. "A special form of diffraction. Bending results when the lower part of the wave front loses energy due to currents induced in the ground (ARRL Handbook)".*

**B-007-1-9 (3) The radio wave which follows a path from the transmitter to the ionosphere and back to earth is known correctly as the:**

1. F layer

2. surface wave

**3. ionospheric wave**

4. skip wave

*> key word: IONOSPHERE. Sky Waves or 'ionospheric waves' rely on refraction in layers of the ionosphere.*

**B-007-1-10 (2) Reception of high frequency (HF) radio waves beyond 4000 km is generally possible by:**

1. ground wave

**2. ionospheric wave**

3. skip wave

4. surface wave

*> One hop via the E layer of the ionosphere can reach to 2000 km. One hop via the F2 layer can reach to 4000 km.*

**B-007-2-1 (2) What causes the ionosphere to form?**

1. Lightning ionizing the outer atmosphere

**2. Solar radiation ionizing the outer atmosphere**

3. Release of fluorocarbons into the atmosphere

4. Temperature changes ionizing the outer atmosphere

*> Ultraviolet (UV) radiation and particles emanating from the Sun breaks down molecules in the ionosphere to form charged ions.*

**B-007-2-2 (3) What type of solar radiation is most responsible for ionization in the outer atmosphere?**

1. Microwave

2. Ionized particle

**3. Ultraviolet**

4. Thermal

*> Ultraviolet (UV) radiation and particles emanating from the Sun breaks down molecules in the ionosphere to form charged ions.*

**B-007-2-3 (2) Which ionospheric region is closest to the earth?**

1. The E region

**2. The D region**

3. The F region

4. The A region

*> Above the troposphere and stratosphere, the layers of the ionosphere are: D, E, F1 and F2 (from lowest to highest).*

**B-007-2-4 (3) Which region of the ionosphere is the least useful for long distance radio-wave propagation?**

1. The F2 region

2. The F1 region

**3. The D region**

4. The E region

*> The D layer, closest of the layers, is fairly dense.  Once ionized during daylight hours, it ABSORBS lower frequencies ( i.e., 160m and 80m ).*

**B-007-2-5 (4) What two sub-regions of ionosphere exist only in the daytime?**

1. Troposphere and stratosphere

2. Electrostatic and electromagnetic

3. D and E

**4. F1 and F2**

*> key word:  SUB-REGIONS.  The F1 and F2 layers present during the day combine at night to form the F layer.  D and E are two distinct layers of their own.*

**B-007-2-6 (3) When is the ionosphere most ionized?**

1. Dawn

2. Midnight

**3. Midday**

4. Dusk

*> key word:  MOST.  At midday, with the Sun shining directly at the ionosphere, ionization is most intense.  As the Sun sets and throughout the night, ions recombine (how quickly depending on the density of a given layer) so that ionization is minimum right before dawn (sunrise).*

**B-007-2-7 (1) When is the ionosphere least ionized?**

**1. Shortly before dawn**

2. Just after noon

3. Just after dusk

4. Shortly before midnight

*> key word:  LEAST.  At midday, with the Sun shining directly at the ionosphere, ionization is most intense.  As the Sun sets and throughout the night, ions recombine (how quickly depending on the density of a given layer) so that ionization is minimum right before dawn (sunrise).*

**B-007-2-8 (4) Why is the F2 region mainly responsible for the longest distance radio-wave propagation?**

1. Because it exists only at night

2. Because it is the lowest ionospheric region

3. Because it does not absorb radio waves as much as other ionospheric regions

**4. Because it is the highest ionospheric region**

*> Above the troposphere and stratosphere, the layers of the ionosphere are: D, E, F1 and F2 (from lowest to highest).*

**B-007-2-9 (2) What is the main reason the 160, 80 and 40 metre amateur bands tend to be useful only for short-distance communications during daylight hours?**

1. Because of auroral propagation

**2. Because of D-region absorption**

3. Because of magnetic flux

4. Because of a lack of activity

*> The D layer, closest of the layers, is fairly dense. Once ionized during daylight hours, it ABSORBS lower frequencies ( i.e., 160m and 80m ).*

**B-007-2-10 (4) During the day, one of the ionospheric layers splits into two parts called:**

1. D1 & D2

2. E1 & E2

3. A & B

**4. F1 & F2**

*> The F1 and F2 layers present during the day combine at night to form the F layer. The other designations simply do not exist.*

**B-007-2-11 (2) The position of the E layer in the ionosphere is:**

1. below the D layer

**2. below the F layer**

3. sporadic

4. above the F layer

*> From the Earth up and above the troposphere and stratosphere, the layers of the ionosphere are: D, E, F1 and F2.*

**B-007-3-1 (3) What is a skip zone?**

1. An area which is too far away for ground-wave or sky-wave propagation

2. An area covered by sky-wave propagation

**3. An area which is too far away for ground-wave propagation, but too close for sky-wave propagation**

4. An area covered by ground-wave propagation

*> The Skip Zone is a zone of silence beyond the reach of the Ground Wave but closer than the nearest point where the Sky Wave returns to Earth.*

**B-007-3-2 (3) What is the maximum distance along the earth's surface that is normally covered in one hop using the F2 region?**

1. None; the F2 region does not support radio-wave propagation

2. 2160 km (1200 miles)

**3. 4500km (2500 miles)**

4. 325 km (180 miles)

*> One hop via the E layer of the ionosphere can reach to 2000 km. One hop via the F2 layer can reach to 4000 km. Note: 2500 miles is 4023 kilometres.*

**B-007-3-3 (1) What is the maximum distance along the earth's surface that is normally covered in one hop using the E region?**

**1. 2160 km (1200 miles)**

2. 325 km (180 miles)

3. 4500 km (2500 miles)

4. None; the E region does not support radio-wave propagation

*> One hop via the E layer of the ionosphere can reach to 2000 km. One hop via the F2 layer can reach to 4000 km. Note: 1200 miles is 1931 kilometres.*

**B-007-3-4 (3) Skip zone is:**

1. a zone of silence caused by lost sky waves

2. a zone between any two refracted waves

**3. a zone between the end of the ground wave and the point where the first refracted wave returns to earth**

4. a zone between the antenna and the return of the first refracted wave

*> The Skip Zone is a zone of silence beyond the reach of the Ground Wave but closer than the nearest point where the Sky Wave returns to Earth.*

**B-007-3-5 (3) The distance to Europe from your location is approximately 5000 km. What sort of propagation is the most likely to be involved?**

1. sporadic "E"

2. back scatter

**3. multihop**

4. tropospheric scatter

*> One hop via the E layer of the ionosphere can reach to 2000 km. One hop via the F2 layer can reach to 4000 km.*

**B-007-3-6 (4) For radio signals, the skip distance is determined by the:**

1. power fed to the final

2. angle of radiation

3. type of transmitting antenna used

**4. height of the ionosphere and the angle of radiation**

*> How far one hop through the ionosphere reaches depends on the take-off angle of the wave with respect to ground ( the lower, the further ) AND the height of the layer where refraction takes place ( the higher, the further ). One hop via the E layer of the ionosphere can reach to 2000 km. One hop via the F2 layer can reach to 4000 km.*

**B-007-3-7 (3) The distance from the transmitter to the nearest point where the sky wave returns to the earth is called the:**

1. skip zone

2. angle of radiation

**3. skip distance**

4. maximum usable frequency

*> Do not confuse Skip Distance and Skip Zone. Skip Distance is the "nearest point where the sky wave returns". It marks the end of the Skip Zone which extended from beyond the reach of the Ground Wave to the "nearest point where the sky wave returns".*

**B-007-3-8 (1) Skip distance is the:**

**1. the minimum distance reached by a signal after one reflection by the ionosphere**

2. the maximum distance reached by a signal after one reflection by the ionosphere

3. the minimum distance reached by a ground-wave signal

4. the maximum distance a signal will travel by both a ground wave and reflected wave

*> Skip Distance is the "nearest point where the sky wave returns".*

**B-007-3-9 (1) Skip distance is a term associated with signals from the ionosphere. Skip effects are due to:**

**1. reflection and refraction from the ionosphere**

2. selective fading of local signals

3. high gain antennas being used

4. local cloud cover

*> The phenomenon which returns certain radio waves to earth is primarily refraction.*

