

## ESTA 1045 - Electrical Service Technician "A" Answer Schedule

- Notes:
- (1 mark) means that the preceding statement/answer earns 1 mark.
  - 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.
  - Symbols and terms - alternatives  
Power                      W or P  
Voltage                    V or E or U  
Phase                      Active
  - Key to abbreviated terms:  
EA                      Electricity Act 1992  
ER                      Electricity Regulations 1997  
AS/NZS                Australia and New Zealand Joint Standard  
NZS                      New Zealand Standard  
AS                        Australian Standard  
ECP                      New Zealand Electrical Code of Practice  
GK                        General Knowledge
  - Where applicable, the parts of an answer underlined are the points that need to be covered.

### Question 1

Each part in this question is worth 2 marks.

- (a) Doubled  
**multi-choice answer – (2)**
- (b) 559.5 watts  
**multi-choice answer – (3)**
- (c) Disconnect a large fault current  
**multi-choice answer –(4)**
- (d) 435 mA  
**multi-choice answer – (2)**
- (e) 10 metres of 0.75mm<sup>2</sup> cord  
**multi-choice answer – (3)**
- (f) Contact by any person or animal with live parts  
**multi-choice answer – (3)**
- (g) Only far enough so the insulation touches the terminal post.  
**multi-choice answer – (1)**

(h) 20A

**multi-choice answer – (1)**

(i) Decrease

**multi-choice answer – (3)**

(j) 69 cents

**multi-choice answer – (2)**

## Question 2

$$(a) R = \frac{V^2}{P} \quad (1/2 \text{ mark})$$

$$= \frac{230 \times 230}{55} \quad (1/2 \text{ mark})$$

$$= 961.82\Omega \quad (1 \text{ mark})$$

$$I = \frac{V}{R} \quad (1/2 \text{ mark})$$

$$= \frac{230}{961.82} \quad (1/2 \text{ mark})$$

$$= 0.12A \quad (1 \text{ mark})$$

$$(b) I = \frac{V}{R} \quad (1/2 \text{ mark})$$

$$= \frac{230}{961.82} \quad (1/2 \text{ mark})$$

$$= 0.24A \quad (1 \text{ mark})$$

$$(c) R_t = \frac{\text{Product}}{\text{Sum}} \quad (1/2 \text{ mark})$$

$$= \frac{961.82 \times 961.82}{1923.64} \quad (1/2 \text{ mark})$$

$$= 480.91\Omega \quad (1 \text{ mark})$$

$$I = \frac{V}{R} \quad (1/2 \text{ mark})$$

$$= \frac{230}{480.91} \quad (1/2 \text{ mark})$$

$$= 0.48A \quad (1 \text{ mark})$$

### Question 3

(a) Class I appliance

(1/2 mark)

- Three cores
- Colour coding
  - Brown, light blue (or blue) and green/yellow
  - or
  - Red, black, green

(1 mark)

(3 marks)

Class II appliance

(1/2 mark)

- Two cores
- Colour coding
  - Brown and light blue (or blue)
  - or
  - Red and black

(1 mark)

(2 marks)

- (b)
- Fully unwind the cord from the drum
  - Only use the cord to supply a load that has a current rating less than that of the cord

(2 marks)

#### Question 4

(a) (i) Current flowing I =  $\frac{V}{R}$  (½ mark)  
=  $\frac{230}{10.6}$  (½ mark)  
= 21.7 fault current (1 mark)

(ii) Fusing current of the fuse is  $16 \times 1.5 = 24$  amps. (1 mark)

The fuse will not operate because the fault current is 21.7 amps. (1 mark)

(iii) W = V x I (½ mark)  
=  $230 \times 21.7$  (½ mark)  
= 4991W (1 mark)

- (b) (i) • The neutral conductor has been connected to the supply side of the switch instead of the phase conductor  
• The phase and neutral have been transposed at the plug on the flexible cord (3 marks)

(ii) Most of the internal wiring will be alive at 230V to earth with the switch in the "OFF" position. (1 mark)

