

## V2 - ESTA 1050 - Electrical Service Technician "A" Answer Schedule

- Notes: 1. (1 mark) means that the preceding statement/answer earns 1 mark.
2. This schedule sets out the expected answers to the examination questions. The marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.
3. Symbols and terms - alternatives  
 Power                      W or P  
 Voltage                  V or E or U  
 Phase                      Active

Question 1	<i>Reference Marks</i>	<i>Marking notes</i>
Each part in this question is worth 2 marks		
(a) 1.89 kW	answer - (4)	
(b) 20A	answer - (4)	
(c) AS /NZS 3760.	answer - (1)	
(d) Only far enough so the insulation touches the terminal post.	answer - (3)	
(e) Any ONE of:		
• An Electrical Practising Licence	answer - (2)	
• A Practising Licence	answer - (3)	
(f) 20A	answer - (3)	
(g) No earthing facility	answer - (2)	
(h) Lowest current	answer - (4)	
(i) Current and resistance	answer - (1)	
(j) 1.89 kW	answer - (3)	

<b>Question 2</b>	<i>Reference Marks</i>	<i>Marking notes</i>
(a) (i) A flashover or tracking could occur	(1 mark)	
Due to moisture inside the appliance.	(1 mark)	
(ii) Under fault conditions, moisture decreases the resistance to earth	(1 mark)	
Increases the risk of shock hazard.	(1 mark)	
(b) Any TWO of: <ul style="list-style-type: none"> <li>• High dielectric strength</li> <li>• Good flexibility</li> <li>• Non absorbent</li> <li>• Can withstand mechanical stress</li> <li>• Can withstand corrosive environments in which it will be used</li> <li>• Can withstand the temperature range of environment in which it will be used.</li> <li>• Can withstand heat from the circuit conductors.</li> </ul>	(2 marks)	

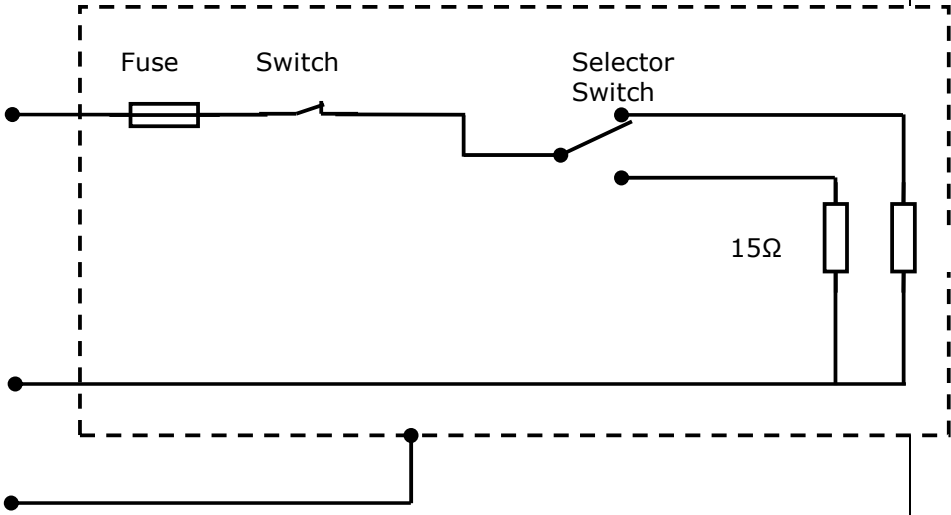
<b>Question 2</b>	<i>Reference Marks</i>	<i>Marking notes</i>
(c) The method has to show:		
<ul style="list-style-type: none"> <li>• Testing to detect source of high resistance.</li> </ul>	(1 mark)	
<ul style="list-style-type: none"> <li>• Repairing faulty terminations or replacing faulty cord or replacement of faulty plug.</li> </ul>	(1 mark)	
<ul style="list-style-type: none"> <li>• Re-testing of the protective earthing conductor to ensure resistance is less than 1 <math>\Omega</math>.</li> </ul>	(2 marks)	To gain the marks for this bullet point, the re-tested resistance of the protective earthing conductor must be stated.

Question 3	Reference Marks	Marking notes
(a) $W = \frac{V^2}{R}$	(1/2 mark)	
= $\frac{230 \times 230}{70}$	(1/2 mark)	
= 755.71W	(1 mark)	
(b) $I = \frac{V}{R}$	(1/2 mark)	
= $\frac{230}{35}$	(1/2 mark)	
= 6.57A	(1 mark)	
(c) $R_t = \frac{\text{Product}}{\text{Sum}}$	(1/2 mark)	
= $\frac{35 \times 35}{35 + 35}$	(1/2 mark)	
= 17.5 ohms	(1 mark)	
$W = \frac{V^2}{R}$	(1/2 mark)	
= $\frac{230 \times 230}{17.5}$	(1/2 mark)	
= 3022.86W	(1 mark)	
<u>Alternative solution</u>		
$R = \frac{1}{\frac{1}{35} + \frac{1}{35}}$	(1/2 mark)	
= $\frac{1}{0.029 + 0.029}$		
= $\frac{1}{0.058}$	(1/2 mark)	
= 17.24Ω	(1 mark)	
$P = \frac{V^2}{R}$	(1/2 mark)	
= $\frac{230 \times 230}{17.24}$	(1/2 mark)	
= 3068.45W	(1 mark)	

