Technician Licensing Class

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Presented by These!
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
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!

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- Antennas
- Feed Me with Some Good Coax!
- Safety First!
T6C1  Schematic symbols is the name for standardized representations of components in an electrical wiring diagram.
The symbols on an electrical circuit schematic diagram represent electrical components.
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- T6C13 The way electrical components are interconnected accurately represent electrical circuit schematic diagrams.
Component 3 in figure T3 is a variable inductor.
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- T6C11 Component 4 in figure T3 is an antenna.
A capacitor is used together with an inductor to make a tuned circuit.
Component 1 in figure T1 is a resistor.
Component 2 in figure T1 is a transistor.

To control the flow of current is the function of component 2 in Figure T1.
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- Component 3 in figure T1 is a lamp.

Figure T1
Component 4 in figure T1 is a battery.
A single-pole single-throw switch is represented by item 3 in figure T2.
Component 4 in figure T2 is a transformer.
T6C6 Component 6 in figure T2 is a capacitor.
Component 8 in figure T2 is a light emitting diode.
Component 9 in figure T2 is a variable resistor.
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- **T6D4** A meter can be used to display signal strength on a numeric scale.

![S-Meter](image)

Icom 7600

Icom 7800
A switch controlled by an electromagnet best describes a relay.
The approximate amount of change, measured in decibels (dB), of a power increase from 5 watts to 10 watts is 3 dB.

3 dB gain is a double of power.

<table>
<thead>
<tr>
<th>dB</th>
<th>Power Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 dB</td>
<td>2x Power</td>
</tr>
<tr>
<td>6 dB</td>
<td>4x change</td>
</tr>
<tr>
<td>9 dB</td>
<td>8x Power</td>
</tr>
<tr>
<td>10 dB</td>
<td>10x change</td>
</tr>
<tr>
<td>20 dB</td>
<td>100x Power</td>
</tr>
<tr>
<td>30 dB</td>
<td>1000x change</td>
</tr>
<tr>
<td>40 dB</td>
<td>10,000x change</td>
</tr>
</tbody>
</table>

Derivation:
If dB = 10 \log_{10} \left( \frac{P_1}{P_2} \right)
then what power ratio is 20 dB?

\[ \frac{20}{10} = \log_{10} \left( \frac{P_1}{P_2} \right) \]

Or \( P_1 = 100 \times P_2 \)

20 dB means \( P_1 \) is 100 times \( P_2 \)

The approximate amount of change, measured in decibels (dB), of a power decrease from 12 watts to 3 watts is 6 dB.

The approximate amount of change, measured in decibels (dB), of a power increase from 20 watts to 200 watts is 10 dB.
• **T6D5**  A regulator is a type of circuit that controls the amount of voltage from a power supply.

• **T6D6**  A transformer is a component commonly used to change 120V AC house current to a lower AC voltage for other uses.

• **T6D9**  Integrated circuit is the name of a device that combines several semiconductors and other components into one package.
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- T6B7 The abbreviation "LED" stands for Light Emitting Diode.

- T6D7 An LED is commonly used as a visual indicator.

An array of LEDs and resistors mounted on a printed circuit board
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- **T5B2** 1500 kHz is another way to specify a radio signal frequency of 1,500,000 hertz.
- **T5B3** One thousand volts are equal to one kilovolt.
- **T5B6** If an ammeter calibrated in amperes is used to measure a 3000-milliampere of current, the reading would it to be 3 amperes.

### Scientific Notation

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Multiplication Factor</th>
<th>Prefix</th>
<th>Multiplication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor</td>
<td></td>
<td>Factor</td>
<td></td>
</tr>
<tr>
<td>tera</td>
<td>$10^{12}$</td>
<td>deci</td>
<td>$10^{-1}$</td>
</tr>
<tr>
<td>giga</td>
<td>$10^9$</td>
<td>centi</td>
<td>$10^{-2}$</td>
</tr>
<tr>
<td>mega</td>
<td>$10^6$</td>
<td>milli</td>
<td>$10^{-3}$</td>
</tr>
<tr>
<td>kilo</td>
<td>$10^3$</td>
<td>micro</td>
<td>$10^{-6}$</td>
</tr>
<tr>
<td>hecto</td>
<td>$10^2$</td>
<td>nano</td>
<td>$10^{-9}$</td>
</tr>
<tr>
<td>deca</td>
<td>$10^1$</td>
<td>pico</td>
<td>$10^{-12}$</td>
</tr>
<tr>
<td>unit</td>
<td>$10^0$</td>
<td>femto</td>
<td>$10^{-15}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Go Picture These!

