2014-2018 Technician Class
FCC Element 2 Syllabus
Effective December 12, 2013

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  - T5A - Electrical principles, units, and terms: current and voltage; conductors and insulators; alternating and direct current
  - T5B - Math for electronics: conversion of electrical units; decibels; the metric system
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- **SUBELEMENT T0: Electrical safety: AC and DC power circuits; antenna installation; RF hazards [3 Exam Questions - 3 Groups – 36 Pool Questions]**

  - T0A - Power circuits and hazards: hazardous voltages; fuses and circuit breakers; grounding; lightning protection; battery safety; electrical code compliance
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SUBELEMENT T1

FCC Rules, descriptions and definitions for the Amateur Radio Service, operator and station license responsibilities

[6 Exam Questions - 6 Groups - 78 Pool Questions]

T1A - Amateur Radio Service: purpose and permissible use of the Amateur Radio Service; operator/primary station license grant; where FCC rules are codified; basis and purpose of FCC rules; meanings of basic terms used in FCC rules; interference; spectrum management (14 Questions)

- **T1A01** [97.1] Which of the following is a purpose of the Amateur Radio Service as stated in the FCC rules and regulations?
    - Providing personal radio communications for as many citizens as possible
    - Providing communications for international non-profit organizations
    - **Advancing skills in the technical and communication phases of the radio art**
    - All of these choices are correct

- **T1A02** [97.1] Which agency regulates and enforces the rules for the Amateur Radio Service in the United States?
    - FEMA
    - The ITU
    - **The FCC**
    - Homeland Security

- **T1A03** Which part of the FCC regulations contains the rules governing the Amateur Radio Service?
    - Part 73
    - Part 95
    - Part 90
    - **Part 97**

- **T1A04** [97.3(a)(23)] Which of the following meets the FCC definition of harmful interference?
    - Radio transmissions that annoy users of a repeater
    - Unwanted radio transmissions that cause costly harm to radio station apparatus
    - **That which seriously degrades, obstructs, or repeatedly interrupts a radio communication service operating in accordance with the Radio Regulations**
    - Static from lightning storms

- **T1A05** [97.1 (e)] Which of the following is a purpose of the Amateur Radio Service rules and regulations as defined by the FCC?

    - **Enhancing international goodwill**
    - Providing inexpensive communication for local emergency organizations
    - Training of operators in military radio operating procedures
    - All of these choices are correct

- **T1A06** [97.101 (d), 97.303 (o)(2)] Which of the following services are protected from interference by amateur signals under all circumstances?

    - Citizens Radio Service
    - Broadcast Service
    - Land Mobile Radio Service
    - **Radionavigation Service**

- **T1A07** [97.3(a)(46)] What is the FCC Part 97 definition of telemetry?

    - An information bulletin issued by the FCC
    - A one-way transmission to initiate, modify or terminate functions of a device at a distance
    - **A one-way transmission of measurements at a distance from the measuring instrument**
    - An information bulletin from a VEC

- **T1A08** [97.3(a)(22)] Which of the following entities recommends transmit/receive channels and other parameters for auxiliary and repeater stations?

    - Frequency Spectrum Manager
    - **Frequency Coordinator**
    - FCC Regional Field Office
    - International Telecommunications Union

- **T1A09** [97.3(a)(22)] Who selects a Frequency Coordinator?

    - The FCC Office of Spectrum Management and Coordination Policy
    - The local chapter of the Office of National Council of Independent Frequency Coordinators
    - **Amateur operators in a local or regional area whose stations are eligible to be auxiliary or repeater stations**
    - FCC Regional Field Office

- **T1A10** [97.3(a)(5)] What is the FCC Part 97 definition of an amateur station?

    - **A station in the Amateur Radio Service consisting of the apparatus necessary for carrying on radio communications**
    - A building where Amateur Radio receivers, transmitters, and RF power amplifiers are installed
    - Any radio station operated by a non-professional
    - Any radio station for hobby use

- **T1A11** [97.101 (d)] When is willful interference to other amateur radio stations permitted?

    - Only if the station being interfered with is expressing extreme religious or political views
    - **At no time**
    - Only during a contest
    - At any time, amateurs are not protected from willful interference

- **T1A12** Which of the following is a permissible use of the Amateur Radio Service?

    - Broadcasting music and videos to friends
    - **Providing a way for amateur radio operators to earn additional income by using their stations to pass messages**
    - Providing low-cost communications for start-up businesses
    - Allowing a person to conduct radio experiments and to communicate with other licensed hams around the world

- **T1A13** [97.3(a)(45)] What is the FCC Part 97 definition of telecommand?

    - An instruction bulletin issued by the FCC
    - A one-way radio transmission of measurements at a distance from the measuring instrument
    - **A one-way transmission to initiate, modify or terminate functions of a device at a distance**
    - An instruction from a VEC

- **T1A14** [97.303(d)] What must you do if you are operating on the 23 cm band and learn that you are interfering with a radiolocation station outside the United States?

    - **Stop operating or take steps to eliminate the harmful interference**
    - Nothing, because this band is allocated exclusively to the amateur service
    - Establish contact with the radiolocation station and ask them to change frequency
    - Change to CW mode, because this would not likely cause interference

T1B - Authorized frequencies: frequency allocations; ITU regions; emission modes; restricted sub-bands; spectrum sharing; transmissions near band edges (13 Questions)

- **T1B01** What is the ITU?
    - An agency of the United States Department of Telecommunications Management
    - **A United Nations agency for information and communication technology issues**
    - An independent frequency coordination agency
    - A department of the FCC

- **T1B02** [97.301] Why are the frequency assignments for some U.S. Territories different from those in the 50 U.S. States?
    - **Some U. S. Territories are located in ITU regions other than region 2**
    - Territorial governments are allowed to select their own frequency allocations
    - Territorial frequency allocations must also include those of adjacent countries
    - Any territory that was in existence before the ratification of the Communications Act of 1934 is exempt from FCC frequency regulations

- **T1B03** [97.301(a)] Which frequency is within the 6 meter band?
    - 49.00 MHz
    - **52.525 MHz**
    - 28.50 MHz
    - 222.15 MHz

- **T1B04** [97.301(a)] Which amateur band are you using when your station is transmitting on 146.52 MHz?
    - **2 meter band**
    - 20 meter band
    - 14 meter band
    - 6 meter band

- **T1B05** [97.301(a)] Which 70 cm frequency is authorized to a Technician Class license holder operating in ITU Region 2?

    - 53.350 MHz
    - 146.520 MHz
    - **443.350 MHz**
    - 222.520 MHz

- **T1B06** [97.301(a)] Which 23 cm frequency is authorized to a Technician Class licensee?

    - 2315 MHz
    - **1296 MHz**
    - 3390 MHz
    - 146.52 MHz

- **T1B07** [97.301(a)] What amateur band are you using if you are transmitting on 223.50 MHz?

    - 15 meter band
    - 10 meter band
    - 2 meter band
    - **1.25 meter band**

- **T1B08** [97.303] Which of the following is a result of the fact that the amateur service is secondary in some portions of the 70 cm band?

    - **U.S. amateurs may find non-amateur stations in the bands, and must avoid interfering with them**
    - U.S. amateurs must give foreign amateur stations priority in those portions
    - International communications are not permitted on 70 cm
    - Digital transmissions are not permitted on 70 cm

- **T1B09** [97.101(a), 97.301(a-e)] Why should you not set your transmit frequency to be exactly at the edge of an amateur band or sub-band?

    - To allow for calibration error in the transmitter frequency display
    - So that modulation sidebands do not extend beyond the band edge
    - To allow for transmitter frequency drift
    - **All of these choices are correct**

- **T1B10** [97.301(e), 97.305(c)] Which of the bands above 30 MHz that are available to Technician Class operators have mode-restricted sub-bands?

    - The 6 meter, 2 meter, and 70 cm bands
    - The 2 meter and 13 cm bands
    - **The 6 meter, 2 meter, and 1.25 meter bands**
    - The 2 meter and 70 cm bands

- **T1B11** [97.301(a), 97.305 (a)(c)] What emission modes are permitted in the mode-restricted sub-bands at 50.0 to 50.1 MHz and 144.0 to 144.1 MHz?

    - **CW only**
    - CW and RTTY
    - SSB only
    - CW and SSB

- **T1B12** [97.301] Why are frequency assignments for U.S. stations operating maritime mobile not the same everywhere in the world?

    - Amateur maritime mobile stations in international waters must conform to the frequency assignments of the country nearest to their vessel
    - **Amateur frequency assignments can vary among the three ITU regions**
    - Frequency assignments are determined by the captain of the vessel
    - Amateur frequency assignments are different in each of the 90 ITU zones

- **T1B13** [97.305(c)] Which emission may be used between 219 and 220 MHz?

    - Spread spectrum
    - **Data**
    - SSB voice
    - Fast-scan television

T1C - Operator licensing: operator classes; sequential, special event, and vanity call sign systems; international communications; reciprocal operation; station license and licensee; places where the amateur service is regulated by the FCC; name and address on FCC license database; license term; renewal; grace period (14 Questions)

- **T1C01** [97.3(a)(11)(iii)] Which type of call sign has a single letter in both its prefix and suffix?
    - Vanity
    - Sequential
    - **Special event**
    - In-memoriam

- **T1C02** Which of the following is a valid US amateur radio station call sign?
    - KMA3505
    - **W3ABC**
    - KDKA
    - 11Q1176

- **T1C03** [97.117] What types of international communications are permitted by an FCC-licensed amateur station?
    - **Communications incidental to the purposes of the amateur service and remarks of a personal character**
    - Communications incidental to conducting business or remarks of a personal nature
    - Only communications incidental to contest exchanges, all other communications are prohibited
    - Any communications that would be permitted by an international broadcast station

- **T1C04** [97.107] When are you allowed to operate your amateur station in a foreign country?
    - **When the foreign country authorizes it**
    - When there is a mutual agreement allowing third party communications
    - When authorization permits amateur communications in a foreign language
    - When you are communicating with non-licensed individuals in another country

- **T1C05** Which of the following is a vanity call sign which a technician class amateur operator might select if available?

    - **K1XXX**
    - KA1X
    - W1XX
    - All of these choices are correct

- **T1C06** [97.5(a)(2)] From which of the following locations may an FCC-licensed amateur station transmit, in addition to places where the FCC regulates communications?

    - From within any country that belongs to the International Telecommunications Union
    - From within any country that is a member of the United Nations
    - From anywhere within in ITU Regions 2 and 3
    - **From any vessel or craft located in international waters and documented or registered in the United States**

- **T1C07** [97.23] What may result when correspondence from the FCC is returned as undeliverable because the grantee failed to provide the correct mailing address?

    - Fine or imprisonment
    - **Revocation of the station license or suspension of the operator license**
    - Require the licensee to be re-examined
    - A reduction of one rank in operator class

- **T1C08** [97.25] What is the normal term for an FCC-issued primary station/operator amateur radio license grant?

    - Five years
    - Life
    - **Ten years**
    - Twenty years

- **T1C09** [97.21(a)(b)] What is the grace period following the expiration of an amateur license within which the license may be renewed?

    - **Two years**
    - Three years
    - Five years
    - Ten years

- **T1C10** [97.5a] How soon after passing the examination for your first amateur radio license may you operate a transmitter on an amateur service frequency?

    - Immediately
    - 30 days after the test date
    - **As soon as your operator/station license grant appears in the FCC's license database**
    - You must wait until you receive your license in the mail from the FCC

- **T1C11** [97.21(b)] If your license has expired and is still within the allowable grace period, may you continue to operate a transmitter on amateur service frequencies?

    - **No, transmitting is not allowed until the FCC license database shows that the license has been renewed**
    - Yes, but only if you identify using the suffix GP
    - Yes, but only during authorized nets
    - Yes, for up to two years

- **T1C12** [97.19] Who may select a desired call sign under the vanity call sign rules?

    - Only licensed amateurs with general or extra class licenses
    - Only licensed amateurs with an extra class license
    - Only an amateur licensee who has been licensed continuously for more than 10 years
    - **Any licensed amateur**

- **T1C13** [97.9(a), 97.17(a)] For which licenses classes are new licenses currently available from the FCC?

    - Novice, Technician, General, Advanced
    - Technician, Technician Plus, General, Advanced
    - Novice, Technician Plus, General, Advanced
    - **Technician, General, Amateur Extra**

- **T1C14** [97.21(1)] Who may select a vanity call sign for a club station?

    - Any Extra Class member of the club
    - Any member of the club
    - Any officer of the club
    - **Only the person named as trustee on the club station license grant**

T1D - Authorized and prohibited transmission: communications with other countries; music; exchange of information with other services; indecent language; compensation for use of station; retransmission of other amateur signals; codes and ciphers; sale of equipment; unidentified transmissions; broadcasting (12Questions)

- **T1D01** [97.111(a)(1)] With which countries are FCC-licensed amateur stations prohibited from exchanging communications?

    - **Any country whose administration has notified the ITU that it objects to such communications**
    - Any country whose administration has notified the ARRL that it objects to such communications
    - Any country engaged in hostilities with another country
    - Any country in violation of the War Powers Act of 1934

- **T1D02** [97.111(a)(5)] On which of the following occasions may an FCC-licensed amateur station exchange messages with a U.S. military station?

    - **During an Armed Forces Day Communications Test**
    - During a Memorial Day Celebration
    - During an Independence Day celebration
    - During a propagation test

- **T1D03** [97.211(b), 97.215(b)] When is the transmission of codes or ciphers that hide the meaning of a message allowed by an amateur station?

