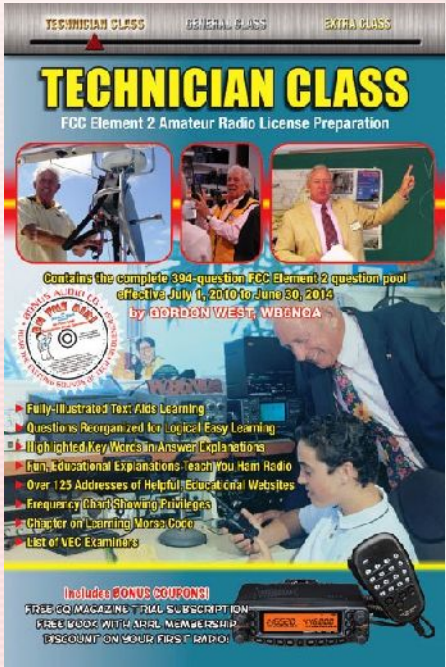
Technician Licensing Class

Safety First!

Presented by



Amateur Radio Technician Class
Element 2 Course Presentation

ELEMENT 2 SUB-ELEMENTS
(Groupings)

- **About Ham Radio**
- **Call Signs**
- **Control**
- **Mind the Rules**
- **Tech Frequencies**
- **Your First Radio**
- **Going On The Air!**
- **Repeaters**
- **Emergency!**
- **Weak Signal Propagation**

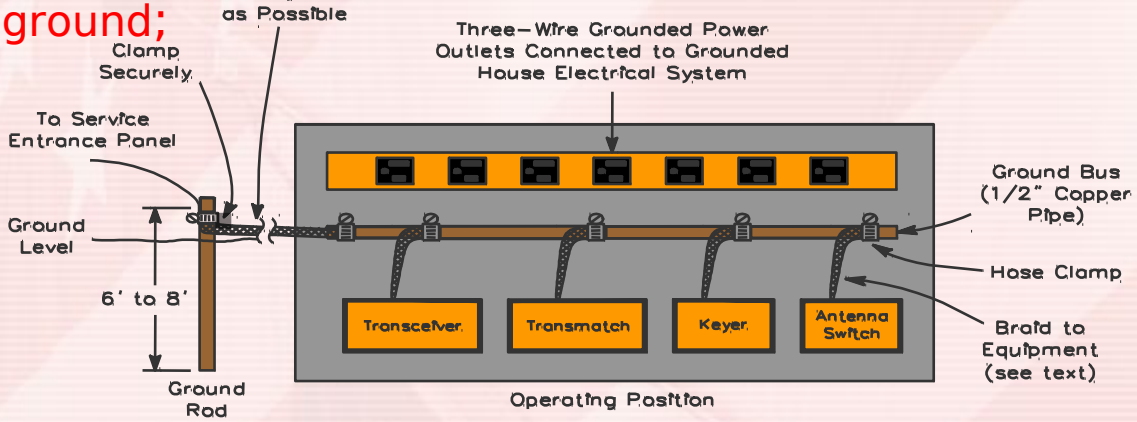
Amateur Radio Technician Class
Element 2 Course Presentation

- **ELEMENT 2 SUB-ELEMENTS** **(Groupings)**
  - **Talk to Outer Space!**
  - **Your Computer Goes Ham Digital!**
  - **Multi-Mode Radio Excitement**
  - **Run Some Interference Protection**
  - **Electrons – Go With the Flow!**
  - **It's the Law, per Mr. Ohm!**
  - **Go Picture These!**
  - **Antennas**
  - **Feed Me with Some Good Coax!**
  - **Safety First!**

Safety First!

