Advanced and Standard Licence Course Review Answers

Questions with the number in **black** are for Standard licence candidates.

Questions with the number in **black** and **red** are for Advanced licence candidates.

<table>
<tr><th>No</th><th>Question</th><th>Answer</th></tr>
<tr><td>1</td><td>Describe how voltage is measured.</td><td>Voltage is measured across two points.</td></tr>
<tr><td>2</td><td>Describe how current is measured.</td><td>Current flow must be measured in the circuit.</td></tr>
<tr><td>3</td><td>Complete the table
<table>
<tr><th>Voltage (E)</th><th>Current (I)</th><th>Resistance (R)</th></tr>
<tr><td>12 V</td><td>2 A</td><td></td></tr>
<tr><td>120 V</td><td></td><td>6 MΩ</td></tr>
<tr><td></td><td>500 mA</td><td>20 Ω</td></tr>
<tr><td>60 V</td><td></td><td>1 KΩ</td></tr>
<tr><td>90 V</td><td>3.3 A</td><td></td></tr>
<tr><td>24 V</td><td></td><td>6 MΩ</td></tr>
<tr><td>6 V</td><td>1000 A</td><td></td></tr>
<tr><td></td><td>3 mA</td><td>3 KΩ</td></tr>
</table></td><td>
<table>
<tr><th>Voltage (E)</th><th>Current (I)</th><th>Resistance (R)</th></tr>
<tr><td>12 V</td><td>2 A</td><td>6Ω</td></tr>
<tr><td>120 V</td><td>20 µA</td><td>6 MΩ</td></tr>
<tr><td>10 V</td><td>500 mA</td><td>20 Ω</td></tr>
<tr><td>60 V</td><td>60 mA</td><td>1 KΩ</td></tr>
<tr><td>90 V</td><td>3.3 A</td><td>27.27 Ω</td></tr>
<tr><td>24 V</td><td>4 µA</td><td>6 MΩ</td></tr>
<tr><td>6 V</td><td>1000 A</td><td>6 mΩ</td></tr>
<tr><td>9 V</td><td>3 mA</td><td>3 KΩ</td></tr>
</table></td></tr>
<tr><td>4</td><td>If doubling the voltage across a resistor doubles the current through the resistor, then
A. the resistor value decreased.
B. the resistor value did not change.
C. the resistor value incresed.
D. It is imposible to calculate.</td><td>a) the resistor value decreased.
b) <u>the resistor value did not change.</u>
c) the resistor value incresed.
d) It is imposible to calculate.</td></tr>
<tr><td>5</td><td>If doubling the voltage across a resistor doubles the current through the resistor, then
A. the resistor value decreased.
B. the resistor value did not change.
C. the resistor value incresed.
D. It is imposible to calculate.</td><td>a) the resistor value decreased.
b) <u>the resistor value did not change.</u>
c) the resistor value incresed.
d) It is imposible to calculate.</td></tr>
</table>

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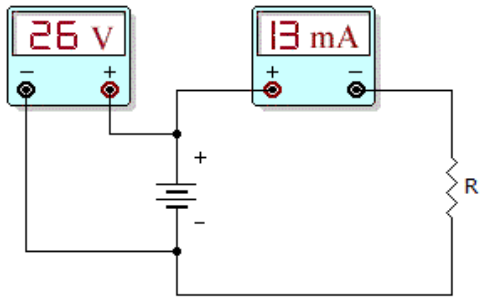
No	Question	Answer
6	If the voltage is increased five times across a fixed value of resistence, what does the current do**?** A. <u>The current increases by a factor of five.</u> B. The current decreases by a factor of five. C. Current stays the same. D. It is imposible to calculate	a) **<u>The current increases by a factor of five</u>**. b) The current decreases by a factor of five. c) Current stays the same. d) It is imposible to calculate
7	 What is the resistor value in the given circuit? **IMPORTANT:** Observe the difference in measuring voltage and current. Voltage is measured across the terminals, but current is measured in the circuit	200 Ohms
8	If the voltage doubles across a fixed resistance A.The current is halved B. The resistance doubles C.The current is unchanged D.The current doubles	A.The current is halved B. The resistance doubles C.The current is unchanged D.**<u>The current doubles</u>**
9	Ohm's law describes the mathematical relationship between A. ohms, kilohms, and megohms B. resistor size and resistor value C. resistance, voltage, and current D. none of the above	A. ohms, kilohms, and megohms B. resistor size and resistor value C. **<u>resistance, voltage, and current</u>** D. none of the above
10	If current through a fixed resistance is halved A. the resistance is halved B. the voltage is halved C. the voltage doubles D. The current cannot change	A. the resistance is halved B. **<u>the voltage is halved</u>** C. the voltage doubles D. The current cannot change

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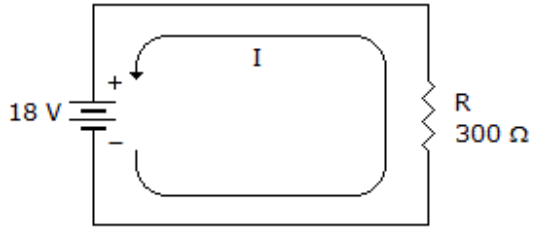
<table>
<tr><th>No</th><th>Question</th><th>Answer</th></tr>
<tr><td>11</td><td>If the voltage in the circuit to the right was cut in half, what would the current equal?
 
</td><td>30 mA</td></tr>
<tr><td>12</td><td>Describe the difference between conventional current flow and electon flow.</td><td>CCF positive to neg
EF negative to positive.</td></tr>
<tr><td>13</td><td>Complete the table.
<table>
<tr><th>Voltage (E)</th><th>Current (I)</th><th>Resistance (R)</th><th>Power (W)</th></tr>
<tr><td>12 V</td><td>0.75 A</td><td></td><td></td></tr>
<tr><td></td><td>0.4 mA</td><td>110 Ω</td><td></td></tr>
<tr><td></td><td></td><td>10.75 Ω</td><td>60 W</td></tr>
<tr><td>12 kV</td><td></td><td>25 Ω</td><td></td></tr>
<tr><td>2 V</td><td>75 mA</td><td></td><td></td></tr>
<tr><td></td><td>3 A</td><td>1 MΩ</td><td></td></tr>
</table></td><td>
<table>
<tr><th>Voltage (E)</th><th>Current (I)</th><th>Resistance (R)</th><th>Power (W)</th></tr>
<tr><td>12 V</td><td>0.75 A</td><td>16 Ω</td><td>9 W</td></tr>
<tr><td>44 mW</td><td>0.4 mA</td><td>110 Ω</td><td>176 µW</td></tr>
<tr><td>25.39 V</td><td>2.36 A</td><td>10.75 Ω</td><td>60 W</td></tr>
<tr><td>12 kV</td><td>230.4 kA</td><td>25 Ω</td><td>2764 MW</td></tr>
<tr><td>2 V</td><td>75 mA</td><td>26.6 Ω</td><td>0.15 W</td></tr>
<tr><td>3 MV</td><td>3 A</td><td>1 MΩ</td><td>9 MW</td></tr>
</table>
</td></tr>
<tr><td>14</td><td>What happens to the power level When the voltage, across a fixed load, doubles?
A. the power value increased by 2.
B. the lights go out.
C. the power value increased by 4
D. It is imposible to calculate</td><td>a) the power value increased by 2.
b) the lights go out.
c) the power value increased by 4
d) It is imposible to calculate</td></tr>
<tr><td>15</td><td>You accidently replace a 15 W bulb with a 5 W bulb in your car. The voltage remains at 12V. What was the current drain originally and after you replaced the bulb?
A. The current increases by a factor of three.
B. The current decreases by a factor of three.
C. Current stays the same.
D. The bulb Will destruct</td><td>a) The current increases by a factor of three.
b) <u>The current decreases by a factor of three.</u>
c) Current stays the same.
d) The bulb Will destruct</td></tr>
</table>