    - Only during contests
    - Only when operating mobile
    - **Only when transmitting control commands to space stations or radio control craft**
    - Only when frequencies above 1280 MHz are used

- **T1D04** [97.113(a)(4), 97.113(c)] What is the only time an amateur station is authorized to transmit music?

    - **When incidental to an authorized retransmission of manned spacecraft communications**
    - When the music produces no spurious emissions
    - When the purpose is to interfere with an illegal transmission
    - When the music is transmitted above 1280 MHz

- **T1D05** [97.113(a)(3)(ii)] When may amateur radio operators use their stations to notify other amateurs of the availability of equipment for sale or trade?

    - **When the equipment is normally used in an amateur station and such activity is not conducted on a regular basis**
    - When the asking price is $100.00 or less
    - When the asking price is less than its appraised value
    - When the equipment is not the personal property of either the station licensee or the control operator or their close relatives

- **T1D06** [97.113(a)(4)] What, if any, are the restrictions concerning transmission of language that may be considered indecent or obscene?

    - The FCC maintains a list of words that are not permitted to be used on amateur frequencies
    - **Any such language is prohibited**
    - The ITU maintains a list of words that are not permitted to be used on amateur frequencies
    - There is no such prohibition

- **T1D07** [97.113(d)] What types of amateur stations can automatically retransmit the signals of other amateur stations?

    - Auxiliary, beacon, or Earth stations
    - **Auxiliary, repeater, or space stations**
    - Beacon, repeater, or space stations
    - Earth, repeater, or space stations

- **T1D08** [97.113(a)(3)(iii)] In which of the following circumstances may the control operator of an amateur station receive compensation for operating the station?

    - When engaging in communications on behalf of their employer
    - **When the communication is incidental to classroom instruction at an educational institution**
    - When re-broadcasting weather alerts during a RACES net
    - When notifying other amateur operators of the availability for sale or trade of apparatus

- **T1D09** [97.113(5)(b)] Under which of the following circumstances are amateur stations authorized to transmit signals related to broadcasting, program production, or news gathering, assuming no other means is available?

    - **Only where such communications directly relate to the immediate safety of human life or protection of property**
    - Only when broadcasting communications to or from the space shuttle
    - Only where noncommercial programming is gathered and supplied exclusively to the National Public Radio network
    - Only when using amateur repeaters linked to the Internet

- **T1D10** [97.3(a)(10)] What is the meaning of the term "broadcasting" in the FCC rules for the amateur services?

    - Two-way transmissions by amateur stations
    - Transmission of music
    - Transmission of messages directed only to amateur operators
    - **Transmissions intended for reception by the general public**

- **T1D11** [97.119(a)] When may an amateur station transmit without identifying?

    - When the transmissions are of a brief nature to make station adjustments
    - When the transmissions are unmodulated
    - When the transmitted power level is below 1 watt
    - **When transmitting signals to control a model craft**

- **T1D12** [97.111(b)(4,5,6) Under which of the following circumstances may an amateur radio station engage in broadcasting?

    - Under no circumstances
    - **When transmitting code practice, information bulletins, or transmissions necessary to provide emergency communications**
    - At any time as long as no music is transmitted
    - At any time as long as the material being transmitted did not originate from a commercial broadcast station

T1E - Control operator and control types: control operator required; eligibility; designation of control operator; privileges and duties; control point; local, automatic and remote control; location of control operator (12 Questions)

- **T1E01** [97.7(a)] When is an amateur station permitted to transmit without a control operator?
    - When using automatic control, such as in the case of a repeater
    - When the station licensee is away and another licensed amateur is using the station
    - When the transmitting station is an auxiliary station
    - **Never**

- **T1E02** [97.7(a)] Who may a station licensee designate to be the control operator of an amateur station?
    - Any U.S. citizen or registered alien
    - Any family member of the station licensee
    - Any person over the age of 18
    - **Only a person for whom an amateur operator/primary station license grant appears in the FCC database or who is authorized for alien reciprocal operation**

- **T1E03** [97.103(b)] Who must designate the station control operator?
    - **The station licensee**
    - The FCC
    - The frequency coordinator
    - The ITU

- **T1E04** [97.103(b)] What determines the transmitting privileges of an amateur station?
    - The frequency authorized by the frequency coordinator
    - The class of operator license held by the station licensee
    - The highest class of operator license held by anyone on the premises
    - **The class of operator license held by the control operator**

- **T1E05** [97.3(a)(14)] What is an amateur station control point?
    - The location of the station's transmitting antenna
    - The location of the station transmitting apparatus
    - **The location at which the control operator function is performed**
    - The mailing address of the station licensee

- **T1E06** [97.109(d)] Under what type of control do APRS network digipeaters operate?

    - **Automatic**
    - Remote
    - Local
    - Manual

- **T1E07** [97.103(a)] When the control operator is not the station licensee, who is responsible for the proper operation of the station?

    - All licensed amateurs who are present at the operation
    - Only the station licensee
    - Only the control operator
    - **The control operator and the station licensee are equally responsible**

- **T1E08** [97.3(a)(6), 97.205(d)] Which of the following is an example of automatic control?

    - **Repeater operation**
    - Controlling the station over the Internet
    - Using a computer or other device to automatically send CW
    - Using a computer or other device to automatically identify

- **T1E09** [97.109(b)] What type of control is being used when the control operator is at the control point?

    - Radio control
    - Unattended control
    - Automatic control
    - **Local control**

- **T1E10** [97.3(a)(39)] Which of the following is an example of remote control as defined in Part 97?

    - Repeater operation
    - **Operating the station over the Internet**
    - Controlling a model aircraft, boat or car by amateur radio
    - All of these choices are correct

- **T1E11** [97.103(a)] Who does the FCC presume to be the control operator of an amateur station, unless documentation to the contrary is in the station records?

    - The station custodian
    - The third party participant
    - The person operating the station equipment
    - **The station licensee**

- **T1E12** [97.119(e)] When, under normal circumstances, may a Technician Class licensee be the control operator of a station operating in an exclusive Extra Class operator segment of the amateur bands?

    - **At no time**
    - When operating a special event station
    - As part of a multi-operator contest team
    - When using a club station whose trustee is an Extra Class operator licensee

T1F - Station identification; repeaters; third party communications; club stations; FCC inspection (13 Questions)

- **T1F01** What type of identification is being used when identifying a station on the air as Race Headquarters?

    - **Tactical call sign**
    - An official call sign reserved for RACES drills
    - SSID
    - Broadcast station

- **T1F02** [97.119 (a)] When using tactical identifiers such as "Race Headquarters" during a community service net operation, how often must your station transmit the station's FCC-assigned call sign?

    - Never, the tactical call is sufficient
    - Once during every hour
    - **At the end of each communication and every ten minutes during a communication**
    - At the end of every transmission

- **T1F03** [97.119(a)] When is an amateur station required to transmit its assigned call sign?

    - At the beginning of each contact, and every 10 minutes thereafter
    - At least once during each transmission
    - At least every 15 minutes during and at the end of a communication
    - **At least every 10 minutes during and at the end of a communication**

- **T1F04** [97.119(b)(2)] Which of the following is an acceptable language to use for station identification when operating in a phone sub-band?

    - Any language recognized by the United Nations
    - Any language recognized by the ITU
    - **The English language**
    - English, French, or Spanish

- **T1F05** [97.119(b)(2)] What method of call sign identification is required for a station transmitting phone signals?

    - Send the call sign followed by the indicator RPT
    - **Send the call sign using CW or phone emission**
    - Send the call sign followed by the indicator R
    - Send the call sign using only phone emission

- **T1F06** [97.119(c)] Which of the following formats of a self-assigned indicator is acceptable when identifying using a phone transmission?

    - KL7CC stroke W3
    - KL7CC slant W3
    - KL7CC slash W3
    - **All of these choices are correct**

- **T1F07** [97.115(a)(2)] Which of the following restrictions apply when a non-licensed person is allowed to speak to a foreign station using a station under the control of a Technician Class control operator?

    - The person must be a U.S. citizen
    - **The foreign station must be one with which the U.S. has a third party agreement**
    - The licensed control operator must do the station identification
    - All of these choices are correct

- **T1F08** [97.119(f)] Which indicator is required by the FCC to be transmitted after a station call sign?

    - /M when operating mobile
    - /R when operating a repeater
    - / followed the FCC Region number when operating out of the region in which the license was issued
    - **/KT, /AE or /AG when using new license privileges earned by CSCE while waiting for an upgrade to a previously issued license to appear in the FCC license database**

- **T1F09** [97.3(a)(40)] What type of amateur station simultaneously retransmits the signal of another amateur station on a different channel or channels?

    - Beacon station
    - Earth station
    - **Repeater station**
    - Message forwarding station

- **T1F10** [97.205(g)] Who is accountable should a repeater inadvertently retransmit communications that violate the FCC rules?

    - **The control operator of the originating station**
    - The control operator of the repeater
    - The owner of the repeater
    - Both the originating station and the repeater owner

- **T1F11** [97.115(a)] To which foreign stations do the FCC rules authorize the transmission of non-emergency third party communications?

    - **Any station whose government permits such communications**
    - Those in ITU Region 2 only
    - Those in ITU Regions 2 and 3 only
    - Those in ITU Region 3 only

- **T1F12** [97.5(b)(2)] How many persons are required to be members of a club for a club station license to be issued by the FCC?

    - At least 5
    - **At least 4**
    - A trustee and 2 officers
    - At least 2

- **T1F13** [97.103(c)] When must the station licensee make the station and its records available for FCC inspection?

    - At any time ten days after notification by the FCC of such an inspection
    - **At any time upon request by an FCC representative**
    - Only after failing to comply with an FCC notice of violation
    - Only when presented with a valid warrant by an FCC official or government agent

SUBELEMENT T2
Operating Procedures
[3 Exam Questions - 3 Groups - 37 Pool Questions]

T2A - Station operation: choosing an operating frequency; calling another station; test transmissions; procedural signs; use of minimum power; choosing an operating frequency; band plans; calling frequencies; repeater offsets (12 Questions)

- **T2A01** What is the most common repeater frequency offset in the 2 meter band?
    - Plus 500 kHz
    - **Plus or minus 600 kHz**
    - Minus 500 kHz
    - Only plus 600 kHz

- **T2A02** What is the national calling frequency for FM simplex operations in the 70 cm band?
    - 146.520 MHz
    - 145.000 MHz
    - 432.100 MHz
    - **446.000 MHz**

- **T2A03** What is a common repeater frequency offset in the 70 cm band?
    - **Plus or minus 5 MHz**
    - Plus or minus 600 kHz
    - Minus 600 kHz
    - Plus 600 kHz

- **T2A04** What is an appropriate way to call another station on a repeater if you know the other station's call sign?
    - Say break, break then say the station's call sign
    - **Say the station's call sign then identify with your call sign**
    - Say CQ three times then the other station's call sign
    - Wait for the station to call CQ then answer it

- **T2A05** How should you respond to a station calling CQ?
    - Transmit CQ followed by the other station’s call sign
    - Transmit your call sign followed by the other station’s call sign
    - **Transmit the other station’s call sign followed by your call sign**
    - Transmit a signal report followed by your call sign

- **T2A06** What must an amateur operator do when making on-air transmissions to test equipment or antennas?

    - **Properly identify the transmitting station**
    - Make test transmissions only after 10:00 p.m. local time
    - Notify the FCC of the test transmission
    - State the purpose of the test during the test procedure

- **T2A07** Which of the following is true when making a test transmission?

    - Station identification is not required if the transmission is less than 15 seconds
    - Station identification is not required if the transmission is less than 1 watt
    - Station identification is only required once an hour when the transmissions are for test purposes only
    - **Station identification is required at least every ten minutes during the test and at the end of the test**

- **T2A08** What is the meaning of the procedural signal "CQ"?

    - Call on the quarter hour
    - A new antenna is being tested (no station should answer)
    - Only the called station should transmit
    - **Calling any station**

- **T2A09** What brief statement is often transmitted in place of "CQ" to indicate that you are listening on a repeater?

    - The words "Hello test" followed by your call sign
    - **Your call sign**
    - The repeater call sign followed by your call sign
    - The letters "QSY" followed by your call sign

- **T2A10** What is a band plan, beyond the privileges established by the FCC?

    - **A voluntary guideline for using different modes or activities within an amateur band**
    - A mandated list of operating schedules
    - A list of scheduled net frequencies
    - A plan devised by a club to indicate frequency band usage

- **T2A11** [97.313(a)] Which of the following is an FCC rule regarding power levels used in the amateur bands, under normal, non-distress circumstances?

    - There is no limit to power as long as there is no interference with other services
    - No more than 200 watts PEP may be used
    - Up to 1500 watts PEP may be used on any amateur frequency without restriction
    - **While not exceeding the maximum power permitted on a given band, use the minimum power necessary to carry out the desired communication**

- **T2A12** Which of the following is a guideline to use when choosing an operating frequency for calling CQ?