**B-007-3-10 (3) The skip distance of a sky wave will be greatest when the:**

1. polarization is vertical

2. ionosphere is most densely ionized

**3. angle between ground and radiation is smallest**

4. signal given out is strongest

*> How far one hop through the ionosphere reaches depends on the take-off angle of the wave with respect to ground ( the lower, the further ) AND the height of the layer where refraction takes place ( the higher, the further ). One hop via the E layer of the ionosphere can reach to 2000 km. One hop via the F2 layer can reach to 4000 km.*

**B-007-3-11 (3) If the height of the reflecting layer of the ionosphere increases, the skip distance of a high frequency (HF) transmission:**

1. stays the same

2. varies regularly

**3. becomes greater**

4. decreases

*> How far one hop through the ionosphere reaches depends on the take-off angle of the wave with respect to ground ( the lower, the further ) AND the height of the layer where refraction takes place ( the higher, the further ). One hop via the E layer of the ionosphere can reach to 2000 km. One hop via the F2 layer can reach to 4000 km.*

**B-007-4-1 (1) What effect does the D region of the ionosphere have on lower frequency HF signals in the daytime?**

**1. It absorbs the signals**

2. It bends the radio waves out into space

3. It refracts the radio waves back to earth

4. It has little or no effect on 80-metre radio waves

*> The D layer, closest of the layers, is fairly dense. Once ionized during daylight hours, it ABSORBS lower frequencies ( i.e., 160m and 80m ).*

**B-007-4-2 (2) What causes the ionosphere to absorb radio waves?**

1. The presence of ionized clouds in the E region

**2. The ionization of the D region**

3. The splitting of the F region

4. The weather below the ionosphere

*> The D layer, closest of the layers, is fairly dense. Once ionized during daylight hours, it ABSORBS lower frequencies ( i.e., 160m and 80m ).*

**B-007-4-3 (1) Two or more parts of the radio wave follow different paths during propagation and this may result in phase differences at the receiver. This "change" at the receiver is called:**

**1. fading**

2. baffling

3. absorption

4. skip

*> Parts of a wave arriving with difference in phases (Selective Fading) cause a fluctuation in the perceived signal. Signals with large bandwidths are more susceptible to Selective Fading. SSB is less affected.*

**B-007-4-4 (4) A change or variation in signal strength at the antenna, caused by differences in path lengths, is called:**

1. absorption

2. fluctuation

3. path loss

**4. fading**

*> Parts of a wave arriving with difference in phases (Selective Fading) cause a fluctuation in the perceived signal. Signals with large bandwidths are more susceptible to Selective Fading. SSB is less affected.*

**B-007-4-5 (3) When a transmitted radio signal reaches a station by a one-hop and two-hop skip path, small changes in the ionosphere can cause:**

1. consistent fading of received signal

2. consistently stronger signals

**3. variations in signal strength**

4. a change in the ground-wave signal

*> This effect called 'multipath' (where copies of the same signal arrive with phase differences after travelling different path lengths) causes Rapid Fading.*

**B-007-4-6 (2) The usual effect of ionospheric storms is to:**

1. produce extreme weather changes

**2. cause a fade-out of sky-wave signals**

3. prevent communications by ground wave

4. increase the maximum usable frequency

*> Ionospheric Storm:  exceptional solar activity where greater quantities of particles arrive from the Sun make for more ionization (too much ionization), absorption is increased and may last for days.*

**B-007-4-7 (1) On the VHF and UHF bands, polarization of the receiving antenna is very important in relation to the transmitting antenna, yet on HF bands it is relatively unimportant. Why is that so?**

**1. The ionosphere can change the polarization of the signal from moment to moment**

2. The ground wave and the sky wave continually shift the polarization

3. Anomalies in the earth's magnetic field produce a profound effect on HF polarization

4. Greater selectivity is possible with HF receivers making changes in polarization redundant

*> As a radio wave travels through the changing layers of the ionosphere and is refracted back to Earth, wave polarization will have changed.*

**B-007-4-8 (1) What causes selective fading?**

**1. Phase differences between radio wave components of the same transmission, as experienced at the receiving station**

2. Small changes in beam heading at the receiving station

3. Time differences between the receiving and transmitting stations

4. Large changes in the height of the ionosphere at the receiving station ordinarily occurring shortly before sunrise and sunset

*> Parts of a wave arriving with difference in phases (Selective Fading) cause a fluctuation in the perceived signal.  Signals with large bandwidths are more susceptible to Selective Fading.  SSB is less affected.*

**B-007-4-9 (2) How does the bandwidth of a transmitted signal affect selective fading?**

1. It is the same for both wide and narrow bandwidths

**2. It is more pronounced at wide bandwidths**

3. Only the receiver bandwidth determines the selective fading effect

4. It is more pronounced at narrow bandwidths

*> Parts of a wave arriving with difference in phases (Selective Fading) cause a fluctuation in the perceived signal. Signals with large bandwidths are more susceptible to Selective Fading. SSB is less affected*.

**B-007-4-10 (1) Polarization change often takes place on radio waves that are propagated over long distances. Which of these does not cause polarization change?**

**1. Parabolic interaction**

2. Reflections

3. Passage through magnetic fields (Faraday rotation)

4. Refractions

*> key word: NOT. Refraction, reflection and magnetic fields all affect wave polarization as waves travel to and from the ionosphere..*

**B-007-4-11 (1) Reflection of a SSB transmission from the ionosphere causes:**

**1. little or no phase-shift distortion**

2. phase-shift distortion

3. signal cancellation at the receiver

4. a high-pitch squeal at the receiver

*> Parts of a wave arriving with difference in phases (Selective Fading) cause a fluctuation in the perceived signal. Signals with large bandwidths are more susceptible to Selective Fading. SSB is less affected.*

**B-007-5-1 (1) How do sunspots change the ionization of the atmosphere?**

**1. The more sunspots there are, the greater the ionization**

2. The more sunspots there are, the less the ionization

3. Unless there are sunspots, the ionization is zero

4. They have no effect

*> The number of sunspots visible on the surface of the Sun are related to overall solar activity. The higher the sunspot numbers, the higher the emission of Ultraviolet (UV) and particles. Ionization is directly influenced by the level of radiation.*

**B-007-5-2 (3) How long is an average sunspot cycle?**

1. 17 years

2. 5 years

**3. 11 years**

4. 7 years

*> key word: AVERAGE. The duration of the solar cycles varies from 7 to 17 years but the AVERAGE is 11 YEARS.*

**B-007-5-3 (3) What is solar flux?**

1. A measure of the tilt of the earth's ionosphere on the side toward the sun

2. The number of sunspots on the side of the sun facing the earth

**3. The radio energy emitted by the sun**

4. The density of the sun's magnetic field

*> The Sun's activity can be observed by visually counting sunspots but also by measuring noise at a microwave frequency. Sunspot numbers and solar flux are well co-related. The measurement of the solar flux is reported as a Solar Flux Index.*

**B-007-5-4 (3) What is the solar-flux index?**

1. Another name for the American sunspot number

2. A measure of solar activity that compares daily readings with results from the last six months

**3. A measure of solar activity that is taken at a specific frequency**

4. A measure of solar activity that is taken annually

*> The Sun's activity can be observed by visually counting sunspots but also by measuring noise at a microwave frequency. Sunspot numbers and solar flux are well co-related. The measurement of the solar flux is reported as a Solar Flux Index.*

**B-007-5-5 (3) What influences all radiocommunication beyond ground-wave or line-of-sight ranges?**

1. The F2 region of the ionosphere

2. The F1 region of the ionosphere

**3. Solar activity**

4. Lunar tidal effects

*> Because the Sun affects the ionosphere and the troposphere (e.g., temperature inversions), it can be said that it has an influence on all radiocommunications.*

**B-007-5-6 (4) Which two types of radiation from the sun influence propagation?**

1. Subaudible and audio-frequency emissions

2. Polar region and equatorial emissions

3. Infra-red and gamma-ray emissions

**4. Electromagnetic and particle emissions**

*> Ultraviolet (UV) rays, a form of electromagnetic radiation, and particles [namely alpha and beta] are responsible for ionization in the ionosphere.*

**B-007-5-7 (1) When sunspot numbers are high, how is the ionosphere affected?**

**1. Frequencies up to 40 MHz or higher are normally usable for long-distance communication**

2. High frequency radio signals are absorbed

3. Frequencies up to 100 MHz or higher are normally usable for long-distance communication

4. High frequency radio signals become weak and distorted

*> Maximum Usable Frequencies (MUF) in the range of 30 to 50 MHz become possible during solar cycle peaks. Stronger ionization allow upper layers of the ionosphere to refract higher frequencies rather than let them escape into space (as is the case during solar cycle lows).*

