

2007 Element 3 General Class Question Pool

(Revised February 23, 2007)

**This is the official release of the 2007 Element 3 Questions pool from the Question Pool Committee of the NCVEC**

This file is normally available to the public in Adobe PDF (Portable Document Format). VECs and other interested parties requiring an editable version of the pool should contact the QPC directly, or check the NCVEC web site at NCVEC.ORG.

**There are 484 questions in the pool.**

Section G7A requires the use of one illustration, a schematic drawing. This drawing is available in JPEG and BMP (Windows Bitmap) versions upon request. The drawing file is published separately. The applicable graphic is identified as G7-1.

As always, VECs are free to correct minor typographical and punctuation errors, including obvious minor omissions. Such corrections must not cause a change in the meaning of a question or any of the proposed answers to that question. Also, since rule citation references are not part of the question itself, but are included only to assist instructors and students when looking up the applicable section of the rules, errors in the reference identifiers are not considered adequate reason for removal of a question from the pool.

**Please note that in this version, question G5B10 and G2C06 have been removed.** Other questions in these sections were not and should not be renumbered.

- Jim, KL7CC  
Chairman, NCVEC QPC

Additional members of the committee:

Roland Anders, K3RA  
Perry Green, WY1O  
Larry Pollock, NB5X

2007 General Class (Element 3) Master syllabus  
Update version, Released February 23,2007

35 Exam questions

**SUBELEMENT G1 - COMMISSION'S RULES [5 Exam Questions - 5 Groups]**

G1A - General class control operator frequency privileges; primary and secondary allocations

G1B - Antenna structure limitations; good engineering and good amateur practice; beacon operation; restricted operation; retransmitting radio signals

G1C - Transmitter power regulations; HF data emission standards

G1D - Volunteer Examiners and Volunteer Examiner Coordinators; temporary identification

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**SUBELEMENT G2 - OPERATING PROCEDURES [6 Exam Questions - 6 Groups]**

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G2B - Operating courtesy; band plans

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G2D - Amateur auxiliary; minimizing Interference; HF operations

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**SUBELEMENT G3 - RADIO WAVE PROPAGATION [3 Exam Questions - 3 Groups]**

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G6A - Resistors; capacitors; inductors

G6B - Rectifiers; solid state diodes and transistors; solar cells; vacuum tubes; batteries

G6C - Analog and digital integrated circuits (IC's); microprocessors; memory; I/O devices; microwave IC's (MMIC's ); display devices

**SUBELEMENT G7 - PRACTICAL CIRCUITS [2 exam question - 2 groups]**

G7A - Power supplies; transmitters and receivers; filters; schematic symbols

G7B - Digital circuits (gates, flip-flops, shift registers); amplifiers and oscillators

**SUBELEMENT G8 - SIGNALS AND EMISSIONS [2 exam questions - 2 groups]**

G8A - Carriers and modulation: AM; FM; single and double sideband ; modulation envelope; deviation; overmodulation

G8B - Frequency mixing; multiplication; HF data communications; bandwidths of various modes

**SUBELEMENT G9 - ANTENNAS [4 exam questions - 4 groups]**

G9A - Antenna feedlines: characteristic impedance, and attenuation; SWR calculation, measurement and effects; matching networks

G9B - Basic antennas

G9C - Directional antennas

G9D - Specialized antennas

**SUBELEMENT G0 - ELECTRICAL AND RF SAFETY [2 Exam Questions - 2 groups]**

G0A - RF safety principles, rules and guidelines; routine station evaluation

G0B - Safety in the ham shack: electrical shock and treatment, grounding, fusing, interlocks, wiring, antenna and tower safety

2007 General Class Questions Pool

This pool is valid for Element 3 exams given on or after July 1, 2007

SUBELEMENT G1 - COMMISSION'S RULES [5 Exam Questions - 5 Groups]

G1A - General class control operator frequency privileges; primary and secondary allocations

G1A01 (C) [97.301(d)]

On which of the following bands is a General Class license holder granted all amateur frequency privileges?

C. 160, 30, 17, 12, and 10 meters

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G1A02 (B) [97.305]

On which of the following bands is phone operation prohibited?

B. 30 meters

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G1A03 (B) [97.305]

On which of the following bands is image transmission prohibited?

B. 30 meters

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G1A04 (D) [97.303(s)]

Which amateur band restricts communication to specific channels, using only USB voice, and prohibits all other modes, including CW and data?

D. 60 meters

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G1A05 (A) [97.301(d)]

Which of the following frequencies is in the General Class portion of the 40 meter band?

A. 7.250 MHz

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G1A06 (D) [97.301(d)]

Which of the following frequencies is in the 12 meter band?

D. 24.940 MHz

~~

G1A07 (C) [97.301(d)]

Which of the following frequencies is within the General class portion of the 75 meter phone band?

C. 3900 kHz

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G1A08 (C) [97.301(d)]

Which of the following frequencies is within the General Class portion of the 20 meter phone band?

C. 14305 kHz

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G1A09 (C) [97.301(d)]

Which of the following frequencies is within the General Class portion of the 80 meter band?

C. 3560 kHz

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G1A10 (C) [97.301(d)]

Which of the following frequencies is within the General Class portion of the 15 meter band?

C. 21300 kHz

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G1A11 (D) [97.301(d)]

Which of the following frequencies is available to a control operator holding a General Class license?

D. All of these answers are correct

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G1A12 (B) [97.301]

When a General Class licensee is not permitted to use the entire voice portion of a particular band, which portion of the voice segment is generally available to them?

B. The upper end

~~

G1A13 (D) [97.303]

Which amateur band is shared with the Citizens Radio Service?

D. None

~~

G1A14 (C) [97.303]

Which of the following applies when the FCC rules designate the amateur service as a secondary user and another service as a primary user on a band?

C. Amateur stations are allowed to use the frequency band only if they do not cause harmful interference to primary users

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G1A15 (D) [97.303]

What must you do if, when operating on either the 30 or 60 meter bands, a station in the primary service interferes with your contact?

D. Stop transmitting at once and/or move to a clear frequency

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G1A16 (A) [97.303(s)]

Which of the following operating restrictions applies to amateur radio stations as a secondary service in the 60 meter band?

A. They must not cause harmful interference to stations operating in other radio services

~~

**G1B - Antenna structure limitations; good engineering and good amateur practice; beacon operation; restricted operation; retransmitting radio signals**

G1B01 (C) [97.15(a)]

What is the maximum height above ground to which an antenna structure may be erected without requiring notification to the FAA and registration with the FCC, provided it is not at or near a public-use airport?

C. 200 feet

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G1B02 (D) [97.203(b)]

With which of the following conditions must beacon stations comply?

D. There must be no more than one beacon signal in the same band from a single location

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G1B03 (A) [97.1(a)(9)]

Which of the following is a purpose of a beacon station as identified in the FCC Rules?

A. Observation of propagation and reception, or other related activities

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G1B04 (A) [97.113(b)]

Which of the following must be true before an amateur station may provide news information to the media during a disaster?

A. The information must directly relate to the immediate safety of human life or protection of property and there is no other means of communication available

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G1B05 (D) [97.113(a)(4),(e)]

When may music be transmitted by an amateur station?

D. When it is an incidental part of a space shuttle or ISS retransmission

~~

G1B06 (B) [97.113(a)(4) and 97.207(f)]

When is an amateur station permitted to transmit secret codes?

B. To control a space station

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G1B07 (B) [97.113(a)(4)]

What are the restrictions on the use of abbreviations or procedural signals in the amateur service?

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

~~

G1B08 (D) [97.113(a)(4), 97.113(e)]

Which of the following is prohibited by the FCC Rules for amateur radio stations?

D. All of these answers are correct

~~

G1B09 (A) [97.113(a)(3)]

When may an amateur station transmit communications in which the licensee or control operator has a pecuniary (monetary) interest?

A. Only when other amateurs are being notified of the sale of apparatus normally used in an amateur station and such activity is not done on a regular basis

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G1B10 (C) [97.203(c)]

What is the power limit for beacon stations?

C. 100 watts PEP output

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G1B11 (C) [97.101(a)]

How does the FCC require an amateur station to be operated in all respects not covered by the Part 97 rules?

C. In conformance with good engineering and good amateur practice

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G1B12 (A) [97.101(a)]

Who or what determines "good engineering and good amateur practice" that apply to operation of an amateur station in all respects not covered by the Part 97 rules?

A. The FCC

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G1B13 (A) [97.121(a)]

What restrictions may the FCC place on an amateur station that is causing interference to a broadcast receiver of good engineering design?

A. Restrict the amateur station operation to times other than 8 pm to 10:30 pm local time every day, as well as on Sundays from 10:30 am to 1 pm local time

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**G1C - Transmitter power regulations; HF data emission standards**

G1C01 (A) [97.313(c)(1)]

What is the maximum transmitting power an amateur station may use on 10.140 MHz?

A. 200 watts PEP output

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G1C02 (C) [97.313(a),(b)]

What is the maximum transmitting power an amateur station may use on the 12 meter band?

C. 1500 watts PEP output

G1C03 (B) [97.313]

What is the maximum transmitting power a General class licensee may use when operating between 7025 and 7125 kHz?

B. 1500 watts PEP output

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G1C04 (A) [97.313]

What limitations, other than the 1500 watt PEP limit, are placed on transmitter power in the 14 MHz band?