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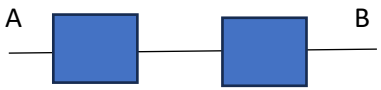
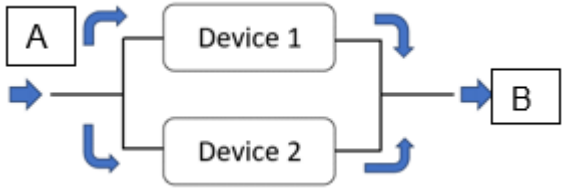
<table>
<tr><th>No</th><th>Question</th><th>Answer</th></tr>
<tr><td>16</td><td>If the energy of 120 joules is applied and this moves 6 coulombs, What is the required voltage?</td><td>20V</td></tr>
<tr><td>17</td><td>If device 1 and 2 are 10 V batteries, What is the potential difference between A and B?
 
</td><td>20V</td></tr>
<tr><td>18</td><td>If device 1 and 2 above are 10 V batteries, What is the potential difference between A and B?
 
</td><td>10V</td></tr>
<tr><td>19</td><td>Complete the following table and indicate the formula you used to get the answer.
<table>
<tr><th>Unit</th><th>Unit</th><th>Answer</th></tr>
<tr><td>12 V</td><td>10 J</td><td></td></tr>
<tr><td>5 A</td><td>20 Q</td><td></td></tr>
<tr><td>5 kJ</td><td>20 seconds</td><td></td></tr>
<tr><td>100 V</td><td>6 Q</td><td></td></tr>
</table></td><td>
<table>
<tr><th>Unit</th><th>Unit</th><th>Answer</th></tr>
<tr><td>12 V</td><td>10 J</td><td>V = J /Q Q = J/V = 10 / 12 = 0.83 Q</td></tr>
<tr><td>5 A</td><td>20 Q</td><td>A = Q / t t = Q / A = 20 / 5 = 4 seconds</td></tr>
<tr><td>5 kJ</td><td>20 seconds</td><td>W = J / t = 5000 / 20 = 250 W</td></tr>
<tr><td>100 V</td><td>6 Q</td><td>V = J / Q J = V x Q = 100 x 6 = 600 J</td></tr>
</table>
</td></tr>
</table>

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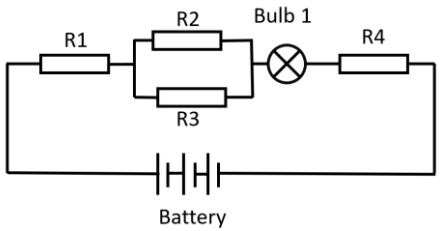
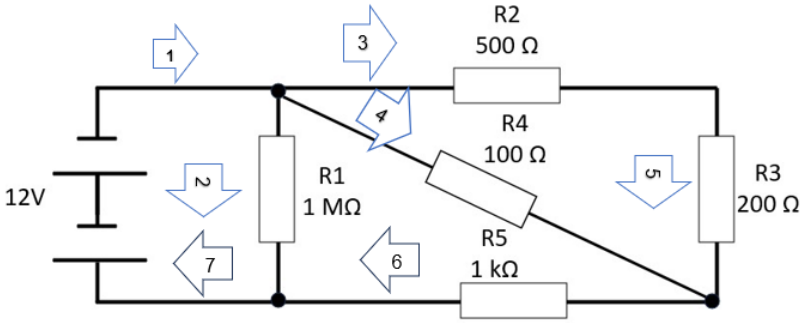
<table>
<tr><th>No</th><th>Question</th><th>Answer</th></tr>
<tr><td>20</td><td>


Complete the table assuming the following values.
<table>
<tr><th>Battery</th><th>Current</th><th>R1</th><th>R2</th><th>R3</th><th>Bulb</th><th>R4</th></tr>
<tr><td>90v</td><td>3A</td><td>4Ω</td><td>40Ω</td><td>40Ω</td><td></td><td>4Ω</td></tr>
<tr><td>12v</td><td></td><td>20 Ω</td><td>100 Ω</td><td>100 Ω</td><td>15 Ω</td><td>10 Ω</td></tr>
<tr><td>60v</td><td>60 mA</td><td>100 Ω</td><td></td><td></td><td>15 Ω</td><td>870 Ω</td></tr>
</table>
</td><td>
<table>
<tr><th>Battery</th><th>Current</th><th>R1</th><th>R2</th><th>R3</th><th>Bulb</th><th>R4</th></tr>
<tr><td>90v</td><td>3A</td><td>4Ω</td><td>40Ω</td><td>40Ω</td><td>2 Ω</td><td>4Ω</td></tr>
<tr><td>12v</td><td>126 mA</td><td>20 Ω</td><td>100 Ω</td><td>100 Ω</td><td>15 Ω</td><td>10 Ω</td></tr>
<tr><td>60v</td><td>60 mA</td><td>100 Ω</td><td>30 Ω</td><td>30 Ω</td><td>15 Ω</td><td>870 Ω</td></tr>
</table>
</td></tr>
<tr><td>21</td><td>


Hint: Redraw the equivalent circuit.
<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Find the currents for 1 to 7
</td><td>
<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th></tr>
<tr><td>11 mA</td><td>12 µA</td><td>0.88 mA</td><td>10.1 mA</td><td>0.88 mA</td><td>10.98 mA</td><td>11 mA</td></tr>
</table>
</td></tr>
</table>

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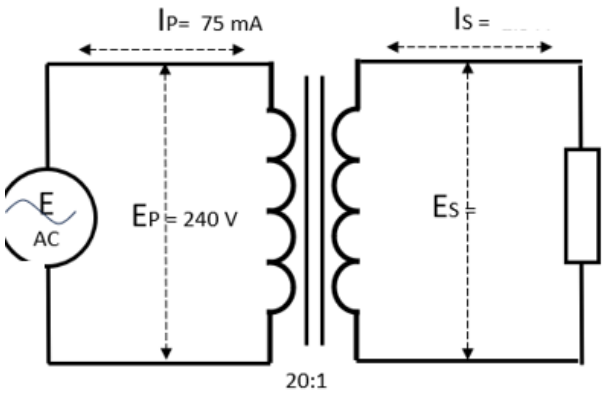
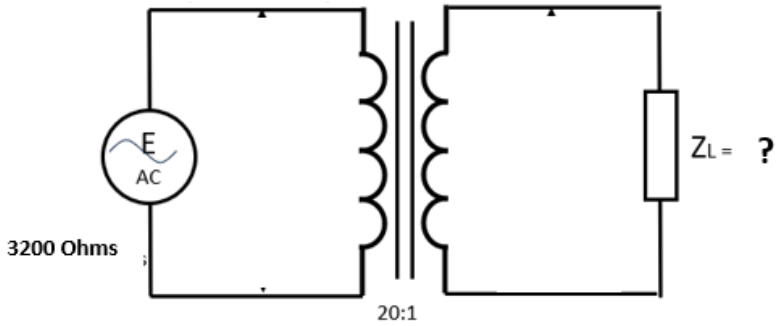
No	Question	Answer
22	 Calculate Is and Es.	Is = 1.5A Es =12v
23	 What is ZL?	8 Ohms
24	What is the period of a signal at 144.0MHz?	6.9nS
25	A tank circuit with an inductor of 15µH and a capacitor of 220nF will oscillate at what frequency?	87.6kHz
26	What is Peak Inverse Voltage (PIV)?	The PIV applies is reverse voltage a diode can tolerate without breaking down.
27	What are the variables in designing a capacitor?	• Area of the plates • Distance between the plates. • Dielectric
28	<table><tr><th>C1</th><th>C2</th><th>C3</th><th>C Total</th></tr><tr><td>3 mF</td><td>10 mF</td><td>2 mF</td><td></td></tr><tr><td>6 pF</td><td>3 pF</td><td>1 pF</td><td></td></tr><tr><td>6 nF</td><td>12 nF</td><td>1 nF</td><td></td></tr></table>What is the total capacitance of these capacitors in series?	<table><tr><th>C1</th><th>C2</th><th>C3</th><th>C Total</th></tr><tr><td>3 mF</td><td>10 mF</td><td>2 mF</td><td>1.07 mF</td></tr><tr><td>6 pF</td><td>3 pF</td><td>1 pF</td><td>0.66 pF</td></tr><tr><td>6 nF</td><td>12 nF</td><td>1 nF</td><td>0.8 nF</td></tr></table>