    - Listen first to be sure that no one else is using the frequency
    - Ask if the frequency is in use
    - Make sure you are in your assigned band
    - **All of these choices are correct**

T2B - VHF/UHF operating practices: SSB phone; FM repeater; simplex; splits and shifts; CTCSS; DTMF; tone squelch; carrier squelch; phonetics; operational problem resolution; Q signals (13 Questions)

- **T2B01** What is the term used to describe an amateur station that is transmitting and receiving on the same frequency?
    - Full duplex communication
    - Diplex communication
    - **Simplex communication**
    - Multiplex communication

- **T2B02** What is the term used to describe the use of a sub-audible tone transmitted with normal voice audio to open the squelch of a receiver?
    - Carrier squelch
    - Tone burst
    - DTMF
    - **CTCSS**

- **T2B03** Which of the following describes the muting of receiver audio controlled solely by the presence or absence of an RF signal?
    - Tone squelch
    - **Carrier squelch**
    - CTCSS
    - Modulated carrier

- **T2B04** Which of the following common problems might cause you to be able to hear but not access a repeater even when transmitting with the proper offset?
    - The repeater receiver may require an audio tone burst for access
    - The repeater receiver may require a CTCSS tone for access
    - The repeater receiver may require a DCS tone sequence for access
    - **All of these choices are correct**

- **T2B05** What determines the amount of deviation of an FM (as opposed to PM) signal?

    - Both the frequency and amplitude of the modulating signal
    - The frequency of the modulating signal
    - **The amplitude of the modulating signal**
    - The relative phase of the modulating signal and the carrier

- **T2B06** What happens when the deviation of an FM transmitter is increased?

    - **Its signal occupies more bandwidth**
    - Its output power increases
    - Its output power and bandwidth increases
    - Asymmetric modulation occurs

- **T2B07** What could cause your FM signal to interfere with stations on nearby frequencies?

    - **Microphone gain too high, causing over-deviation**
    - SWR too high
    - Incorrect CTCSS Tone
    - All of these choices are correct

- **T2B08** Which of the following applies when two stations transmitting on the same frequency interfere with each other?

    - **Common courtesy should prevail, but no one has absolute right to an amateur frequency**
    - Whoever has the strongest signal has priority on the frequency
    - Whoever has been on the frequency the longest has priority on the frequency
    - The station which has the weakest signal has priority on the frequency

- **T2B09** [97.119(b)(2)] Which of the following methods is encouraged by the FCC when identifying your station when using phone?

    - **Use of a phonetic alphabet**
    - Send your call sign in CW as well as voice
    - Repeat your call sign three times
    - Increase your signal to full power when identifying

- **T2B10** Which Q signal indicates that you are receiving interference from other stations?
    - **QRM**
    - QRN
    - QTH
    - QSB

- **T2B11** Which Q signal indicates that you are changing frequency?
    - QRU
    - **QSY**
    - QSL
    - QRZ

- **T2B12** Under what circumstances should you consider communicating via simplex rather than a repeater?
    - **When the stations can communicate directly without using a repeater**
    - Only when you have an endorsement for simplex operation on your license
    - Only when third party traffic is not being passed
    - Only if you have simplex modulation capability

- **T2B13** Which of the following is true of the use of SSB phone in amateur bands above 50 MHz?
    - It is permitted only by holders of a General Class or higher license
    - It is permitted only on repeaters
    - **It is permitted in at least some portion of all the amateur bands above 50 MHz**
    - It is permitted only on when power is limited to no more than 100 watts

T2C - Public service: emergency and non-emergency operations; applicability of FCC rules; RACES and ARES; net and traffic procedures; emergency restrictions (12 Questions)

- **T2C01** [97.103(a)] When do the FCC rules N
  OT apply to the operation of an amateur station?
  - When operating a RACES station
  - When operating under special FEMA rules
  - When operating under special ARES rules
  - **Never, FCC rules always apply**

- **T2C02** What is one way to recharge a 12-volt lead-acid station battery if the commercial power is out?
  - Cool the battery in ice for several hours
  - Add acid to the battery
  - **Connect the battery in parallel with a vehicle's battery and run the engine**
  - All of these choices are correct

- **T2C03** What should be done to insure that voice message traffic containing proper names and unusual words are copied correctly by the receiving station?
  - The entire message should be repeated at least four times
  - Such messages must be limited to no more than 10 words
  - **Such words and terms should be spelled out using a standard phonetic alphabet**
  - All of these choices are correct

- **T2C04** What do RACES and ARES have in common?
  - They represent the two largest ham clubs in the United States
  - Both organizations broadcast road and weather information
  - Neither may handle emergency traffic supporting public service agencies
  - **Both organizations may provide communications during emergencies**

- **T2C05** [97.3(a)(38), 97.407] Which of the following describes the Radio Amateur Civil Emergency Service (RACES)?

    - A radio service using amateur frequencies for emergency management or civil defense communications
    - A radio service using amateur stations for emergency management or civil defense communications
    - An emergency service using amateur operators certified by a civil defense organization as being enrolled in that organization
    - A**ll of these choices are correct**

- **T2C06** Which of the following is an accepted practice to get the immediate attention of a net control station when reporting an emergency?

    - Repeat the words SOS three times followed by the call sign of the reporting station
    - Press the push-to-talk button three times
    - **Begin your transmission by saying "Priority" or "Emergency" followed by your call sign**
    - Play a pre-recorded emergency alert tone followed by your call sign

- **T2C07** Which of the following is an accepted practice for an amateur operator who has checked into an emergency traffic net?

    - Provided that the frequency is quiet, announce the station call sign and location every 5 minutes
    - Move 5 kHz away from the net's frequency and use high power to ask other hams to keep clear of the net frequency
    - **Remain on frequency without transmitting until asked to do so by the net control station**
    - All of the choices are correct

- **T2C08** Which of the following is a characteristic of good emergency traffic handling?

    - **Passing messages exactly as received**
    - Making decisions as to whether or not messages should be relayed or delivered
    - Communicating messages to the news media for broadcast outside the disaster area
    - All of these choices are correct

- **T2C09** Are amateur station control operators ever permitted to operate outside the frequency privileges of their license class?

    - No
    - Yes, but only when part of a FEMA emergency plan
    - Yes, but only when part of a RACES emergency plan
    - **Yes, but only if necessary in situations involving the immediate safety of human life or protection of property**

- **T2C10** What is the preamble in a formal traffic message?

    - The first paragraph of the message text
    - The message number
    - The priority handling indicator for the message
    - **The information needed to track the message as it passes through the amateur radio traffic handling system**

- **T2C11** What is meant by the term "check" in reference to a formal traffic message?

    - **The check is a count of the number of words or word equivalents in the text portion of the message**
    - The check is the value of a money order attached to the message
    - The check is a list of stations that have relayed the message
    - The check is a box on the message form that tells you the message was received

- **T2C12** What is the Amateur Radio Emergency Service (ARES)?

    - **Licensed amateurs who have voluntarily registered their qualifications and equipment for communications duty in the public service**
    - Licensed amateurs who are members of the military and who voluntarily agreed to provide message handling services in the case of an emergency
    - A training program that provides licensing courses for those interested in obtaining an amateur license to use during emergencies
    - A training program that certifies amateur operators for membership in the Radio Amateur Civil Emergency Service

SUBELEMENT T3

Radio wave characteristics: properties of radio waves; propagation modes

[3 Exam Questions - 3 Groups - 34 Pool Questions]

T3A - Radio wave characteristics: how a radio signal travels; fading; multipath; wavelength vs. penetration; antenna orientation (11 Questions)

- **T3A01** What should you do if another operator reports that your station's 2 meter signals were strong just a moment ago, but now they are weak or distorted?

    - Change the batteries in your radio to a different type
    - Turn on the CTCSS tone
    - Ask the other operator to adjust his squelch control
    - **Try moving a few feet or changing the direction of your antenna if possible, as reflections may be causing multi-path distortion**

- **T3A02** Why are UHF signals often more effective from inside buildings than VHF signals?

    - VHF signals lose power faster over distance
    - **The shorter wavelength allows them to more easily penetrate the structure of buildings**
    - This is incorrect; VHF works better than UHF inside buildings
    - UHF antennas are more efficient than VHF antennas

- **T3A03** What antenna polarization is normally used for long-distance weak-signal CW and SSB contacts using the VHF and UHF bands?

    - Right-hand circular
    - Left-hand circular
    - Horizontal
    - **Vertical**

- **T3A04** What can happen if the antennas at opposite ends of a VHF or UHF line of sight radio link are not using the same polarization?

    - The modulation sidebands might become inverted
    - **Signals could be significantly weaker**
    - Signals have an echo effect on voices
    - Nothing significant will happen

- **T3A05** When using a directional antenna, how might your station be able to access a distant repeater if buildings or obstructions are blocking the direct line of sight path?

    - Change from vertical to horizontal polarization
    - **Try to find a path that reflects signals to the repeater**
    - Try the long path
    - Increase the antenna SWR

- **T3A06** What term is commonly used to describe the rapid fluttering sound sometimes heard from mobile stations that are moving while transmitting?

    - Flip-flopping
    - **Picket fencing**
    - Frequency shifting
    - Pulsing

- **T3A07** What type of wave carries radio signals between transmitting and receiving stations?

    - **Electromagnetic**
    - Electrostatic
    - Surface acoustic
    - Magnetostrictive

- **T3A08** Which of the following is a likely cause of irregular fading of signals received by ionospheric reflection?

    - Frequency shift due to Faraday rotation
    - Interference from thunderstorms
    - **Random combining of signals arriving via different paths**
    - Intermodulation distortion

- **T3A09** Which of the following results from the fact that skip signals refracted from the ionosphere are elliptically polarized?

    - Digital modes are unusable
    - **Either vertically or horizontally polarized antennas may be used for transmission or reception**
    - FM voice is unusable
    - Both the transmitting and receiving antennas must be of the same polarization

- **T3A10** What may occur if data signals propagate over multiple paths?
    - Transmission rates can be increased by a factor equal to the number of separate paths observed
    - Transmission rates must be decreased by a factor equal to the number of separate paths observed
    - No significant changes will occur if the signals are transmitting using FM
    - **Error rates are likely to increase**

- **T3A11** Which part of the atmosphere enables the propagation of radio signals around the world?
    - The stratosphere
    - The troposphere
    - **The ionosphere**
    - The magnetosphere

T3B - Radio and electromagnetic wave properties: the electromagnetic spectrum; wavelength vs. frequency; velocity of electromagnetic waves; calculating wavelength (11 Questions)

- T3B01 What is the name for the distance a radio wave travels during one complete cycle?
    - Wave speed
    - Waveform
    - **Wavelength**
    - Wave spread

- T3B02 What property of a radio wave is used to describe its polarization?
    - **The orientation of the electric field**
    - The orientation of the magnetic field
    - The ratio of the energy in the magnetic field to the energy in the electric field
    - The ratio of the velocity to the wavelength

- T3B03 What are the two components of a radio wave?
    - AC and DC
    - Voltage and current
    - **Electric and magnetic fields**
    - Ionizing and non-ionizing radiation

- T3B04 How fast does a radio wave travel through free space?
    - **At the speed of light**
    - At the speed of sound
    - Its speed is inversely proportional to its wavelength
    - Its speed increases as the frequency increases

- T3B05 How does the wavelength of a radio wave relate to its frequency?
    - The wavelength gets longer as the frequency increases
    - **The wavelength gets shorter as the frequency increases**
    - There is no relationship between wavelength and frequency
    - The wavelength depends on the bandwidth of the signal

- T3B06 What is the formula for converting frequency to approximate wavelength in meters?
    - Wavelength in meters equals frequency in hertz multiplied by 300
    - Wavelength in meters equals frequency in hertz divided by 300
    - Wavelength in meters equals frequency in megahertz divided by 300
    - **Wavelength in meters equals 300 divided by frequency in megahertz**

- T3B07 What property of radio waves is often used to identify the different frequency bands?
    - **The approximate wavelength**
    - The magnetic intensity of waves
    - The time it takes for waves to travel one mile
    - The voltage standing wave ratio of waves

- T3B08 What are the frequency limits of the VHF spectrum?
    - 30 to 300 kHz
    - **30 to 300 MHz**
    - 300 to 3000 kHz
    - 300 to 3000 MHz

- T3B09 What are the frequency limits of the UHF spectrum?
    - 30 to 300 kHz
    - 30 to 300 MHz
    - 300 to 3000 kHz
    - **300 to 3000 MHz**

- T3B10 What frequency range is referred to as HF?
    - 300 to 3000 MHz
    - 30 to 300 MHz
    - **3 to 30 MHz**
    - 300 to 3000 kHz

- **T3B11** What is the approximate velocity of a radio wave as it travels through free space?
    - 3000 kilometers per second
    - **300,000,000 meters per second**
    - 300,000 miles per hour
    - 186,000 miles per hour

T3C - Propagation modes: line of sight; sporadic E; meteor and auroral scatter and reflections; tropospheric ducting; F layer skip; radio horizon (12 Questions)

- **T3C01** Why are direct (not via a repeater) UHF signals rarely heard from stations outside your local coverage area?
    - They are too weak to go very far
    - FCC regulations prohibit them from going more than 50 miles
    - **UHF signals are usually not reflected by the ionosphere**
    - They collide with trees and shrubbery and fade out

- **T3C02** Which of the following might be happening when VHF signals are being received from long distances?
    - Signals are being reflected from outer space
    - Signals are arriving by sub-surface ducting
    - Signals are being reflected by lightning storms in your area
    - **Signals are being refracted from a sporadic E layer**

- **T3C03** What is a characteristic of VHF signals received via auroral reflection?
    - Signals from distances of 10,000 or more miles are common
    - **The signals exhibit rapid fluctuations of strength and often sound distorted**
    - These types of signals occur only during winter nighttime hours
    - These types of signals are generally strongest when your antenna is aimed west

- **T3C04** Which of the following propagation types is most commonly associated with occasional strong over-the-horizon signals on the 10, 6, and 2 meter bands?
    - Backscatter
    - **Sporadic E**
    - D layer absorption
    - Gray-line propagation

- **T3C05** Which of the following effects might cause radio signals to be heard despite obstructions between the transmitting and receiving stations?