A. Only the minimum power necessary to carry out the desired communications should be used

~~

G1C05 (C) [97.313]

What is the maximum transmitting power a station with a General Class control operator may use on the 28 MHz band?

C. 1500 watts PEP output

~~

G1C06 (D) [97.313(b)]

What is the maximum transmitting power an amateur station may use on 1825 kHz?

D. 1500 watts PEP output

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G1C07 (C) [97.303(s)]

Which of the following is a requirement when a station is transmitting on the 60 meter band?

C. Transmissions must not exceed an effective radiated power of 50 Watts PEP referred to a dipole antenna

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G1C08 (D) [97.305(c) and 97.307(f)(3)]

What is the maximum symbol rate permitted for RTTY emissions transmitted on frequency bands below 28 MHz?

D. 300 baud

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G1C09 (C) [97.305(c) and 97.307(f)(5)]

What is the maximum symbol rate permitted for packet emission transmissions on the 2 meter band?

C. 19.6 kilobaud

G1C10 (C) [97.305(c) and 97.307(f)(4)]

What is the maximum symbol rate permitted for RTTY or data emission transmissions on the 10 meter band?

C. 1200 baud

~~

G1C11 (B) [97.305(c) and 97.307(f)(5)]

What is the maximum symbol rate permitted for RTTY or data emission transmissions on the 6 and 2 meter bands?

B. 19.6 kilobaud

~~

G1C12 (A) [97.305(c) and 97.307(f)(5)]

What is the maximum authorized bandwidth for RTTY, data or multiplexed emissions using an unspecified digital code transmitted on the 6 and 2 meter bands?

A. 20 kHz

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G1C13 (A) [97.303s]

What is the maximum bandwidth permitted by FCC rules for amateur radio stations when operating on USB frequencies in the 60-meter band?

A. 2.8 kHz

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**G1D - Volunteer Examiners and Volunteer Examiner Coordinators; temporary identification**

G1D01 (C) [97.119(f)(2)]

What is the proper way to identify when transmitting on General class frequencies if you have a CSCE for the required elements but your upgrade from Technician has not appeared in the ULS database?

C. Give your call sign followed by the words "temporary AG"

G1D02 (C) [97.509(b)(3)(i)]

What license examinations may you administer when you are an accredited VE holding a General Class operator license?

C. Technician

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G1D03 (C) [97.9(b)]

Which of the following band segments may you operate on if you are a Technician Class operator and have a CSCE for General Class privileges?

C. On any General Class band segment

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G1D04 (A) [97.509(a)(b)]

Which of the following are requirements for administering a Technician Class operator examination?

A. At Least three VEC-accredited General Class or higher VEs must be present

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G1D05 (D) [97.509(b)(3)(i)]

Which of the following is sufficient for you to be an administering VE for a Technician Class operator license examination?

D. A FCC General class or higher license and VEC accreditation

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G1D06 (A) [97.119(f)(2)]

When must you add the special identifier "AG" after your call sign if you are a Technician Class licensee and have a CSCE for General Class operator privileges?

A. Whenever you operate using General class frequency privileges

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G1D07 (B) [97.509(h)]

Who is responsible at a Volunteer Exam Session for determining the correctness of the answers on the exam?

B. The administering VEs

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G1D08 (B) [97.509(i)]

What document must be issued to a person that passes an exam element?

B. CSCE

~~

G1D09 (C) [97.3(a)(15)]

How long is a Certificate of Successful Completion of Examination(CSCE)valid for exam element credit?

C. 365 days

~~

G1D10 (B) [97.509(b)(2)]

What is the minimum age that one must be to qualify as an accredited Volunteer Examiner?

B. 18 years

~~

G1D11 (B) [97.509 (b)(3)]

What criteria must be met for a non U.S. citizen to be an accredited Volunteer Examiner?

B. The person must hold a U.S. amateur radio license of General class or above

G1D12 (C) [97.509(b)(1)]

Volunteer Examiners are accredited by what organization?

C. A Volunteer Examiner Coordinator

G1D13 (D) [97.509]

When may you participate as a VE in administering an amateur radio license examination?

D. Once you have been granted your General class license and received your VEC accreditation

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**G1E - Control categories; repeater regulations; harmful interference; third party rules; ITU regions**

G1E01 (A) [97.115(b)(2)]

Which of the following would disqualify a third party from participating in stating a message over an amateur station?

A. The third party is a person previously licensed in the amateur service whose license had been revoked

~~

G1E02 (D) [97.205(a)]

When may a 10 meter repeater retransmit the 2 meter signal from a station having a Technician Class control operator?

D. Only if the 10 meter control operator holds at least a General class license

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G1E03 (A) [97.3(a)(39)]

What kind of amateur station simultaneously retransmits the signals of other stations on another channel?

A. Repeater Station

~~

G1E04 (D) [97.13(b),97.311(b), 97.303]

Which of the following conditions require an amateur radio station to take specific steps to avoid harmful interference to other users or facilities?

D. All of these answers are correct

~~

G1E05 (C) [97.115(a)(2), 97.117]

What types of messages for a third party in another country may be transmitted by an amateur station?

C. Only messages relating to amateur radio or remarks of a personal character, or messages relating to emergencies or disaster relief

G1E06 (A) [97.205(c)]

Which of the following applies in the event of interference between a coordinated repeater and an uncoordinated repeater?

A. The licensee of the non-coordinated repeater has primary responsibility to resolve the interference

~~

G1E07 (C) [97.115(a)(2)]

With which of the following is third-party traffic prohibited, except for messages directly involving emergencies or disaster relief communications?

C. Any country other than the United States, unless there is a third-party agreement in effect with that country

)

~~

G1E08 (B) [97.115(a)(b)]

Which of the following is a requirement for a non-licensed person to communicate with a foreign amateur radio station from a US amateur station at which a licensed control operator is present?

B. The foreign amateur station must be in a country with which the United States has a third party agreement

~~

G1E09 (C) [97.119(b)(2)]

What language must you use when identifying your station if you are using a language other than English in making a contact?

C. English

~~

G1E10 (D) [97.115(a)(2)]

Which of the following is a permissible third party communication during routine amateur radio operations?

D. Sending a message to a third party through a foreign station, as long as that person is a licensed amateur radio operator

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## **SUBELEMENT G2 - OPERATING PROCEDURES [6 Exam Questions - 6 Groups]**

**G2A Phone operating procedures; USB/LSB utilization conventions; procedural signals; breaking into a QSO in progress; VOX operation**

G2A01 (A)

Which sideband is most commonly used for phone communications on the bands above 20 meters?

A. Upper Sideband

G2A02 (B)

Which sideband is commonly used on the 160, 75, and 40 meter bands?

B. Lower Sideband

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G2A03 (A)

Which sideband is commonly used in the VHF and UHF bands?

A. Upper Sideband

~~

G2A04 (A)

Which mode is most commonly used for voice communications on the 17 and 12 meter bands?

A. Upper Sideband

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G2A05 (C)

Which mode of voice communication is most commonly used on the High Frequency Amateur bands?

C. SSB

~~

G2A06 (B)

Which of the following is an advantage when using single sideband as compared to other voice modes on the HF amateur bands?

B. Less bandwidth used and high power efficiency

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G2A07 (B)

Which of the following statements is true of the single sideband (SSB) voice mode?

B. Only one sideband is transmitted; the other sideband and carrier are suppressed

G2A08 (A)

Which of the following statements is true of single sideband (SSB) voice mode?

A. It is a form of amplitude modulation in which one sideband and the carrier are suppressed

~~

G2A09 (D)

Why do most amateur stations use lower sideband on the 160, 75 and 40 meter bands?

D. Current amateur practice is to use lower sideband on these frequency bands

~~

G2A10 (B)

Which of the following statements is true of VOX operation?

B. VOX allows "hands free" operation

~~

G2A11 (D)

Which of the following user adjustable controls are usually associated with VOX circuitry?

D. All of these choices are correct

~~

G2A12 (B)

What is the recommended way to break into a conversation when using phone?

B. Say your call sign during a break between transmissions from the other stations

~~

G2A13 (C)

What does the expression "CQ DX" usually indicate?

C. The caller is looking for any station outside their own country

~~

**G2B - Operating courtesy; band plans**

G2B01 (C)

What action should be taken if the frequency on which a net normally meets is in use just before the net begins?

C. Ask the stations if the net may use the frequency, or move the net to a nearby clear frequency if necessary

~~

G2B02 (A)

What should be done if a net is about to begin on a frequency you and another station are using?

A. Move to a different frequency as a courtesy to the net

~~

G2B03 (C)

What should you do if you notice increasing interference from other activity on a frequency you are using?

C. Move your contact to another frequency

G2B04 (B)

What minimum frequency separation between CW signals should be allowed to minimize interference?

B. 150 to 500 Hz

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G2B05 (B)

What minimum frequency separation between SSB signals should be allowed to minimize interference?

B. Approximately 3 kHz

~~

G2B06 (B)

What minimum frequency separation between 170 Hz shift RTTY signals should be allowed to minimize interference?

B. 250 to 500 Hz

G2B07 (A)

What is a band plan?

A. A voluntary guideline for band use beyond the divisions established by the FCC

G2B08 (A)

What is the "DX window" in a voluntary band plan?

A. A portion of the band that should not be used for contacts between stations within the 48 contiguous United States

~~

G2B09 (D)

What should you do to comply with good amateur practice when choosing a frequency for Slow-Scan TV (SSTV) operation?