- T0A6 A good way to guard against electrical shock at your station:
  - Use three-wire cords and plugs for all AC powered equipment;

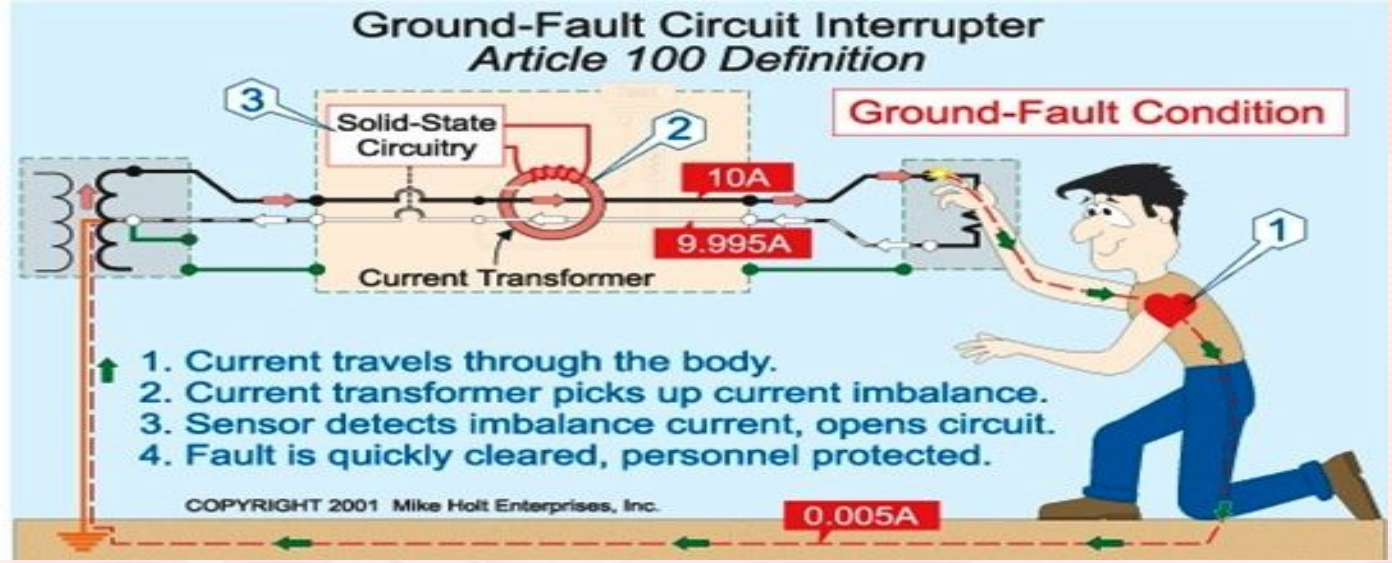
  - Connect all AC powered station equipment to a common safety ground;



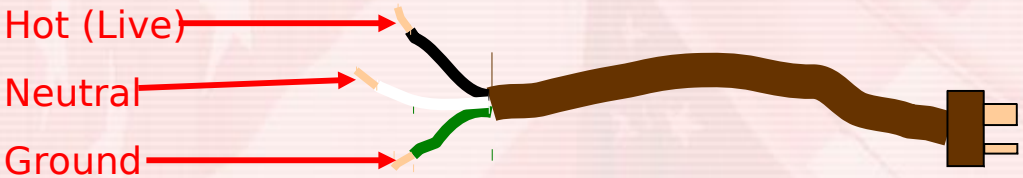
All of these choices are correct.

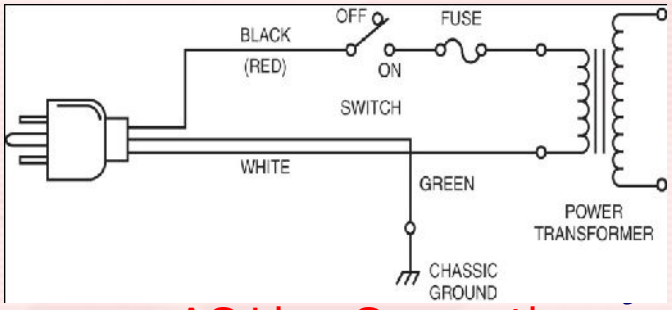
Safety First!

- Use a circuit protected by a ground-fault interrupter.



- T0A3 The green wire in a three-wire electrical AC plug is safety ground.