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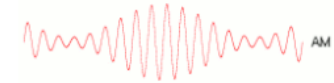
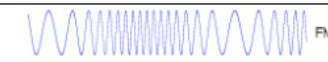
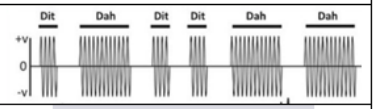
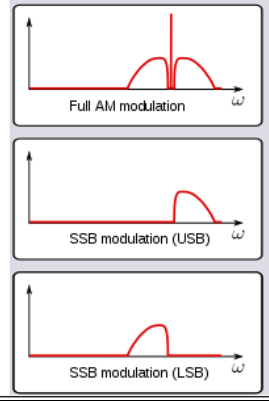
<table>
<tr><th>No</th><th>Question</th><th>Answer</th></tr>
<tr><td>29</td><td>
<table>
<tr><th>C1</th><th>C2</th><th>C3</th><th>C Total</th></tr>
<tr><td>3 mF</td><td>10 mF</td><td>2 mF</td><td></td></tr>
<tr><td>6 pF</td><td>3 pF</td><td>1 pF</td><td></td></tr>
<tr><td>6 nF</td><td>12 nF</td><td>1 nF</td><td></td></tr>
</table>
What is the total capacitance of these capacitors in parallel?
</td><td>
<table>
<tr><th>C1</th><th>C2</th><th>C3</th><th>C Total</th></tr>
<tr><td>3 mF</td><td>10 mF</td><td>2 mF</td><td>15 mF</td></tr>
<tr><td>6 pF</td><td>3 pF</td><td>1 pF</td><td>10 pF</td></tr>
<tr><td>6 nF</td><td>12 nF</td><td>1 nF</td><td>19 nF</td></tr>
</table>
</td></tr>
<tr><td>30</td><td>Name and describe the four modulation methods used by amateur radio operators.</td><td>
<table>
<tr><td>Amplitude modulation (AM)</td><td>AM is a modulation technique where the amplitude of the carrier is varied in proportion to that of the message signal.</td><td>  </td></tr>
<tr><td>Frequency modulation (FM)</td><td>FM is a modulation technique where the frequency of the carrier wave is varied by the message signal.</td><td>  </td></tr>
<tr><td>Continuous Wave (CW)</td><td>The term continuous wave refers to a method of radio transmission in which a sinusoidal carrier wave is switched on and off as in Morse code.</td><td>  </td></tr>
<tr><td>Single-Sideband modulation (SSB)</td><td>SSB is a refinement of amplitude modulation, SSB uses transmitter Single-sideband modulation avoids this bandwidth increase, and the power wasted on a carrier, at the cost of increased device complexity and more difficult tuning at the receiver.</td><td>  </td></tr>
</table>
</td></tr>
<tr><td>31</td><td>
<table>
<tr><th>L1</th><th>L2</th><th>L3</th><th>L Total</th></tr>
<tr><td>16 mH</td><td>15 mH</td><td>21 mH</td><td></td></tr>
<tr><td>16 pH</td><td>30 pH</td><td>0.1 pH</td><td></td></tr>
<tr><td>60 nH</td><td>12 nH</td><td>100 nH</td><td></td></tr>
</table>
What is the total inductance of these inductors in parallel?
</td><td>
<table>
<tr><th>L1</th><th>L2</th><th>L3</th><th>L Total</th></tr>
<tr><td>16 mH</td><td>15 mH</td><td>21 mH</td><td>5.6 mH</td></tr>
<tr><td>16 pH</td><td>30 pH</td><td>0.1 pH</td><td>0.099 pH</td></tr>
<tr><td>60 nH</td><td>12 nH</td><td>100 nH</td><td>9.09 nH</td></tr>
</table>
</td></tr>
</table>

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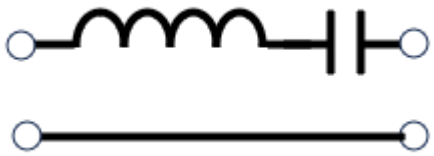
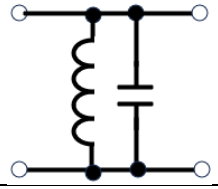
<table>
<tr><th>No</th><th>Question</th><th>Answer</th></tr>
<tr><td>32</td><td><table><tr><td>L1</td><td>L2</td><td>L3</td><td>L Total</td></tr><tr><td>16 mH</td><td>15 mH</td><td>21 mH</td><td></td></tr><tr><td>16 pH</td><td>30 pH</td><td>0.1 pH</td><td></td></tr><tr><td>60 nH</td><td>12 nH</td><td>100 nH</td><td></td></tr></table>What is the total inductance of these inductors in series?</td><td><table><tr><td>L1</td><td>L2</td><td>L3</td><td>L Total</td></tr><tr><td>16 mH</td><td>15 mH</td><td>21 mH</td><td>52 mH</td></tr><tr><td>16 pH</td><td>30 pH</td><td>0.1 pH</td><td>46.1 pH</td></tr><tr><td>60 nH</td><td>12 nH</td><td>100 nH</td><td>172 nH</td></tr></table></td></tr>
<tr><td>33</td><td>What is a filter and why are they used?</td><td>Electronic filters remove unwanted frequency components from the applied signal, enhance wanted ones or both.</td></tr>
<tr><td>34</td><td>What is the reactance of a series tuned circuit at frequency?</td><td>Low</td></tr>
<tr><td>35</td><td>What is the inductive reactance (XL) of a 0.3H inductor at 60Hz?</td><td>113.1Ohms</td></tr>
<tr><td>36</td><td>What is the reactance of a parallel tuned circuit at frequency?</td><td>High</td></tr>
<tr><td>37</td><td>What is the configuration and purpose of the filter shown?
  </td><td>This is a series tuned circuit that only allows resonant frequencies to pass.</td></tr>
<tr><td>38</td><td>What is the configuration and purpose of the filter shown?
  </td><td>This is a parallel tuned circuit passes all but resonant frequencies to earth.</td></tr>
<tr><td>39</td><td>Describe the four basic filter configurations.</td><td>Low pass, high pass, band pass and band stop.</td></tr>
<tr><td>40</td><td>Describe where the cutoff point is for a filter.</td><td>When the signal is attenuated to the 3dB point of half power point.</td></tr>
<tr><td>41</td><td>Why is it necessary to be cautious when handling equipment with valves?</td><td>Valves get very hot during operation and some of the anode voltages on the valve can be very high.</td></tr>
<tr><td>42</td><td>What is the gain of a valve if the change in plate voltage is 50 V and the change in grid voltage is 2 V?</td><td>25</td></tr>
<tr><td>43</td><td>Write the dB formula to calculate power and voltage.</td><td>Voltage – db = 20 Log Vout / V in
Power – db = 10 Log P out / P in</td></tr>
</table>