<b>Question 3</b>	<i>Reference Marks</i>	<i>Marking notes</i>
(d) Any TWO of: <ul style="list-style-type: none"> <li>• One of the elements has a short to earth.</li> <li>• The MCB protecting the circuit is under-rated</li> <li>• Faulty switch</li> </ul>	(2 marks)	

Question 4	Reference Marks	Marking notes
(a) (i) The current rating is too low for the circuit, and could blow for no apparent reason well below the circuit full-load current.	(1 mark)	
(ii) The current rating is too large and could allow the circuit current to increase to a high level causing damage, before the fuse blows.	(1 mark)	
(b) Any THREE of:- <ul style="list-style-type: none"> <li>• It will safely interrupt short circuit currents of much higher values.</li> <li>• It eliminates arcing because the fuse element is sealed.</li> <li>• It is obtainable in a range of Utilisation category (fusing factors).</li> <li>• Current rating is clearly marked.</li> <li>• Reliable operation within prescribed limits.</li> <li>• Discrimination is easier to achieve.</li> <li>• Constant fusing characteristics.</li> <li>• Faster operation/acting.</li> <li>• Doesn't deteriorate over time.</li> </ul>	(3 marks)	
(c) Any THREE of: <ul style="list-style-type: none"> <li>• If the fuse blows again an arc may be established between the fuse terminals causing damage or injury</li> <li>• Cannot safely interrupt short circuit currents of much higher values.</li> <li>• Fuse wire may protrude past the holder which creates an exposure to shock.</li> <li>• Suitable fixing for the fuse wire is <u>not</u> generally available.</li> <li>• Fuse holder is not fire proof.</li> <li>• Slower operation/acting.</li> <li>• The utilisation category (fusing factor) is most likely changed.</li> </ul>	(3 marks)	
(d) (i) An overload	(1 mark)	
(ii) A short circuit	(1 mark)	

Question 5	Reference Marks	Marking notes
(a) The output voltage of the ohmmeter is insufficient to stress the insulation	(2 marks)	
(b) (i) An ohmmeter Or Any meter that can accurately read values of less than 1 ohm.	(1 mark)	
(ii) Measure the resistance between the earth pin and the exposed metal of the appliance frame.	(2 marks)	
(iii) (1) 1 ohm	(½ mark)	
(2) Maximum	(½ mark)	
(c) The supply and/or the appliance would be short-circuited	(1 mark)	
Any ONE of:  <ul style="list-style-type: none"> <li>• Meter protection would operate,</li> <li>• The circuit protection would operate.</li> <li>• A personal hazard – flash burns.</li> <li>• Meter and/or appliance components could be damaged</li> </ul>	(1 mark)	
(d) A 0 volt reading can lead to the false conclusion that there is no voltage on the appliance	(2 marks)	The safety reason must be stated

Question 6	Reference Marks	Marking notes
<p>(a)</p> 		
<ul style="list-style-type: none"> <li>• Correct polarity</li> </ul>	(1½ marks)	<p>No marks can be awarded for (a), if there is any of the following hazards:</p> <ul style="list-style-type: none"> <li>• The appliance is not correctly earthed</li> <li>• A phase and neutral transposition</li> </ul>
<ul style="list-style-type: none"> <li>• The fuse is in the phase and protects the whole circuit</li> </ul>	(½ mark)	
<ul style="list-style-type: none"> <li>• The switch is in the phase and controls the whole circuit.</li> </ul>	(½ mark)	
<ul style="list-style-type: none"> <li>• The selector switch is connected so two different load settings can be achieved.</li> </ul>	(1 mark)	
<ul style="list-style-type: none"> <li>• The elements are connected in parallel.</li> </ul>	(½ mark)	
<ul style="list-style-type: none"> <li>• Working circuit.</li> </ul>	(1 mark)	
<p>(b) <math>I = \frac{V}{R}</math></p>	(½ mark)	
<p><math>= \frac{230}{15}</math></p>	(½ mark)	
<p><math>= 15.33 \text{ A}</math></p>	(1 mark)	
<p>(c) <math>P = V \times I</math></p>	(½ mark)	
<p><math>= 230 \times 15.33</math></p>	(½ mark)	
<p><math>= 3525.9 \text{ W}</math></p>	(1 mark)	
<p><u>Alternative solution</u></p>		

<b>Question 6</b>	<i>Reference Marks</i>	<i>Marking notes</i>
P = I <sup>2</sup> x R	(½ mark)	
= 15.33 x 15.33 x 15	(½ mark)	
= 3525.13W	(1 mark)	
(d) A 16A <u>or</u> 20A is the most suitable fuse	(1 mark)	