AC Line Connections

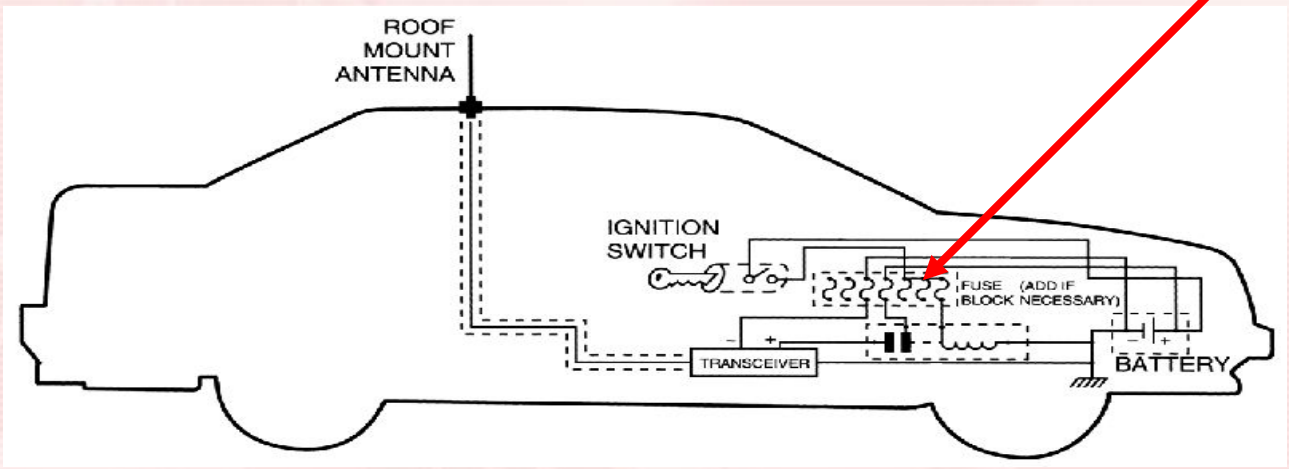
Safety First!

- T0A13 A fuse or circuit breaker in series with the AC "hot" conductor is safety equipment that should always be included in home-built equipment that is powered from 120V AC power circuits.
- T0A4 The purpose of a fuse in an electrical circuit is to interrupt powe[illegible] overload.

Slow-Blow fuse

Automobile fuse

Fuses



Place the fuses as close to the battery as possible

Safety First!

- T0A5 It is unwise to install a 20-ampere fuse in the place of a 5-ampere fuse because excessive current could cause a fire.
- T0A12 The kind of hazard that might exist in a power supply when it is turned off and disconnected is that you might receive an electric shock from stored charge in large c

Filter Capacitors

Charges stored from capacitors can HURT !

Safety First!

- T0A1 A commonly accepted value for the lowest voltage that can cause a dangerous electric shock is 30 volts.

- T0A2 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.

- T0A8 One way to recharge a 12-volt lead-acid station battery if the commercial power is out is to connect the battery to a car's battery and run the engine.

Safety First!

- T0A10 If a lead-acid storage battery is charged or discharged too quickly it could overheat and give off flammable gas or explode
- T0A9 A hazard is presented by a conventional 12-volt storage battery with its explosive gas that can collect if not properly vented.
- T0B4 Looking for and staying clear of any overhead electrical wires is an important safety precaution to observe when putting up an antenna tower.
  - Overhead electrical wires carry more than 120 VAC
  - Use common sense and think safety first
  - Have help, don’t work alone

Safety First!

- T0B6 The minimum safe distance to allow from a power line when installing an antenna so that if the antenna falls unexpectedly, no part of it can come closer than 10 feet to the power wires.
  - This is a ‘minimum’ distance
  - Keep away from all wires
- T0B9 You should avoid attaching an antenna to a utility pole as the antenna could contact high-voltage power wires.
  - And it may be illegal to do

Safety First!

- T0B2 Putting on a climbing harness and safety glasses is a good precaution to observe before climbing an antenna tower