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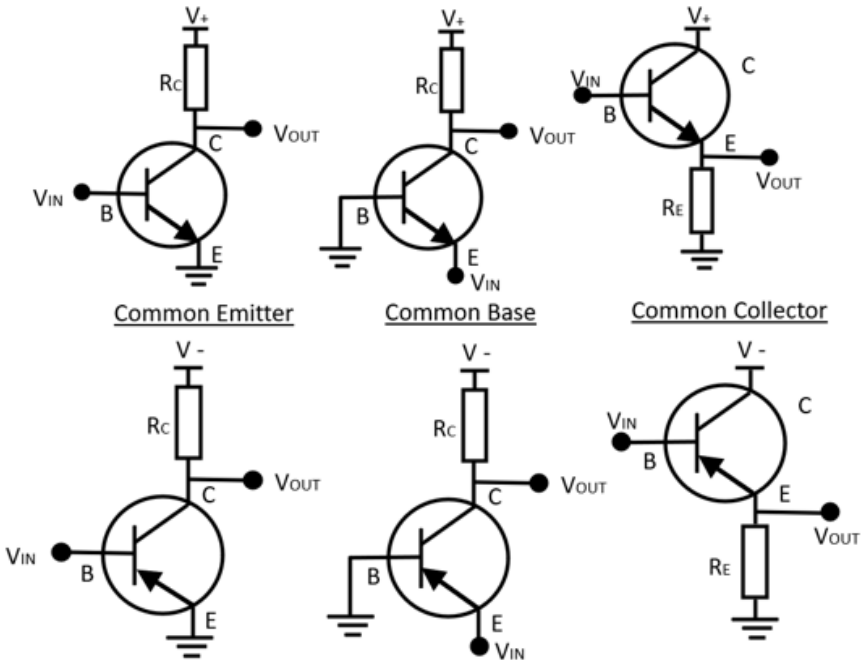
<table>
<tr><th>No</th><th>Question</th><th>Answer</th></tr>
<tr><td>44</td><td>Complete the following decibel table. (Use the correct suffixes)
<table>
<tr><th>Input or Reference</th><th>Output</th><th>+- Decibels</th></tr>
<tr><td>dBµV</td><td>171 µV</td><td></td></tr>
<tr><td>12 V</td><td></td><td>- 6 dB</td></tr>
<tr><td>22 µV</td><td>22 mV</td><td></td></tr>
<tr><td></td><td>100 V</td><td>10dB</td></tr>
</table></td><td>
<table>
<tr><th>Input or Reference</th><th>Output</th><th>+- Decibels</th></tr>
<tr><td>dBµV</td><td>171 µV</td><td>44.7 dB</td></tr>
<tr><td>12 V</td><td>6 V</td><td>- 6 dB</td></tr>
<tr><td>22 µV</td><td>22 mV</td><td>60 dB</td></tr>
<tr><td>31.6 V</td><td>100 V</td><td>10dB</td></tr>
</table></td></tr>
<tr><td>45</td><td>Complete the following decibel table. (Use the correct suffixes)
<table>
<tr><th>Input or Reference</th><th>Output</th><th>+- Decibels</th></tr>
<tr><td>0.25 W</td><td>6 W</td><td></td></tr>
<tr><td>1.2 W</td><td></td><td>9.3 dB</td></tr>
<tr><td>dBW</td><td>12 W</td><td></td></tr>
<tr><td>dBm</td><td>171 mW</td><td></td></tr>
</table></td><td>
<table>
<tr><th>Input or Reference</th><th>Output</th><th>+- Decibels</th></tr>
<tr><td>0.25 W</td><td>6 W</td><td>13.8 dB</td></tr>
<tr><td>1.2 W</td><td>10.2 W</td><td>9.3 dB</td></tr>
<tr><td>dBW</td><td>12 W</td><td>10.7 dB</td></tr>
<tr><td>dBm</td><td>171 mW</td><td>22.3 dB</td></tr>
</table></td></tr>
<tr><td>46</td><td>Draw the following diagrams for either NPN or PNP transistors.
Common emitter, common base and Common collector.</td><td> 
</td></tr>
<tr><td>47</td><td>What are the characteristics of each configuration?</td><td>
<table>
<tr><th>Configuration</th><th>Input Impedance</th><th>Output impedance</th><th>Gain</th><th>Orientation</th></tr>
<tr><td>Common Emitter</td><td>Medium</td><td>High</td><td>High</td><td>Inverting</td></tr>
<tr><td>Common Base</td><td>Low</td><td>High</td><td>Unity</td><td>Non - inverting</td></tr>
<tr><td>Common Collector</td><td>High</td><td>Low</td><td>High</td><td>Non - inverting</td></tr>
</table></td></tr>
</table>

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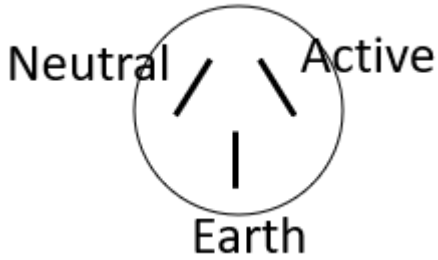
No	Question	Answer
48	Describe the following classes (A, B, AB and C) of amplifiers.	**Class A** - Class A amps are simple devices using one transistor and transmit over the full 360 degrees of the signal. Class A efficiency is only 30%. **Class B** – Class B uses two transistors, each operating in only 180 degrees of the signal. This provides a greater amplification and clearer signal. The downside is that each transistor requires 0.7 V to turn on and this can cause distortion. This area is termed the 'Dead Zone'. **Class AB** – Diodes are fitted to the circuit to bias the transistors across the dead zone and minimise distortion. **Class C** – Class C power amplifier is where the transistor conducts for less than one half of the input cycle. The reduced conduction angle improves efficiency but causes distortion. Theoretical maximum efficiency of a Class C amplifier is around 90%.
49	What is the forward bias of a diode?	This is the point at which the diode will start conducting in the forward direction.
50	Looking at the pin end of a three-pin plug, identify the terminals. 	
51	What is a power supply?	A power supply is a device that provides the required electric power for an electrical load.

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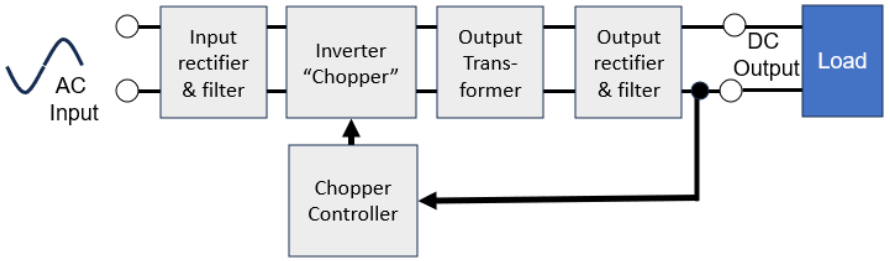
<table>
<tr><th>No</th><th>Question</th><th>Answer</th></tr>
<tr><td>52</td><td>What is the difference in the output of a half wave rectifier compared to a full wave rectifier?</td><td>Half wave has alternat peaks and a full wave has continual peaks.