    - **Knife-edge diffraction**
    - Faraday rotation
    - Quantum tunneling
    - Doppler shift

- **T3C06** What mode is responsible for allowing over-the-horizon VHF and UHF communications to ranges of approximately 300 miles on a regular basis?

    - **Tropospheric scatter**
    - D layer refraction
    - F2 layer refraction
    - Faraday rotation

- **T3C07** What band is best suited for communicating via meteor scatter?

    - 10 meters
    - **6 meters**
    - 2 meters
    - 70 cm

- **T3C08** What causes tropospheric ducting?

    - Discharges of lightning during electrical storms
    - Sunspots and solar flares
    - Updrafts from hurricanes and tornadoes
    - **Temperature inversions in the atmosphere**

- **T3C09** What is generally the best time for long-distance 10 meter band propagation via the F layer?

    - **From dawn to shortly after sunset during periods of high sunspot activity**
    - From shortly after sunset to dawn during periods of high sunspot activity
    - From dawn to shortly after sunset during periods of low sunspot activity
    - From shortly after sunset to dawn during periods of low sunspot activity

- **T3C10** What is the radio horizon?

    - **The distance over which two stations can communicate by direct path**
    - The distance from the ground to a horizontally mounted antenna
    - The farthest point you can see when standing at the base of your antenna tower
    - The shortest distance between two points on the Earth's surface

- **T3C11** Why do VHF and UHF radio signals usually travel somewhat farther than the visual line of sight distance between two stations?

    - Radio signals move somewhat faster than the speed of light
    - Radio waves are not blocked by dust particles
    - **The Earth seems less curved to radio waves than to light**
    - Radio waves are blocked by dust particles

- **T3C12** Which of the following bands may provide long distance communications during the peak of the sunspot cycle?

    - **Six or ten meters**
    - 23 centimeters
    - 70 centimeters or 1.25 meters
    - All of these choices are correct

SUBELEMENT T4
Amateur radio practices and station set up
[2 Exam Questions - 2 Groups – 24 Pool Questions]

T4A - Station setup: connecting microphones; reducing unwanted emissions; power source; connecting a computer; RF grounding; connecting digital equipment; connecting an SWR meter (12 Questions)

- T4A01 Which of the following is true concerning the microphone connectors on amateur transceivers?
    - All transceivers use the same microphone connector type
    - **Some connectors include push-to-talk and voltages for powering the microphone**
    - All transceivers using the same connector type are wired identically
    - Un-keyed connectors allow any microphone to be connected

- T4A02 How might a computer be used as part of an amateur radio station?
    - For logging contacts and contact information
    - For sending and/or receiving CW
    - For generating and decoding digital signals
    - **All of these choices are correct**

- T4A03 Which is a good reason to use a regulated power supply for communications equipment?
    - **It prevents voltage fluctuations from reaching sensitive circuits**
    - A regulated power supply has FCC approval
    - A fuse or circuit breaker regulates the power
    - Power consumption is independent of load

- T4A04 Where must a filter be installed to reduce harmonic emissions from your station?
    - **Between the transmitter and the antenna**
    - Between the receiver and the transmitter
    - At the station power supply
    - At the microphone

- T4A05 Where should an in-line SWR meter be connected to monitor the standing wave ratio of the station antenna system?

    - **In series with the feed line, between the transmitter and antenna**
    - In series with the station's ground
    - In parallel with the push-to-talk line and the antenna
    - In series with the power supply cable, as close as possible to the radio

- T4A06 Which of the following would be connected between a transceiver and computer in a packet radio station?

    - Transmatch
    - Mixer
    - **Terminal node controller**
    - Antenna

- T4A07 How is a computer's sound card used when conducting digital communications using a computer?

    - The sound card communicates between the computer CPU and the video display
    - The sound card records the audio frequency for video display
    - **The sound card provides audio to the microphone input and converts received audio to digital form**
    - All of these choices are correct
    -

- T4A08 Which type of conductor is best to use for RF grounding?

    - Round stranded wire
    - Round copper-clad steel wire
    - Twisted-pair cable
    - **Flat strap**

- T4A09 Which of the following could you use to cure distorted audio caused by RF current flowing on the shield of a microphone cable?

    - Band-pass filter
    - Low-pass filter
    - Preamplifier
    - **Ferrite choke**

- T4A10 What is the source of a high-pitched whine that varies with engine speed in a mobile transceiver's receive audio?

    - The ignition system
    - **The alternator**
    - The electric fuel pump
    - Anti-lock braking system controllers

- T4A11 Where should the negative return connection of a mobile transceiver's power cable be connected?

    - **At the battery or engine block ground strap**
    - At the antenna mount
    - To any metal part of the vehicle
    - Through the transceiver's mounting bracket

- T4A12 What could be happening if another operator reports a variable high-pitched whine on the audio from your mobile transmitter?

    - Your microphone is picking up noise from an open window
    - You have the volume on your receiver set too high
    - You need to adjust your squelch control
    - **Noise on the vehicle's electrical system is being transmitted along with your speech audio**

T4B - Operating controls: tuning; use of filters; squelch function; AGC; repeater offset; memory channels (12 Questions)

- T4B01 What may happen if a transmitter is operated with the microphone gain set too high?
    - The output power might be too high
    - **The output signal might become distorted**
    - The frequency might vary
    - The SWR might increase

- T4B02 Which of the following can be used to enter the operating frequency on a modern transceiver?
    - **The keypad or VFO knob**
    - The CTCSS or DTMF encoder
    - The Automatic Frequency Control
    - All of these choices are correct

- T4B03 What is the purpose of the squelch control on a transceiver?
    - To set the highest level of volume desired
    - To set the transmitter power level
    - To adjust the automatic gain control
    - **To mute receiver output noise when no signal is being received**

- T4B04 What is a way to enable quick access to a favorite frequency on your transceiver?
    - Enable the CTCSS tones
    - **Store the frequency in a memory channel**
    - Disable the CTCSS tones
    - Use the scan mode to select the desired frequency

- T4B05 Which of the following would reduce ignition interference to a receiver?
    - Change frequency slightly
    - Decrease the squelch setting
    - **Turn on the noise blanker**
    - Use the RIT control

- T4B06 Which of the following controls could be used if the voice pitch of a single-sideband signal seems too high or low?

    - The AGC or limiter
    - The bandwidth selection
    - The tone squelch
    - **The receiver RIT or clarifier**

- T4B07 What does the term 'RIT' mean?

    - Receiver Input Tone
    - **Receiver Incremental Tuning**
    - Rectifier Inverter Test
    - Remote Input Transmitter

- T4B08 What is the advantage of having multiple receive bandwidth choices on a multimode transceiver?

    - Permits monitoring several modes at once
    - **Permits noise or interference reduction by selecting a bandwidth matching the mode**
    - Increases the number of frequencies that can be stored in memory
    - Increases the amount of offset between receive and transmit frequencies

- T4B09 Which of the following is an appropriate receive filter bandwidth to select in order to minimize noise and interference for SSB reception?

    - 500 Hz
    - 1000 Hz
    - **2400 Hz**
    - 5000 Hz

- T4B10 Which of the following is an appropriate receive filter bandwidth to select in order to minimize noise and interference for CW reception?

    - **500 Hz**
    - 1000 Hz
    - 2400 Hz
    - 5000 Hz

- T4B11 Which of the following describes the common meaning of the term "repeater offset"?

    - The distance between the repeater's transmit and receive antennas
    - The time delay before the repeater timer resets
    - **The difference between the repeater's transmit and receive frequencies**
    - Matching the antenna impedance to the feed line impedance

- T4B12 What is the function of automatic gain control or AGC?

    - **To keep received audio relatively constant**
    - To protect an antenna from lightning
    - To eliminate RF on the station cabling
    - An asymmetric goniometer control used for antenna matching

SUBELEMENT T5

Electrical principles: math for electronics; electronic principles; Ohm's Law

[4 Exam Questions - 4 Groups – 50 Pool Questions]

T5A - Electrical principles, units, and terms: current and voltage; conductors and insulators; alternating and direct current (12 Questions)

- **T5A01** Electrical current is measured in which of the following units?
    - Volts
    - Watts
    - Ohms
    - **Amperes**

- **T5A02** Electrical power is measured in which of the following units?
    - Volts
    - **Watts**
    - Ohms
    - Amperes

- **T5A03** What is the name for the flow of electrons in an electric circuit?
    - Voltage
    - Resistance
    - Capacitance
    - **Current**

- **T5A04** What is the name for a current that flows only in one direction?
    - Alternating current
    - **Direct current**
    - Normal current
    - Smooth current

- **T5A05** What is the electrical term for the electromotive force (EMF) that causes electron flow?
    - **Voltage**
    - Ampere-hours
    - Capacitance
    - Inductance

- **T5A06** How much voltage does a mobile transceiver usually require?
    - **About 12 volts**
    - About 30 volts
    - About 120 volts
    - About 240 volts

- **T5A07** Which of the following is a good electrical conductor?
    - Glass
    - Wood
    - **Copper**
    - Rubber

- **T5A08** Which of the following is a good electrical insulator?
    - Copper
    - **Glass**
    - Aluminum
    - Mercury

- **T5A09** What is the name for a current that reverses direction on a regular basis?
    - **Alternating current**
    - Direct current
    - Circular current
    - Vertical current

- **T5A10** Which term describes the rate at which electrical energy is used?
    - Resistance
    - Current
    - **Power**
    - Voltage

- **T5A11** What is the basic unit of electromotive force?
    - **The volt**
    - The watt
    - The ampere
    - The ohm

- **T5A12** What term describes the number of times per second that an alternating current reverses direction?

    - Pulse rate
    - Speed
    - Wavelength
    - **Frequency**

T5B - Math for electronics: conversion of electrical units; decibels; the metric system (13 Questions)

- **T5B01** How many milliamperes is 1.5 amperes?
    - 15 milliamperes
    - 150 milliamperes
    - **1,500 milliamperes**
    - 15,000 milliamperes

- **T5B02** What is another way to specify a radio signal frequency of 1,500,000 hertz?
    - **1500 kHz**
    - 1500 MHz
    - 15 GHz
    - 150 kHz

- **T5B03** How many volts are equal to one kilovolt?
    - One one-thousandth of a volt
    - One hundred volts
    - **One thousand volts**
    - One million volts

- **T5B04** How many volts are equal to one microvolt?
    - **One one-millionth of a volt**
    - One million volts
    - One thousand kilovolts
    - One one-thousandth of a volt

- **T5B05** Which of the following is equivalent to 500 milliwatts?
    - 0.02 watts
    - **0.5 watts**
    - 5 watts
    - 50 watts

- **T5B06** If an ammeter calibrated in amperes is used to measure a 3000-milliampere current, what reading would it show?

    - 0.003 amperes
    - 0.3 amperes
    - **3 amperes**
    - 3,000,000 amperes

- **T5B07** If a frequency readout calibrated in megahertz shows a reading of 3.525 MHz, what would it show if it were calibrated in kilohertz?

    - 0.003525 kHz
    - 35.25 kHz
    - 3525 kHz
    - 3,525,000 kHz

- **T5B08** How many microfarads are 1,000,000 picofarads?

    - 0.001 microfarads
    - **1 microfarad**
    - 1000 microfarads
    - 1,000,000,000 microfarads

- **T5B09** What is the approximate amount of change, measured in decibels (dB), of a power increase from 5 watts to 10 watts?

    - 2 dB
    - **3 dB**
    - 5 dB
    - 10 dB

- **T5B10** What is the approximate amount of change, measured in decibels (dB), of a power decrease from 12 watts to 3 watts?

    - -1 dB
    - -3 dB
    - **-6 dB**
    - -9 dB

- **T5B11** What is the approximate amount of change, measured in decibels (dB), of a power increase from 20 watts to 200 watts?

    - **10 dB**
    - 12 dB
    - 18 dB
    - 28 dB

- **T5B12** Which of the following frequencies is equal to 28,400 kHz?

    - **28.400 MHz**
    - 2.800 MHz
    - 284.00 MHz
    - 28.400 kHz

- **T5B13** If a frequency readout shows a reading of 2425 MHz, what frequency is that in GHz?

    - 0.002425 GHZ
    - 24.25 GHz
    - **2.425 GHz**
    - 2425 GHz

T5C - Electronic principles: capacitance; inductance; current flow in circuits; alternating current; definition of RF; DC power calculations; impedance (13 Questions)

- **T5C01** What is the ability to store energy in an electric field called?
    - Inductance
    - Resistance
    - Tolerance
    - **Capacitance**

- **T5C02** What is the basic unit of capacitance?
    - **The farad**
    - The ohm
    - The volt
    - The henry

- **T5C03** What is the ability to store energy in a magnetic field called?
    - Admittance
    - Capacitance
    - Resistance
    - **Inductance**

- **T5C04** What is the basic unit of inductance?
    - The coulomb
    - The farad
    - **The henry**
    - The ohm

- **T5C05** What is the unit of frequency?
    - **Hertz**
    - Henry
    - Farad
    - Tesla

- **T5C06** What does the abbreviation "RF" refer to?

    - **Radio frequency signals of all types**
    - The resonant frequency of a tuned circuit
    - The real frequency transmitted as opposed to the apparent frequency
    - Reflective force in antenna transmission lines

- **T5C07** What is a usual name for electromagnetic waves that travel through space?

    - Gravity waves
    - Sound waves
    - **Radio waves**
    - Pressure waves

- **T5C08** What is the formula used to calculate electrical power in a DC circuit?