Climbing Harness

Safety Glasses

And

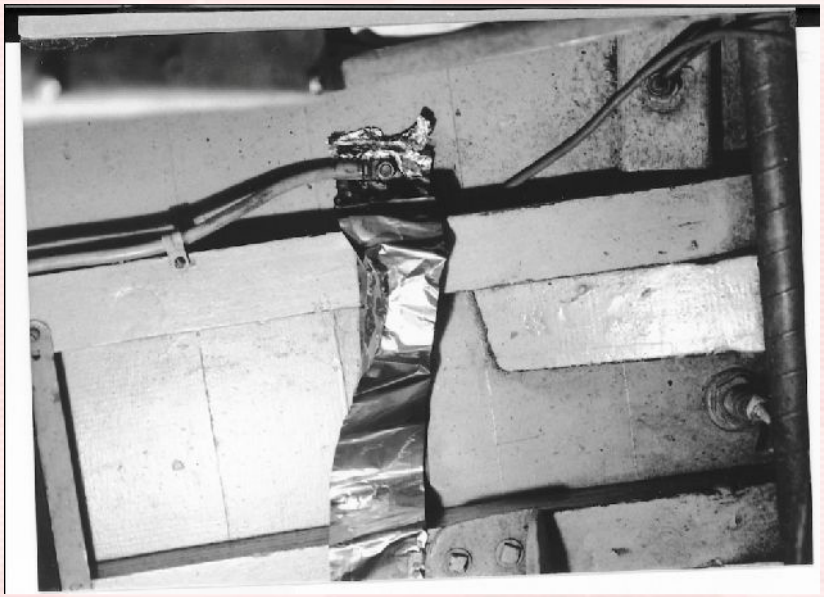
Hard Hat

Safety First!

- T0B3 It is never safe to climb a tower without a helper or observer.
  - Never work on a tower without a helper
- T0B7 An important safety rule to remember when using a crank-up tower is that this type of tower must never be climbed unless it is in the fully retracted position.
  - Think weight overload and **never** climb a cranked up tower
- T0B11 Grounding requirements for an amateur radio tower or antenna are established by local electrical codes
  - Always wear hard hat and safety glasses
  - Check local codes before putting up an antenna
- T0B8 Proper grounding method for a tower is to have separate eight-foot long ground rods for each tower leg, bonded to the tower and each other.

Safety First!

- T4A8 A Flat strap conductor is best to use for RF grounding.
  - Offers best surface area
    - Bleed off static and minimize ground currents
    - Straps usually are 3 inches wide
    - Folding okay to snake down to a healthy ground rod



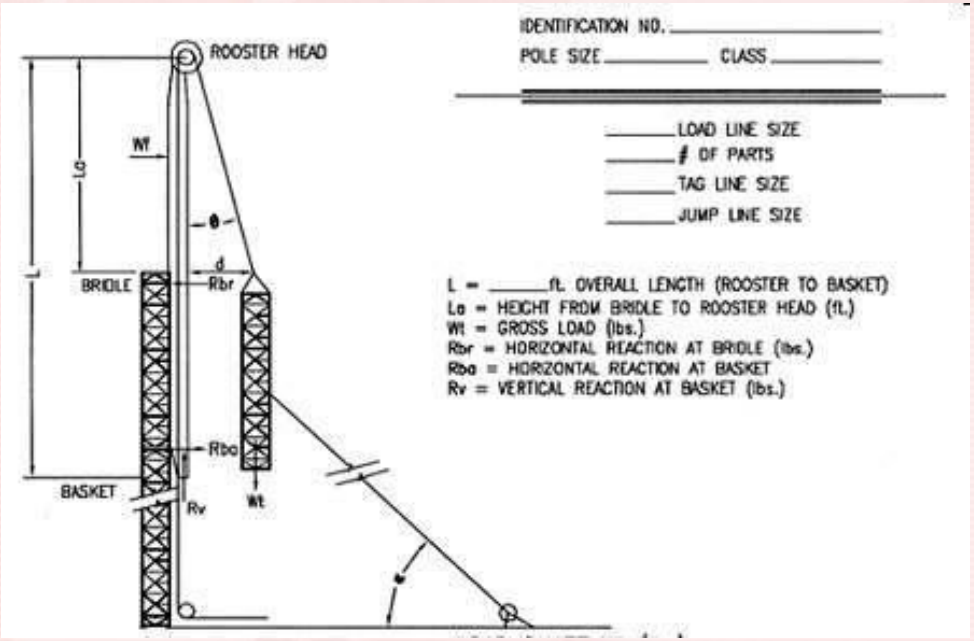
Copper Foil Ground Strap
Provides Good Surface Area
Ground

Safety First!