**B-007-5-8 (4) All communication frequencies throughout the spectrum are affected in varying degrees by the:**

1. ionosphere

2. aurora borealis

3. atmospheric conditions

**4. sun**

*> Because the Sun affects the ionosphere and the troposphere (e.g., temperature inversions), it can be said that it has an influence on all radiocommunications.*

**B-007-5-9 (1) Average duration of a solar cycle is:**

**1. 11 years**

2. 3 years

3. 6 years

4. 1 year

*> key word:  AVERAGE.  The duration of the solar cycles varies from 7 to 17 years but the AVERAGE is 11 YEARS.*

**B-007-5-10 (1) The ability of the ionosphere to reflect high frequency radio signals depends on:**

**1. the amount of solar radiation**

2. the power of the transmitted signal

3. the receiver sensitivity

4. upper atmosphere weather conditions

*> Ionization makes refraction possible.  Ultraviolet (UV) rays, a form of electromagnetic radiation, and particles [namely alpha and beta] are responsible for ionization in the ionosphere.*

**B-007-5-11 (1) Propagation cycles have a period of approximately 11:**

**1. years**

2. months

3. days

4. centuries

*> key word:  11.  The duration of the solar cycles varies from 7 to 17 years but the AVERAGE is 11 YEARS.*

**B-007-6-1 (1) What happens to signals higher in frequency than the critical frequency?**

**1. They pass through the ionosphere**

2. They are absorbed by the ionosphere

3. Their frequency is changed by the ionosphere to be below the maximum usable frequency

4. They are reflected back to their source

*> The 'Critical Frequency' is a measurement of the highest frequency which will be refracted back to Earth when sent straight up at a given time.  Above the Critical Frequency, the wave escapes into space.  How high the Critical Frequency is, relates to the ionization level.*

**B-007-6-2 (1) What causes the maximum usable frequency to vary?**

**1. The amount of radiation received from the sun, mainly ultraviolet**

2. The temperature of the ionosphere

3. The speed of the winds in the upper atmosphere

4. The type of weather just below the ionosphere

*> The Maximum Usable Frequency (MUF) is the highest frequency usable for sky wave propagation between two points on the globe.  MUF varies with ionization levels (solar cycle, time of the day).  Maximum Usable Frequencies (MUF) in the range of 30 to 50 MHz become possible during solar cycle peaks.*

**B-007-6-3 (4) What does maximum usable frequency mean?**

1. The lowest frequency signal that will reach its intended destination

2. The highest frequency signal that is most absorbed by the ionosphere

3. The lowest frequency signal that is most absorbed by the ionosphere

**4. The highest frequency signal that will reach its intended destination**

*> The Maximum Usable Frequency (MUF) is the highest frequency usable for sky wave propagation between two points on the globe.  MUF varies with ionization levels (solar cycle, time of the day).  Maximum Usable Frequencies (MUF) in the range of 30 to 50 MHz become possible during solar cycle peaks.*

**B-007-6-4 (1) What can be done at an amateur station to continue HF communications during a sudden ionospheric disturbance?**

**1. Try a higher frequency**

2. Try the other sideband

3. Try a different antenna polarization

4. Try a different frequency shift

*> A Sudden Ionospheric Disturbance is a sudden rise radiation, due to solar flares, which increases D-layer ABSORPTION for an hour or so.  The only option is to "try a higher frequency" in an attempt to cut through the absorption.*

**B-007-6-5 (1) What is one way to determine if the maximum usable frequency (MUF) is high enough to support 28 MHz propagation between your station and western Europe?**

**1. Listen for signals on the 10-metre beacon frequency**

2. Listen for signals on the 20-metre beacon frequency

3. Listen for signals on the 39-metre broadcast frequency

4. Listen for WWVH time signals on 20 MHz

*> The 10m band spans 28.0 MHz to 29.7 MHz. 'Beacons' are one-way automated stations maintained by amateurs which operate on known frequencies to permit evaluating propagation conditions.*

**B-007-6-6 (3) What usually happens to radio waves with frequencies below the maximum usable frequency (MUF) when they are sent into the ionosphere?**

1. They are changed to a frequency above the MUF

2. They are completely absorbed by the ionosphere

**3. They are bent back to the earth**

4. They pass through the ionosphere

*> As Maximum Usable Frequency (MUF) is the highest frequency usable for sky wave propagation between two points on the globe, using lower frequencies are also refracted back to Earth. In fact, the Optimum Working Frequency is somewhat lower than the MUF [85%]. Note that frequencies below the MUF are more subject to absorption and noise so a lower limit does exist. Refraction of a given signal by the ionosphere is dependent on the frequency, the level of ionization and the angle of entry into a layer.*

**B-007-6-7 (3) At what point in the solar cycle does the 20-metre band usually support worldwide propagation during daylight hours?**

1. Only at the minimum point of the solar cycle

2. Only at the maximum point of the solar cycle

**3. At any point in the solar cycle**

4. At the summer solstice

*> During solar peaks and solar lows, the 20m band (14.0 MHz to 14.35 MHz) usually support worldwide communications during the day.*

**B-007-6-8 (2) If we transmit a signal, the frequency of which is so high we no longer receive a reflection from the ionosphere, the signal frequency is above the:**

1. skip distance

**2. maximum usable frequency**

3. speed of light

4. sunspot frequency

*> The Maximum Usable Frequency (MUF) is the highest frequency usable for sky wave propagation between two points on the globe. MUF varies with ionization levels (solar cycle, time of the day). Maximum Usable Frequencies (MUF) in the range of 30 to 50 MHz become possible during solar cycle peaks.*

**B-007-6-9 (1) Communication on the 80 metre band is generally most difficult during:**

**1. daytime in summer**

2. evening in winter

3. evening in summer

4. daytime in winter

*> During the summer, two problems can affect 160m and 80m: static from lightning (thunderstorms) and D-layer absorption. The D layer, closest of the layers, is fairly dense. Once ionized during daylight hours, it ABSORBS lower frequencies ( i.e., 160m and 80m ).*

B-007-6-10 (3) The optimum working frequency provides the best long range HF communication. Compared with the maximum usable frequency (MUF), it is usually:

1. double the MUF

2. half the MUF

**3. slightly lower**

4. slightly higher

*> As Maximum Usable Frequency (MUF) is the highest frequency usable for sky wave propagation between two points on the globe, using lower frequencies are also refracted back to Earth. In fact the Optimum Working Frequency is somewhat lower than the MUF [85%]. Note that frequencies below the MUF are more subject to absorption and noise so a lower limit does exist. Refraction of a given signal by the ionosphere is dependent on the frequency, the level of ionization and the angle of entry into a layer.*

**B-007-6-11 (1) During summer daytime, which bands are the most difficult for communications beyond ground wave?**

**1. 160 and 80 metres**

2. 40 metres

3. 30 metres

4. 20 metres

*> During the summer, two problems can affect 160m and 80m:  static from lightning (thunderstorms) and D-layer absorption.  The D layer, closest of the layers, is fairly dense.  Once ionized during daylight hours, it ABSORBS lower frequencies ( i.e., 160m and 80m ).*

**B-007-7-1 (3) Which ionospheric region most affects sky-wave propagation on the 6 metre band?**

1. The F2 region

2. The F1 region

**3. The E region**

4. The D region

*> At 50 to 54 MHz, the 6m band normally escapes into space.  However, 'Sporadic E' ( intense but temporary ionization of patches in the upper regions of the E layer ) can provide refraction paths for 6m.*

**B-007-7-2 (4) What effect does tropospheric bending have on 2-metre radio waves?**

1. It causes them to travel shorter distances

2. It garbles the signal

3. It reverses the sideband of the signal

**4. It lets you contact stations farther away**

*> key word:  BENDING.  Tropospheric bending : refraction occurs when a wave travels through masses of differing densities (humidity content) in the troposphere. The wave travels further rather than escape right away into space.*

**B-007-7-3 (3) What causes tropospheric ducting of radio waves?**

1. Lightning between the transmitting and receiving stations

2. An aurora to the north

**3. A temperature inversion**

4. A very low pressure area

*> key word: DUCTING. Wave gets caught between sandwiched masses of different humidity contents (like in a waveguide). A 'temperature inversion', where hot air masses find themselves riding over cooler air, lead to conditions supporting 'Ducting'. Except for 'Tropo Ducting', common troposcatter (scattering through the troposphere) opens VHF paths out to 500 km for well-equipped stations (800 at the most). 'Tropospheric Ducting' permit distances beyond 800 km.*