E Peak = 1.4 x E RMS
E AV = 0.45 x E RMS
E PRV = 1.4 to 2.8 E RMS
Ripple = 50 Hz

E Peak = 1.4 x E RMS
E AV = 0.9 x E RMS
E PRV = 2.8 E RMS
Ripple = 100 Hz</td></tr>
<tr><td>53</td><td>Draw the block diagram of a SMPS and name the parts.</td><td>  </td></tr>
<tr><td>54</td><td>Why is an RCD better than a fuse?</td><td>The RCD is faster acting and prevents the full current of a fuse passing through the short.</td></tr>
<tr><td>55</td><td>Complete the following table with regards to 230 V wiring.
<table><tr><th>Wire</th><th>Colour</th><th>Voltage to Ground</th></tr><tr><td>Active</td><td></td><td></td></tr><tr><td>Neutral</td><td></td><td></td></tr><tr><td>Earth</td><td></td><td></td></tr></table></td><td><table><tr><th>Wire</th><th>Colour</th><th>Voltage to Ground</th></tr><tr><td>Active</td><td>Brown</td><td>230 V</td></tr><tr><td>Neutral</td><td>Blue</td><td>0</td></tr><tr><td>Earth</td><td>Yellow and green</td><td>0</td></tr></table></td></tr>
<tr><td>56</td><td>What is the main oscillating component in a Pierce oscillator?</td><td>Crystal</td></tr>
<tr><td>57</td><td>What was the first oscillator in use and why was it called a tickler oscillator?</td><td>The Armstrong oscillator is an oscillator circuit which uses an inductor and capacitor to generate oscillation and is the earliest oscillator circuit. This oscillator was used in the first vacuum tube radio transmitters. It is also called a “tickler oscillator” because its distinguishing feature is that the feedback signal is magnetically coupled into the tank inductor "tickler coil" in the output circuit.</td></tr>
<tr><td>58</td><td>What is a PLL?</td><td>A phase-locked loop compares the phase of a reference oscillator to the phase of an adjustable oscillator.</td></tr>
</table>

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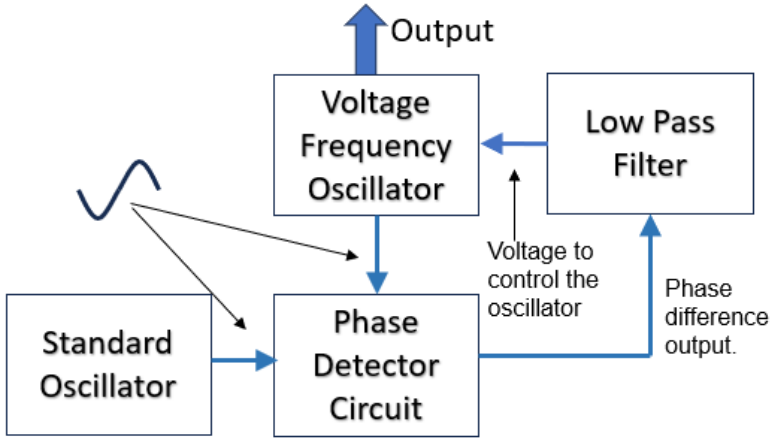
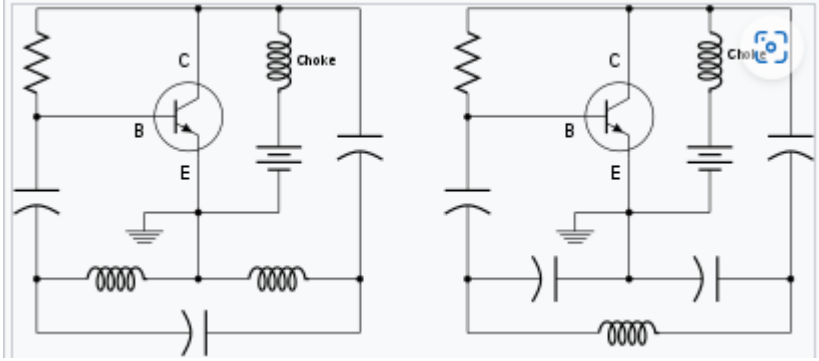
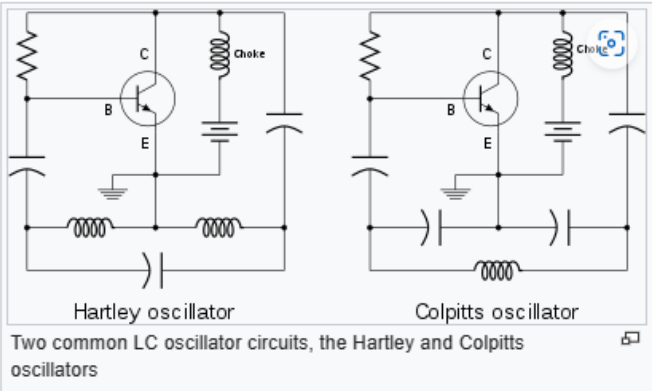
No	Question	Answer
59	Draw the block diagram of a PLL and name the parts.	 Phase Locked Loop (PLL) Oscillator
60	Name the two oscillators below. 	 Two common LC oscillator circuits, the Hartley and Colpitts oscillators
61	What is a BFO?	Beat frequency oscillator. A beat frequency oscillator (BFO) is a dedicated oscillator used to create an audio frequency signal from Morse code radiotelegraphy (CW) transmissions.
62	What is a VCO?	Voltage controlled oscillator. A VCO is an oscillator whose output frequency is controlled by an input voltage.

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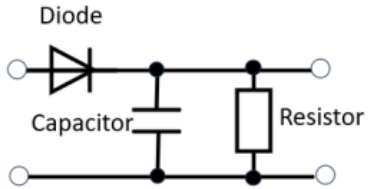
No	Question	Answer
63	What are the three criteria for a receiver? Explain each criterion.	Sensitivity Receiver sensitivity indicates how faint an input signal can be to be successfully received by the receiver. Sensitivity is defined as the receiver's ability to detect a signal at the input and give a signal-plus-noise ratio of 10dB above the noise output of the receiver. Selectivity Selectivity is an important parameter in any radio receiver. Selectivity is necessary for the receiver to be able to select the wanted signal from the unwanted adjacent signal. Stability Frequency stability means the receiver must stay "tuned" to the incoming radio signal and must not "drift" with time or temperature.
64	What is Thermal Noise?	Thermal noise or Thermal agitation noise is always present in the electrical equipment and is one of the major sources of noise that can affect the detection of weak signals. Thermal noise occurs due to the vibration of charge carriers within an electrical conductor and is directly proportional to the temperature. Thermal noise cannot be eliminated but can be reduced by controlling the temperature of devices. The thermal noise power is proportional to the bandwidth and is effectively white noise.
65	What is this circuit and where is it used? 	An AM signal detector for demodulating AM signals
66	If the RF signal is fc and the oscillator frequency is fo, what are the two possible frequencies at the output of the mixer?	fc + fo and fc - fo
67	What is an image frequency?	Image frequency is the unwanted signal frequency that could also produce the same IF frequency.