    - **Power (P) equals voltage (E) multiplied by current (I)**
    - Power (P) equals voltage (E) divided by current (I)
    - Power (P) equals voltage (E) minus current (I)
    - Power (P) equals voltage (E) plus current (I)

- **T5C09** How much power is being used in a circuit when the applied voltage is 13.8 volts DC and the current is 10 amperes?

    - **138 watts**
    - 0.7 watts
    - 23.8 watts
    - 3.8 watts

- **T5C10** How much power is being used in a circuit when the applied voltage is 12 volts DC and the current is 2.5 amperes?

    - 4.8 watts
    - **30 watts**
    - 14.5 watts
    - 0.208 watts

- **T5C11** How many amperes are flowing in a circuit when the applied voltage is 12 volts DC and the load is 120 watts?

    - 0.1 amperes
    - **10 amperes**
    - 12 amperes
    - 132 amperes

- **T5C12** What is meant by the term impedance?

    - **It is a measure of the opposition to AC current flow in a circuit**
    - It is the inverse of resistance
    - It is a measure of the Q or Quality Factor of a component
    - It is a measure of the power handling capability of a component

- **T5C13** What are the units of impedance?

    - Volts
    - Amperes
    - Coulombs
    - **Ohms**

T5D - Ohm's Law: formulas and usage (12 Questions)

- **T5D01** What formula is used to calculate current in a circuit?

    - Current (I) equals voltage (E) multiplied by resistance (R)
    - **Current (I) equals voltage (E) divided by resistance (R)**
    - Current (I) equals voltage (E) added to resistance (R)
    - Current (I) equals voltage (E) minus resistance (R)

- **T5D02** What formula is used to calculate voltage in a circuit?

    - **Voltage (E) equals current (I) multiplied by resistance (R)**
    - Voltage (E) equals current (I) divided by resistance (R)
    - Voltage (E) equals current (I) added to resistance (R)
    - Voltage (E) equals current (I) minus resistance (R)

- **T5D03** What formula is used to calculate resistance in a circuit?

    - Resistance (R) equals voltage (E) multiplied by current (I)
    - **Resistance (R) equals voltage (E) divided by current (I)**
    - Resistance (R) equals voltage (E) added to current (I)
    - Resistance (R) equals voltage (E) minus current (I)

- **T5D04** What is the resistance of a circuit in which a current of 3 amperes flows through a resistor connected to 90 volts?

    - 3 ohms
    - **30 ohms**
    - 93 ohms
    - 270 ohms

- **T5D05** What is the resistance in a circuit for which the applied voltage is 12 volts and the current flow is 1.5 amperes?

    - 18 ohms
    - 0.125 ohms
    - **8 ohms**
    - 13.5 ohms

- **T5D06** What is the resistance of a circuit that draws 4 amperes from a 12-volt source?
    - **3 ohms**
    - 16 ohms
    - 48 ohms
    - 8 Ohms

- **T5D07** What is the current flow in a circuit with an applied voltage of 120 volts and a resistance of 80 ohms?
    - 9600 amperes
    - 200 amperes
    - 0.667 amperes
    - **1.5 amperes**

- **T5D08** What is the current flowing through a 100-ohm resistor connected across 200 volts?
    - 20,000 amperes
    - 0.5 amperes
    - **2 amperes**
    - 100 amperes

- **T5D09** What is the current flowing through a 24-ohm resistor connected across 240 volts?
    - 24,000 amperes
    - 0.1 amperes
    - **10 amperes**
    - 216 amperes

- **T5D10** What is the voltage across a 2-ohm resistor if a current of 0.5 amperes flows through it?
    - **1 volt**
    - 0.25 volts
    - 2.5 volts
    - 1.5 volts

- **T5D11** What is the voltage across a 10-ohm resistor if a current of 1 ampere flows through it?
    - 1 volt
    - **10 volts**
    - 11 volts
    - 9 volts

- **T5D12** What is the voltage across a 10-ohm resistor if a current of 2 amperes flows through it?
    - 8 volts
    - 0.2 volts
    - 12 volts
    - **20 volts**

SUBELEMENT T6

Electrical components: semiconductors; circuit diagrams; component functions

[4 Exam Questions - 4 Groups – 48 Pool Questions]

T6A - Electrical components: fixed and variable resistors; capacitors and inductors; fuses; switches; batteries (11 Questions)

- **T6A01** What electrical component is used to oppose the flow of current in a DC circuit?
    - Inductor
    - **Resistor**
    - Voltmeter
    - Transformer

- **T6A02** What type of component is often used as an adjustable volume control?
    - Fixed resistor
    - Power resistor
    - **Potentiometer**
    - Transformer

- **T6A03** What electrical parameter is controlled by a potentiometer?
    - Inductance
    - **Resistance**
    - Capacitance
    - Field strength

- **T6A04** What electrical component stores energy in an electric field?
    - Resistor
    - **Capacitor**
    - Inductor
    - Diode

- **T6A05** What type of electrical component consists of two or more conductive surfaces separated by an insulator?
    - Resistor
    - Potentiometer
    - Oscillator
    - **Capacitor**

- **T6A06** What type of electrical component stores energy in a magnetic field?
    - Resistor
    - Capacitor
    - **Inductor**
    - Diode

- **T6A07** What electrical component is usually composed of a coil of wire?
    - Switch
    - Capacitor
    - Diode
    - **Inductor**

- **T6A08** What electrical component is used to connect or disconnect electrical circuits?
    - Magnetron
    - **Switch**
    - Thermistor
    - All of these choices are correct

- **T6A09** What electrical component is used to protect other circuit components from current overloads?
    - **Fuse**
    - Capacitor
    - Inductor
    - All of these choices are correct

- **T6A10** Which of the following battery types is rechargeable?
    - Nickel-metal hydride
    - Lithium-ion
    - Lead-acid gel-cell
    - **All of these choices are correct**

- **T6A11** Which of the following battery types is not rechargeable?
    - Nickel-cadmium
    - **Carbon-zinc**
    - Lead-acid
    - Lithium-ion

T6B -Semiconductors: basic principles and applications of solid state devices; diodes and transistors (12 Questions)

- **T6B01** What class of electronic components is capable of using a voltage or current signal to control current flow?
    - Capacitors
    - Inductors
    - Resistors
    - **Transistors**

- **T6B02** What electronic component allows current to flow in only one direction?
    - Resistor
    - Fuse
    - **Diode**
    - Driven Element

- **T6B03** Which of these components can be used as an electronic switch or amplifier?
    - Oscillator
    - Potentiometer
    - **Transistor**
    - Voltmeter

- **T6B04** Which of the following components can be made of three layers of semiconductor material?
    - Alternator
    - **Transistor**
    - Triode
    - Pentagrid converter

- **T6B05** Which of the following electronic components can amplify signals?
    - **Transistor**
    - Variable resistor
    - Electrolytic capacitor
    - Multi-cell battery

- **T6B06** How is the cathode lead of a semiconductor diode usually identified?
    - With the word cathode
    - **With a stripe**
    - With the letter C
    - All of these choices are correct

- **T6B07** What does the abbreviation LED stand for?
    - Low Emission Diode
    - **Light Emitting Diode**
    - Liquid Emission Detector
    - Long Echo Delay

- **T6B08** What does the abbreviation FET stand for?
    - **Field Effect Transistor**
    - Fast Electron Transistor
    - Free Electron Transition
    - Field Emission Thickness

- **T6B09** What are the names of the two electrodes of a diode?
    - Plus and minus
    - Source and drain
    - **Anode and cathode**
    - Gate and base

- **T6B10** What are the three electrodes of a PNP or NPN transistor?
    - **Emitter, base, and collector**
    - Source, gate, and drain
    - Cathode, grid, and plate
    - Cathode, drift cavity, and collector

- **T6B11** What at are the three electrodes of a field effect transistor?
    - Emitter, base, and collector
    - **Source, gate, and drain**
    - Cathode, grid, and plate
    - Cathode, gate, and anode

- **T6B12** What is the term that describes a transistor's ability to amplify a signal?
    - **Gain**
    - Forward resistance
    - Forward voltage drop
    - On resistance

T6C - Circuit diagrams; schematic symbols (13 Questions)

- **T6C01** What is the name for standardized representations of components in an electrical wiring diagram?
    - Electrical depictions
    - Grey sketch
    - **Schematic symbols**
    - Component callouts

- **T6C02** What is component 1 in figure T1?
    - **Resistor**
    - Transistor
    - Battery
    - Connector

- **T6C03** What is component 2 in figure T1?
    - Resistor
    - **Transistor**
    - Indicator lamp
    - Connector

- **T6C04** What is component 3 in figure T1?
    - Resistor
    - Transistor
    - **Lamp**
    - Ground symbol

- **T6C05** What is component 4 in figure T1?
    - Resistor
    - Transistor
    - **Battery**
    - Ground symbol

- **T6C06** What is component 6 in figure T2?
    - Resistor
    - **Capacitor**
    - Regulator IC
    - Transistor

- **T6C07** What is component 8 in figure T2?
    - Resistor
    - Inductor
    - Regulator IC
    - **Light emitting diode**

- **T6C08** What is component 9 in figure T2?
    - Variable capacitor
    - Variable inductor
    - **Variable resistor**
    - Variable transformer

- **T6C09** What is component 4 in figure T2?
    - Variable inductor
    - Double-pole switch
    - Potentiometer
    - **Transformer**

- **T6C10** What is component 3 in figure T3?
    - Connector
    - Meter
    - Variable capacitor
    - **Variable inductor**

- **T6C11** What is component 4 in figure T3?

    - **Antenna**
    - Transmitter
    - Dummy load
    - Ground

- **T6C12** What do the symbols on an electrical circuit schematic diagram represent?

    - **Electrical components**
    - Logic states
    - Digital codes
    - Traffic nodes

- **T6C13** Which of the following is accurately represented in electrical circuit schematic diagrams?

    - Wire lengths
    - Physical appearance of components
    - **The way components are interconnected**
    - All of these choices are correct

T6D - Component functions: rectification; switches; indicators; power supply components; resonant circuit; shielding; power transformers; integrated circuits (12 Questions)

- **T6D01** Which of the following devices or circuits changes an alternating current into a varying direct current signal?
    - Transformer
    - **Rectifier**
    - Amplifier
    - Reflector

- **T6D02** What best describes a relay?
    - **A switch controlled by an electromagnet**
    - A current controlled amplifier
    - An optical sensor
    - A pass transistor

- **T6D03** What type of switch is represented by component 3 in figure T2?
    - **Single-pole single-throw**
    - Single-pole double-throw
    - Double-pole single-throw
    - Double-pole double-throw

- **T6D04** Which of the following can be used to display signal strength on a numeric scale?
    - Potentiometer
    - Transistor
    - **Meter**
    - Relay

- **T6D05** What type of circuit controls the amount of voltage from a power supply?
    - **Regulator**
    - Oscillator
    - Filter
    - Phase inverter

- **T6D06** What component is commonly used to change 120V AC house current to a lower AC voltage for other uses?

    - Variable capacitor
    - **Transformer**
    - Transistor
    - Diode

- **T6D07** Which of the following is commonly used as a visual indicator?

    - **LED**
    - FET
    - Zener diode
    - Bipolar transistor

- **T6D08** Which of the following is used together with an inductor to make a tuned circuit?

    - Resistor
    - Zener diode
    - Potentiometer
    - **Capacitor**

- **T6D09** What is the name of a device that combines several semiconductors and other components into one package?

    - Transducer
    - Multi-pole relay
    - **Integrated circuit**
    - Transformer

- **T6D10** What is the function of component 2 in Figure T1?

    - Give off light when current flows through it
    - Supply electrical energy
    - **Control the flow of current**
    - Convert electrical energy into radio waves

- **T6D11** What is a simple resonant or tuned circuit?

    - **An inductor and a capacitor connected in series or parallel to form a filter**
    - A type of voltage regulator
    - A resistor circuit used for reducing standing wave ratio
    - A circuit designed to provide high fidelity audio

- **T6D12** Which of the following is a common reason to use shielded wire?