- T0A11 A good practice when installing ground wires on a tower for lightning protection is to ensure that connections are short and direct.
- T0B10 Concerning grounding conductors used for lightning protection, sharp bends must be avoided.
- T0A7 Precautions should be taken when installing devices for lightning protection in a coaxial cable feedline by grounding all of the protectors to a common plate which is in turn connected to an external ground.
  - Good for nearby lightning strikes
  - Direct hits, forget it, kiss everything goodbye for good
- T0B1 Members of a tower work team should wear a hard hat and safety glasses at all times when any work is being done on the tower.
  - On ground or up the tower
    - Wear hard hat and safety glasses

Safety First!

- T0B5 The purpose of a gin pole is to lift tower sections or antennas.

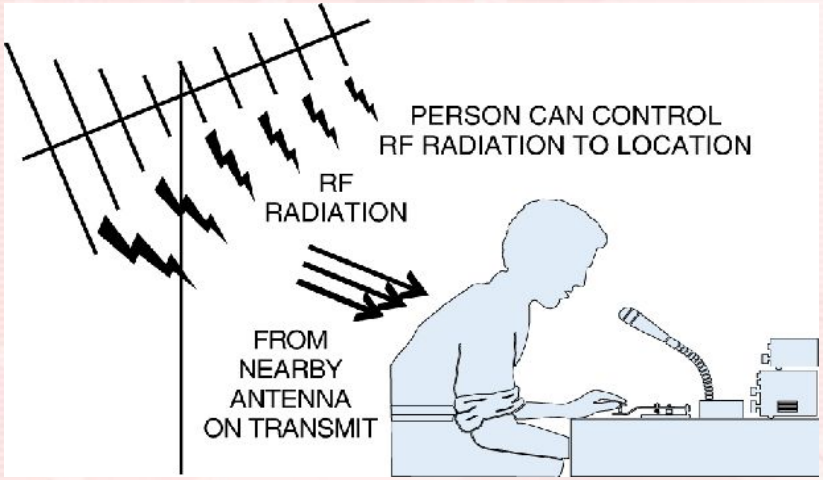


Gin Pole

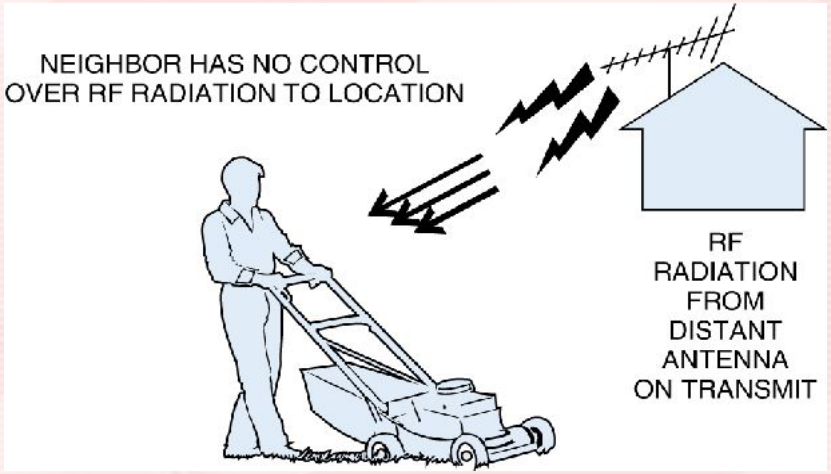
Safety First!

- T0C4 Factors affecting 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.



Controlled



Uncontrolled

Safety First!

- T0C5 Exposure limits vary with frequency because the human body absorbs more RF energy at some frequencies than at others.
- T0C2 With 3.5 MHz, 50 MHz, 440 MHz, and 1296 MHz; a 50 MHz frequency has the lowest Maximum Permissible Exposure limit.
- T0C3 The maximum power level that an amateur radio station may use at VHF frequencies before an RF exposure s 50 watts PEP at the antenna.

Never stand in front of a microwave feedhorn antenna. On transmit, it radiates a concentrated beam of RF energy.

Safety First!