### Question 5

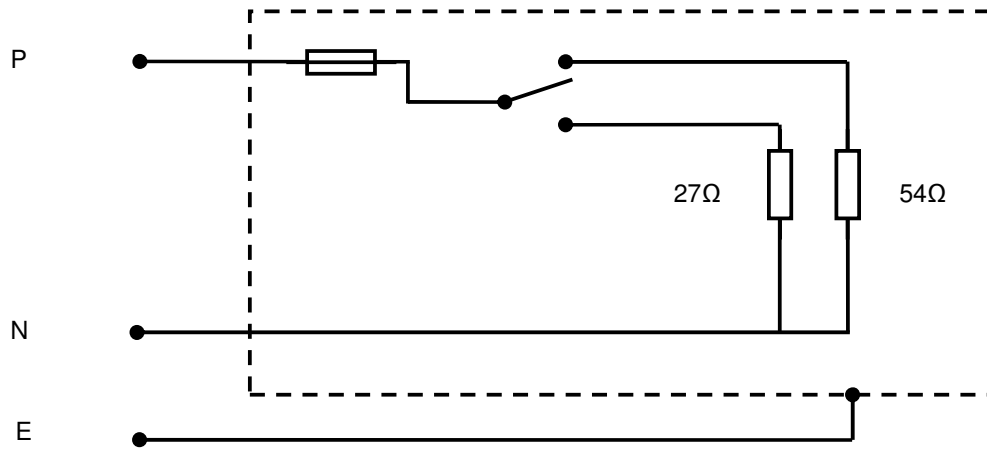
- (a) (i) An ohmmeter  
or  
Any meter that can accurately read values of 1 ohm or less. (1 mark)
- (ii) Measure the resistance between the earth pin and the exposed metal of the appliance frame. (2 marks)
- (iii) (1) 1 ohm (1 mark)  
(2) Maximum (1 mark)
- (b) The output voltage of the ohmmeter is insufficient to stress the insulation (2 marks)
- (c) • The supply and/or the appliance would be short-circuited. (2 marks)
- Meter protection would operate,  
or  
The circuit protection would operate.  
or  
A personal hazard – flash burns.  
or  
Meter and/or appliance components could be damaged. (1 mark)

## Question 6

- (a) • Bridge the phase and neutral together. (2 marks)
- Test between the bridge and the frame of the appliance (or earth pin on the plug). (1 mark)
- Test voltage - 500V d.c. (1 mark)
- Test result - 1 M $\Omega$  minimum (1 mark)
- (b) (i) Any ONE of:
- To establish that a low resistance exists of no greater than 1 ohm.
  - To ensure the appliance is effectively earthed.
  - To ensure no potential difference can develop across the protective earthing conductor.
  - To ensure the appliance frame is held at 0 V and no shock hazard exists.
  - To ensure the protection will operate.
- (1 mark)
- (ii) Any ONE of:
- To ensure that the phase, neutral and earth conductors are terminated at the correct terminals.
  - To ensure that a switch is in the phase (active) conductor.
- (1 mark)
- (iii) Any ONE of:
- To ensure the insulation resistance is not less than 1 M $\Omega$ .  
or  
To ensure the insulation resistance is not less than 10,000 ohms.
  - To see if the insulation can withstand the voltage pressure
- (1 mark)
- (c) Any ONE of:
- To ensure that the Protective Earthing conductor is continuous and of a resistance less than 1 ohm.
  - To ensure that a false reading is not obtained if the Protective Earthing Conductor resistance is very high or is open-circuited.
- (2 marks)

### Question 7

(a)



- Correct polarity (1½ marks)
- The fuse is in the phase and protects all the heater components. (½ mark)
- The selector switch and resistors are connected so two different load settings can be achieved. (2 marks)
- Fully correct diagram (2 marks)

(b)  $W = \frac{V^2}{R}$  (½ mark)

$= \frac{230 \times 230}{27}$  (½ mark)

$= 1959.26W$  (1 mark)

(c)  $I = \frac{V}{R}$  (½ mark)

$= \frac{230}{54}$  (½ mark)

$= 4.26A$  (1 mark)

### Question 8

- (a) (i) Overload caused by too many appliances in use. (1 mark)
- (ii) • The fusing current is  $20 \times 1.5 = 30\text{A}$  (1 mark)
- Total up the rating of appliances from their name-plates to establish that the total loading exceeds 30A. (1 mark)
- (iii) Limit the number of appliances to used so the combined current does not exceed 20 amps (1 mark)
- (b) (i) Any ONE of:
- There is a short to earth in an appliance.
  - There is a short between active and neutral in an appliance. (1 mark)
- (ii) • On each appliance, carry out an insulation resistance test between active and neutral and between active and the frame of the appliance. (2 marks)
- Use an insulation resistance tester. (½ mark)
  - The test voltage is 500V d.c. (½ mark)
  - If there is a fault on the appliance the test result should be significantly less than  $1\text{ M}\Omega$ . (1 mark)
- (iii) Repair the faulty appliance  
or  
Put an "out-of-service tag" on the appliance while awaiting repair. (1 mark)

### Question 9

- (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 the circuit current could increase to a high level causing damage, before the fuse blows. (1 mark)
- (b) Any THREE of:-
- It will safely interrupt short circuit currents of much higher values or higher rupturing capacity.
  - It eliminates arcing because the fuse element is sealed.
  - It is obtainable in a range of Utilisation category (fusing factors).
  - Current rating is clearly marked.
  - Reliable operation within prescribed limits.
  - Good discrimination.
  - Constant fusing characteristics.
  - Faster operation/acting.
  - Doesn't deteriorate over time.
- (3 marks)
- (c) Any THREE of:
- If the fuse blows again an arc may be established between the fuse terminals causing damage or injury
  - Cannot safely interrupt short circuit currents of much higher values.
  - Fuse wire may protrude past the holder which creates an exposure to shock.
  - Suitable fixing for the fuse wire is not generally available.
  - Fuse holder is not fire proof.
  - Slower operation/acting.
  - The utilisation category (fusing factor) is most likely changed.
- (3 marks)
- (d) (i) A sustained overload (1 mark)
- (ii) A short circuit (1 mark)