    - To decrease the resistance of DC power connections
    - To increase the current carrying capability of the wire
    - **To prevent coupling of unwanted signals to or from the wire**
    - To couple the wire to other signals

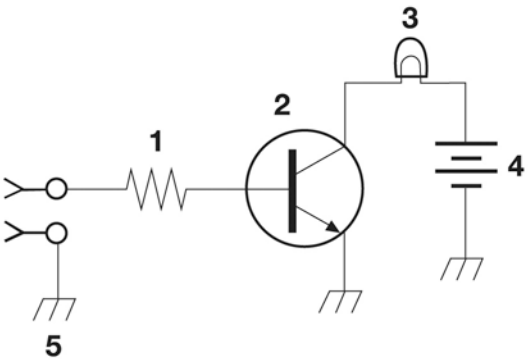

Figure T-1

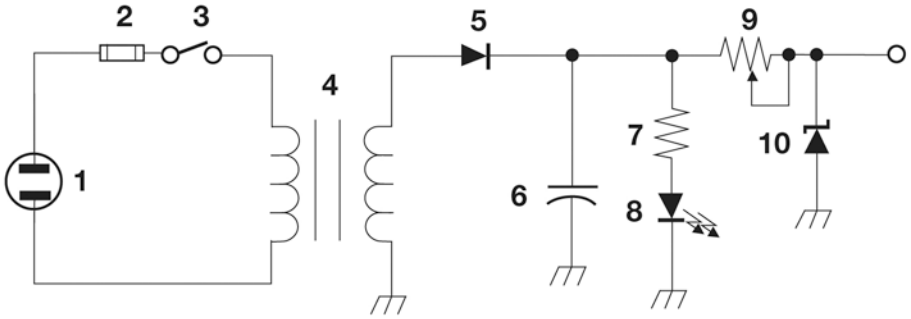

Figure T-2

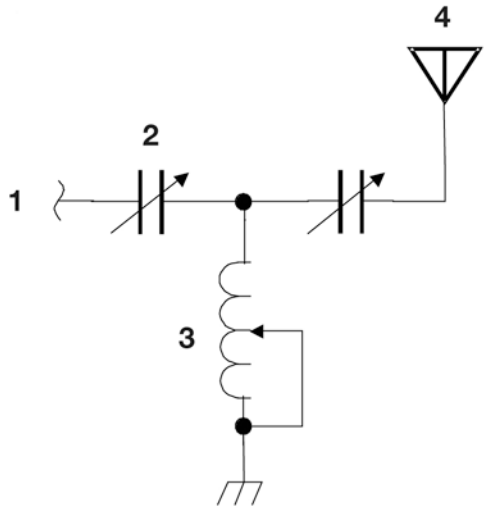

Figure T-3

SUBELEMENT T7

Station equipment: common transmitter and receiver problems; antenna measurements; troubleshooting; basic repair and testing

[4 Exam Questions - 4 Groups – 48 Pool Questions]

T7A - Station equipment: receivers; transmitters; transceivers; modulation; transverters; low power and weak signal operation; transmit and receive amplifiers (11 Questions)

- **T7A01** Which term describes the ability of a receiver to detect the presence of a signal?
    - Linearity
    - **Sensitivity**
    - Selectivity
    - Total Harmonic Distortion

- **T7A02** What is a transceiver?
    - A type of antenna switch
    - **A unit combining the functions of a transmitter and a receiver**
    - A component in a repeater which filters out unwanted interference
    - A type of antenna matching network

- **T7A03** Which of the following is used to convert a radio signal from one frequency to another?
    - Phase splitter
    - **Mixer**
    - Inverter
    - Amplifier

- **T7A04** Which term describes the ability of a receiver to discriminate between multiple signals?
    - Discrimination ratio
    - Sensitivity
    - **Selectivity**
    - Harmonic Distortion

- **T7A05** What is the name of a circuit that generates a signal of a desired frequency?
    - Reactance modulator
    - Product detector
    - Low-pass filter
    - **Oscillator**

- **T7A06** What device takes the output of a low-powered 28 MHz SSB exciter and produces a 222 MHz output signal?

    - High-pass filter
    - Low-pass filter
    - **Transverter**
    - Phase converter

- **T7A07** What is meant by term 'PTT'?

    - Pre-transmission tuning to reduce transmitter harmonic emission
    - Precise tone transmissions used to limit repeater access to only certain signals
    - A primary transformer tuner use to match antennas
    - **The push to talk function which switches between receive and transmit**

- **T7A08** Which of the following describes combining speech with an RF carrier signal?

    - Impedance matching
    - Oscillation
    - **Modulation**
    - Low-pass filtering

- **T7A09** Which of the following devices is most useful for VHF weak-signal communication?

    - A quarter-wave vertical antenna
    - **A multi-mode VHF transceiver**
    - An omni-directional antenna
    - A mobile VHF FM transceiver

- **T7A10** What device increases the low-power output from a handheld transceiver?

    - A voltage divider
    - **An RF power amplifier**
    - An impedance network
    - All of these choices are correct

- **T7A11** Where is an RF preamplifier installed?

    - **Between the antenna and receiver**
    - At the output of the transmitter's power amplifier
    - Between a transmitter and antenna tuner
    - At the receiver's audio output

T7B - Common transmitter and receiver problems: symptoms of overload and overdrive; distortion; causes of interference; interference and consumer electronics; part 15 devices; over and under modulation; RF feedback; off frequency signals; fading and noise; problems with digital communications interfaces (12 Questions)

- **T7B01** What can you do if you are told your FM handheld or mobile transceiver is over-deviating?
    - Talk louder into the microphone
    - Let the transceiver cool off
    - Change to a higher power level
    - **Talk farther away from the microphone**

- **T7B02** What would cause a broadcast AM or FM radio to receive an amateur radio transmission unintentionally?
    - **The receiver is unable to reject strong signals outside the AM or FM band**
    - The microphone gain of the transmitter is turned up too high
    - The audio amplifier of the transmitter is overloaded
    - The deviation of an FM transmitter is set too low

- **T7B03** Which of the following may be a cause of radio frequency interference?
    - Fundamental overload
    - Harmonics
    - Spurious emissions
    - **All of these choices are correct**

- **T7B04** Which of the following is a way to reduce or eliminate interference by an amateur transmitter to a nearby telephone?
    - Put a filter on the amateur transmitter
    - Reduce the microphone gain
    - Reduce the SWR on the transmitter transmission line
    - **Put a RF filter on the telephone**

- **T7B05** How can overload of a non-amateur radio or TV receiver by an amateur signal be reduced or eliminated?

    - **Block the amateur signal with a filter at the antenna input of the affected receiver**
    - Block the interfering signal with a filter on the amateur transmitter
    - Switch the transmitter from FM to SSB
    - Switch the transmitter to a narrow-band mode

- **T7B06** Which of the following actions should you take if a neighbor tells you that your station's transmissions are interfering with their radio or TV reception?

    - **Make sure that your station is functioning properly and that it does not cause interference to your own radio or television when it is tuned to the same channel**
    - Immediately turn off your transmitter and contact the nearest FCC office for assistance
    - Tell them that your license gives you the right to transmit and nothing can be done to reduce the interference
    - Install a harmonic doubler on the output of your transmitter and tune it until the interference is eliminated

- **T7B07** Which of the following may be useful in correcting a radio frequency interference problem?

    - Snap-on ferrite chokes
    - Low-pass and high-pass filters
    - Band-reject and band-pass filters
    - **All of these choices are correct**

- **T7B08** What should you do if something in a neighbor's home is causing harmful interference to your amateur station?

    - Work with your neighbor to identify the offending device
    - Politely inform your neighbor about the rules that prohibit the use of devices which cause interference
    - Check your station and make sure it meets the standards of good amateur practice
    - **All of these choices are correct**

- **T7B09** What is a Part 15 device?

    - **An unlicensed device that may emit low powered radio signals on frequencies used by a licensed service**
    - A type of amateur radio that can legally be used in the citizen's band
    - A device for long distance communications using special codes sanctioned by the International Amateur Radio Union
    - A type of test set used to determine whether a transmitter is in compliance with FCC regulation 91.15

- **T7B10** What might be the problem if you receive a report that your audio signal through the repeater is distorted or unintelligible?

    - Your transmitter may be slightly off frequency
    - Your batteries may be running low
    - You could be in a bad location
    - **All of these choices are correct**

- **T7B11** What is a symptom of RF feedback in a transmitter or transceiver?

    - Excessive SWR at the antenna connection
    - The transmitter will not stay on the desired frequency
    - **Reports of garbled, distorted, or unintelligible transmissions**
    - Frequent blowing of power supply fuses

- **T7B12** What might be the first step to resolve cable TV interference from your ham radio transmission?

    - Add a low pass filter to the TV antenna input
    - Add a high pass filter to the TV antenna input
    - Add a preamplifier to the TV antenna input
    - **Be sure all TV coaxial connectors are installed properly**

T7C - Antenna measurements and troubleshooting: measuring SWR; dummy loads; coaxial cables; feed line failure modes (13 Questions)

- **T7C01** What is the primary purpose of a dummy load?
    - **To prevent the radiation of signals when making tests**
    - To prevent over-modulation of your transmitter
    - To improve the radiation from your antenna
    - To improve the signal to noise ratio of your receiver

- **T7C02** Which of the following instruments can be used to determine if an antenna is resonant at the desired operating frequency?
    - A VTVM
    - **An antenna analyzer**
    - A Q meter
    - A frequency counter

- **T7C03** What, in general terms, is standing wave ratio (SWR)?
    - **A measure of how well a load is matched to a transmission line**
    - The ratio of high to low impedance in a feed line
    - The transmitter efficiency ratio
    - An indication of the quality of your station's ground connection

- **T7C04** What reading on an SWR meter indicates a perfect impedance match between the antenna and the feed line?
    - 2 to 1
    - 1 to 3
    - **1 to 1**
    - 10 to 1

- **T7C05** What is the approximate SWR value above which the protection circuits in most solid-state transmitters begin to reduce transmitter power?
    - **2 to 1**
    - 1 to 2
    - 6 to 1
    - 10 to 1

- **T7C06** What does an SWR reading of 4:1 indicate?
    - Loss of -4dB
    - Good impedance match
    - Gain of +4dB
    - **Impedance mismatch**

- **T7C07** What happens to power lost in a feed line?
    - It increases the SWR
    - It comes back into your transmitter and could cause damage
    - **It is converted into heat**
    - It can cause distortion of your signal

- **T7C08** What instrument other than an SWR meter could you use to determine if a feed line and antenna are properly matched?
    - Voltmeter
    - Ohmmeter
    - Iambic pentameter
    - **Directional wattmeter**

- **T7C09** Which of the following is the most common cause for failure of coaxial cables?
    - **Moisture contamination**
    - Gamma rays
    - The velocity factor exceeds 1.0
    - Overloading

- **T7C10** Why should the outer jacket of coaxial cable be resistant to ultraviolet light?
    - Ultraviolet resistant jackets prevent harmonic radiation
    - Ultraviolet light can increase losses in the cable's jacket
    - Ultraviolet and RF signals can mix together, causing interference
    - **Ultraviolet light can damage the jacket and allow water to enter the cable**

- **T7C11** What is a disadvantage of air core coaxial cable when compared to foam or solid dielectric types?

    - It has more loss per foot
    - It cannot be used for VHF or UHF antennas
    - **It requires special techniques to prevent water absorption**
    - It cannot be used at below freezing temperatures

- **T7C12** Which of the following is a common use of coaxial cable?

    - Carrying dc power from a vehicle battery to a mobile radio
    - **Carrying RF signals between a radio and antenna**
    - Securing masts, tubing, and other cylindrical objects on towers
    - Connecting data signals from a TNC to a computer

- **T7C13** What does a dummy load consist of?

    - A high-gain amplifier and a TR switch
    - **A non-inductive resistor and a heat sink**
    - A low voltage power supply and a DC relay
    - A 50 ohm reactance used to terminate a transmission line

T7D - Basic repair and testing: soldering; using basic test instruments; connecting a voltmeter, ammeter, or ohmmeter (12 Questions)

- **T7D01** Which instrument would you use to measure electric potential or electromotive force?
    - An ammeter
    - **A voltmeter**
    - A wavemeter
    - An ohmmeter

- **T7D02** What is the correct way to connect a voltmeter to a circuit?
    - In series with the circuit
    - **In parallel with the circuit**
    - In quadrature with the circuit
    - In phase with the circuit

- **T7D03** How is an ammeter usually connected to a circuit?
    - **In series with the circuit**
    - In parallel with the circuit
    - In quadrature with the circuit
    - In phase with the circuit

- **T7D04** Which instrument is used to measure electric current?
    - An ohmmeter
    - A wavemeter
    - A voltmeter
    - **An ammeter**

- **T7D05** What instrument is used to measure resistance?
    - An oscilloscope
    - A spectrum analyzer
    - A noise bridge
    - **An ohmmeter**

- **T7D06** Which of the following might damage a multimeter?

    - Measuring a voltage too small for the chosen scale
    - Leaving the meter in the milliamps position overnight
    - **Attempting to measure voltage when using the resistance setting**
    - Not allowing it to warm up properly

- **T7D07** Which of the following measurements are commonly made using a multimeter?

    - SWR and RF power
    - Signal strength and noise
    - Impedance and reactance
    - **Voltage and resistance**

- **T7D08** Which of the following types of solder is best for radio and electronic use?

    - Acid-core solder
    - Silver solder
    - **Rosin-core solder**
    - Aluminum solder

- **T7D09** What is the characteristic appearance of a cold solder joint?

    - Dark black spots
    - A bright or shiny surface
    - **A grainy or dull surface**
    - A greenish tint

- **T7D10** What is probably happening when an ohmmeter, connected across an unpowered circuit, initially indicates a low resistance and then shows increasing resistance with time?

    - The ohmmeter is defective
    - **The circuit contains a large capacitor**
    - The circuit contains a large inductor
    - The circuit is a relaxation oscillator

- **T7D11** Which of the following precautions should be taken when measuring circuit resistance with an ohmmeter?

    - Ensure that the applied voltages are correct
    - **Ensure that the circuit is not powered**
    - Ensure that the circuit is grounded
    - Ensure that the circuit is operating at the correct frequency

- **T7D12** Which of the following precautions should be taken when measuring high voltages with a voltmeter?