D. Follow generally accepted band plans for SSTV operation

~~

G2B10 (D)

What should you do to comply with good amateur practice when choosing a frequency for radio-teletype (RTTY) operation?

D. Follow generally accepted band plans for RTTY operation

~~

G2B11 (D)

What should you do to comply with good amateur practice when choosing a frequency for HF PSK operation?

D. Follow generally accepted band plans for PSK operation

~~

G2B12 (A)

What is a practical way to avoid harmful interference when selecting a frequency to call CQ using phone?

A. Ask if the frequency is in use, say your callsign, and listen for a response

~~

G2B13 (C)

What is a practical way to avoid harmful interference when calling CQ using Morse code or CW?

C. Send "QRL? de" followed by your callsign and listen for a response

~~

## **G2C - Emergencies, including drills and emergency communications**

G2C01 (C) [97.403]

When normal communications systems are not available, what means may an amateur station use to provide essential communications when there is an immediate threat to the safety of human life or the protection of property?

C. Any means of radiocommunication at its disposal

G2C02 (A) [97.407(a)]

Who may be the control operator of an amateur station transmitting in RACES to assist relief operations during a disaster?

A. Only a person holding an FCC issued amateur operator license

~~

G2C03 (D) [97.407(b)]

When may the FCC restrict normal frequency operations of amateur stations participating in RACES?

D. When the President's War Emergency Powers have been invoked

~~

G2C04 (C) [97.405(b)]

When is an amateur station prevented from using any means at its disposal to assist another station in distress?

C. Never

G2C05 (B) [97.403]

What type of transmission would a control operator be making when transmitting out of the amateur band without station identification during a life threatening emergency?

B. An unidentified transmission

~~

G2C07 (B)

What is the first thing you should do if you are communicating with another amateur station and hear a station in distress break in?

B. Acknowledge the station in distress and determine what assistance may be needed

~~

G2C08 (C) [97.405(b)]

When are you prohibited from helping a station in distress?

C. You are never prohibited from helping any station in distress

G2C09 (B) [97.111(a)(2)]

What type of transmissions may an amateur station make during a disaster?

B. Transmissions necessary to meet essential communications needs and to facilitate relief actions

G2C10 (C)

Which emission mode must be used to obtain assistance during a disaster?

C. Any mode

G2C11 (B)

What information should be given to a station answering a distress transmission?

B. The location and nature of the emergency

G2C12 (A)

What frequency should be used to send a distress call?

A. Whatever frequency has the best chance of communicating the distress message

#### **G2D - Amateur auxiliary; minimizing Interference; HF operations**

G2D01 (A)

What is the Amateur Auxiliary to the FCC?

A. Amateur volunteers who are formally enlisted to monitor the airwaves for rules violations

G2D02 (B)

What are the objectives of the Amateur Auxiliary?

B. To encourage amateur self-regulation and compliance with the rules

G2D03 (B)

What skills learned during "Fox Hunts" are of help to the Amateur Auxiliary?

B. Direction-finding skills used to locate stations violating FCC Rules

G2D04 (B)

What is an azimuthal projection map?

B. A world map projection centered on a particular location

G2D05 (A)

What is the most useful type of map to use when orienting a directional HF antenna toward a distant station?

A. Azimuthal projection

G2D06 (C)

How is a directional antenna pointed when making a "long-path" contact with another station?

C. 180 degrees from its short-path heading

G2D07 (B) [97.103b]

Which of the following information must a licensee retain as part of their station records?

B. Antenna gain calculations or manufacturer's data for antennas used on 60 meters

G2D08 (D)

Why do many amateurs keep a log even though the FCC doesn't require it?

D. To help with a reply if the FCC requests information on who was control operator of your station at a given date and time

~~

G2D09 (D)

What information is traditionally contained in a station log?

D. All of these choices are correct

~~

G2D10 (B)

What is QRP operation?

B. Low power transmit operation, typically about 5 watts

G2D11 (C)

Which HF antenna would be the best to use for minimizing interference?

C. A unidirectional antenna

G2D12 (A) [97.303s]

Which of the following is required by the FCC rules when operating in the 60 meter band?

A. If you are using other than a dipole antenna, you must keep a record of the gain of your antenna

## **G2E - Digital operating: procedures, procedural signals and common abbreviations**

G2E01 (D)

Which mode should be selected when using a SSB transmitter with an Audio Frequency Shift Keying (AFSK) RTTY signal?

D. LSB

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G2E02 (A)

How many data bits are sent in a single PSK31 character?

A. The number varies

G2E03 (C)

What part of a data packet contains the routing and handling information?

C. Header

G2E04 (B)

Which of the following 20 meter band segments is most often used for most data transmissions?

B. 14.070 - 14.100 MHz

G2E05 (C)

Which of the following describes Baudot RTTY?

C. 5-bit code, with additional start and stop bits

G2E06 (B)

What is the most common frequency shift for RTTY emissions in the amateur HF bands?

B. 170 Hz

G2E07 (B)

What does the abbreviation "RTTY" stand for?

B. Radio-Teletype

G2E08 (A)

What segment of the 80 meter band is most commonly used for data transmissions?

A. 3570 - 3600 kHz

~~

G2E09 (D)

Where are PSK signals generally found on the 20 meter band?

D. Around 14.070 MHz

~~

G2E10 (D)

What is a major advantage of MFSK16 compared to other digital modes?

D. It offers good performance in weak signal environment without error correction

~~

G2E11 (B)

What does the abbreviation "MFSK" stand for?

B. Multi (or Multiple) Frequency Shift Keying

**G2F - CW operating procedures and procedural signals, Q signals and common abbreviations; full break in**

G2F01 (D)

Which of the following describes full break-in telegraphy (QSK)?

D. Incoming signals are received between transmitted code character elements

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G2F02 (A)

What should you do if a CW station sends "QRS" when using Morse code?

A. Send slower

G2F03 (C)

What does it mean when a CW operator sends "KN" at the end of a transmission?

C. Listening only for a specific station or stations

G2F04 (D)

What does it mean when a CW operator sends "CL" at the end of a transmission?

D. Closing station

~~

G2F05 (B)

What is the best speed to use answering a CQ in Morse Code?

B. The speed at which the CQ was sent

G2F06 (D)

What does the term "zero beat" mean in CW operation?

D. Matching the frequency of the transmitting station

~~

G2F07 (A)

When sending CW, what does a "C" mean when added to the RST report?

A. Chirpy or unstable signal

G2F08 (C)

What prosign is sent using CW to indicate the end of a formal message?

C. AR

G2F09 (C)

What does the Q signal "QSL" mean when operating CW?

C. I acknowledge receipt

G2F10 (B)

What does the Q signal "QRQ" mean when operating CW?

B. Send faster

G2F11 (D)

What does the Q signal "QRV" mean when operating CW?

D. I am ready to receive messages

~~

**SUBELEMENT G3 - RADIO WAVE PROPAGATION [3 Exam Questions - 3 Groups]**

**G3A - Sunspots and solar radiation; ionospheric disturbances; propagation forecasting and indices**

G3A01 (A)

What can be done at an amateur station to continue communications during a sudden ionospheric disturbance?

A. Try a higher frequency

G3A02 (B)

What effect does a Sudden Ionospheric Disturbance (SID) have on the daytime ionospheric propagation of HF radio waves?

B. It disrupts signals on lower frequencies more than those on higher frequencies

G3A03 (C)

How long does it take the increased ultraviolet and X-ray radiation from solar flares to affect radio-wave propagation on the Earth?

C. Approximately 8 minutes

G3A04 (B)

What is measured by the solar flux index?

B. The radio energy emitted by the sun

G3A05 (D)

What is the solar-flux index?

D. A measure of solar activity at 10.7 cm

~~

G3A06 (D)

What is a geomagnetic disturbance?

D. A significant change in the Earth's magnetic field over a short period of time

~~

G3A07 (A)

Which latitudes have propagation paths that are more sensitive to geomagnetic disturbances?

A. Those greater than 45 degrees North or South latitude

G3A08 (B)

What can be an effect of a geomagnetic storm on radio-wave propagation?

B. Degraded high-latitude HF propagation

G3A09 (C)

What is the effect on radio communications when sunspot numbers are high?  
C. Long-distance communication in the upper HF and lower VHF range is enhanced

G3A10 (A)

What is the sunspot number?  
A. A measure of solar activity based on counting sunspots and sunspot groups

G3A11 (D)

How long is the typical sunspot cycle?  
D. Approximately 11 years

~~

G3A12 (B)

What is the K-index?  
B. A measure of the short term stability of the Earth's magnetic field

G3A13 (C)

What is the A-index?  
C. An indicator of the long term stability of the Earth's geomagnetic field

G3A14 (B)

How are radio communications usually affected by the charged particles that reach the Earth from solar coronal holes?  
B. HF communications are disturbed

G3A15 (D)

How long does it take charged particles from Coronal Mass Ejections to affect radio-wave propagation on the Earth?  
D. 20 to 40 hours

~~

G3A16 (A)

What is a possible benefit to radio communications resulting from periods of high geomagnetic activity?  
A. Aurora that can reflect VHF signals

G3A17 (D)

At what point in the solar cycle does the 20 meter band usually support worldwide propagation during daylight hours?  
D. At any point in the solar cycle

~~

G3A18 (C)

If the HF radio-wave propagation (skip) is generally good on the 24-MHz and 28-MHz bands for several days, when might you expect a similar condition to occur?  
C. 28 days later

G3A19 (D)

Which frequencies are least reliable for long distance communications during periods of low solar activity?  
D. Frequencies above 20 MHz

~~

**G3B - Maximum Usable Frequency; Lowest Usable Frequency; propagation "hops"**

G3B01 (B)

Which band should offer the best chance for a successful contact if the maximum usable frequency (MUF) between the two stations is 22 MHz?  
B. 15 meters

G3B02 (C)

Which band should offer the best chance for a successful contact if the maximum usable frequency (MUF) between the two stations is 16 MHz?