<table>
<thead>
<tr>
<th>Metric English</th>
<th>Exponent</th>
<th>Metric Exponent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tera</td>
<td>$10^{12}$</td>
<td>Trillion</td>
</tr>
<tr>
<td>Giga</td>
<td>$10^9$</td>
<td>Billion</td>
</tr>
<tr>
<td>Mega</td>
<td>$10^6$</td>
<td>Million</td>
</tr>
<tr>
<td>Kilo</td>
<td>$10^3$</td>
<td>Thousand</td>
</tr>
<tr>
<td>Centi</td>
<td>$10^{-2}$</td>
<td>Hundredth</td>
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<tr>
<td>Milli</td>
<td>$10^{-3}$</td>
<td>Thousandth</td>
</tr>
<tr>
<td>Micro</td>
<td>$10^{-6}$</td>
<td>Millionth</td>
</tr>
<tr>
<td>Nano</td>
<td>$10^{-9}$</td>
<td>Billionth</td>
</tr>
<tr>
<td>Pico</td>
<td>$10^{-12}$</td>
<td>Trillionth</td>
</tr>
</tbody>
</table>

- **T5B5** 0.5 watts is equivalent to 500 milliwatts.
- **T5B1** 1,500 milliamperes is 1.5 amperes.
- **T5B8** One microfarads is equal to 1,000,000 picofarads.
- **T5B4** One one-millionth of a volts is equal to one microvolt.
• T7D8 Rosin-core solder is best for radio and electronic use.
• T7D9 A grainy or dull surface is the characteristic appearance of a "cold" solder joint.
• T7D7 Voltage and resistance are measurements commonly made using a multimeter.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Basic Unit</th>
<th>Measuring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage (E)</td>
<td>Volts</td>
<td>Voltmeter</td>
</tr>
<tr>
<td>Current (I)</td>
<td>Amperes</td>
<td>Ammeter</td>
</tr>
<tr>
<td>Resistance</td>
<td>Ohms$10^3$</td>
<td>Ohmmeter</td>
</tr>
<tr>
<td>Power (P)</td>
<td>Watts</td>
<td>Wattmeter</td>
</tr>
</tbody>
</table>

Volt Ohm Meter VOM

Digital Volt Ohm Meter
Much more accurate
• T7D11 A precaution taken when measuring circuit resistance with an ohmmeter is to ensure that the circuit is not powered.

• T7D6 Attempting to measure voltage when using the resistance setting might damage a multimeter.

• T7D10 When an ohmmeter is connected across a circuit and initially indicates a low resistance and then shows increasing resistance with time, the circuit contains a large capacitor.

Learning how to use a multimeter is an essential skill in testing and repairing radio gear.
Element 2 Technician Class Question Pool

Go Picture These!

Valid July 1, 2010
Through
June 30, 2014
What is the name for standardized representations of components in an electrical wiring diagram?

A. Electrical depictions
B. Grey sketch
C. Schematic symbols
D. Component callouts
What do the symbols on an electrical circuit schematic diagram represent?

A. Electrical components  
B. Logic states  
C. Digital codes  
D. Traffic nodes
Which of the following is accurately represented in electrical circuit schematic diagrams?

A. Wire lengths
B. Physical appearance of components
C. The way components are interconnected
D. All of these choices
What is component 3 in figure T3?

A. Connector
B. Meter
C. Variable capacitor
D. Variable inductor
What is component 4 in figure T3?

A. Antenna  
B. Transmitter  
C. Dummy load  
D. Ground
Which of the following is used together with an inductor to make a tuned circuit?

A. Resistor
B. Zener diode
C. Potentiometer
D. Capacitor
What is component 1 in figure T1?

A. Resistor
B. Transistor
C. Battery
D. Connector
What is component 2 in figure T1?

A. Resistor
B. Transistor
C. Indicator lamp
D. Connector
What is the function of component 2 in Figure T1?

A. Give off light when current flows through it
B. Supply electrical energy
C. Control the flow of current
D. Convert electrical energy into radio waves
What is component 3 in figure T1?

A. Resistor
B. Transistor
C. Lamp
D. Ground symbol
What is component 4 in figure T1?

A. Resistor  
B. Transistor  
C. Battery  
D. Ground symbol
What type of switch is represented by item 3 in figure T2?

A. Single-pole single-throw
B. Single-pole double-throw
C. Double-pole single-throw
D. Double-pole double-throw
What is component 4 in figure T2?