    - Ensure that the voltmeter has very low impedance
    - **Ensure that the voltmeter and leads are rated for use at the voltages to be measured**
    - Ensure that the circuit is grounded through the voltmeter
    - Ensure that the voltmeter is set to the correct frequency

SUBELEMENT T8

Modulation modes: amateur satellite operation; operating activities; non-voice communications

[4 Exam Questions - 4 Groups – 46 Pool Questions]

T8A - Modulation modes: bandwidth of various signals; choice of emission type (11 Questions)

- **T8A01** Which of the following is a form of amplitude modulation?
    - Spread-spectrum
    - Packet radio
    - **Single sideband**
    - Phase shift keying

- **T8A02** What type of modulation is most commonly used for VHF packet radio transmissions?
    - **FM**
    - SSB
    - AM
    - Spread Spectrum

- **T8A03** Which type of voice mode is most often used for long-distance (weak signal) contacts on the VHF and UHF bands?
    - FM
    - DRM
    - **SSB**
    - PM

- **T8A04** Which type of modulation is most commonly used for VHF and UHF voice repeaters?
    - AM
    - SSB
    - PSK
    - **FM**

- **T8A05** Which of the following types of emission has the narrowest bandwidth?
    - FM voice
    - SSB voice
    - **CW**
    - Slow-scan TV

- **T8A06** Which sideband is normally used for 10 meter HF, VHF and UHF single-sideband communications?

    - **Upper sideband**
    - Lower sideband
    - Suppressed sideband
    - Inverted sideband

- **T8A07** What is the primary advantage of single sideband over FM for voice transmissions?

    - SSB signals are easier to tune
    - SSB signals are less susceptible to interference
    - **SSB signals have narrower bandwidth**
    - All of these choices are correct

- **T8A08** What is the approximate bandwidth of a single sideband voice signal?

    - 1 kHz
    - **3 kHz**
    - 6 kHz
    - 15 kHz

- **T8A09** What is the approximate bandwidth of a VHF repeater FM phone signal?

    - Less than 500 Hz
    - About 150 kHz
    - **Between 10 and 15 kHz**
    - Between 50 and 125 kHz

- **T8A10** What is the typical bandwidth of analog fast-scan TV transmissions on the 70 cm band?

    - More than 10 MHz
    - **About 6 MHz**
    - About 3 MHz
    - About 1 MHz

- **T8A11** What is the approximate maximum bandwidth required to transmit a CW signal?

    - 2.4 kHz
    - **150 Hz**
    - 1000 Hz
    - 15 kHz

T8B - Amateur satellite operation; Doppler shift, basic orbits, operating protocols; control operator, transmitter power considerations; satellite tracking; digital modes (11 Questions)

- **T8B01** [97.301, 97.207(c)] Who may be the control operator of a station communicating through an amateur satellite or space station?
    - Only an Amateur Extra Class operator
    - A General Class licensee or higher licensee who has a satellite operator certification
    - Only an Amateur Extra Class operator who is also an AMSAT member
    - **Any amateur whose license privileges allow them to transmit on the satellite uplink frequency**

- **T8B02** [97.313] How much transmitter power should be used on the uplink frequency of an amateur satellite or space station?
    - The maximum power of your transmitter
    - **The minimum amount of power needed to complete the contact**
    - No more than half the rating of your linear amplifier
    - Never more than 1 watt

- **T8B03** Which of the following are provided by satellite tracking programs?
    - Maps showing the real-time position of the satellite track over the earth
    - The time, azimuth, and elevation of the start, maximum altitude, and end of a pass
    - The apparent frequency of the satellite transmission, including effects of Doppler shift
    - **All of these answers are correct**

- **T8B04** [97.301, 97.207(c)] Which amateur stations may make contact with an amateur station on the International Space Station using 2 meter and 70 cm band amateur radio frequencies?
    - Only members of amateur radio clubs at NASA facilities
    - **Any amateur holding a Technician or higher class license**
    - Only the astronaut's family members who are hams
    - You cannot talk to the ISS on amateur radio frequencies

- **T8B05** What is a satellite beacon?
    - The primary transmit antenna on the satellite
    - An indicator light that that shows where to point your antenna
    - A reflective surface on the satellite
    - **A transmission from a space station that contains information about a satellite**

- **T8B06** Which of the following are inputs to a satellite tracking program?
    - The weight of the satellite
    - **The Keplerian elements**
    - The last observed time of zero Doppler shift
    - All of these answers are correct

- **T8B07** With regard to satellite communications, what is Doppler shift?
    - A change in the satellite orbit
    - A mode where the satellite receives signals on one band and transmits on another
    - **An observed change in signal frequency caused by relative motion between the satellite and the earth station**
    - A special digital communications mode for some satellites

- **T8B08** What is meant by the statement that a satellite is operating in mode U/V?
    - The satellite uplink is in the 15 meter band and the downlink is in the 10 meter band
    - **The satellite uplink is in the 70 cm band and the downlink is in the 2 meter band**
    - The satellite operates using ultraviolet frequencies
    - The satellite frequencies are usually variable

- **T8B09** What causes spin fading when referring to satellite signals?
    - Circular polarized noise interference radiated from the sun
    - **Rotation of the satellite and its antennas**
    - Doppler shift of the received signal
    - Interfering signals within the satellite uplink band

- **T8B10** What do the initials LEO tell you about an amateur satellite?

    - The satellite battery is in Low Energy Operation mode
    - The satellite is performing a Lunar Ejection Orbit maneuver
    - **The satellite is in a Low Earth Orbit**
    - The satellite uses Light Emitting Optics

- **T8B11** What is a commonly used method of sending signals to and from a digital satellite?

    - USB AFSK
    - PSK31
    - **FM Packet**
    - WSJT

T8C - Operating activities: radio direction finding; radio control; contests; linking over the Internet; grid locators (13 Questions)

- **T8C01** Which of the following methods is used to locate sources of noise interference or jamming?
    - Echolocation
    - Doppler radar
    - **Radio direction finding**
    - Phase locking

- **T8C02** Which of these items would be useful for a hidden transmitter hunt?
    - Calibrated SWR meter
    - **A directional antenna**
    - A calibrated noise bridge
    - All of these choices are correct

- **T8C03** What popular operating activity involves contacting as many stations as possible during a specified period of time?
    - **Contesting**
    - Net operations
    - Public service events
    - Simulated emergency exercises

- **T8C04** Which of the following is good procedure when contacting another station in a radio contest?
    - Be sure to sign only the last two letters of your call if there is a pileup calling the station
    - Work the station twice to be sure that you are in his log
    - **Send only the minimum information needed for proper identification and the contest exchange**
    - All of these choices are correct

- **T8C05** What is a grid locator?

    - **A letter-number designator assigned to a geographic location**
    - A letter-number designator assigned to an azimuth and elevation
    - An instrument for neutralizing a final amplifier
    - An instrument for radio direction finding

- **T8C06** How is access to an IRLP node accomplished?

    - By obtaining a password which is sent via voice to the node
    - **By using DTMF signals**
    - By entering the proper Internet password
    - By using CTCSS tone codes

- **T8C07** [97.215(c)] What is the maximum power allowed when transmitting telecommand signals to radio controlled models?

    - 500 milliwatts
    - **1 watt**
    - 25 watts
    - 1500 watts

- **T8C08** [97.215(a)] What is required in place of on-air station identification when sending signals to a radio control model using amateur frequencies?

    - Voice identification must be transmitted every 10 minutes
    - Morse code ID must be sent once per hour
    - **A label indicating the licensee's name, call sign and address must be affixed to the transmitter**
    - A flag must be affixed to the transmitter antenna with the station call sign in 1 inch high letters or larger

- **T8C09** How might you obtain a list of active nodes that use VoIP?

    - From the FCC Rulebook
    - From your local emergency coordinator
    - **From a repeater directory**
    - From the local repeater frequency coordinator

- **T8C10** How do you select a specific IRLP node when using a portable transceiver?

    - Choose a specific CTCSS tone
    - Choose the correct DSC tone
    - Access the repeater autopatch
    - **Use the keypad to transmit the IRLP node ID**

- **T8C11** What name is given to an amateur radio station that is used to connect other amateur stations to the Internet?

    - **A gateway**
    - A repeater
    - A digipeater
    - A beacon

- **T8C12** What is meant by Voice Over Internet Protocol (VoIP) as used in amateur radio?

    - A set of rules specifying how to identify your station when linked over the Internet to another station
    - A set of guidelines for working DX during contests using Internet access
    - A technique for measuring the modulation quality of a transmitter using remote sites monitored via the Internet
    - **A method of delivering voice communications over the Internet using digital techniques**

- **T8C13** What is the Internet Radio Linking Project (IRLP)?

    - **A technique to connect amateur radio systems, such as repeaters, via the Internet using Voice Over Internet Protocol**
    - A system for providing access to websites via amateur radio
    - A system for informing amateurs in real time of the frequency of active DX stations
    - A technique for measuring signal strength of an amateur transmitter via the Internet

T8D - Non-voice communications: image signals; digital modes; CW; packet; PSK31; APRS; error detection and correction; NTSC (11 Questions)

- **T8D01** Which of the following is an example of a digital communications method?
    - Packet
    - PSK31
    - MFSK
    - **All of these choices are correct**

- **T8D02** What does the term 'APRS' mean?
    - **Automatic Packet Reporting System**
    - Associated Public Radio Station
    - Auto Planning Radio Set-up
    - Advanced Polar Radio System

- **T8D03** Which of the following devices provides data to the transmitter when sending automatic position reports from a mobile amateur radio station?
    - The vehicle speedometer
    - A WWV receiver
    - A connection to a broadcast FM sub-carrier receiver
    - **A Global Positioning System receiver**

- **T8D04** What type of transmission is indicated by the term NTSC?
    - A Normal Transmission mode in Static Circuit
    - A special mode for earth satellite uplink
    - **An analog fast scan color TV signal**
    - A frame compression scheme for TV signals

- **T8D05** Which of the following is an application of APRS (Automatic Packet Reporting System)?
    - **Providing real time tactical digital communications in conjunction with a map showing the locations of stations**
    - Showing automatically the number of packets transmitted via PACTOR during a specific time interval
    - Providing voice over Internet connection between repeaters
    - Providing information on the number of stations signed into a repeater

- **T8D06** What does the abbreviation PSK mean?
    - Pulse Shift Keying
    - **Phase Shift Keying**
    - Packet Short Keying
    - Phased Slide Keying

- **T8D07** What is PSK31?
    - A high-rate data transmission mode
    - A method of reducing noise interference to FM signals
    - A method of compressing digital television signals
    - **A low-rate data transmission mode**

- **T8D08** Which of the following may be included in packet transmissions?
    - A check sum which permits error detection
    - A header which contains the call sign of the station to which the information is being sent
    - Automatic repeat request in case of error
    - **All of these choices are correct**

- **T8D09** What code is used when sending CW in the amateur bands?
    - Baudot
    - Hamming
    - **International Morse**
    - Gray

- **T8D10** Which of the following can be used to transmit CW in the amateur bands?
    - Straight Key
    - Electronic Keyer
    - Computer Keyboard
    - **All of these choices are correct**

- **T8D11** What is an ARQ transmission system?

    - A special transmission format limited to video signals
    - A system used to encrypt command signals to an amateur radio satellite
    - **A digital scheme whereby the receiving station detects errors and sends a request to the sending station to retransmit the information**
    - A method of compressing the data in a message so more information can be sent in a shorter time

SUBELEMENT T9
Antennas and feed lines
[2 Exam Questions - 2 Groups – 25 Pool Questions]

T9A - Antennas: vertical and horizontal polarization; concept of gain; common portable and mobile antennas; relationships between antenna length and frequency (14 Questions)

- **T9A01** What is a beam antenna?
    - An antenna built from aluminum I-beams
    - An omnidirectional antenna invented by Clarence Beam
    - **An antenna that concentrates signals in one direction**
    - An antenna that reverses the phase of received signals

- **T9A02** Which of the following is true regarding vertical antennas?
    - The magnetic field is perpendicular to the Earth
    - **The electric field is perpendicular to the Earth**
    - The phase is inverted
    - The phase is reversed

- **T9A03** Which of the following describes a simple dipole mounted so the conductor is parallel to the Earth's surface?
    - A ground wave antenna
    - **A horizontally polarized antenna**
    - A rhombic antenna
    - A vertically polarized antenna

- **T9A04** What is a disadvantage of the “rubber duck” antenna supplied with most handheld radio transceivers?
    - I**t does not transmit or receive as effectively as a full-sized antenna**
    - It transmits a circularly polarized signal
    - If the rubber end cap is lost it will unravel very quickly
    - All of these choices are correct

- **T9A05** How would you change a dipole antenna to make it resonant on a higher frequency?
    - Lengthen it
    - Insert coils in series with radiating wires
    - **Shorten it**
    - Add capacitive loading to the ends of the radiating wires

- **T9A06** What type of antennas are the quad, Yagi, and dish?
    - Non-resonant antennas
    - Loop antennas
    - **Directional antennas**
    - Isotropic antennas

- **T9A07** What is a good reason not to use a 'rubber duck' antenna inside your car?
    - **Signals can be significantly weaker than when it is outside of the vehicle**
    - It might cause your radio to overheat
    - The SWR might decrease, decreasing the signal strength
    - All of these choices are correct

- **T9A08** What is the approximate length, in inches, of a quarter-wavelength vertical antenna for 146 MHz?
    - 112
    - 50
    - **19**
    - 12

- **T9A09** What is the approximate length, in inches, of a 6 meter 1/2-wavelength wire dipole antenna?
    - 6
    - 50
    - **112**
    - 236

- **T9A10** In which direction is the radiation strongest from a half-wave dipole antenna in free space?
    - Equally in all directions
    - Off the ends of the antenna
    - **Broadside to the antenna**
    - In the direction of the feed line

- **T9A11** What is meant by the gain of an antenna?

    - The additional power that is added to the transmitter power
    - The additional power that is lost in the antenna when transmitting on a higher frequency
    - **The increase in signal strength in a specified direction when compared to a reference antenna**
    - The increase in impedance on receive or transmit compared to a reference antenna

- **T9A12** What is a reason to use a properly mounted 5/8 wavelength antenna for VHF or UHF mobile service?