**B-007-7-4 (3) That portion of the radiation kept close to the earth's surface due to bending in the atmosphere is called the:**

1. inverted wave

2. ground wave

**3. tropospheric wave**

4. ionospheric wave

*> key word: BENDING. Tropospheric bending : refraction occurs when a wave travels through masses of differing densities (humidity content) in the troposphere. The wave travels further rather than escape right away into space.*

**B-007-7-5 (1) What is a sporadic-E condition?**

**1. Patches of dense ionization at E-region height**

2. Partial tropospheric ducting at E-region height

3. Variations in E-region height caused by sunspot variations

4. A brief decrease in VHF signals caused by sunspot variations

*> At 50 to 54 MHz, the 6m band normally escapes into space. However, 'Sporadic E' ( intense but temporary ionization of patches in the upper regions of the E layer ) can provide refraction paths for 6m.*

**B-007-7-6 (3) On which amateur frequency band is the extended-distance propagation effect of sporadic-E most often observed?**

1. 160 metres

2. 20 metres

**3. 6 metres**

4. 2 metres

*> At 50 to 54 MHz, the 6m band normally escapes into space.  However, 'Sporadic E' ( intense but temporary ionization of patches in the upper regions of the E layer ) can provide refraction paths for 6m*.

**B-007-7-7 (2) In the northern hemisphere, in which direction should a directional antenna be pointed to take maximum advantage of auroral propagation?**

1. East

**2. North**

3. West

4. South

*> key word:  AURORA.  The arrival of high-energy particles from the Sun (e.g., after a solar flare) disturb the Earth's magnetic field (a geomagnetic storm).  The resulting unusual ionization of gases in the E layer above the poles produce the visual display known as 'aurora' ("Northern Lights").  Pointing antennas at the aurora front permit oblique paths to distant stations.*

**B-007-7-8 (2) Where in the ionosphere does auroral activity occur?**

1. At F-region height

**2. At E-region height**

3. In the equatorial band

4. At D-region height

*> key word:  AURORA.  The arrival of high-energy particles from the Sun (e.g., after a solar flare) disturb the Earth's magnetic field (a geomagnetic storm).  The resulting unusual ionization of gases in the E layer above the poles produce the visual display known as 'aurora' ("Northern Lights").  Pointing antennas at the aurora front permit oblique paths to distant stations.*

**B-007-7-9 (3) Which emission modes are best for auroral propagation?**

1. RTTY and AM

2. FM and CW

**3. CW and SSB**

4. SSB and FM

*> The unstable front of the aurora and ensuing scattering of the radio wave make for distorted signals, only the smaller bandwidth signals are usable.*

**B-007-7-10 (2) Excluding enhanced propagation modes, what is the approximate range of normal VHF tropospheric propagation?**

1. 2400 km (1500 miles)

**2. 800 km (500 miles)**

3. 3200 km (2000 miles)

4. 1600 km (1000 miles)

*> Except for 'Tropo Ducting', common troposcatter (scattering through the troposphere) opens VHF paths out to 500 km for well-equipped stations (800 at the most). 'Tropospheric Ducting' (where a wave gets caught between sandwiched air masses during a 'temperature inversion') permit distances beyond 800 km.*

**B-007-7-11 (2) What effect is responsible for propagating a VHF signal over 800 km (500 miles)?**

1. Faraday rotation

**2. Tropospheric ducting**

3. D-region absorption

4. Moon bounce

*> Except for 'Tropo Ducting', common troposcatter (scattering through the troposphere) opens VHF paths out to 500 km for well-equipped stations (800 at the most). 'Tropospheric Ducting' (where a wave gets caught between sandwiched air masses during a 'temperature inversion') permit distances beyond 800 km.*

**B-007-8-1 (1) What kind of propagation would best be used by two stations within each other's skip zone on a certain frequency?**

**1. Scatter-mode**

2. Sky-wave

3. Ducting

4. Ground-wave

*> "Beyond Ground Wave and too close for normal Sky Wave" is the 'Skip Zone', a zone of silence. The only explanation for propagation into the Skip Zone is HF SCATTER.*

**B-007-8-2 (3) If you receive a weak, distorted signal from a distance, and close to the maximum usable frequency, what type of propagation is probably occurring?**

1. Ground-wave

2. Line-of-sight

**3. Scatter**

4. Ducting

*> key words: WEAK, DISTORTED. Signals propagated via 'HF Scatter' have a characteristic weak and distorted (hollow, echo-like) sound. The distortion is caused by multi-path effects. Unlike simple refraction, where the entire signal changes direction, scattering splits the signal in many directions (thus explaining the weakness).*

**B-007-8-3 (2) What is a characteristic of HF scatter signals?**

1. Reversed modulation

**2. A wavering sound**

3. Reversed sidebands

4. High intelligibility

*> key words: SCATTER, WAVERING. Signals propagated via 'HF Scatter' have a characteristic weak and distorted (hollow, echo-like) sound. The distortion is caused by multi-path effects. Unlike simple refraction, where the entire signal changes direction, scattering splits the signal in many directions (thus explaining the weakness).*

**B-007-8-4 (1) What makes HF scatter signals often sound distorted?**

**1. Energy scattered into the skip zone through several radio-wave paths**

2. Auroral activity and changes in the earth's magnetic field

3. Propagation through ground waves that absorb much of the signal

4. The state of the E-region at the point of refraction

*> key words: SCATTER, DISTORTED. Signals propagated via 'HF Scatter' have a characteristic weak and distorted (hollow, echo-like) sound. The distortion is caused by multi-path effects. Unlike simple refraction, where the entire signal changes direction, scattering splits the signal in many directions (thus explaining the weakness).*

**B-007-8-5 (2) Why are HF scatter signals usually weak?**

1. Propagation through ground waves absorbs most of the signal energy

**2. Only a small part of the signal energy is scattered into the skip zone**

3. The F region of the ionosphere absorbs most of the signal energy

4. Auroral activity absorbs most of the signal energy

*> key words: SCATTER, WEAK. Signals propagated via 'HF Scatter' have a characteristic weak and distorted (hollow, echo-like) sound. The distortion is caused by multi-path effects. Unlike simple refraction, where the entire signal changes direction, scattering splits the signal in many directions (thus explaining the weakness).*

**B-007-8-6 (3) What type of radio-wave propagation allows a signal to be detected at a distance too far for ground-wave propagation but too near for normal sky-wave propagation?**

1. Short-path skip

2. Sporadic-E skip

**3. Scatter**

4. Ground wave

*> "Beyond Ground Wave and too close for normal Sky Wave" is the 'Skip Zone', a zone of silence. The only explanation for propagation into the Skip Zone is HF SCATTER.*

**B-007-8-7 (4) When does scatter propagation on the HF bands most often occur?**

1. When the sunspot cycle is at a minimum and D-region absorption is high

2. At night

3. When the F1 and F2 regions are combined

**4. When communicating on frequencies above the maximum usable frequency (MUF)**

*> 'HF Scatter' is frequently observed on paths where the MUF for the target location has not quite risen to the operating frequency. Communication with unusual locations or via unusual paths (side scatter, back scatter) become possible because of the different path angles to those locations. ARRL Handbook (1965): "Even though the operating frequency is above the MUF for a given distance, it is usually possible to hear signals from the skip zone. This phenomenon, called back scatter, is caused by reflections from distances beyond the skip zone."*

**B-007-8-8 (4) Which of the following IS NOT a scatter mode?**

1. Meteor scatter

2. Tropospheric scatter

3. Ionospheric scatter

**4. Absorption scatter**

*> Meteor Scatter (bouncing signals off the ionized trails left by meteors), Troposcatter (scattering by layers of varying humidity content in the lower atmosphere) and Ionospheric Scatter (through irregularities, turbulence or stratification in the ionospheric layers) are all known scatter modes.*

**B-007-8-9 (2) Meteor scatter is most effective on what band?**

1. 40 metres

**2. 6 metres**

3. 15 metres

4. 160 metres

*> 30 MHz to 100 MHz is the range where 'Meteor Scatter' is most effective. This makes the 6m amateur band (50 MHz to 54 MHz) the band of choice for Meteor Scatter.*

**B-007-8-10 (3) Which of the following IS NOT a scatter mode?**

1. Side scatter

2. Back scatter

**3. Inverted scatter**

4. Forward scatter

*> key word: NOT. Scattering has to do with dispersing in many DIRECTIONS. 'Side Scatter', 'Back Scatter' and ' Forward Scatter' are valid paths.*