C. 20 meters

G3B03 (A)

Which of the following guidelines should be selected for lowest attenuation when transmitting on HF?

A. Select a frequency just below the MUF

G3B04 (A)

What is a reliable way to determine if the maximum usable frequency (MUF) is high enough to support 28-MHz propagation between your station and Western Europe?

A. Listen for signals on a 28 MHz international beacon

G3B05 (A)

What usually happens to radio waves with frequencies below the maximum usable frequency (MUF) when they are sent into the ionosphere?

A. They are bent back to the Earth

G3B06 (C)

What usually happens to radio waves with frequencies below the lowest usable frequency (LUF)?

C. They are completely absorbed by the ionosphere

G3B07 (A)

What does LUF stand for?

A. The Lowest Usable Frequency for communications between two points

G3B08 (B)

What does MUF stand for?

B. The Maximum Usable Frequency for communications between two points

G3B09 (C)

What is the maximum distance along the Earth's surface that is normally covered in one hop using the F2 region?

C. 2,500 miles

G3B10 (B)

What is the maximum distance along the Earth's surface that is normally covered in one hop using the E region?

B. 1,200 miles

G3B11 (A)

What happens to HF propagation when the lowest usable frequency (LUF) exceeds the maximum usable frequency (MUF)?

A. No HF radio frequency will support communications over the path

G3B12 (D)

What factors affect the maximum usable frequency (MUF)?

D. All of these choices are correct

~~

G3B13 (D)

How might a sky-wave signal sound if it arrives at your receiver by both short path and long path propagation?

D. A well-defined echo can be heard

~~

G3B14 (A)

Which of the following is a good indicator of the possibility of sky-wave propagation on the 6 meter band?

A. Short hop sky-wave propagation on the 10 meter band

**G3C - Ionospheric layers; critical angle and frequency; HF scatter; Near Vertical Incidence Sky waves**

G3C01 (A)

Which of the following ionospheric layers is closest to the surface of the Earth?

A. The D layer

G3C02 (A)

When can the F2 region be expected to reach its maximum height at your location?

A. At noon during the summer

G3C03 (C)

Why is the F2 region mainly responsible for the longest distance radio wave propagation?

C. Because it is the highest ionospheric region

G3C04 (D)

What does the term "critical angle" mean as used in radio wave propagation?

D. The highest takeoff angle that will return a radio wave to the Earth under specific ionospheric conditions

~~

G3C05 (C)

Why is long distance communication on the 40, 60, 80 and 160 meter bands more difficult during the day?

C. The D layer absorbs these frequencies during daylight hours

G3C06 (B)

What is a characteristic of HF scatter signals?

B. They have a wavering sound

G3C07 (D)

What makes HF scatter signals often sound distorted?

D. Energy is scattered into the skip zone through several radio wave paths

~~

G3C08 (A)

Why are HF scatter signals in the skip zone usually weak?

A. Only a small part of the signal energy is scattered into the skip zone

G3C09 (B)

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?

B. Scatter

G3C10 (D)

Which of the following might be an indication that signals heard on the HF bands are being received via scatter propagation?

D. The signal is heard on a frequency above the maximum usable frequency

~~

G3C11 (A)

Which of the following is true about ionospheric absorption near the maximum usable frequency (MUF)?

A. Absorption will be minimum

G3C12 (D)

Which ionospheric layer is the most absorbent of long skip signals during daylight hours on frequencies below 10 MHz?

D. The D layer

~~

G3C13 (B)

What is Near Vertical Incidence Sky-wave (NVIS) propagation?

B. Short distance HF propagation using high elevation angles

G3C14 (B)

Which of the following antennas will be most effective for skip communications on 40 meters during the day?

B. A horizontal dipole placed between 1/8 and 1/4 wavelength above the ground

#### **G4 - AMATEUR RADIO PRACTICES [5 Questions - 5 groups]**

##### **G4A - Two-tone Test; amplifier tuning and neutralization; DSP**

G4A01 (B)

Which of the following is one use for a DSP in an amateur station?

B. To remove noise from received signals

G4A02 (B)

Which of the following instruments may be used to measure the output of a single-sideband transmitter when performing a two-tone test of amplitude linearity?

B. An oscilloscope

G4A03 (D)

Which of the following is needed for a DSP IF filter?

D. All of the these answers are correct

~~

G4A04 (A)

Which of the following is an advantage of a receiver IF filter created with a DSP as compared to an analog filter?

A. A wide range of filter bandwidths and shapes can be created

G4A05 (B)

How is DSP filtering accomplished?

B. By converting the signal from analog to digital and using digital processing

G4A06 (B)

What reading on the plate current meter of a vacuum tube RF power amplifier indicates correct adjustment of the plate tuning control?

B. A pronounced dip

G4A07 (D)

What is the correct adjustment for the "Load" or "Coupling" control of a vacuum tube RF power amplifier?

D. Maximum power output without exceeding maximum allowable plate current

~~

G4A08 (C)

Which of the following techniques is used to neutralize an RF amplifier?

C. Negative feedback

G4A09 (B)

What does a neutralizing circuit do in an RF amplifier?

B. It cancels the effects of positive feedback

G4A10 (B)

What is the reason for neutralizing the final amplifier stage of a transmitter?

B. To eliminate self oscillations

G4A11 (A)

What type of transmitter performance does a two-tone test analyze?

A. Linearity

G4A12 (B)

What type of signals are used to conduct a two-tone test?

B. Two non-harmonically related audio signals

G4A13 (B)

Which of the following performs automatic notching of interfering carriers?

B. A DSP filter

#### **G4B - Test and monitoring equipment**

G4B01 (D)

What item of test equipment contains horizontal and vertical channel amplifiers?

D. An oscilloscope

~~

G4B02 (D)

Which of the following is an advantage of an oscilloscope versus a digital voltmeter?

D. Complex waveforms can be measured

~~

G4B03 (D)

How would a signal tracer normally be used?

D. To identify an inoperative stage in a receiver

~~

G4B04 (C)

How is a noise bridge normally used?

C. It is connected between a receiver and an antenna of unknown impedance and is adjusted for minimum noise

G4B05 (A)

Which of the following is the best instrument to use to check the keying waveform of a CW transmitter?

A. A monitoring oscilloscope

G4B06 (D)

What signal source is connected to the vertical input of a monitoring oscilloscope when checking the quality of a transmitted signal?

D. The attenuated RF output of the transmitter

~~

G4B07 (C)

What is an advantage of a digital voltmeter as compared to an analog voltmeter?

C. Significantly better precision for most uses

G4B08 (A)

What instrument may be used to monitor relative RF output when making antenna and transmitter adjustments?

A. A field-strength meter

G4B09 (C)

How much must the power output of a transmitter be raised to change the "S" meter reading on a distant receiver from S8 to S9?

C. Approximately 4 times

G4B10 (B)

Which of the following can be determined with a field strength meter?

B. The radiation pattern of an antenna

G4B11 (A)

Which of the following might be a use for a field strength meter?

A. Close-in radio direction-finding

G4B12 (B)

What is one way a noise bridge might be used?

B. Pre-tuning an antenna tuner

G4B13 (A)

What is one measurement that can be made with a dip meter?

A. The resonant frequency of a circuit

G4B14 (C)

Which of the following must be connected to an antenna analyzer when it is being used for SWR measurements?

C. Antenna and feedline

G4B15 (A)

Which of the following can be measured with a directional wattmeter?

A. Standing Wave Ratio

G4B16 (D)

Why is high input impedance desirable for a voltmeter?

D. It decreases the loading on circuits being measured

~~

#### **G4C - Interference with consumer electronics; grounding**

G4C01 (B)

Which of the following might be useful in reducing RF interference to audio-frequency devices?

B. Bypass capacitor

G4C02 (B)

Which of the following should be installed if a properly operating amateur station is interfering with a nearby telephone?

B. An RFI filter at the affected telephone

G4C03 (C)

What sound is heard from a public-address system if there is interference from a nearby single-sideband phone transmitter?

C. Distorted speech

G4C04 (A)

What is the effect on a public-address system if there is interference from nearby CW transmitter?

A. On-and-off humming or clicking

G4C05 (D)

What might be the problem if you receive an RF burn when touching your equipment while transmitting on a HF band, assuming the equipment is connected to a ground rod?

D. The ground wire is resonant

~~

G4C06 (D)

Which of the following is an important reason to have a good station ground?

D. All of these answers are correct

~~

G4C07 (A)

What is one good way to avoid stray RF energy in an amateur station?

A. Keep the station's ground wire as short as possible

G4C08 (A)

Which of the following is a reason to place ferrite beads around audio cables to reduce common mode RF interference?

A. They act as a series inductor

G4C09 (C)

Which of the following statements about station grounding is true?

C. RF hot spots can occur in a station located above the ground floor if the equipment is grounded by a long ground wire

G4C10 (C)

Which of the following is covered in the National Electrical Code?