    - **It offers a lower angle of radiation and more gain than a 1/4 wavelength antenna and usually provides improved coverage**
    - It features a very high angle of radiation and is better for communicating via a repeater
    - The 5/8 wavelength antenna completely eliminates distortion caused by reflected signals
    - The 5/8 wavelength antenna offers a 10-times power gain over a 1/4 wavelength design

- **T9A13** Why are VHF or UHF mobile antennas often mounted in the center of the vehicle roof?

    - Roof mounts have the lowest possible SWR of any mounting configuration
    - Only roof mounting can guarantee a vertically polarized signal
    - **A roof mounted antenna normally provides the most uniform radiation pattern**
    - Roof mounted antennas are always the easiest to install

- **T9A14** Which of the following terms describes a type of loading when referring to an antenna?

    - **Inserting an inductor in the radiating portion of the antenna to make it electrically longer**
    - Inserting a resistor in the radiating portion of the antenna to make it resonant
    - Installing a spring at the base of the antenna to absorb the effects of collisions with other objects
    - Making the antenna heavier so it will resist wind effects when in motion

T9B - Feed lines: types of feed lines; attenuation vs. frequency; SWR concepts; matching; weather protection; choosing RF connectors and feed lines (11 Questions)

- **T9B01** Why is it important to have a low SWR in an antenna system that uses coaxial cable feed line?
    - To reduce television interference
    - **To allow the efficient transfer of power and reduce losses**
    - To prolong antenna life
    - All of these choices are correct

- **T9B02** What is the impedance of the most commonly used coaxial cable in typical amateur radio installations?
    - 8 ohms
    - **50 ohms**
    - 600 ohms
    - 12 ohms

- **T9B03** Why is coaxial cable used more often than any other feed line for amateur radio antenna systems?
    - **It is easy to use and requires few special installation considerations**
    - It has less loss than any other type of feed line
    - It can handle more power than any other type of feed line
    - It is less expensive than any other types of feed line

- **T9B04** What does an antenna tuner do?
    - **It matches the antenna system impedance to the transceiver's output impedance**
    - It helps a receiver automatically tune in weak stations
    - It allows an antenna to be used on both transmit and receive
    - It automatically selects the proper antenna for the frequency band being used

- **T9B05** What generally happens as the frequency of a signal passing through coaxial cable is increased?

    - The apparent SWR increases
    - The reflected power increases
    - The characteristic impedance increases
    - **The loss increases**

- **T9B06** Which of the following connectors is most suitable for frequencies above 400 MHz?

    - A UHF (PL-259/SO-239) connector
    - **A Type N connector**
    - An RS-213 connector
    - A DB-25 connector

- **T9B07** Which of the following is true of PL-259 type coax connectors?

    - They are preferred for microwave operation
    - They are water tight
    - **They are commonly used at HF frequencies**
    - They are a bayonet type connector

- **T9B08** Why should coax connectors exposed to the weather be sealed against water intrusion?

    - **To prevent an increase in feed line loss**
    - To prevent interference to telephones
    - To keep the jacket from becoming loose
    - All of these choices are correct

- **T9B09** What might cause erratic changes in SWR readings?

    - The transmitter is being modulated
    - **A loose connection in an antenna or a feed line**
    - The transmitter is being over-modulated
    - Interference from other stations is distorting your signal

- **T9B10** What electrical difference exists between the smaller RG-58 and larger RG-8 coaxial cables?

    - There is no significant difference between the two types
    - RG-58 cable has less loss at a given frequency
    - **RG-8 cable has less loss at a given frequency**
    - RG-58 cable can handle higher power levels

- **T9B11** Which of the following types of feed line has the lowest loss at VHF and UHF?

    - 50-ohm flexible coax
    - Multi-conductor unbalanced cable
    - **Air-insulated hard line**
    - 75-ohm flexible coax

SUBELEMENT T0

Electrical safety: AC and DC power circuits; antenna installation; RF hazards

[3 Exam Questions - 3 Groups – 36 Pool Questions]

T0A - Power circuits and hazards: hazardous voltages; fuses and circuit breakers; grounding; lightning protection; battery safety; electrical code compliance (11 Questions)

- **T0A01** Which of the following is a safety hazard of a 12-volt storage battery?
    - Touching both terminals with the hands can cause electrical shock
    - **Shorting the terminals can cause burns, fire, or an explosion**
    - RF emissions from the battery
    - All of these choices are correct

- **T0A02** How does current flowing through the body cause a health hazard?
    - By heating tissue
    - It disrupts the electrical functions of cells
    - It causes involuntary muscle contractions
    - **All of these choices are correct**

- **T0A03** What is connected to the green wire in a three-wire electrical AC plug?
    - Neutral
    - Hot
    - **Safety ground**
    - The white wire

- **T0A04** What is the purpose of a fuse in an electrical circuit?
    - To prevent power supply ripple from damaging a circuit
    - **To interrupt power in case of overload**
    - To limit current to prevent shocks
    - All of these choices are correct

- **T0A05** Why is it unwise to install a 20-ampere fuse in the place of a 5-ampere fuse?
    - The larger fuse would be likely to blow because it is rated for higher current
    - The power supply ripple would greatly increase
    - **Excessive current could cause a fire**
    - All of these choices are correct

- **T0A06** What is a good way to guard against electrical shock at your station?
    - Use three-wire cords and plugs for all AC powered equipment
    - Connect all AC powered station equipment to a common safety ground
    - Use a circuit protected by a ground-fault interrupter
    - **All of these choices are correct**

- **T0A07** Which of these precautions should be taken when installing devices for lightning protection in a coaxial cable feed line?
    - Include a parallel bypass switch for each protector so that it can be switched out of the circuit when running high power
    - Include a series switch in the ground line of each protector to prevent RF overload from inadvertently damaging the protector
    - Keep the ground wires from each protector separate and connected to station ground
    - **Ground all of the protectors to a common plate which is in turn connected to an external ground**

- **T0A08** What safety equipment should always be included in home-built equipment that is powered from 120V AC power circuits?
    - **A fuse or circuit breaker in series with the AC hot conductor**
    - An AC voltmeter across the incoming power source
    - An inductor in series with the AC power source
    - A capacitor across the AC power source

- **T0A09** What kind of hazard is presented by a conventional 12-volt storage battery?
    - It emits ozone which can be harmful to the atmosphere
    - Shock hazard due to high voltage
    - **Explosive gas can collect if not properly vented**
    - All of these choices are correct

- **T0A10** What can happen if a lead-acid storage battery is charged or discharged too quickly?
    - **The battery could overheat and give off flammable gas or explode**
    - The voltage can become reversed
    - The memory effect will reduce the capacity of the battery
    - All of these choices are correct

- **T0A11** What kind of hazard might exist in a power supply when it is turned off and disconnected?

    - Static electricity could damage the grounding system
    - Circulating currents inside the transformer might cause damage
    - The fuse might blow if you remove the cover
    - **You might receive an electric shock from the charged stored in large capacitors**

T0B - Antenna safety: tower safety; erecting an antenna support; overhead power lines; installing an antenna (12 Questions)

- **T0B01** When should members of a tower work team wear a hard hat and safety glasses?
    - At all times except when climbing the tower
    - At all times except when belted firmly to the tower
    - **At all times when any work is being done on the tower**
    - Only when the tower exceeds 30 feet in height

- **T0B02** What is a good precaution to observe before climbing an antenna tower?
    - Make sure that you wear a grounded wrist strap
    - Remove all tower grounding connections
    - **Put on a climbing harness and safety glasses**
    - All of the these choices are correct

- **T0B03** Under what circumstances is it safe to climb a tower without a helper or observer?
    - When no electrical work is being performed
    - When no mechanical work is being performed
    - When the work being done is not more than 20 feet above the ground
    - **Never**

- **T0B04** Which of the following is an important safety precaution to observe when putting up an antenna tower?
    - Wear a ground strap connected to your wrist at all times
    - Insulate the base of the tower to avoid lightning strikes
    - **Look for and stay clear of any overhead electrical wires**
    - All of these choices are correct

- **T0B05** What is the purpose of a gin pole?
    - To temporarily replace guy wires
    - To be used in place of a safety harness
    - **To lift tower sections or antennas**
    - To provide a temporary ground

- **T0B06** What is the minimum safe distance from a power line to allow when installing an antenna?

    - Half the width of your property
    - The height of the power line above ground
    - 1/2 wavelength at the operating frequency
    - **So that if the antenna falls unexpectedly, no part of it can come closer than 10 feet to the power wires**

- **T0B07** Which of the following is an important safety rule to remember when using a crank-up tower?

    - This type of tower must never be painted
    - This type of tower must never be grounded
    - **This type of tower must never be climbed unless it is in the fully retracted position**
    - All of these choices are correct

- **T0B08** What is considered to be a proper grounding method for a tower?

    - A single four-foot ground rod, driven into the ground no more than 12 inches from the base
    - A ferrite-core RF choke connected between the tower and ground
    - **Separate eight-foot long ground rods for each tower leg, bonded to the tower and each other**
    - A connection between the tower base and a cold water pipe

- **T0B09** Why should you avoid attaching an antenna to a utility pole?

    - The antenna will not work properly because of induced voltages
    - The utility company will charge you an extra monthly fee
    - **The antenna could contact high-voltage power wires**
    - All of these choices are correct

- **T0B10** Which of the following is true concerning grounding conductors used for lightning protection?

    - Only non-insulated wire must be used
    - Wires must be carefully routed with precise right-angle bends
    - **Sharp bends must be avoided**
    - Common grounds must be avoided

- **T0B11** Which of the following establishes grounding requirements for an amateur radio tower or antenna?

    - FCC Part 97 Rules
    - **Local electrical codes**
    - FAA tower lighting regulations
    - Underwriters Laboratories' recommended practices

- **T0B12** Which of the following is good practice when installing ground wires on a tower for lightning protection?

    - Put a loop in the ground connection to prevent water damage to the ground system
    - Make sure that all bends in the ground wires are clean, right angle bends
    - **Ensure that connections are short and direct**
    - All of these choices are correct

T0C - RF hazards: radiation exposure; proximity to antennas; recognized safe power levels; exposure to others; radiation types; duty cycle (13 Questions)

- **T0C01** What type of radiation are VHF and UHF radio signals?
    - Gamma radiation
    - Ionizing radiation
    - Alpha radiation
    - **Non-ionizing radiation**

- **T0C02** Which of the following frequencies has the lowest value for Maximum Permissible Exposure limit?
    - 3.5 MHz
    - **50 MHz**
    - 440 MHz
    - 1296 MHz

- **T0C03** What is the maximum power level that an amateur radio station may use at VHF frequencies before an RF exposure evaluation is required?
    - 1500 watts PEP transmitter output
    - 1 watt forward power
    - **50 watts PEP at the antenna**
    - 50 watts PEP reflected power

- **T0C04** What factors affect the RF exposure of people near an amateur station antenna?
    - Frequency and power level of the RF field
    - Distance from the antenna to a person
    - Radiation pattern of the antenna
    - **All of these choices are correct**

- **T0C05** Why do exposure limits vary with frequency?
    - Lower frequency RF fields have more energy than higher frequency fields
    - Lower frequency RF fields do not penetrate the human body
    - Higher frequency RF fields are transient in nature
    - **The human body absorbs more RF energy at some frequencies than at others**

- **T0C06** Which of the following is an acceptable method to determine that your station complies with FCC RF exposure regulations?

    - By calculation based on FCC OET Bulletin 65
    - By calculation based on computer modeling
    - By measurement of field strength using calibrated equipment
    - **All of these choices are correct**

- **T0C07** What could happen if a person accidentally touched your antenna while you were transmitting?

    - Touching the antenna could cause television interference
    - **They might receive a painful RF burn**
    - They might develop radiation poisoning
    - All of these choices are correct

- **T0C08** Which of the following actions might amateur operators take to prevent exposure to RF radiation in excess of FCC-supplied limits?

    - **Relocate antennas**
    - Relocate the transmitter
    - Increase the duty cycle
    - All of these choices are correct

- **T0C09** How can you make sure your station stays in compliance with RF safety regulations?

    - By informing the FCC of any changes made in your station
    - **By re-evaluating the station whenever an item of equipment is changed**
    - By making sure your antennas have low SWR
    - All of these choices are correct

- **T0C10** Why is duty cycle one of the factors used to determine safe RF radiation exposure levels?

    - **It affects the average exposure of people to radiation**
    - It affects the peak exposure of people to radiation
    - It takes into account the antenna feed line loss
    - It takes into account the thermal effects of the final amplifier

- **T0C11** What is the definition of duty cycle during the averaging time for RF exposure?
    - The difference between the lowest power output and the highest power output of a transmitter
    - The difference between the PEP and average power output of a transmitter
    - **The percentage of time that a transmitter is transmitting**
    - The percentage of time that a transmitter is not transmitting

- **T0C12** How does RF radiation differ from ionizing radiation (radioactivity)?
    - **RF radiation does not have sufficient energy to cause genetic damage**
    - RF radiation can only be detected with an RF dosimeter
    - RF radiation is limited in range to a few feet
    - RF radiation is perfectly safe

- **T0C13** If the averaging time for exposure is 6 minutes, how much power density is permitted if the signal is present for 3 minutes and absent for 3 minutes rather than being present for the entire 6 minutes?
    - 3 times as much
    - 1/2 as much
    - **2 times as much**
    - There is no adjustment allowed for shorter exposure times