- T0C1 VHF and UHF radio signals are non-ionizing radiation.
  - Quite different from X-ray, gamma ray, and ultra violet radiation
- T0C6 Acceptable methods to determine that your station complies with FCC RF exposure regulations:

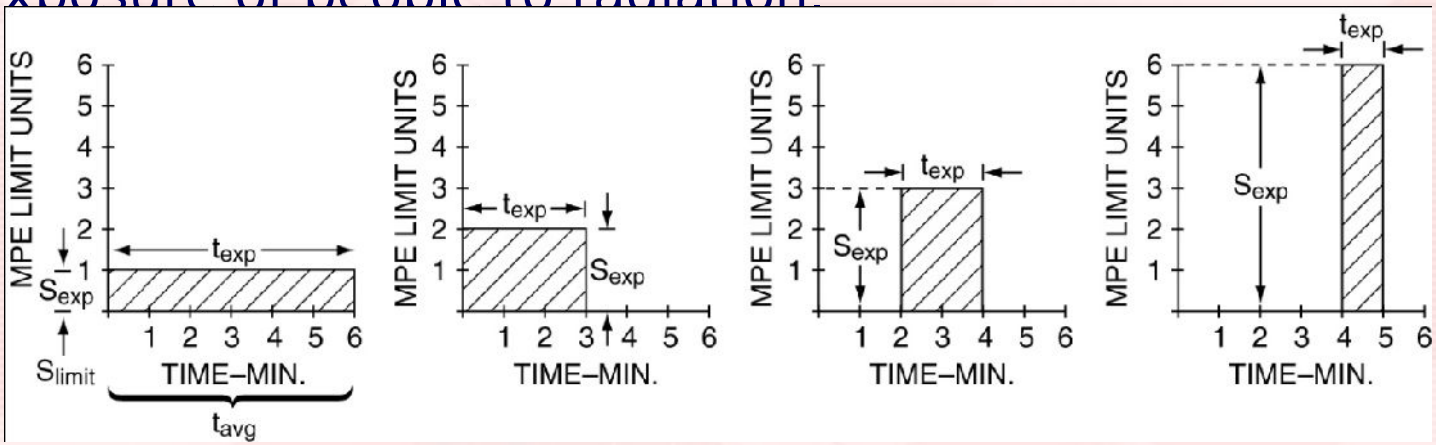
All of these choices are correct.

  - By calculation based on FCC OET Bulletin 65
  - By calculation based on computer modeling
  - By measurement of field strength using calibrated equipment
- T0C8 An acti[illegible]erators might take to prevent exposure t[illegible] excess of FCC-supplied limits is to relocate

The safest place to mount the mobile antenna for minimum RF exposure is on the metal roof as shown.

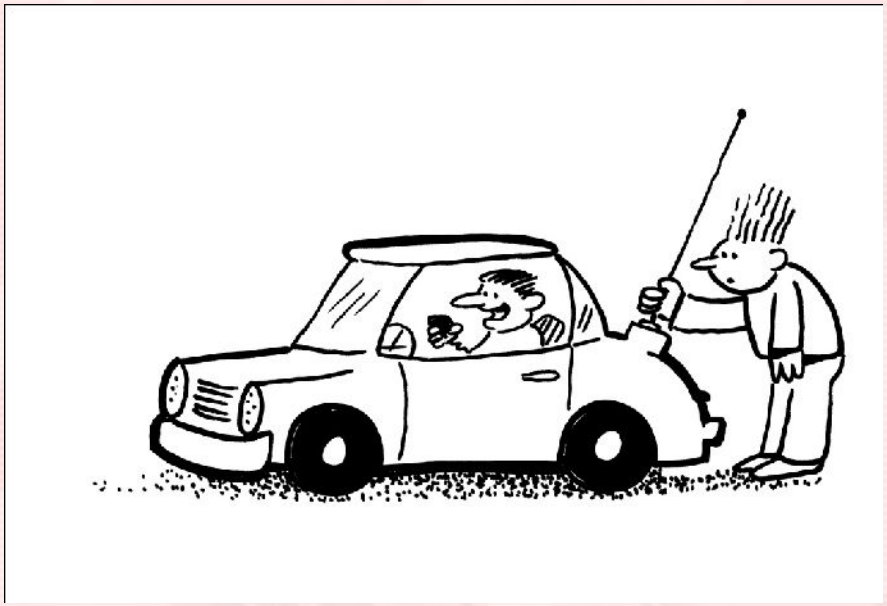
Safety First!

- T0C9 To make sure your station stays in compliance with RF safety regulations, re-evaluate the station whenever an item of equipment is changed.
- T0C11 When referring to RF exposure, "duty cycle" is the ratio of "on-air" time to total operating time of a transmitted signal.
- T0C10 Duty cycle is one of the factors used to determine safe RF radiation exposure levels because it affects the average exposure of people to radiation.