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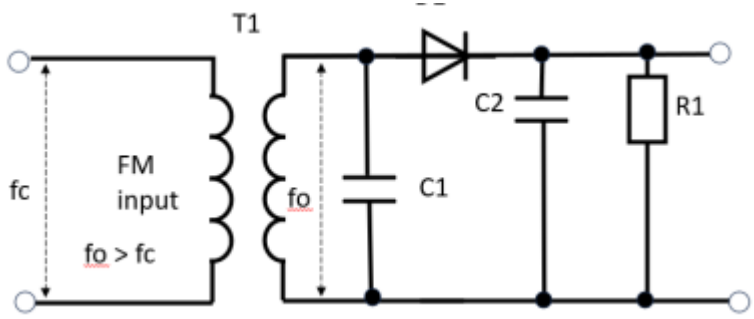
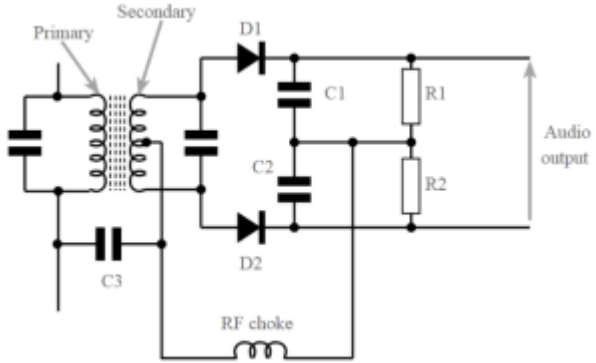
No	Question	Answer
68	What is the circuit below and where is it used? 	A slope detector for demodulating FM signals.
69	Below is the circuit of a Foster Seeley discriminator. What is it used for? 	The Foster Seeley FM discriminator is characterised by the transformer, choke and diodes used in the circuit. The Foster Seeley discriminator also provides a voltage for automatic frequency control. Like the slope detector, the Foster-Seely discriminator converts the FM signal to an AM signal and uses diodes for detection.
70	What is an IF frequency and why is it used?	This section basically amplifies the output of the mixer. IF amplifier provides sensitivity(gain) and selectivity (bandwidth requirement) to the receiver. The sensitivity and selectivity are uniform and do not show variations as in case of TRF receivers because IF amplifiers are independent of that of the received signal frequency. The IF has a narrow bandwidth and rejects all other frequencies, reducing the risk from interference.

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No	Question	Answer
71	Name the demodulators for AM, CW, FM and SSB.	**Amplitude modulation (AM)** Envelope detector or synchronous detector **Morse code (CW)** Product detector **Frequency modulation (FM)** Slope detector, Foster-Seely discriminator, Ratio detector or Quadrature detector. **Single Side Band (SSB)** Product detector.
72	What is the signal to noise ratio of a 50uV signal and the noise level of 1uV?	33.9dB
73	What is an S meter and what level is required for S9?	An S meter or signal strength meter is an indicator often provided on communications receivers, such as amateur radio or shortwave broadcast receivers. The scale markings are derived from a system of reporting signal strength from S1 to S9 as part of the R-S-T system. The term S unit refers to the amount of signal strength required to move an S meter indication from one marking to the next. Analogue S meters are sensitive microammeters. The standard is that a reading of S9 corresponds to a 50µV signal at the antenna input to the receiver.
74	What is de-emphasis?	Pre-emphasis is performed in the transmitter, and the de-emphasis is undertaken at the receiver. The purpose is to improve the signal-to-noise ratio for FM reception. A time constant of 75µs is specified in the RC or L/Z network for pre-emphasis and de-emphasis. De-emphasis performs the following functions. Applies a low-pass filter to the received signal. Attenuates or reduces the boosted high frequencies. Rolls-off highs above 2-3 kHz Restores original frequency spectrum. Reduces noise and distortion picked up during transmission.

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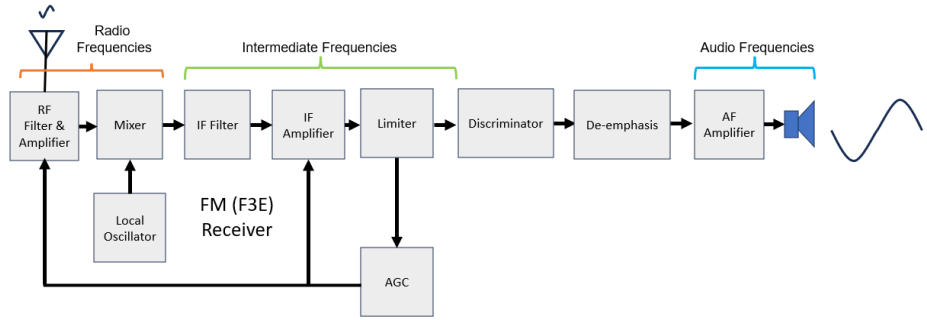
No	Question	Answer
75	Draw and label a block diagram of an FM receiver.	
76	What is AGC and how does it work?	Automatic gain control (AGC) is closed-loop feedback regulating circuit in an amplifier. The purpose of the AGC is to maintain a suitable signal amplitude at its output, despite variation of the signal amplitude at the input. The average or peak output signal level is used to dynamically adjust the gain of the amplifiers. AGC is used in most radio receivers to equalise the average volume (loudness) of different radio stations due to differences in received signal strength, as well as variations in a single station's radio signal due to fading. Without AGC the sound emitted from an AM radio receiver would vary to an extreme extent from a weak to a strong signal; the AGC effectively reduces the volume if the signal is strong and raises it when it is weaker. In a typical receiver the AGC feedback control signal is usually taken from the detector stage and applied to control the gain of the IF or RF amplifier stages.

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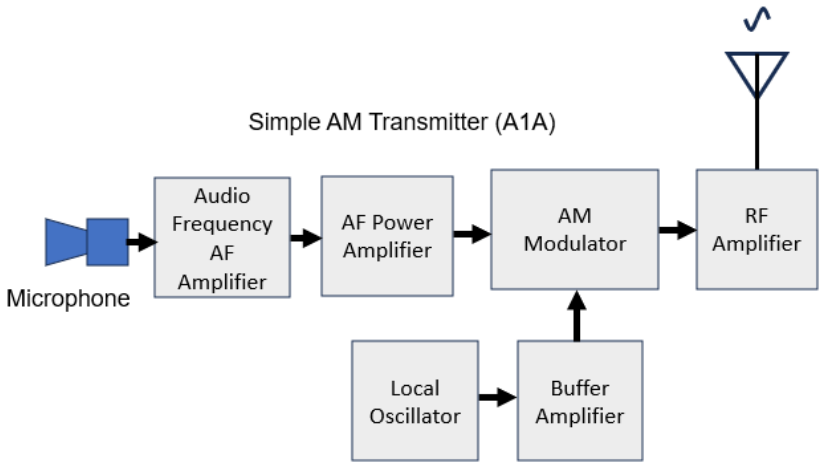
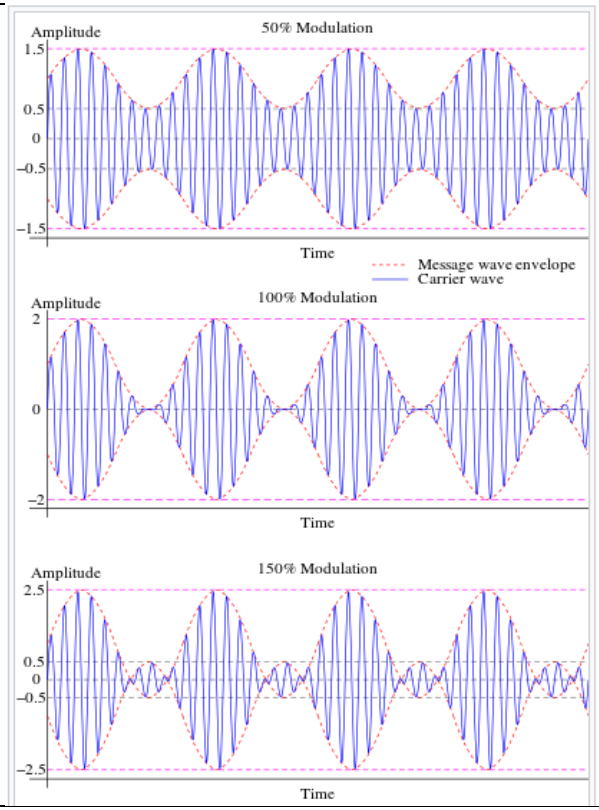
No	Question	Answer
77	Draw and label a block diagram of a simple AM transmitter.	
78	Draw an AM carrier wave modulated to 50%, 100% and 150%	