C. Electrical safety inside the ham shack

G4C11 (A)

Which of the following can cause unintended rectification of RF signal energy and can result in interference to your station as well as nearby radio and TV receivers?

A. Induced currents in conductors that are in poor electrical contact

G4C12 (C)

What is one cause of broadband radio frequency interference at an amateur radio station?

C. Arcing at a poor electrical connection

G4C13 (D)

How can a ground loop be avoided?

D. Connect all ground conductors to a single point

~~

#### **G4D - Speech processors; S meters; common connectors**

G4D01 (D)

What is the reason for using a properly adjusted speech processor with a single sideband phone transmitter?

D. It improves signal intelligibility at the receiver

~~

G4D02 (B)

Which of the following describes how a speech processor affects a transmitted single sideband signal?

B. It increases the average power

G4D03 (D)

Which of the following can be the result of an incorrectly adjusted speech processor?

D. All of these answers are correct

~~

G4D04 (C)

What does an S-meter measure?

C. Received signal strength

G4D05 (D)

How does an S-meter reading of 20 db over S-9 compare to an S-9 signal, assuming a properly calibrated S meter?

D. It is 100 times stronger

~~

G4D06 (A)

Where is an S-meter generally found?

A. In a receiver

G4D07 (A)

Which of the following describes a Type-N connector?

A. A moisture resistant RF connector useful to 10 GHz

G4D08 (D)

Which of the following connectors would be a good choice for a serial data port?

D. DB-9

~~

G4D09 (C)

Which of these connector types is commonly used for RF service at frequencies up to 150 MHz?

C. UHF

G4D10 (C)

Which of these connector types is commonly used for audio signals in amateur radio stations?

C. RCA Phono

G4D11 (B)

What is the main reason to use keyed connectors over non-keyed types?

B. Reduced chance of damage due to incorrect mating

#### **G4E - HF mobile radio installations; emergency and battery powered operation**

G4E01 (D)

Which of the following emission types are permissible while operating HF mobile?

D. All of these choices are correct

~~

G4E02 (C)

What is alternator whine?

C. A tone or buzz in transmitted or received audio that varies with engine speed

G4E03 (A)

Which of the following power connections would be the best for a 100-watt HF mobile installation?

A. A direct, fused connection to the battery using heavy gauge wire

G4E04 (B)

Why is it best NOT to draw the DC power for a 100-watt HF transceiver from an automobile's cigarette lighter socket?

B. The socket's wiring may be inadequate for the current being drawn by the transceiver

G4E05 (C)

Which of the following most limits the effectiveness of an HF mobile transceiver operating in the 75 meter band?

C. The HF mobile antenna system

G4E06 (A)

Which of the following is true of an emergency generator installation?

A. The generator should be located in a well ventilated area

G4E07 (C)

When might a lead-acid storage battery give off explosive hydrogen gas?

C. When being charged

G4E08 (A)

What is the name of the process by which sunlight is changed directly into electricity?

A. Photovoltaic conversion

G4E09 (B)

What is the approximate open-circuit voltage from a modern, well illuminated photovoltaic cell?

B. 0.5 VDC

G4E10 (A)

Which of these materials is used as the active element of a solar cell?

A. Doped Silicon

G4E11 (C)

Which of the following is a disadvantage to using wind power as the primary source of power for an emergency station?

C. A large energy storage system is needed to supply power when the wind is not blowing

G4E12 (A)

Which of the following is a primary reason for not placing a gasoline-fueled generator inside an occupied area?

A. Danger of carbon monoxide poisoning

G4E13 (A)

Why would it be unwise to power your station by back feeding the output of a gasoline generator into your house wiring by connecting the generator through an AC wall outlet?

A. It might present a hazard for electric company workers

#### **SUBELEMENT G5 - ELECTRICAL PRINCIPLES [3 exam questions - 3 groups]**

#### **G5A - Resistance; reactance; inductance; capacitance; impedance; impedance matching**

G5A01 (C)

What is impedance?

C. The opposition to the flow of current in an AC circuit

G5A02 (B)

What is reactance?

B. Opposition to the flow of alternating current caused by capacitance or inductance

G5A03 (D)

Which of the following causes opposition to the flow of alternating current in an inductor?

D. Reactance

~~

G5A04 (C)

Which of the following causes opposition to the flow of alternating current in a capacitor?

C. Reactance

G5A05 (D)

How does a coil react to AC?

D. As the frequency of the applied AC increases, the reactance increases

~~

G5A06 (A)

How does a capacitor react to AC?

A. As the frequency of the applied AC increases, the reactance decreases

G5A07 (D)

What happens when the impedance of an electrical load is equal to the internal impedance of the power source?

D. The source can deliver maximum power to the load

~~

G5A08 (A)

Why is impedance matching important?

A. So the source can deliver maximum power to the load

G5A09 (B)

What unit is used to measure reactance?

B. Ohm

G5A10 (B)

What unit is used to measure impedance?

B. Ohm

G5A11 (A)

Why should core saturation of a conventional impedance matching transformer be avoided?

A. Harmonics and distortion could result

G5A12 (B)

What is one reason to use an impedance matching transformer?

B. To maximize the transfer of power

G5A13 (D)

Which of the following devices can be used for impedance matching at radio frequencies?

D. All of these choices are correct

~~

G5A14 (A)

Which of the following describes one method of impedance matching between two AC circuits?

A. Insert an LC network between the two circuits

**G5B - The Decibel; current and voltage dividers; electrical power calculations; sine wave root-mean-square (RMS) values; PEP calculations**

G5B01 (B)

A two-times increase or decrease in power results in a change of how many dB?

B. 3 dB

G5B02 (C)

How does the total current relate to the individual currents in each branch of a parallel circuit?

C. It equals the sum of the currents through each branch

G5B03 (B)

How many watts of electrical power are used if 400 VDC is supplied to an 800-ohm load?

B. 200 watts

G5B04 (A)

How many watts of electrical power are used by a 12-VDC light bulb that draws 0.2 amperes?

A. 2.4 watts

G5B05 (A)

How many watts are being dissipated when a current of 7.0 milliamperes flows through 1.25 kilohms?

A. Approximately 61 milliwatts

G5B06 (B)

What is the output PEP from a transmitter if an oscilloscope measures 200 volts peak-to-peak across a 50-ohm dummy load connected to the transmitter output?

B. 100 watts

G5B07 (C)

Which measurement of an AC signal is equivalent to a DC voltage of the same value?

C. The RMS value

G5B08 (D)

What is the peak-to-peak voltage of a sine wave that has an RMS voltage of 120 volts?

D. 339.4 volts

~~

G5B09 (B)

What is the RMS voltage of sine wave with a value of 17 volts peak?

B. 12 volts

G5B11 (B)

What is the ratio of peak envelope power to average power for an unmodulated carrier?

B. 1.00

G5B12 (B)

What would be the voltage across a 50-ohm dummy load dissipating 1200 watts?  
B. 245 volts

G5B13 (C)  
What percentage of power loss would result from a transmission line loss of 1 dB?  
C. 20.5 %

G5B14 (B)  
What is the output PEP from a transmitter if an oscilloscope measures 500 volts peak-to-peak across a 50-ohm resistor connected to the transmitter output?  
B. 625 watts

G5B15 (B)  
What is the output PEP of an unmodulated carrier if an average reading wattmeter connected to the transmitter output indicates 1060 watts?  
B. 1060 watts

### **G5C - Resistors, capacitors, and inductors in series and parallel; transformers**

G5C01 (C)  
What causes a voltage to appear across the secondary winding of a transformer when an AC voltage source is connected across its primary winding?  
C. Mutual inductance

G5C02 (B)  
Where is the source of energy normally connected in a transformer?  
B. To the primary winding

G5C03 (A)  
What is current in the primary winding of a transformer called if no load is attached to the secondary?  
A. Magnetizing current

G5C04 (C)  
What is the total resistance of three 100-ohm resistors in parallel?  
C. 33.3 ohms

G5C05 (C)  
What is the value of each resistor if three equal value resistors in parallel produce 50 ohms of resistance, and the same three resistors in series produce 450 ohms?  
C. 150 ohms

G5C06 (C)  
What is the voltage across a 500-turn secondary winding in a transformer if the 2250-turn primary is connected to 120 VAC?  
C. 26.7 volts

G5C07 (A)  
What is the turns ratio of a transformer used to match an audio amplifier having a 600-ohm output impedance to a speaker having a 4-ohm impedance?  
A. 12.2 to 1

G5C08 (D)  
What is the equivalent capacitance of two 5000 picofarad capacitors and one 750 picofarad capacitor connected in parallel?  
D. 10750 picofarads  
~~

G5C09 (C)  
What is the capacitance of three 100 microfarad capacitors connected in series?

C. 33.3 microfarads

G5C10 (C)

What is the inductance of three 10 millihenry inductors connected in parallel?

C. 3.3 millihenrys

G5C11 (C)

What is the inductance of a 20 millihenry inductor in series with a 50 millihenry inductor?

C. 70 millihenrys

G5C12 (B)

What is the capacitance of a 20 microfarad capacitor in series with a 50 microfarad capacitor?

B. 14.3 microfarads

G5C13 (C)

What component should be added to a capacitor in a circuit to increase the circuit capacitance?

C. A capacitor in parallel

G5C14 (D)

What component should be added to an inductor in a circuit to increase the circuit inductance?