**B-007-8-11 (1) In which frequency range is meteor scatter most effective for extended-range communication?**

**1. 30 - 100 MHz**

2. 10 - 30 MHz

3. 3 - 10 MHz

4. 100 - 300 MHz

*> 30 MHz to 100 MHz is the range where 'Meteor Scatter' is most effective.  This makes the 6m amateur band (50 MHz to 54 MHz) the band of choice for Meteor Scatter.*

# Interference and Suppression

**B-008-1-1 (3) What is meant by receiver overload?**

1. Interference caused by turning the volume up too high

2. Too much current from the power supply

**3. Interference caused by strong signals from a nearby transmitter**

4. Too much voltage from the power supply

*> 'Receiver Overload', also known as 'Front-End Overload' or 'RF Overload', is a problem where the early stages of a receiver (i.e., RF amplifier or Mixer) are overwhelmed by some strong nearby transmitter. For example, TV reception is affected by an HF transmitter. In the case of 'Overload', the exact transmit frequency does not seem to matter: the effect is the same for a broad range of transmit frequencies. This contrasts with 'Harmonics' where a multiple of a given transmit frequency is the cause of the interference.*

**B-008-1-2 (3) What is one way to tell if radio frequency interference to a receiver is caused by front-end overload?**

1. If grounding the receiver makes the problem worse

2. If connecting a low pass filter to the receiver greatly cuts down the interference

**3. If the interference is about the same no matter what frequency is used for the transmitter**

4. If connecting a low pass filter to the transmitter greatly cuts down the interference

*> 'Receiver Overload', also known as 'Front-End Overload' or 'RF Overload', is a problem where the early stages of a receiver (i.e., RF amplifier or Mixer) are overwhelmed by some strong nearby transmitter. For example, TV reception is affected by an HF transmitter. In the case of 'Overload', the exact transmit frequency does not seem to matter: the effect is the same for a broad range of transmit frequencies. This contrasts with 'Harmonics' where a multiple of a given transmit frequency is the cause of the interference*.

**B-008-1-3 (3) If a neighbour reports television interference whenever you transmit, no matter what band you use, what is probably the cause of the interference?**

1. Incorrect antenna length

2. Receiver VR tube discharge

**3. Receiver overload**

4. Too little transmitter harmonic suppression

*> 'Receiver Overload', also known as 'Front-End Overload' or 'RF Overload', is a problem where the early stages of a receiver (i.e., RF amplifier or Mixer) are overwhelmed by some strong nearby transmitter. For example, TV reception is affected by an HF transmitter. In the case of 'Overload', the exact transmit frequency does not seem to matter: the effect is the same for a broad range of transmit frequencies. This contrasts with 'Harmonics' where a multiple of a given transmit frequency is the cause of the interference.*

**B-008-1-4 (1) What type of filter should be connected to a TV receiver as the first step in trying to prevent RF overload from an amateur HF station transmission?**

**1. High-pass**

2. Low-pass

3. Band-pass

4. No filter

*> key words: TV, OVERLOAD, HF. TV Channels begin at 54 MHz; the HF range ends at 30 MHz. To prevent overload to a TV receiver from an HF transmitter, a HIGH-PASS filter can be installed on the TV receiver to allow higher frequencies through while attenuating lower frequencies. The object of the filtering being to keep the HF signals out of the TV receiver.*

**B-008-1-5 (2) When the signal from a transmitter overloads the audio stages of a broadcast receiver, the transmitted signal:**

1. is distorted on voice peaks

**2. can appear wherever the receiver is tuned**

3. appears only on one frequency

4. appears only when a station is tuned

*> key words: AUDIO STAGES. Such interference is termed 'Audio Rectification', a special case of overload. If you recall your receiver block diagrams, Audio Amplification is the last stage of the receiver. If an interfering signal finds its way into the audio stages, it does not matter to which frequency the 'front-end' is tuned.*

**B-008-1-6 (2) Cross-modulation of a broadcast receiver by a nearby transmitter would be noticed in the receiver as:**

1. interference only when a broadcast signal is tuned

**2. the undesired signal in the background of the desired signal**

3. distortion on transmitted voice peaks

4. interference continuously across the dial

*> key words:  IN THE BACKGROUND.  'Cross-Modulation' is a special case of overload:  it too supposes a strong undesired signal.  The peculiarity of 'Cross-Modulation' is that the two signals are heard at the same time:  the one you want AND the undesired interfering signal.*

**B-008-1-7 (4) What is cross-modulation interference?**

1. Interference between two transmitters of different modulation type

2. Interference caused by audio rectification in the receiver preamplifier

3. Harmonic distortion of the transmitted signal

**4. Modulation from an unwanted signal is heard in addition to the desired signal**

*> key words:  IN ADDITION.  'Cross-Modulation' is a special case of overload:  it too supposes a strong undesired signal.  The peculiarity of 'Cross-Modulation' is that the two signals are heard at the same time:  the one you want AND the undesired interfering signal.  "2" makes no sense as it ties 'Audio Rectification' (overload of the back-end audio stages) with 'Front-End Overload' (overload of the first RF Amplifier or Mixer).*

**B-008-1-8 (2) What is the term used to refer to the condition where the signals from a very strong station are superimposed on other signals being received?**

1. Receiver quieting

**2. Cross-modulation interference**

3. Capture effect

4. Intermodulation distortion

*> key word:  SUPERIMPOSED.  'Cross-Modulation' is a special case of overload:  it too supposes a strong undesired signal.  The peculiarity of 'Cross-Modulation' is that the two signals are heard at the same time:  the one you want AND the undesired interfering signal.*

**B-008-1-9 (4) What is the result of cross-modulation?**

1. Receiver quieting

2. A decrease in modulation level of transmitted signals

3. Inverted sidebands in the final stage of the amplifier

**4. The modulation of an unwanted signal is heard on the desired signal**

*> 'Cross-Modulation' is a special case of overload:  it too supposes a strong undesired signal.  The peculiarity of 'Cross-Modulation' is that the two signals are heard at the same time:  the one you want AND the undesired interfering signal.*

**B-008-1-10 (3) If a television receiver suffers from cross-modulation when a nearby amateur transmitter is operating at 14 MHz, which of the following cures might be effective?**

1. A low pass filter attached to the antenna output of the transmitter

2. A high pass filter attached to the antenna output of the transmitter

**3. A high pass filter attached to the antenna input of the television**

4. A low pass filter attached to the antenna input of the television

*> 'Cross-Modulation' is a special case of overload.  TV Channels begin at 54 MHz; the HF range ends at 30 MHz.  To prevent overload to a TV receiver from an HF transmitter, a HIGH-PASS filter can be installed on the TV receiver to allow higher frequencies through while attenuating lower frequencies.  The object of the filtering being to keep the HF signals out of the TV receiver.*

**B-008-1-11 (1) How can cross-modulation be reduced?**

**1. By installing a suitable filter at the receiver**

2. By using a better antenna

3. By increasing the receiver RF gain while decreasing the AF gain

4. By adjusting the passband tuning

*> 'Cross-Modulation' is a special case of overload.  TV Channels begin at 54 MHz; the HF range ends at 30 MHz.  To prevent overload to a TV receiver from an HF transmitter, a HIGH-PASS filter can be installed on the TV receiver to allow higher frequencies through while attenuating lower frequencies.  The object of the filtering being to keep the HF signals out of the TV receiver.*

**B-008-2-1 (3) What devices would you install to reduce or eliminate audio-frequency interference to home entertainment systems?**

1. Bypass resistors

2. Metal-oxide varistors

**3. Bypass capacitors**

4. Bypass inductors

*> A frequent cause of interference to home entertainment systems is that the long speaker leads act as antennas and bring radio energy into the audio amplifier stages. 'Bypass Capacitors', connected between the speaker leads and the chassis, can*

*provide a low impedance path to divert the RF energy without affecting audio frequencies.*

**B-008-2-2 (3) What should be done if a properly operating amateur station is the cause of interference to a nearby telephone?**

1. Ground and shield the local telephone distribution amplifier

2. Stop transmitting whenever the telephone is in use

**3. Ask the telephone company to install RFI filters**

4. Make internal adjustments to the telephone equipment

*> "RFI Filter" = Radio-Frequency Interference Filter. Much like home entertainment systems with their long speaker leads acting as antennas, wire-line telephones with cabling running through the house and streets can easily pickup RF energy. Filters installed at the telephone set usually solve the problem. [Note: this question was written up at a time when phone companies necessarily owned all telephone equipment. Today, you may have to get and install the filters yourself.]*