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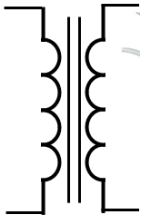
No	Question	Answer
79	What is a balanced modulator and why is it used?	A balanced modulator adds the message to the carrier so that only the sideband signals come through the output modulator. This creates a balanced signal, as there is less noise because the carrier signal has been removed.
80	Where would an amateur operator find the frequencies for amateur use?	Radiocommunications (Amateur Stations) Class Licence 2023 Schedule 2 Foundation Table A, Standard Table B and Advanced Table C
81	What does this symbol mean? 	Iron core transformer
82	Where would an amateur operator find the modes of operation for each amateur frequency?	Australian Amateur Band Plan.
83	What is the ALC?	An ALC circuit controls the signal strength at the input to the power amplifier in a ham radio transmitter. The ALC keeps the power amplifier input at the designed range for linear operation. Overdriving the ALC circuit can distort the signal and cause interference.
84	Calculate the ERP. Transmitter gain = 20dB Cable loss = -2dB Antenna gain = 5dB	23dB
85	What duty cycle does RTTY transmission occupy?	100%
86	What bandwidth is occupied by a FM signal if a 2KHz tone deviates the carrier by 100KHz?	204 kHz

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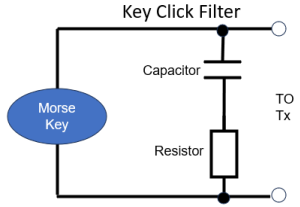
No	Question	Answer
87	What are key clicks and chirps?	Two issues with CW transmitters are Key clicks and chirps. Key Clicks. CW transmitted with poor waveform shaping causes interference. This is heard as clicks and thumps by other CW operators on nearby frequencies. Key Clicks can be reduced by using a Key Click filter to shape the transients between transmission bursts of morse code. This filter can be a simple RC network to shape the attack and decay times of the transmissions.  Chirps. Oscillator stability is essential for a clean transmission. Any variation in the frequency as the transmitter is keyed is called a chirp. This is an unpleasant signal to receive.
88	What is the inductive reactance (XL) of a 0.1µH capacitor at 144MHz?	904Ohms
89	What is the Q, for the capacitor above, if the resistance is 100Ohms?	9
90	What is the bandwidth of this circuit above. XL of 904Ω and resistance of 100Ω?	100Hz
91	Describe how a dynamic speaker works.	The incoming audio signals energise the coil which is repelled or attracted to the permanent magnet. The coil is attached to a diaphragm. As the coil and diaphragm moil back and forward in accordance with the audio signal, the diaphragm produces sound waves which are heard by the listener.
92	What are ZS, ZO and ZL with regard to transmission impedances?	Z_S = Impedance of the signal source, transmitter Z_O = Impedance of the line Z_L = Impedance of the load, antenna
93	Name an unbalanced transmission line.	Coaxial cable
94	How do you know if an antenna is balanced or unbalanced?	Balanced antennas are centre fed. Un balanced antennas are of set centre fed.

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No	Question	Answer
95	What is a waveguide?	A waveguide is a special form of transmission line consisting of a hollow metal tube.
96	Explain SWR?	SWR is the ratio of the maximum to minimum voltage on a transmission line. SWR is measured using a dedicated SWR meter.
97	Measuring the signal on a transmission line, the maximum is 12V and the minimum is 2 V. What is the SWR?	6:1
98	How do you test the continuity of a transmission line?	Use a multimeter to test the cable.
99	From the previous test, you got results of 500 Ω Zo and 100 Ω. ZSc. What is the impedance of the line?	223.6 Ω
100	How is a resistor rated?	Resistance value in ohms and power rating in Watts.
101	What is a balun?	A balun is a device that allows balanced and unbalanced lines to be connected without disturbing the impedance of either line.
102	Connecting a balanced line of 450 Ω to an unbalanced line of 50 Ω. What is the turns ratio for the balun?	3:1
103	What is frequency deviation?	The Deviation (Δ f): This represents how far the frequency swings on either side of the centre point. For example, a 5 kHz deviation means the signal swings +5 kHz and -5 kHz from the centre.
104	What is the role of an antenna?	An antenna is a transducer that converts alternating voltage electrical signals into electromagnetic fields for transmission and converts electromagnetic fields to alternating voltage electrical signals for reception.
105	What are the three main groupings of antennas?	**Directional** – This antenna can direct the signal in one direction e.g., Yagi. **Semi-directional** - This antenna can direct the signal in two dominant directions e.g., dipole. **Omni-directional** - This antenna is not able to direct the signal and radiates in all directions e.g., vertical whip.
106	What is an isotropic antenna?	The ideal antenna by which all antennas are compared, is called the isotropic antenna. The isotropic antenna is a theoretical antenna that radiates equally in all directions - horizontally and vertically with the same intensity. The antenna has a gain of 1 (0 dB) in the spherical space all around it and has an efficiency of 100%.

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No	Question	Answer
107	You are listening to a broadcast on 100MHz. The IF for your radio is 10MHz and the oscillator is running at 110MHz. What is the image frequency?	120MHz
108	What is the wavelength of a signal at 14.2MHz?	21.1metres
109	Name five types of antennas?	Dipole, Folded dipole, Yagi, Vertical, End fed
110	What causes receiver noise?	Receiver noise is the noise present in the receiver input circuits caused by the random thermal motion of molecules (Thermal Noise).
111	What is the thermal noise level generated by a 1kΩ resistor at room temperature? Boltzmann's constant (k): 1.38×10^{-23} J/K Temperature (T): 290 K (standard room temperature, approx. 17°C) Resistance (R): 1000 Ω Bandwidth (B): 100 MHz (10^8 H	The noise voltage is approximately 12.65μV
112	What are the three methods of polarisation in an antenna?	**Horizonal -** the electric field will move sideways in a horizontal plane. **Vertical** - the electric field will oscillate up and down in a vertical plane. **Circular** - the polarisation represented by the E-field rotates as the signal propagates. Signals rotating to the right are referred to as right-hand circular polarization (RHCP). Signals rotating to the left are referred to as left-hand circular polarization (LHCP)
113	What is the critical frequency?	The critical frequency is an indication of the ionosphere and HF propagation. CF is obtained by sending a signal pulse directly upwards (vertically) and received back at the same site.
114	What is the maximum usable frequency?	The maximum usable frequency (MUF) is the maximum frequency you can use at that time to achieve the skip. Frequencies above the MUF will go through the ionosphere and is lost. The MUF is generally three times greater than the CF (for the F region) and up to five times (for the E region).
115	Why is the height of an antenna important for an amateur operator?	Placing the horizontal antenna as high as possible above ground give the antenna the lowest take of angle.
116	Explain what a noise floor is?	thermal noise floor. The noise floor is the measure of the signals created from all the noise sources where noise is defined as any signal other than the one being monitored.