D. An inductor in series

~~

G5C15 (A)

What is the total resistance of a 10 ohm, a 20 ohm, and a 50 ohm resistor in parallel?

A. 5.9 ohms

G5C16 (B)

What component should be added to an existing resistor in a circuit to increase circuit resistance?

B. A resistor in series

#### **SUBELEMENT G6 - CIRCUIT COMPONENTS [3 exam question - 3 groups]**

##### **G6A - Resistors; capacitors; inductors**

G6A01 (C)

What will happen to the resistance if the temperature of a carbon resistor is increased?

C. It will change depending on the resistor's temperature coefficient rating

G6A02 (D)

What type of capacitor is often used in power-supply circuits to filter the rectified AC?

D. Electrolytic

~~

G6A03 (D)

Which of the following is the primary advantage of ceramic capacitors?

D. Comparatively low cost

~~

G6A04 (C)

Which of the following is an advantage of an electrolytic capacitor?

C. High capacitance for given volume

G6A05 (A)

Which of the following is one effect of lead inductance in a capacitor used at VHF and above?

A. Effective capacitance may be reduced

G6A06 (B)

What is the main disadvantage of using a conventional wire-wound resistor in a resonant circuit?

B. The resistor's inductance could detune the circuit

G6A07 (D)

What is an advantage of using a ferrite core with a toroidal inductor?

D. All of these choices are correct

~~

G6A08 (C)

How should two solenoid inductors be placed so as to minimize their mutual inductance?

C. With their winding axes at right angles to each another

G6A09 (B)

Why might it be important to minimize the mutual inductance between two inductors? B.To reduce or eliminate unwanted coupling

G6A10 (B)

What is an effect of inter-turn capacitance in an inductor?

B. The inductor may become self resonant at some frequencies

G6A11 (D)

What is the common name for a capacitor connected across a transformer secondary that is used to absorb transient voltage spikes?

D. Suppressor capacitor

~~

G6A12 (D)

What is the common name for an inductor used to help smooth the DC output from the rectifier in a conventional power supply?

D. Filter choke

~~

G6A13 (B)

What type of component is a thermistor?

B. A device having a controlled change in resistance with temperature variations

**G6B - Rectifiers; solid state diodes and transistors; solar cells; vacuum tubes; batteries**

G6B01 (C)

What is the peak-inverse-voltage rating of a rectifier?

C. The maximum voltage the rectifier will handle in the non-conducting direction

G6B02 (A)

What are the two major ratings that must not be exceeded for silicon-diode rectifiers?

A. Peak inverse voltage; average forward current

G6B03 (B)

What is the approximate junction threshold voltage of a germanium diode?

B. 0.3 volts

G6B04 (C)

When two or more diodes are connected in parallel to increase current handling capacity, what is the purpose of the resistor connected in series with each diode?  
C. The resistors ensure that one diode doesn't carry most of the current

G6B05 (C)

What is the approximate junction threshold voltage of a silicon diode?  
C. 0.7 volts

G6B06 (A)

Which of the following is an advantage of using a Schottky diode in an RF switching circuit as compared to a standard silicon diode?  
A. Lower capacitance

G6B07 (A)

What are the stable operating points for a bipolar transistor that is used as a switch in a logic circuit?  
A. Its saturation and cut-off regions

G6B08 (D)

Why is it often necessary to insulate the case of a large power transistor?  
D. To avoid shorting the collector or drain voltage to ground  
~~

G6B09 (B)

Which of the following describes the construction of a MOSFET?  
B. The gate is separated from the channel with a thin insulating layer

G6B10 (A)

Which element of a triode vacuum tube is used to regulate the flow of electrons between cathode and plate?  
A. Control grid

G6B11 (B)

Which of the following solid state devices is most like a vacuum tube in its general characteristics?  
B. An FET

G6B12 (A)

What is the primary purpose of a screen grid in a vacuum tube?  
A. To reduce grid-to-plate capacitance

G6B13 (B)

What is an advantage of the low internal resistance of Nickel Cadmium batteries?  
B. High discharge current

G6B14 (C)

What is the minimum allowable discharge voltage for maximum life of a standard 12 volt lead acid battery?  
C. 10.5 volts

G6B15 (D)

When is it acceptable to recharge a carbon-zinc primary cell?

D. Never

~~

G6B16 (C)

Which of the following is a rechargeable battery?

C. Nickel Metal Hydride

**G6C - Analog and digital integrated circuits (IC's); microprocessors; memory; I/O devices; microwave IC's (MMIC's ); display devices**

G6C01 (D)

Which of the following is most often provided as an analog integrated circuit?

D. Linear voltage regulator

~~

G6C02 (C)

Which of the following is the most commonly used digital logic family of integrated circuits?

C. CMOS

G6C03 (A)

Which of the following is an advantage of CMOS Logic integrated circuits compared to TTL logic circuits?

A. Low power consumption

G6C04 (B)

What is meant by the term ROM?

B. Read Only Memory

G6C05 (C)

What is meant when memory is characterized as "non-volatile"?

C. The stored information is maintained even if power is removed

G6C06 (D)

Which type of integrated circuit is an operational amplifier?

D. Analog

~~

G6C07 (D)

What is one disadvantage of an incandescent indicator compared to a LED?

D. High power consumption

~~

G6C08 (D)

How is an LED biased when emitting light?

D. Forward Biased

~~

G6C09 (A)

Which of the following is a characteristic of a liquid crystal display?

A. It requires ambient or back lighting

G6C10 (B)

What is meant by the term MMIC?

B. Monolithic Microwave Integrated Circuit

G6C11 (B)

What is a microprocessor?

B. A miniature computer on a single integrated circuit chip

G6C12 (A)

What two devices in an amateur radio station might be connected using a USB interface?

A. Computer and transceiver

**SUBELEMENT G7 - PRACTICAL CIRCUITS [2 exam question - 2 groups]**

**G7A - Power supplies; transmitters and receivers; filters, schematic drawing symbols**

G7A01 (B)

What safety feature does a power-supply bleeder resistor provide?

B. It discharges the filter capacitors

G7A02 (D)

What components are used in a power-supply filter network?

D. Capacitors and inductors

~~

G7A03 (C)

What should be the minimum peak-inverse-voltage rating of the rectifier in a full-wave power supply?

C. Double the normal peak output voltage of the power supply

G7A04 (D)

What should be the approximate minimum peak-inverse-voltage rating of the rectifier in a half-wave power supply?

D. Two times the normal peak output voltage of the power supply

~~

G7A05 (B)

What should be the impedance of a low-pass filter as compared to the impedance of the transmission line into which it is inserted?

B. About the same

G7A06 (B)

Which of the following might be used to process signals from the balanced modulator and send them to the mixer in a single-sideband phone transmitter?

B. Filter

G7A07 (D)

Which circuit is used to combine signals from the carrier oscillator and speech amplifier and send the result to the filter in a typical single-sideband phone transmitter?

D. Balanced modulator

~~

G7A08 (C)

What circuit is used to process signals from the RF amplifier and local oscillator and send the result to the IF filter in a superheterodyne receiver?

C. Mixer

G7A09 (D)

What circuit is used to process signals from the IF amplifier and BFO and send the result to the AF amplifier in a single-sideband phone superheterodyne receiver?

D. Product detector

~~

G7A10 (A)

What is an advantage of a crystal controlled transmitter?

A. Stable output frequency

G7A11 (C)

What is the simplest combination of stages that can be combined to implement a superheterodyne receiver?

C. HF oscillator, mixer, detector

G7A12 (D)

What type of receiver is suitable for CW and SSB reception but does not require a mixer stage or an IF amplifier?

D. A direct conversion receiver

~~

G7A13 (D)

What type of circuit is used in many FM receivers to convert signals coming from the IF amplifier to audio?

D. Discriminator

~~

G7A14 (A)

Which of the following is a desirable characteristic for capacitors used to filter the DC output of a switching power supply?

A. Low equivalent series resistance

G7A15 (C)

Which of the following is an advantage of a switched-mode power supply as compared to a linear power supply?

C. High frequency operation allows the use of smaller components

G7A16(B)

What portion of the AC cycle is converted to DC by a half-wave rectifier?

B. 180 degrees

G7A17 (D)

What portion of the AC cycle is converted to DC by a full-wave rectifier?

D. 360 degrees

~~

G7A18 (A)

What is the output waveform of an unfiltered full-wave rectifier connected to a resistive load?

A. A series of DC pulses at twice the frequency of the AC input

G7A19 (C)

Which symbol in figure G7-1 represents a fixed resistor?

C. Symbol 3

G7A20 (D)

Which symbol in figure G7-1 represents a single cell battery?

D. Symbol 13

~~

G7A21 (B)

Which symbol in figure G7-1 represents a NPN transistor?

B. Symbol 4

G7A22 (C)

Which symbol in figure G7-1 represents a variable capacitor?

C. Symbol 5

G7A23 (A)

Which symbol in figure G7-1 represents a transformer?

A. Symbol 6

G7A24 (C)

Which symbol in figure G7-1 represents a single pole switch?

C. Symbol 11

**G7B - Digital circuits (gates, flip-flops, shift registers); amplifiers and oscillators**

G7B01 (B)

Which of the following describes a "flip-flop" circuit?

B. A digital circuit with two stable states

G7B02 (A)

Why do digital circuits use the binary number system?

A. Binary "ones" and "zeros" are easy to represent with an "on" or "off" state

G7B03 (C)

What is the output of a two-input NAND gate, given both inputs are "one"?