Safety First!

- T0C7 If a person accidentally touched your antenna while you were transmitting they might receive a painful RF burn.
  - Accidentally or on purpose, depending on the power too.



Be sure to place your antennas where no one can touch them. All antennas, not just the mobile ones.

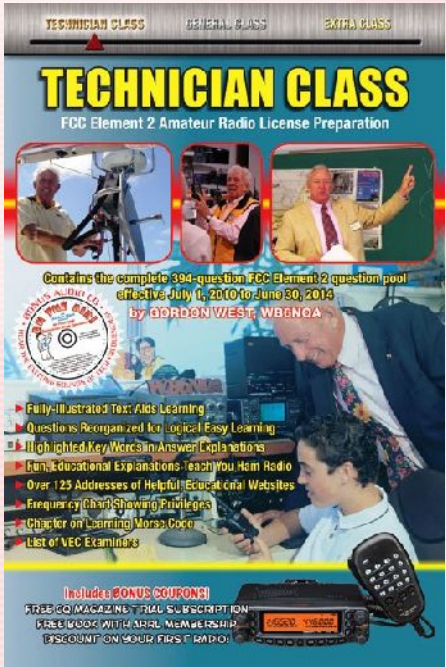
Element 2 Technician Class Question Pool

Safety First!

Valid July 1, 2010

Through

June 30, 2014



T0A06 What is a good way to guard against electrical shock at your station?

A. Use three-wire cords and plugs for all AC powered equipment
B. Connect all AC powered station equipment to a common safety ground
C. Use a circuit protected by a ground-fault interrupter
D. All of these choices are correct

T0A03 a What is connected to the green wire in three-wire electrical AC plug?

A. Neutral
B. Hot
C. Safety ground
D. The white wire

T0A13 What safety equipment should always be included in home-built equipment that is powered from 120V AC power circuits?

A. A fuse or circuit breaker in series with the AC "hot" conductor

B. An AC voltmeter across the incoming power source

C. An inductor in series with the AC power source

D. A capacitor across the AC power source

T0A04 What is the purpose of a fuse in an electrical circuit?

A. To prevent power supply ripple from damaging a circuit
B. To interrupt power in case of overload
C. To limit current to prevent shocks
D. 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?

A. The larger fuse would be likely to blow because it is rated for higher current
B. The power supply ripple would greatly increase
C. Excessive current could cause a fire
D. All of these choices are correct

T0A12 a

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

A. Static electricity could damage the grounding system
B. Circulating currents inside the transformer might cause damage
C. The fuse might blow if you remove the cover
D. You might receive an electric shock from stored charge in large capacitors

T0A01 Which is a commonly accepted value for the lowest voltage that can cause a dangerous electric shock?

A. 12 volts
B. 30 volts
C. 120 volts
D. 300 volts

T0A02 How does current flowing through the body cause a health hazard?

A. By heating tissue
B. It disrupts the electrical functions of cells
C. It causes involuntary muscle contractions
D. All of these choices are correct

T0A08 What is one way to recharge a 12-volt lead-acid station battery if the commercial power is out?

A. Cool the battery in ice for several hours

B. Add acid to the battery

C. Connect the battery to a car's battery and run the engine

D. All of these choices are correct

T0A10 What can happen if a lead-acid storage battery is charged or discharged too quickly?

A. The battery could overheat and give off flammable gas or explode

B. The voltage can become reversed

C. The “memory effect” will reduce the capacity of the battery

D. All of these choices are correct

T0A09 What kind of hazard is presented by a conventional 12-volt storage battery?

A. It emits ozone which can be harmful to the atmosphere
B. Shock hazard due to high voltage
C. Explosive gas can collect if not properly vented
D. All of these choices are correct

T0B04 Which of the following is an important safety precaution to observe when putting up an antenna tower?

A. Wear a ground strap connected to your wrist at all times
B. Insulate the base of the tower to avoid lightning strikes
C. Look for and stay clear of any overhead electrical wires
D. All of these choices are correct

T0B06 What is the minimum safe distance when installing an antenna?

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

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

A. The antenna will not work properly because of induced voltages

B. The utility company will charge you an extra monthly fee

C. The antenna could contact high-voltage power wires

D. All of these choices are correct

T0B02 What is a good precaution to observe before climbing an antenna tower?