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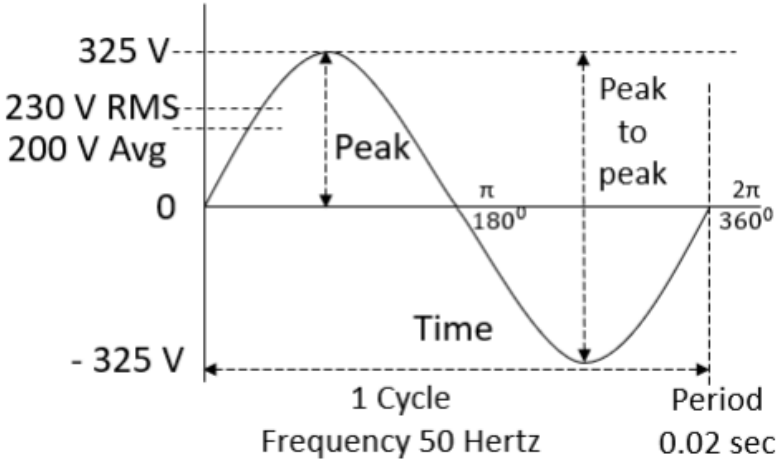
No	Question	Answer
117	How do you measure current in a circuit?	The meter must be in series with the circuit under test.
118	What is this symbol?	Trimmer resistor.
119	What is a D to A?	Digital signal to analogue signal convertor
120	Polarisation of an antenna is related to voltage field or the magnetic field?	The voltage or E field
121	Draw a sine wave for the Australian mains power of 23V at 50Hz. Include RMS, Average, peak, peak to peak and period values.	
122	What is the instantaneous voltage value at 50 degrees for the Australian mains power?	249.16V
123	What is a capacitance hat on an antenna?	Capacitance Hat - Where short masts must be used, a capacitive top load (also known as top hat or capacitance hat) is sometimes added at the top of the mast to increase the radiated power. Since the top load acts electrically like an additional length of mast, this is called "electrically lengthening" the antenna.

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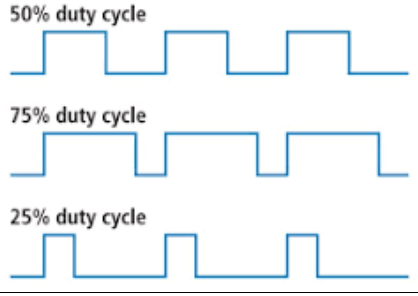
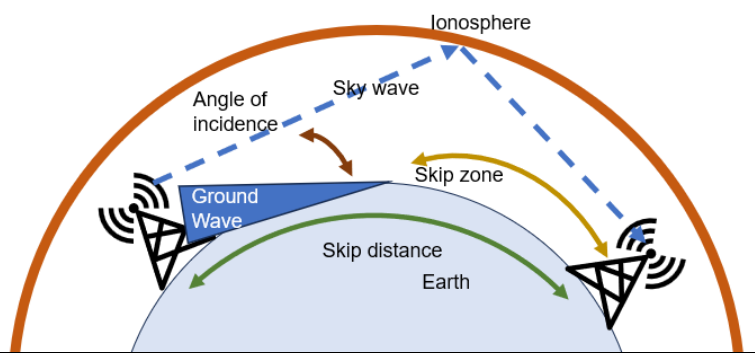
No	Question	Answer
124	Explain duty cycle in a waveform.	The duty cycle is the percentage of the ratio of pulse duration, or pulse width (PW) to the total period (T) of the waveform. 
125	If an antenna undertest resonates at a higher frequency than expected, is the antenna to short or too long?	Too short
126	What is an A to D?	Analogue signal to Digital signal convertor
127	What is the equipment that replaces fuses on mains power and how do they work?	RCB or residual circuit breakers
128	What is the angle of incidence for a radio wave?	The take-off angle of the signal from the transmitter. The lower the angle the better skip distance.
129	Bending radio waves over geometric objects is called……...?	Diffraction
130	What is a signal to noise ratio?	Signal-to-noise ratio (SNR) compares the level of a desired signal to the level of background noise. SNR is the ratio of signal power to noise power in decibels.
131	What ionospheric layer is responsible for most skywave propagation?	F layer
132	What is skip distance and skip zone?	

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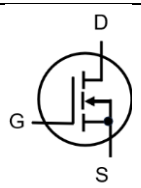
No	Question	Answer
133	Why is the input impedance of a multimeter important?	The meter must have a high input impedance, usually greater than 1 MΩ, to keep the meter load to a minimum.
134	List two operator errors the user should consider when making a measurement.	• Selection of the incorrect instrument. If in doubt, ask but this error will reduce with experience. • Parallax error. This occurs on needle indicator equipment where the operator views the needle at an angle and not directly above. Failure to Calibrate
135	In digital signalling, what do the terms NRZ and RZ mean?	Non return to zero voltage signal Return to zero voltage signal.
136	What are the two golden rules when using Op amps?	These ideal characteristics can be summarized by the two very important Golden Rules: • In a closed loop configuration, the output drives the VIN+ and VIN– to be equal. • The inputs draw no current.
137	What is this symbol? 	N Channel MOSFET
138	What is an open and closed loop amplifier?	Open loop has no feedback. Closed loop has feedback.
139	What is Common Mode rejection in Op Amps?	Common Mode Rejection Ratio (CMRR) is the ability of the op-amp to reject the same signal on both inputs. This is important for the attenuation of noise common to both inputs.
140	What is EMI?	EMI can be defined as interference that impacts the functioning of an electronic device.
141	On which lead of a battery, would the isolation switch be included and why?	Active so when the power is turned off, the equipment is completely isolated.
142	Does the power in the carrier of an FM modulated signal remain constant or change with the degree of modulation?	The power in the carrier of an FM modulated signal changes with the degree of modulation. No modulation and the carrier is at its peak. Side bands develop with increasing modulation, and the carrier power is distributed to the side bands.

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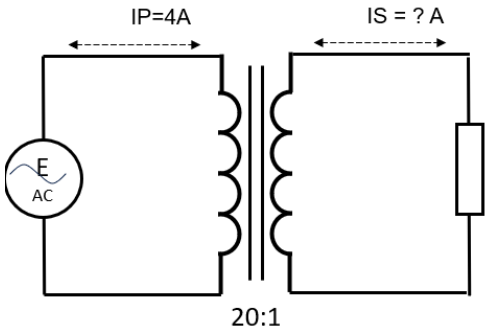
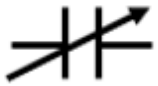
No	Question	Answer
143	Why does an Op amp have a + Vin and a -Vin?	Vin + is noninverting input. Vin – is an inverting input
144	What is the purpose of having an earth pin on the plug?	Ground the chassis of metal equipment to prevent shock to the user
145	How does a fuse work?	The extra current through the fuse heats the fuse to melting point and breaks the current path.
146	What is a discriminator and a detector used for?	A discriminator is a demodulator for FM signals, and a detector is a demodulator for AM signals.
147	An inductor and capacitor each have 250 Ohms of reactance at 1kHz. If they are connected in series, what is their total reactance at 1kHz?	As these components are a series tuned circuit resonating at 1 kHz, the reactance in the series circuit is zero.
148	What is EMC?	EMC is a measure of a device's ability to operate as intended in its shared operating environment while not affecting the ability of other equipment within the same environment to operate as intended. All equipment must play together.
149	An inductor and capacitor each have 250 Ohms of reactance at 1kHz. If they are connected in parallel, what is their total reactance at 1kHz?	As these components are a parallel tuned circuit resonating at 1 kHz, the reactance in the series circuit is infinity.
150	What is Is? 	80A
151	What is this symbol? 	Variable capacitor.

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