C. Zero

G7B04 (B)

What is the output of a NOR gate given that both inputs are "zero"?

B. One

G7B05 (C)

How many states are there in a 3-bit binary counter?

C. 8

G7B06 (A)

What is a shift register?

A. A clocked array of circuits that passes data in steps along the array

G7B07 (D)

What are the basic components of virtually all oscillators?

D. A filter and an amplifier operating in a feedback loop

~~

G7B08 (C)

What determines the frequency of an RC oscillator?

C. The phase shift of the RC feedback circuit

G7B09 (C)

What determines the frequency of an LC oscillator?

C. The inductance and capacitance in the tank circuit

G7B10 (D)

Which of the following is a characteristic of a Class A amplifier?

D. Low distortion

~~

G7B11 (B)

For which of the following modes is a Class C power stage appropriate for amplifying a modulated signal?

B. CW

G7B12 (A)

Which of the following is an advantage of a Class C amplifier?

A. High efficiency

G7B13 (B)

How is the efficiency of an RF power amplifier determined?

B. Divide the RF output power by the DC input power

G7B14 (B)

Which of the following describes a linear amplifier?

B. An amplifier whose output preserves the input waveform

**SUBELEMENT G8 - SIGNALS AND EMISSIONS [2 exam questions - 2 groups]**

**G8A - Carriers and modulation: AM; FM; single and double sideband ; modulation envelope; deviation; overmodulation**

G8A01 (D)

What is the name of the process that changes the envelope of an RF wave to convey information?

D. Amplitude modulation

~~

G8A02 (B)

What is the name of the process that changes the phase angle of an RF wave to convey information?

B. Phase modulation

G8A03 (D)

What is the name of the process which changes the frequency of an RF wave to convey information?

D. Frequency modulation

~~

G8A04 (B)

What emission is produced by a reactance modulator connected to an RF power amplifier?

B. Phase modulation

G8A05 (D)

What type of transmission varies the instantaneous power level of the RF signal to convey information?

D. Amplitude modulation

~~

G8A06 (C)

What is one advantage of carrier suppression in a single-sideband phone transmission?

C. More transmitter power can be put into the remaining sideband

G8A07 (A)

Which of the following phone emissions uses the narrowest frequency bandwidth?

A. Single sideband

G8A08 (D)

What happens to the signal of an over-modulated single-sideband phone transmitter?

D. It becomes distorted and occupies more bandwidth

~~

G8A09 (B)

What control is typically adjusted for proper ALC setting on an amateur single sideband transceiver?

B. Audio or microphone gain

G8A10 (C)

What is meant by flat-topping of a single-sideband phone transmission?

C. Signal distortion caused by excessive drive

G8A11 (A)

What happens to the RF carrier signal when a modulating audio signal is applied to an FM transmitter?

A. The carrier frequency changes proportionally to the instantaneous amplitude of the modulating signal

G8A12 (A)

What signal(s) would be found at the output of a properly adjusted balanced modulator?

A. Both upper and lower sidebands

**G8B - Frequency mixing; multiplication; HF data communications; bandwidths of various modes**

G8B01 (A)

What receiver stage combines a 14.250 MHz input signal with a 13.795 MHz oscillator signal to produce a 455 kHz intermediate frequency (IF) signal?

A. Mixer

G8B02 (B)

If a receiver mixes a 13.800 MHz VFO with a 14.255 MHz received signal to produce a 455 kHz intermediate frequency (IF) signal, what type of interference will a 13.345 MHz signal produce in the receiver?

B. Image response

G8B03 (A)

What stage in a transmitter would change a 5.3 MHz input signal to 14.3 MHz?

A. A mixer

G8B04 (D)

What is the name of the stage in a VHF FM transmitter that selects a harmonic of an HF signal to reach the desired operating frequency?

D. Multiplier

~~

G8B05 (C)

Why isn't frequency modulated (FM) phone used below 29.5 MHz?

C. The bandwidth would exceed FCC limits

G8B06 (D)

What is the total bandwidth of an FM-phone transmission having a 5 kHz deviation and a 3 kHz modulating frequency?

D. 16 kHz

~~

G8B07 (B)

What is the frequency deviation for a 12.21-MHz reactance-modulated oscillator in a 5-kHz deviation, 146.52-MHz FM-phone transmitter?

B. 416.7 Hz

G8B08 (C)

How is frequency shift related to keying speed in an FSK signal?

C. Greater keying speeds require greater frequency shifts

G8B09 (B)

What do RTTY, Morse code, PSK31 and packet communications have in common?

B. They are digital modes

G8B10 (B)

When transmitting a data mode signal, why is it important to know the duty cycle of the mode you are using?

B. To prevent damage to your transmitter's final output stage

G8B11 (D)

What part of the 20 meter band is most commonly used for PSK31 operation?

D. Below the RTTY segment, near 14.070 MHz

~~

G8B12 (A)

What is another term for the mixing of two RF signals?

A. Heterodyning

#### **SUBELEMENT G9 - ANTENNAS AND FEEDLINES [4 exam questions - 4 groups]**

#### **G9A - Antenna feedlines: characteristic impedance, and attenuation; SWR calculation, measurement and effects; matching networks**

G9A01 (A)

Which of the following factors help determine the characteristic impedance of a parallel conductor antenna feedline?

A. The distance between the centers of the conductors and the radius of the conductors

G9A02 (B)

What is the typical characteristic impedance of coaxial cables used for antenna feedlines at amateur stations?

B. 50 and 75 ohms

G9A03 (D)

What is the characteristic impedance of flat ribbon TV type twin lead?

D. 300 ohms

~~

G9A04 (C)

What is a common reason for the occurrence of reflected power at the point where a feedline connects to an antenna?

C. A difference between feedline impedance and antenna feed point impedance

G9A05 (D)

What must be done to prevent standing waves on an antenna feedline?

D. The antenna feed point impedance must be matched to the characteristic impedance of the feedline

~~

G9A06 (C)

Which of the following is a reason for using an inductively coupled matching network between the transmitter and parallel conductor feed line feeding an antenna?

C. To match the unbalanced transmitter output to the balanced parallel conductor feedline

G9A07 (B)

How does the attenuation of coaxial cable change as the frequency of the signal it is carrying increases?

B. It increases

G9A08 (D)

In what values are RF feed line losses usually expressed?

D. dB per 100 ft

~~

G9A09 (A)

What standing-wave-ratio will result from the connection of a 50-ohm feed line to a non-reactive load having a 200-ohm impedance?

A. 4:1

G9A10 (D)

What standing-wave-ratio will result from the connection of a 50-ohm feed line to a non-reactive load having a 10-ohm impedance?

D. 5:1

~~

G9A11 (B)

What standing-wave-ratio will result from the connection of a 50-ohm feed line to a non-reactive load having a 50-ohm impedance?

B. 1:1

G9A12 (A)

What would be the SWR if you feed a vertical antenna that has a 25-ohm feed-point impedance with 50-ohm coaxial cable?

A. 2:1

G9A13 (C)

What would be the SWR if you feed a folded dipole antenna that has a 300-ohm feed-point impedance with 50-ohm coaxial cable?

C. 6:1

G9A14 (B)

If the SWR on an antenna feedline is 5 to 1, and a matching network at the transmitter end of the feedline is adjusted to 1 to 1 SWR, what is the resulting SWR on the feedline?

B. 5 to 1

## **G9B - Basic antennas**

G9B01 (B)

What is one disadvantage of a directly fed random-wire antenna?

B. You may experience RF burns when touching metal objects in your station

~~

G9B02 (D)

What is an advantage of downward sloping radials on a ground-plane antenna?

D. They can be adjusted to bring the feed-point impedance closer to 50 ohms

~~

G9B03 (B)

What happens to the feed-point impedance of a ground-plane antenna when its radials are changed from horizontal to downward-sloping?

B. It increases

G9B04 (A)

What is the low angle azimuthal radiation pattern of an ideal half-wavelength dipole antenna installed 1/2 wavelength high and parallel to the earth?

A. It is a figure-eight at right angles to the antenna

G9B05 (C)

How does antenna height affect the horizontal (azimuthal) radiation pattern of a horizontal dipole HF antenna?

C. If the antenna is less than 1/2 wavelength high, the azimuthal pattern is almost omnidirectional

G9B06 (C)

Where should the radial wires of a ground-mounted vertical antenna system be placed?

C. On the surface or buried a few inches below the ground

G9B07 (B)

How does the feed-point impedance of a 1/2 wave dipole antenna change as the antenna is lowered from 1/4 wave above ground?

B. It steadily decreases

G9B08 (A)

How does the feed-point impedance of a 1/2 wave dipole change as the feed-point location is moved from the center toward the ends?

A. It steadily increases

G9B09 (A)

Which of the following is an advantage of a horizontally polarized as compared to vertically polarized HF antenna?

A. Lower ground reflection losses

G9B10 (D)

What is the approximate length for a 1/2-wave dipole antenna cut for 14.250 MHz?

D. 32.8 feet

~~

G9B11 (C)

What is the approximate length for a 1/2-wave dipole antenna cut for 3.550 MHz?

C. 131.8 feet

G9B12 (A)

What is the approximate length for a 1/4-wave vertical antenna cut for 28.5 MHz?

A. 8.2 feet

### **G9C - Directional antennas**

G9C01 (A)

How can the SWR bandwidth of a Yagi antenna be increased?