**B-008-2-3 (3) What sound is heard from a public-address system if audio rectification of a nearby single-sideband phone transmission occurs?**

1. Clearly audible speech from the transmitter's signals

2. On-and-off humming or clicking

**3. Distorted speech from the transmitter's signals**

4. A steady hum whenever the transmitter's carrier is on the air

*> Much like home entertainment systems, the long speaker leads in a Public-Address sound system act as antennas and bring radio energy into the audio amplifier stages. Interfering SSB signals are heard as distorted speech in the sound system. Interfering CW signals are heard as on-and-off clicks or hum.*

**B-008-2-4 (4) What sound is heard from a public-address system if audio rectification of a nearby CW transmission occurs?**

1. Audible, possibly distorted speech

2. Muffled, severely distorted speech

3. A steady whistling

**4. On-and-off humming or clicking**

*> Much like home entertainment systems, the long speaker leads in a Public-Address sound system act as antennas and bring radio energy into the audio amplifier stages.*

*Interfering SSB signals are heard as distorted speech in the sound system. Interfering CW signals are heard as on-and-off clicks or hum.*

**B-008-2-5 (3) How can you minimize the possibility of audio rectification of your transmitter's signals?**

1. By installing bypass capacitors on all power supply rectifiers

2. By using CW emission only

**3. By ensuring that all station equipment is properly grounded**

4. By using a solid-state transmitter

*> Properly grounding all station equipment minimizes the radiation of RF which may couple into house wiring and affect other devices in the household.*

**B-008-2-6 (2) An amateur transmitter is being heard across the entire dial of a broadcast receiver. The receiver is most probably suffering from:**

1. harmonics interference from the transmitter

**2. cross-modulation or audio rectification in the receiver**

3. poor image rejection

4. splatter from the transmitter

*> key words: ACROSS THE DIAL. This has to be a case of OVERLOAD. 'Cross-Modulation' and 'Audio Rectification' are two manifestations of overload. All other choices would not appear 'across the dial': an 'Harmonic' falls on a precise frequency, 'Splatter' is limited to a few kilohertz.*

**B-008-2-7 (1) Cross-modulation is usually caused by:**

**1. rectification of strong signals**

2. harmonics generated at the transmitter

3. improper filtering in the transmitter

4. lack of receiver sensitivity and selectivity

*> key words: STRONG SIGNAL. 'Cross-Modulation' is a special case of overload. Nothing needs to be wrong with the affected receiver or the transmitter. It is simply that the receiver is exposed to more radio energy that it can handle. 'Rectification' leads to 'detection': any semiconductor device may start acting like a diode and perform the two functions.*

**B-008-2-8 (4) What device can be used to minimize the effect of RF pickup by audio wires connected to stereo speakers, intercom amplifiers, telephones, etc.?**

1. Magnet

2. Attenuator

3. Diode

**4. Ferrite core**

*> Long wires act as antennas.  The wires should be kept as short as possible.  Winding speaker or telephone wires around a 'ferrite core' makes an Inductor (a coil).  Inductors oppose (inductive reactance) high frequency AC signals such as Radio-Frequency.  The 'ferrite core' makes for more inductance even with only a few turns of wire.  Ferrite is a material with electromagnetic properties.*

**B-008-2-9 (1) Stereo speaker leads often act as antennas to pick up RF signals. What is one method you can use to minimize this effect?**

**1. Shorten the leads**

2. Lengthen the leads

3. Connect the speaker through an audio attenuator

4. Connect a diode across the speaker

*> Long wires act as antennas.  The wires should be kept as short as possible.  Winding speaker or telephone wires around a 'ferrite core' makes an Inductor (a coil).  Inductors oppose (inductive reactance) high frequency AC signals such as Radio-Frequency.  The 'ferrite core' makes for more inductance even with only a few turns of wire.  Ferrite is a material with electromagnetic properties.*

**B-008-2-10 (3) One method of preventing RF from entering a stereo set through the speaker leads is to wrap each of the speaker leads around a:**

1. copper bar

2. iron bar

**3. ferrite core**

4. wooden dowel

*> Long wires act as antennas.  The wires should be kept as short as possible.  Winding speaker or telephone wires around a 'ferrite core' makes an Inductor (a coil).  Inductors oppose (inductive reactance) high frequency AC signals such as Radio-Frequency.  The 'ferrite core' makes for more inductance even with only a few turns of wire.  Ferrite is a material with electromagnetic properties.*

**B-008-2-11 (4) Stereo amplifiers often have long leads which pick up transmitted signals because they act as:**

1. transmitting antennas

2. RF attenuators

3. frequency discriminators

**4. receiving antennas**

*> Long wires act as antennas.  The wires should be kept as short as possible. Winding speaker or telephone wires around a 'ferrite core' makes an Inductor (a coil).  Inductors oppose (inductive reactance) high frequency AC signals such as Radio-Frequency.  The 'ferrite core' makes for more inductance even with only a few turns of wire.  Ferrite is a material with electromagnetic properties.*

**B-008-3-1 (2) How can you prevent key-clicks?**

1. By increasing power

**2. By using a key-click filter**

3. By using a better power supply

4. By sending CW more slowly

*> 'Key-Clicks' in a CW Transmitter have two manifestations.  One in DISTANT receivers, caused by "too sharp rise and decay times of the carrier", results in clicks being heard several kHz away from your operating frequency.  The other in NEARBY broadcast receivers, caused by "sparking at the key contacts", results in clicks being heard just like from other electrical devices where currents are switched.  A simple 'key-click filter' comprises a choke (an inductor) and a capacitor inserted at the telegraph key.*

**B-008-3-2 (1) If someone tells you that signals from your hand-held transceiver are interfering with other signals on a frequency near yours, what may be the cause?**

**1. Your hand-held may be transmitting spurious emissions**

2. You may need a power amplifier for your hand-held

3. Your hand-held may have chirp from weak batteries

4. You may need to turn the volume up on your hand-held

*> 'Spurious Emissions':  signals radiated at a frequency other than the operating frequency.  Two examples:  'Harmonics', energy at integer multiples of the operating frequency.  'Parasitic Oscillations', unwanted oscillation above or below the operating frequency.  Proper adjustment and shielding prevent this whole class of transmitter problems called 'Spurious Emissions'.*

**B-008-3-3 (3) If your transmitter sends signals outside the band where it is transmitting, what is this called?**

1. Side tones

2. Transmitter chirping

**3. Spurious emissions**

4. Off-frequency emissions

*> 'Spurious Emissions': signals radiated at a frequency other than the operating frequency. Two examples: 'Harmonics', energy at integer multiples of the operating frequency. 'Parasitic Oscillations', unwanted oscillation above or below the operating frequency. Proper adjustment and shielding prevent this whole class of transmitter problems called 'Spurious Emissions'.*

**B-008-3-4 (2) What problem may occur if your transmitter is operated without the cover and other shielding in place?**

1. It may transmit a weak signal

**2. It may transmit spurious emissions**

3. It may interfere with other stations operating near its frequency

4. It may transmit a chirpy signal

*> 'Spurious Emissions': signals radiated at a frequency other than the operating frequency. Two examples: 'Harmonics', energy at integer multiples of the operating frequency. 'Parasitic Oscillations', unwanted oscillation above or below the operating frequency. Proper adjustment and shielding prevent this whole class of transmitter problems called 'Spurious Emissions'.*

**B-008-3-5 (1) In Morse code transmission, local RF interference (key-clicks) is produced by:**

**1. the making and breaking of the circuit at the Morse key**

2. frequency shifting caused by poor voltage regulation

3. the power amplifier, and is caused by high frequency parasitics

4. poor waveshaping caused by a poor voltage regulator

*> key word: LOCAL. 'Key-Clicks' in a CW Transmitter have two manifestations. One in DISTANT receivers, caused by "too sharp rise and decay times of the carrier", results in clicks being heard several kHz away from your operating frequency. The other in NEARBY broadcast receivers, caused by "sparking at the key contacts", results in clicks being heard just like from other electrical devices where currents are*

*switched.  A simple 'key-click filter' comprises a choke (an inductor) and a capacitor inserted at the telegraph key.*