A. Variable inductor
B. Double-pole switch
C. Potentiometer
D. Transformer
What is component 6 in figure T2?

A. Resistor
B. Capacitor
C. Regulator IC
D. Transistor
T6C07  What is component 8 in figure T2?

A. Resistor  
B. Inductor  
C. Regulator IC  
D. Light emitting diode
What is component 9 in figure T2?

A. Variable capacitor
B. Variable inductor
C. Variable resistor
D. Variable transformer
Which of the following can be used to display signal strength on a numeric scale?

A. Potentiometer  
B. Transistor  
C. Meter  
D. Relay
What best describes a relay?

A. A switch controlled by an electromagnet
B. A current controlled amplifier
C. An optical sensor
D. A pass transistor
What is the approximate amount of change, measured in decibels (dB), of a power increase from 5 watts to 10 watts?

A. 2 dB  
B. 3 dB  
C. 5 dB  
D. 10 dB
What is the approximate amount of change, measured in decibels (dB), of a power decrease from 12 watts to 3 watts?

A. 1 dB  
B. 3 dB  
C. 6 dB  
D. 9 dB
What is the approximate amount of change, measured in decibels (dB), of a power increase from 20 watts to 200 watts?

A. 10 dB
B. 12 dB
C. 18 dB
D. 28 dB
What type of circuit controls the amount of voltage from a power supply?

A. Regulator
B. Oscillator
C. Filter
D. Phase inverter
What component is commonly used to change 120V AC house current to a lower AC voltage for other uses?

A. Variable capacitor
B. Transformer
C. Transistor
D. Diode
What is the name of a device that combines several semiconductors and other components into one package?

A. Transducer
B. Multi-pole relay
C. Integrated circuit
D. Transformer
What does the abbreviation "LED" stand for?

A. Low Emission Diode
B. Light Emitting Diode
C. Liquid Emission Detector
D. Long Echo Delay
Which of the following is commonly used as a visual indicator?

A. LED
B. FET
C. Zener diode
D. Bipolar transistor
T5B02  What is another way to specify a radio signal frequency of 1,500,000 hertz?

A. 1500 kHz
B. 1500 MHz
C. 15 GHz
D. 15 kHz
How many volts are equal to one kilovolt?

A. One one-thousandth of a volt
B. One hundred volts
C. One thousand volts
D. One million volts
If an ammeter calibrated in amperes is used to measure a 3000-milliampere current, what reading would it show?

A. 0.003 amperes
B. 0.3 amperes
C. 3 amperes
D. 3,000,000 amperes
Which of the following is equivalent to 500 milliwatts?

A. 0.02 watts
B. 0.5 watts
C. 5 watts
D. 50 watts
How many milliamperes is 1.5 amperes?

A. 15 milliamperes
B. 150 milliamperes
C. 1,500 milliamperes
D. 15,000 milliamperes
How many microfarads are 1,000,000 picofarads?

A. 0.001 microfarads
B. 1 microfarad
C. 1000 microfarads
D. 1,000,000,000 microfarads
T5B04  How many volts are equal to one microvolt?

A. One one-millionth of a volt
B. One million volts
C. One thousand kilovolts
D. One one-thousandth of a volt
Which of the following types of solder is best for radio and electronic use?

A. Acid-core solder
B. Silver solder
C. Rosin-core solder
D. Aluminum solder
What is the characteristic appearance of a "cold" solder joint?

A. Dark black spots
B. A bright or shiny surface
C. A grainy or dull surface
D. A greenish tint
Which of the following measurements are commonly made using a multimeter?

A. SWR and RF power
B. Signal strength and noise
C. Impedance and reactance
D. Voltage and resistance
Which of the following precautions should be taken when measuring circuit resistance with an ohmmeter?

A. Ensure that the applied voltages are correct
B. Ensure that the circuit is not powered
C. Ensure that the circuit is grounded
D. Ensure that the circuit is operating at the correct frequency
Which of the following might damage a multimeter?

A. Measuring a voltage too small for the chosen scale
B. Leaving the meter in the milliamps position overnight
C. Attempting to measure voltage when using the resistance setting
D. Not allowing it to warm up properly
What is probably happening when an ohmmeter, connected across a circuit, initially indicates a low resistance and then shows increasing resistance with time?

A. The ohmmeter is defective
B. The circuit contains a large capacitor
C. The circuit contains a large inductor
D. The circuit is a relaxation oscillator