A. Use larger diameter elements

G9C02 (B)

What is the approximate length of the driven element of a Yagi antenna?

B. 1/2 wavelength

G9C03 (B)

Which statement about a three-element single-band Yagi antenna is true?  
B. The director is normally the shortest parasitic element

G9C04 (A)

Which statement about a Yagi antenna is true?  
A. The reflector is normally the longest parasitic element

G9C05 (A)

What is one effect of increasing the boom length and adding directors to a Yagi antenna?  
A. Gain increases

G9C06 (C)

Which of the following is a reason why a Yagi antenna is often used for radio communications on the 20 meter band?  
A. It provides excellent omnidirectional coverage in the horizontal plane  
C. It helps reduce interference from other stations to the side or behind the antenna

G9C07 (C)

What does "front-to-back ratio" mean in reference to a Yagi antenna?  
C. The power radiated in the major radiation lobe compared to the power radiated in exactly the opposite direction

G9C08 (D)

What is meant by the "main lobe" of a directive antenna?  
D. The direction of maximum radiated field strength from the antenna  
~~

G9C09 (A)

What is the approximate maximum theoretical forward gain of a 3 Element Yagi antenna?  
A. 9.7 dBi

G9C10 (D)

Which of the following is a Yagi antenna design variable that could be adjusted to optimize forward gain, front-to-back ratio, or SWR bandwidth?  
D. All of these choices are correct  
~~

G9C11 (A)

What is the purpose of a "gamma match" used with Yagi antennas?  
A. To match the relatively low feed-point impedance to 50 ohms

G9C12 (D)

Which of the following describes a common method for insulating the driven element of a Yagi antenna from the metal boom when using a gamma match?  
D. None of these answers are correct. No insulation is needed  
~~

G9C13 (A)

Approximately how long is each side of a cubical-quad antenna driven element?  
A. 1/4 wavelength

G9C14 (B)

How does the forward gain of a 2-element cubical-quad antenna compare to the forward gain of a 3 element Yagi antenna?  
B. About the same

G9C15 (B)

Approximately how long is each side of a cubical-quad antenna reflector element?  
B. Slightly more than 1/4 wavelength

G9C16 (D)

How does the gain of a two element delta-loop beam compare to the gain of a two element cubical quad antenna?

D. About the same

~~

G9C17 (B)

Approximately how long is each leg of a symmetrical delta-loop antenna Driven element?

B. 1/3 wavelengths

G9C18 (D)

Which of the following antenna types consists of a driven element and some combination of parasitically excited reflector and/or director elements?

D. A Yagi antenna

~~

G9C19 (C)

What type of directional antenna is typically constructed from 2 square loops of wire each having a circumference of approximately one wavelength at the operating frequency and separated by approximately 0.2 wavelength?

C. A cubical quad antenna

G9C20 (A)

What happens when the feed-point of a cubical quad antenna is changed from the center of the lowest horizontal wire to the center of one of the vertical wires?

A. The polarization of the radiated signal changes from horizontal to vertical

G9C21 (D)

What configuration of the loops of a cubical-quad antenna must be used for the antenna to operate as a beam antenna, assuming one of the elements is used as a reflector?

D. The reflector element must be approximately 5% longer than the driven element

~~

#### **G9D - Specialized antennas**

G9D01 (D)

What does the term "NVIS" mean as related to antennas?

D. Near Vertical Incidence Skywave

~~

G9D02 (B)

Which of the following is an advantage of an NVIS antenna?

B. High vertical angle radiation for short skip during the day

G9D03 (D)

At what height above ground is an NVIS antenna typically installed?

D. Between 1/10 and 1/4 wavelength

~~

G9D04 (B)

How does the gain of two 3-element horizontally polarized Yagi antennas spaced vertically 1/2 wave apart from each other typically compare to the gain of a single 3-element Yagi?

B. Approximately 3 dB higher

G9D05 (D)

What is the advantage of vertical stacking of horizontally polarized Yagi antennas?

D. Narrows the main lobe in elevation

~~

G9D06 (A)

Which of the following is an advantage of a log periodic antenna?

A. Wide bandwidth

G9D07 (A)

Which of the following describes a log periodic antenna?

A. Length and spacing of the elements increases logarithmically from one end of the boom to the other

G9D08 (B)

Why is a Beverage antenna generally not used for transmitting?

B. It has high losses compared to other types of antennas

G9D09 (B)

Which of the following is an application for a Beverage antenna?

B. Directional receiving for low HF bands

G9D10 (D)

Which of the following describes a Beverage antenna?

D. A very long and low receiving antenna that is highly directional

~~

G9D11 (D)

Which of the following is a disadvantage of multiband antennas?

D. They have poor harmonic rejection

~~

G9D12 (A)

What is the primary purpose of traps installed in antennas?

A. To permit multiband operation

#### **SUBELEMENT G0 - ELECTRICAL AND RF SAFETY [2 Exam Questions - 2 groups]**

#### **G0A - RF safety principles, rules and guidelines; routine station evaluation**

G0A01 (A)

What is one way that RF energy can affect human body tissue?

A. It heats body tissue

G0A02 (B)

Which property is NOT important in estimating if an RF signal exceeds the maximum permissible exposure (MPE)?

B. Its critical angle

G0A03 (B)

Which of the following has the most direct effect on the permitted exposure level of RF radiation?

B. The power level and frequency of the energy

G0A04 (D)

What does "time averaging" mean in reference to RF radiation exposure?

D. The total RF exposure averaged over a certain time

~~G0A05 (A)

What must you do if an evaluation of your station shows RF energy radiated from your station exceeds permissible limits?

A. Take action to prevent human exposure to the excessive RF fields

G0A06 (C)

Which transmitter(s) at a multiple user site is/are responsible for RF safety compliance?

C. Any transmitter that contributes 5% or more of the MPE

G0A07 (A)

What effect does transmitter duty cycle have when evaluating RF exposure?

A. A lower transmitter duty cycle permits greater short-term exposure levels

G0A08 (C)

Which of the following steps must an amateur operator take to ensure compliance with RF safety regulations?

C. Perform a routine RF exposure evaluation

G0A09 (B)

What type of instrument can be used to accurately measure an RF field?

B. A calibrated field-strength meter with a calibrated antenna

G0A10 (D)

What do the RF safety rules require when the maximum power output capability of an otherwise compliant station is reduced?

D. No further action is required

~~

G0A11 (C)

What precaution should you take if you install an indoor transmitting antenna?

C. Make sure that MPE limits are not exceeded in occupied areas

G0A12 (B)

What precaution should you take whenever you make adjustments or repairs to an antenna?

B. Turn off the transmitter and disconnect the feedline

G0A13 (D)

What precaution should be taken when installing a ground-mounted antenna?

D. It should be installed so no one can be exposed to RF radiation in excess of maximum permissible limits

~~

G0A14 (D)

What is one thing that can be done if evaluation shows that a neighbor might receive more than the allowable limit of RF exposure from the main lobe of a directional antenna?

D. Take precautions to ensure that the antenna cannot be pointed at their house

~~

G0A15 (D) [97.13(c)(1)]

How can you determine that your station complies with FCC RF exposure regulations?

D. All of these choices are correct

~~

**G0B - Safety in the ham shack: electrical shock and treatment, grounding, fusing, interlocks, wiring, antenna and tower safety**

G0B01 (A)

Which wire(s) in a four-conductor line cord should be attached to fuses or circuit breakers in a device operated from a 240-VAC single-phase source?

A. Only the "hot" (black and red) wires

G0B02 (C)

What is the minimum wire size that may be safely used for a circuit that draws up to 20 amperes of continuous current?

C. AWG number 12

G0B03 (D)

Which size of fuse or circuit breaker would be appropriate to use with a circuit that uses AWG number 14 wiring?

D. 15 amperes

~~

G0B04 (A)

What is the mechanism by which electrical shock can be lethal?

A. Current through the heart can cause the heart to stop pumping

G0B05 (B)

Which of the following conditions will cause a Ground Fault Circuit Interrupter (GFCI) to disconnect the 120 or 240 Volt AC line power to a device?

B. Current flowing from the hot wire to ground

G0B06 (D)

Why must the metal chassis of every item of station equipment be grounded (assuming the item has such a chassis)?

D. It ensures that hazardous voltages cannot appear on the chassis

~~

G0B07 (B)

Which of the following should be observed for safety when climbing on a tower using a safety belt or harness?

B. Always attach the belt safety hook to the belt "D" ring with the hook opening away from the tower

G0B08 (B)

What should be done by any person preparing to climb a tower that supports electrically powered devices?

B. Make sure all circuits that supply power to the tower are locked out and tagged

G0B09 (D)

Why is it not safe to use soldered joints with the wires that connect the base of a tower to a system of ground rods?

D. A soldered joint will likely be destroyed by the heat of a lightning strike

~~

G0B10 (A)

Which of the following is a danger from lead-tin solder?

A. Lead can contaminate food if hands are not washed carefully after handling

G0B11 (D)

Which of the following is good engineering practice for lightning protection grounds?

D. They must be bonded together with all other grounds

~~

G0B12 (C)

What is the purpose of a transmitter power supply interlock?

C. To ensure that dangerous voltages are removed if the cabinet is opened

G0B13 (B)

Which of the following is the most hazardous type of electrical energy?

B. 60 cycle Alternating current

G0B14 (B)

What is the maximum amount of electrical current flow through the human body that can be tolerated safely?

B. 50 microamperes

~~