**B-008-3-6 (2) Key-clicks, heard from a Morse code transmitter at a distant receiver, are the result of:**

1. power supply hum modulating the carrier

**2. too sharp rise and decay times of the carrier**

3. sparks emitting RF from the key contacts

4. changes in oscillator frequency on keying

*> key word:  DISTANT.  'Key-Clicks' in a CW Transmitter have two manifestations. One in DISTANT receivers, caused by "too sharp rise and decay times of the carrier", results in clicks being heard several kHz away from your operating frequency.  The other in NEARBY broadcast receivers, caused by "sparking at the key contacts", results in clicks being heard just like from other electrical devices where currents are switched.  A simple 'key-click filter' comprises a choke (an inductor) and a capacitor inserted at the telegraph key.*

**B-008-3-7 (2) In a Morse code transmission, local RF interference (key-clicks) is produced by:**

1. shift in frequency when keying the transmitter

**2. sparking at the key contacts**

3. sudden movement in the receiver loudspeaker

4. poor shaping of the waveform

*> key word:  LOCAL.  'Key-Clicks' in a CW Transmitter have two manifestations. One in DISTANT receivers, caused by "too sharp rise and decay times of the carrier", results in clicks being heard several kHz away from your operating frequency.  The other in NEARBY broadcast receivers, caused by "sparking at the key contacts", results in clicks being heard just like from other electrical devices where currents are switched.  A simple 'key-click filter' comprises a choke (an inductor) and a capacitor inserted at the telegraph key.*

**B-008-3-8 (1) Key-clicks can be suppressed by:**

**1. inserting a choke and a capacitor at the key**

2. turning the receiver down

3. regulating the oscillator supply voltage

4. using a choke in the RF power output

*> 'Key-Clicks' in a CW Transmitter have two manifestations.  One in DISTANT receivers, caused by "too sharp rise and decay times of the carrier", results in clicks being heard several kHz away from your operating frequency.  The other in NEARBY broadcast receivers, caused by "sparking at the key contacts", results in clicks being heard just like from other electrical devices where currents are switched.  A simple 'key-click filter' comprises a choke (an inductor) and a capacitor inserted at the telegraph key.*

**B-008-3-9 (4) A parasitic oscillation:**

1. is generated by parasitic elements of a Yagi beam

2. does not cause any radio interference

3. is produced in a transmitter oscillator stage

**4. is an unwanted signal developed in a transmitter**

*> 'Spurious Emissions':  signals radiated at a frequency other than the operating frequency.  Two examples:  'Harmonics', energy at integer multiples of the operating frequency.  'Parasitic Oscillations', unwanted oscillation above or below the operating frequency.  Proper adjustment and shielding prevent this whole class of transmitter problems called 'Spurious Emissions'.*

**B-008-3-10 (1) Parasitic oscillations in the RF power amplifier stage of a transmitter may be found:**

**1. at high or low frequencies**

2. on harmonic frequencies

3. at high frequencies only

4. at low frequencies only

*> 'Spurious Emissions':  signals radiated at a frequency other than the operating frequency.  Two examples:  'Harmonics', energy at integer multiples of the operating frequency.  'Parasitic Oscillations', unwanted oscillation above or below the operating frequency.  Proper adjustment and shielding prevent this whole class of transmitter problems called 'Spurious Emissions'.*

**B-008-3-11 (3) Transmitter RF amplifiers can generate parasitic oscillations:**

1. on VHF frequencies only

2. on the transmitter fundamental frequency

**3. on either side of the transmitter frequency**

4. on harmonics of the transmitter frequency

*> 'Spurious Emissions': signals radiated at a frequency other than the operating frequency. Two examples: 'Harmonics', energy at integer multiples of the operating frequency. 'Parasitic Oscillations', unwanted oscillation above or below the operating frequency. Proper adjustment and shielding prevent this whole class of transmitter problems called 'Spurious Emissions'.*

**B-008-4-1 (2) If a neighbour reports television interference on one or two channels only when you transmit on 15 metres, what is probably the cause of the interference?**

1. De ionization of the ionosphere near your neighbour's TV antenna

**2. Harmonic radiation from your transmitter**

3. TV receiver front-end overload

4. Too much low pass filtering on the transmitter

*> Unlike 'Overload' where a TV receiver is likely to be affected by a broad range of transmitter frequencies, interference to a single TV channel from a specific band of transmitter frequencies suggests 'Harmonics' are at play. 'Harmonic Radiation' entails integer (whole-number) multiples of the operating frequency. Apart from proper adjustment of the transmitter, a 'Low-Pass' filter with a cutoff frequency of 30 MHz helps curb harmonics out of an HF transmitter. Three times 21 MHz (15m) affects TV channel 3 [60-66MHz]. Four times 21 MHz affects channel 6 [82-88MHz].*

**B-008-4-2 (1) What is meant by harmonic radiation?**

**1. Unwanted signals at frequencies which are multiples of the fundamental (chosen) frequency**

2. Unwanted signals that are combined with a 60-Hz hum

3. Unwanted signals caused by sympathetic vibrations from a nearby transmitter

4. Signals which cause skip propagation to occur

*> 'Harmonic Radiation' entails integer (whole-number) multiples of the operating frequency. Harmonics result in 'out-of-band' signals: you may be heard on another harmonically-related band (e.g., 3 times 7 MHz (40m) = 21 MHz (15m) ) or interfere with other services. Apart from proper adjustment of the transmitter, a 'Low-Pass' filter with a cutoff frequency of 30 MHz helps curb harmonics out of an HF transmitter.*

**B-008-4-3 (4) Why is harmonic radiation from an amateur station not wanted?**

1. It uses large amounts of electric power

2. It may cause sympathetic vibrations in nearby transmitters

3. It may cause auroras in the air

**4. It may cause interference to other stations and may result in out-of-band signals**

*> 'Harmonic Radiation' entails integer (whole-number) multiples of the operating frequency.  Harmonics result in 'out-of-band' signals:  you may be heard on another harmonically-related band (e.g., 3 times 7 MHz (40m) = 21 MHz (15m) ) or interfere with other services.  Apart from proper adjustment of the transmitter, a 'Low-Pass' filter with a cutoff frequency of 30 MHz helps curb harmonics out of an HF transmitter.*

**B-008-4-4 (2) What type of interference may come from a multi-band antenna connected to a poorly tuned transmitter?**

1. Parasitic excitation

**2. Harmonic radiation**

3. Intermodulation

4. Auroral distortion

*> key words:  POORLY TUNED TX, MULTI-BAND ANTENNA.  Improper adjustment of the transmitter may cause it to put out 'Harmonic Radiation' (integer multiples of the operating frequency).  The multi-band antenna will readily radiate these signals at other frequencies.*

**B-008-4-5 (3) If you are told your station was heard on 21 375 kHz, but at the time you were operating on 7125 kHz, what is one reason this could happen?**

1. Your transmitter's power-supply filter choke was bad

2. You were sending CW too fast

**3. Your transmitter was radiating harmonic signals**

4. Your transmitter's power-supply filter capacitor was bad

*> 'Harmonic Radiation' entails integer (whole-number) multiples of the operating frequency.  Harmonics result in 'out-of-band' signals:  you may be heard on another harmonically-related band (e.g., 3 times 7 MHz (40m) = 21 MHz (15m) ) or interfere with other services.  Apart from proper adjustment of the transmitter, a 'Low-Pass' filter with a cutoff frequency* of 30 MHz helps curb harmonics out of an HF transmitter.