Question 7	Reference Marks	Marking notes
(a) (i) Current flowing $I = \frac{V}{R}$	(½ mark)	
= $\frac{230}{10.6}$	(½ mark)	
current = 21.69 fault	(1 mark)	
(ii) Fusing current of the fuse is $16 \times 1.5 = 24$ amps.	(1 mark)	
The fuse will not operate or The fuse may take a long time to operate	(1 mark)	
(iii) $P = V \times I$	(½ mark)	
= $230 \times 21.69$	(½ mark)	
= 4988.7W	(1 mark)	
<u>Alternative solutions</u>		
(iii) $P = I^2 \times R$	(½ mark)	
= $21.7 \times 21.7 \times 10.6$	(½ mark)	
= 4991.43W	(1 mark)	
(iii) $P = \frac{V^2}{R}$	(½ mark)	
= $\frac{230 \times 230}{10.6}$	(½ mark)	
= 4990.57W	(1 mark)	
(b) (i) • The neutral conductor has been connected to the supply side of the switch instead of the phase conductor	(3 marks)	
• The phase and neutral have been transposed at the plug on the flexible cord		
• The neutral conductor has been connected to the phase terminal on the terminal block that precedes the switch		

<b>Question 7</b>	<i>Reference Marks</i>	<i>Marking notes</i>
(ii) Most of the internal wiring will be alive at 230V to earth with the switch in the "OFF" position.	(1 mark)	

Question 8	Reference Marks	Marking notes
<p>(a) (i)</p> <p>Phase</p> <p>Centrifugal switch</p> <p>Capacitor</p> <p>Start winding</p> <p>Run winding</p> <p>Neutral</p>		
<ul style="list-style-type: none"> <li>• Correctly connected run winding</li> </ul>	(1/2 mark)	
<ul style="list-style-type: none"> <li>• Correctly connected start winding</li> </ul>	(1/2 mark)	
<ul style="list-style-type: none"> <li>• Correctly connected capacitor</li> </ul>	(1/2 mark)	
<ul style="list-style-type: none"> <li>• Correctly connected centrifugal switch</li> </ul>	(1/2 mark)	
<ul style="list-style-type: none"> <li>• Working circuit</li> </ul>	(1 mark)	
<p>(ii) Any ONE of:</p> <ul style="list-style-type: none"> <li>• Reverse the connections to the start winding</li> <li>• Reverse the connections to the run winding.</li> </ul>	(1 mark)	
<p>(iii) A centrifugal switch or a relay opens.</p>	(1 mark)	
<p>(iv) Any ONE of:</p> <ul style="list-style-type: none"> <li>• The motor would not start.</li> </ul>	(1 mark)	
<p>As the start winding is disconnected.</p>	(1 mark)	
<ul style="list-style-type: none"> <li>• If the motor is turning when it is switched on, it could continue to run.</li> </ul>	(2 marks)	

<b>Question 8</b>	<i>Reference Marks</i>	<i>Marking notes</i>
(b) (i) Any ONE of: <ul style="list-style-type: none"> <li>• Reverse the connections to the field windings</li> <li>• Reverse the connections to the armature windings (or brush-holder connections).</li> </ul>	(1 mark)	
(ii) Any TWO of: <ul style="list-style-type: none"> <li>• Vacuum cleaner</li> <li>• Sewing machine</li> <li>• Powered portable hand tools</li> </ul>	(2 marks)	

<b>Question 9</b>			<i>Reference Marks</i>	<i>Marking notes</i>
(a) (i) a.c.			(1 mark)	
(ii)				
<b>Item</b>	<b>Name</b>	<b>Value</b>		
1	Peak value	325V	(1 mark)	
2	RMS value	230V	(1 mark)	
3	Periodic time or time interval or cycle for a 50 Hz waveform	0.02s or 20 milliseconds	(1 mark)	
(b) The number of complete changes/cycles per second.			(1 mark)	
(c) (i) Any TWO of:			(2 marks)	
<ul style="list-style-type: none"> <li>• It maintains the voltage of the frame of the appliance to about 0 volts.</li> <li>• It provides a low resistance path for the fault current.</li> <li>• Ensures sufficient fault current can flow to operate the protection.</li> </ul>				

<b>Question 9</b>	<i>Reference Marks</i>	<i>Marking notes</i>
(ii) The method has to show:	(1 mark)	
<ul style="list-style-type: none"> <li>• Testing to detect source of the high resistance.</li> </ul>	(1 mark)	
<ul style="list-style-type: none"> <li>• Repair faulty terminations or replace faulty cord or replacement of faulty plug.</li> </ul>	(1 mark)	
<ul style="list-style-type: none"> <li>• Re-testing of the protective earthing conductor to ensure resistance is less than 1 <math>\Omega</math>,</li> </ul>		To gain the mark for this bullet point, the re-tested resistance of the protective earthing conductor must be stated.