A. Make sure that you wear a grounded wrist strap
B. Remove all tower grounding connections
C. Put on a climbing harness and safety glasses
D. All of the these choices are correct

T0B03 Under what circumstances is it safe to climb a tower without a helper or observer?

A. When no electrical work is being performed

B. When no mechanical work is being performed

C. When the work being done is not more than 20 feet above the ground

D. Never

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

A. This type of tower must never be painted
B. This type of tower must never be grounded
C. This type of tower must never be climbed unless it is in the fully retracted position
D. All of these choices are correct

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

A. FCC Part 97 Rules
B. Local electrical codes
C. FAA tower lighting regulations
D. Underwriters Laboratories' recommended practices

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

A. A single four-foot ground rod, driven into the ground no more than 12 inches from the base

B. A ferrite-core RF choke connected between the tower and ground

C. Separate eight-foot long ground rods for each tower leg, bonded to the tower and each other

D. A connection between the tower base and a cold water pipe

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

A. Round stranded wire
B. Round copper-clad steel wire
C. Twisted-pair cable
D. Flat strap

T0A11 Which of the following is good practice when installing ground wires on a tower for lightning protection?

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

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

A. Only non-insulated wire must be used
B. Wires must be carefully routed with precise right-angle bends
C. Sharp bends must be avoided
D. Common grounds must be avoided

T0A07 Which of these precautions should be taken when installing devices for lightning protection in a coaxial cable feedline?

A. Include a parallel bypass switch for each protector so that it can be switched out of the circuit when running high power

B. Include a series switch in the ground line of each protector to prevent RF overload from inadvertently damaging the protector

C. Keep the ground wires from each protector separate and connected to station ground

D. Ground all of the protectors to a common plate which is in turn connected to an external ground

T0B01 When should members of a tower work team wear a hard hat and safety glasses?

A. At all times except when climbing the tower
B. At all times except when belted firmly to the tower
C. At all times when any work is being done on the tower
D. Only when the tower exceeds 30 feet in height

T0B05 What is the purpose of a gin pole?

A. To temporarily replace guy wires
B. To be used in place of a safety harness
C. To lift tower sections or antennas
D. To provide a temporary ground

T0C04 What factors affect the RF exposure of people near an amateur station antenna?

A. Frequency and power level of the RF field
B. Distance from the antenna to a person
C. Radiation pattern of the antenna
D. All of these choices are correct

T0C05 Why do exposure limits vary with frequency?

A. Lower frequency RF fields have more energy than higher frequency fields

B. Lower frequency RF fields do not penetrate the human body

C. Higher frequency RF fields are transient in nature

D. The human body absorbs more RF energy at some frequencies than at others

T0C02 Which of the following frequencies has the lowest Maximum Permissible Exposure limit?

A. 3.5 MHz
B. 50 MHz
C. 440 MHz
D. 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?

A. 1500 watts PEP transmitter output
B. 1 watt forward power
C. 50 watts PEP at the antenna
D. 50 watts PEP reflected power

T0C01 What type of radiation are VHF and UHF radio signals?

A. Gamma radiation
B. Ionizing radiation
C. Alpha radiation
D. Non-ionizing radiation

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

A. By calculation based on FCC OET Bulletin 65
B. By calculation based on computer modeling
C. By measurement of field strength using calibrated equipment
D. 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?

A. Relocate antennas
B. Relocate the transmitter
C. Increase the duty cycle
D. All of these choices are correct

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

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

T0C11 What is meant by "duty cycle" when referring to RF exposure?

A. The difference between lowest usable output and maximum rated output power of a transmitter
B. The difference between PEP and average power of an SSB signal
C. The ratio of "on-air" time to total operating time of a transmitted signal
D. The amount of time the operator spends transmitting

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

A. It affects the average exposure of people to radiation
B. It affects the peak exposure of people to radiation
C. It takes into account the antenna feedline loss
D. It takes into account the thermal effects of the final amplifier

T6C01 What could happen if a person accidentally touched your antenna while you were transmitting?

A. Touching the antenna could cause television interference
B. They might receive a painful RF burn
C. They might develop radiation poisoning
D. All of these choices are correct