**B-008-4-6 (4) What causes splatter interference?**

1. Keying a transmitter too fast

2. Signals from a transmitter's output circuit are being sent back to its input circuit

3. The transmitting antenna is the wrong length

**4. Overmodulation of a transmitter**

*> 'Splatter': "unwanted emission immediately outside the normal necessary bandwidth", in other words, you interfere with other stations on adjacent frequencies. Too much microphone gain or too much speech processing may lead to 'Overmodulation', a major cause of 'Splatter'. Overmodulation can also force the Linear Power Amplifier into a non linear zone of operation which leads to 'Harmonic Radiation'.*

**B-008-4-7 (3) Your amateur radio transmitter appears to be creating interference to the television on channel 3 (60-66 MHz) when you are transmitting on the 15 metre band. Other channels are not affected. The most likely cause is:**

1. no high-pass filter on the TV

2. a bad ground at the transmitter

**3. harmonic radiation from the transmitter**

4. front-end overload of the TV

*> 'Harmonic Radiation' (integer multiples of the operating frequency). Harmonics of several amateur HF frequencies fall right on TV channels: Three times 21 MHz (15m) affects TV channel 3 [60-66MHz]. Four times 21 MHz affects channel 6 [82-88MHz]. Twice 28 MHz (10m) affects channel 2 [54-60MHz].*

**B-008-4-8 (3) One possible cause of TV interference by harmonics from an SSB transmitter is from "flat topping" - driving the final amplifier into non-linear operation. The most appropriate remedy for this is:**

1. retune transmitter output

2. use another antenna

**3. reduce microphone gain**

4. reduce oscillator output

*> 'Splatter': "unwanted emission immediately outside the normal necessary bandwidth", in other words, you interfere with other stations on adjacent frequencies. Too much microphone gain or too much speech processing may lead to 'Overmodulation', a major cause of 'Splatter'. Overmodulation can also force the Linear Power Amplifier into a non linear zone of operation which leads to 'Harmonic Radiation'.*

**B-008-4-9 (4) In a transmitter, excessive harmonics are produced by:**

1. low SWR

2. resonant circuits

3. a linear amplifier

**4. overdriven stages**

*> 'Splatter': "unwanted emission immediately outside the normal necessary bandwidth", in other words, you interfere with other stations on adjacent frequencies. Too much microphone gain or too much speech processing may lead to 'Overmodulation', a major cause of 'Splatter'. Overmodulation can also force the Linear Power Amplifier into a non linear zone of operation which leads to 'Harmonic Radiation'.*

**B-008-4-10 (3) An interfering signal from a transmitter is found to have a frequency of 57 MHz (TV Channel 2 is 54 - 60 MHz). This signal could be the:**

1. crystal oscillator operating on its fundamental

2. seventh harmonic of an 80 metre transmission

**3. second harmonic of a 10 metre transmission**

4. third harmonic of a 15 metre transmission

*> 'Harmonic Radiation' (integer multiples of the operating frequency). Harmonics of several amateur HF frequencies fall right on TV channels: Three times 21 MHz (15m) affects TV channel 3 [60-66MHz]. Four times 21 MHz affects channel 6 [82-88MHz]. Twice 28 MHz (10m) affects channel 2 [54-60MHz].*

**B-008-4-11 (1) Harmonics may be produced in the RF power amplifier of a transmitter if:**

**1. excessive drive signal is applied to it**

2. the output tank circuit is not correctly tuned

3. the oscillator frequency is unstable

4. modulation is applied to more than one stage

*> 'Splatter': "unwanted emission immediately outside the normal necessary bandwidth", in other words, you interfere with other stations on adjacent frequencies. Too much microphone gain or too much speech processing may lead to 'Overmodulation', a major cause of 'Splatter'. Overmodulation can also force the Linear Power Amplifier into a non linear zone of operation which leads to 'Harmonic Radiation'.*

**B-008-5-1 (1) What type of filter might be connected to an amateur HF transmitter to cut down on harmonic radiation?**

**1. A low pass filter**

2. A key-click filter

3. A high pass filter

4. A CW filter

*> key word:  HARMONIC.  'Harmonic Radiation' (integer multiples of the operating frequency).  A 'Low-Pass' filter with a cutoff frequency of 30 MHz helps curb harmonics out of an HF transmitter.  The 'Key-Click' filter (choke/capacitor) is used at the telegraph key to prevent 'key-click' interference.  A 'High-Pass' filter is used on a TV receiver to prevent overload from an HF transceiver.*

**B-008-5-2 (3) Why do modern HF transmitters have a built-in low pass filter in their RF output circuits?**

1. To reduce fundamental radiation

2. To reduce low frequency interference to other amateurs

**3. To reduce harmonic radiation**

4. To reduce RF energy below a cut-off point

*> key words:  LOW-PASS.  'Harmonic Radiation' (integer multiples of the operating frequency).  A 'Low-Pass' filter with a cutoff frequency of 30 MHz helps curb harmonics out of an HF transmitter.*

**B-008-5-3 (4) What circuit blocks RF energy above and below a certain limit?**

1. A high pass filter

2. An input filter

3. A low pass filter

**4. A band pass filter**

*> key words:  BLOCKS ABOVE AND BELOW.  A 'Band-Pass' filter lets frequencies between two design limits pass unaffected.  Outside of that range, attenuation is present.  "1" A 'High-Pass' filter passes frequencies above a certain limit but attenuates lower frequencies.  "3" A 'Low-Pass' filter lets frequencies below its cutoff frequency pass unimpeded but attenuates higher frequencies.*

**B-008-5-4 (3) What should be the impedance of a low pass filter as compared to the impedance of the transmission line into which it is inserted?**

1. Substantially lower

2. Twice the transmission line impedance

**3. About the same**

4. Substantially higher

*> All filters are designed with a given impedance in mind. The source impedance and load impedance must match the design criteria of the filter for it to function optimally.*

**B-008-5-5 (4) In order to reduce the harmonic output of a high frequency (HF) transmitter, which of the following filters should be installed at the transmitter?**

1. Band pass

2. High pass

3. Rejection

**4. Low pass**

*> key word: HARMONIC. 'Harmonic Radiation' (integer multiples of the operating frequency). A 'Low-Pass' filter with a cutoff frequency of 30 MHz helps curb harmonics out of an HF transmitter. A 'High-Pass' filter is used on a TV receiver to prevent overload from an HF transceiver.*

**B-008-5-6 (2) To reduce harmonic output from a transmitter, you would put a _____________ in the transmission line as close to the transmitter as possible.**

1. high pass filter

**2. low pass filter**

3. band reject filter

4. wave trap

*> key word: HARMONIC. 'Harmonic Radiation' (integer multiples of the operating frequency). A 'Low-Pass' filter with a cutoff frequency of 30 MHz helps curb harmonics out of an HF transmitter. A 'High-Pass' filter is used on a TV receiver to prevent overload from an HF transceiver.*

**B-008-5-7 (4) To reduce energy from an HF transmitter getting into a television set, you would place a _____________ as close to the TV as possible.**

1. low pass filter

2. wave trap

3. band reject filter

**4. high pass filter**

*> A 'High-Pass' filter is used on a TV receiver to prevent overload from an HF transceiver.  "1" A 'Low-Pass' filter with a cutoff frequency of 30 MHz helps curb harmonics out of an HF transmitter.*

**B-008-5-8 (3) A band pass filter will:**

1. attenuate high frequencies but not low

2. pass frequencies each side of a band

**3. allow only certain frequencies through**

4. stop frequencies in a certain band

*> A 'Band-Pass' filter lets frequencies between two design limits pass unaffected. Outside of that range, attenuation is present.  "1" A 'Low-Pass' filter lets frequencies below its cutoff frequency pass unimpeded but attenuates higher frequencies.  "2", "4" A 'Band-Reject' filter passes everything BUT a narrow range of frequencies.*

**B-008-5-9 (2) A band reject filter will:**

1. allow only two frequencies through

**2. pass frequencies each side of a band**

3. pass frequencies below 100 MHz

4. stop frequencies each side of a band

*> A 'Band-Reject' filter passes everything BUT a narrow range of frequencies.  "3" A 'Low-Pass' filter lets frequencies below its cutoff frequency pass unimpeded but attenuates higher frequencies.  "4" A 'Band-Pass' filter lets frequencies between two design limits pass unaffected.  Outside of that range, attenuation is present.*

**B-008-5-10 (3) A high pass filter would normally be fitted:**

1. between microphone and speech amplifier

2. at the Morse key or keying relay in a transmitter

**3. at the antenna terminals of the TV receiver**

4. between transmitter output and feed line

*> A 'High-Pass' filter is used on a TV receiver to prevent overload from an HF transceiver.  "2" A 'Key-Click' filter (choke/capacitor) is used at the telegraph key to prevent 'key-click' interference.  "4" A 'Low-Pass' filter with a cutoff frequency of 30 MHz helps curb harmonics out of an HF transmitter.*

**B-008-5-11 (3) A low pass filter suitable for a high frequency transmitter would:**

1. pass audio frequencies above 3 kHz

2. attenuate frequencies below 30 MHz

**3. attenuate frequencies above 30 MHz**

4. pass audio frequencies below 3 kHz

*> key words:  HIGH-FREQUENCY.  A 'Low-Pass' filter with a cutoff frequency of 30 MHz helps curb harmonics out of an HF transmitter.  The filter allows frequencies BELOW the cutoff to pass freely but attenuates frequencies above the cutoff.  The HF segment of the radio spectrum spans 3 MHz to 30 MHz*.