

## ESTA 1038 - 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) Lowest heating effect                        | <b>multi-choice answer – (4)</b> |
| (b) A short circuit                              | <b>multi-choice answer – (1)</b> |
| (c) 1 Megohm                                     | <b>multi-choice answer – (4)</b> |
| (d) Withdraw the appliance plug from the socket  | <b>multi-choice answer – (2)</b> |
| (e) 5 metres of 1.5mm <sup>2</sup> flexible cord | <b>multi-choice answer – (3)</b> |
| (f) 1 Meg Ohm                                    | <b>multi-choice answer – (1)</b> |
| (g) 3.8A   | <b>multi-choice answer – (2)</b> |

(h) Two elements in series

**multi-choice answer – (4)**

(i) 115 cents

**multi-choice answer – (1)**

(j) Only far enough so the insulation touches the terminal post.

**multi-choice answer – (1)**

## Question 2

(a) (i) Power dissipated at full operating normal

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

$$= \frac{230 \times 230}{26.45} \quad (1/2 \text{ mark})$$

$$= 2000 \text{ W} \quad (1 \text{ mark})$$

Maximum voltage drop

$$= \frac{230 \times 5}{100} \quad (1/2 \text{ mark})$$

$$= 11.5\text{V} \quad (1/2 \text{ mark})$$

Power dissipated at full voltage drop

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

$$= \frac{218.5 \times 218.5}{26.45} \quad (1/2 \text{ mark})$$

$$= 1804.81\text{W} \quad (1 \text{ mark})$$

Difference in power dissipated

$$= 2000 - 1805 \quad (1/2 \text{ mark})$$

$$= 195 \text{ W} \quad (1/2 \text{ mark})$$

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

$$= \frac{230}{26.45} \quad (1/2 \text{ mark})$$

$$= 8.7\text{A} \quad (1 \text{ mark})$$

(b) (i) Any ONE of:

- One element is open-circuited
- A short circuit between phase and neutral

(1 mark)

(ii) When the selector switch is on "low" the elements are in the "high" setting.

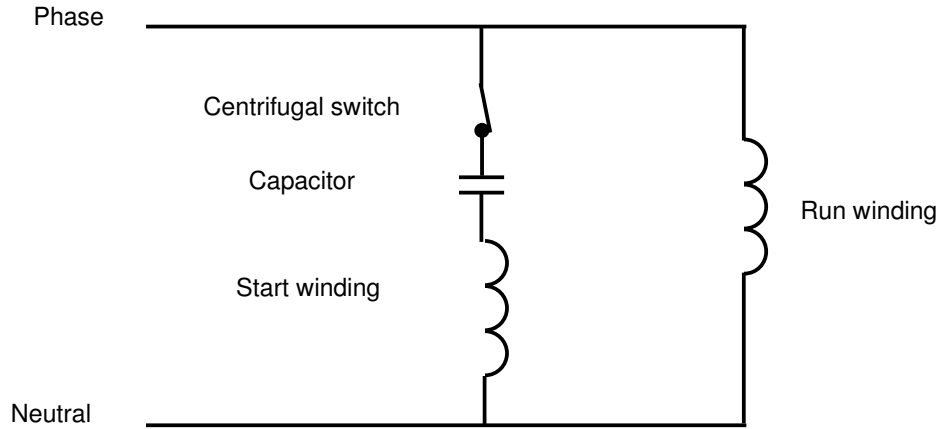
or

When the selector switch is on "high" the elements are in the "low" setting.

(1 mark)

**Question 3**

(a) (i)



- Correctly connected start winding (1/2 mark)
- Correctly connected capacitor (1/2 mark)
- Correctly connected centrifugal switch (1/2 mark)
- Correctly connected run winding (1/2 mark)
- Correctly operating circuit (1 mark)

(ii) Any ONE of:

- A centrifugal switch opens.
- A relay opens. (1 mark)

(b) (i) The motor would not start. (1 mark)

(ii) No effect. (1 mark)

(c) (i) The motor would not start. (1 mark)

(ii) The motor would slow down until the centrifugal switch closed. (1 mark)

The motor will speed up again as the start winding is energised. (1 mark)

The centrifugal switch will open at around 75% full-load speed so the motor will cycle as the switch opens and closes.

(1 mark)

#### Question 4

- (a) (i) A practising licence  
EA 95(1)  
(1 mark)
- (ii) 30 June of the year it is stated to expire.  
(also accept 1 July)  
EA 100  
(1 mark)
- (iii) The Registrar  
100(4)  
(1 mark)
- (b)
  - Safe working practices
  - Testing
  - CPR
  - Basic first aidER 26  
(4 marks)
- (c) Any THREE of:
- The name of the person so notifying and the place at which that person may be contacted (including where possible a telephone number and facsimile number):
  - The place, date, and time of the accident:
  - A complete description of the accident:
  - A description of any injuries, damage, or losses resulting from the accident:
  - Where known, the names and contact information of any witness, investigator at the scene, or other person who could provide cogent information on the accident:
  - Possible causative factors (if any are known):
  - Any resuscitation applied, including the method, the length of time applied, the reason for discontinuing, and the person that applied the resuscitation:
  - Any associated equipment involved, including the type, whether or not it operated correctly, and any reasons why it did not operate correctly:
  - The condition of the associated equipment involved, including its age:
  - Where known, the name, age, sex, occupation, and residential address of the victim.
- ER 106(1)  
(3 marks)

### Question 5

(a) (i) (1) Current flowing I =  $\frac{V}{R}$  (½ mark)  
=  $\frac{230}{17}$  (½ mark)  
= 13.53 A fault current would flow (1 mark)

(2) W = V x I (½ mark)  
= 230 x 13.53 A (½ mark)  
= 3112 W (1 mark)

- (ii) • The minimum fusing current of the fuse = 15 x 1.5 = 22.5A (1 mark)

- The fuse will not operate because the fault current is 13.5A which is less than the fusing current of 22.5A

(1 mark)

(b) Any THREE of:

The phase and neutral conductors were transposed:

- On the in-coming side of the terminal block
- On the out-going side of the terminal block
- On the supply side of the switch
- In the appliance (other than the three bullet points above)
- In the plug on the flexible cord

(3 marks)

(c) Any ONE of:

- Most of the internal wiring will be alive at 230V to earth with the switch in the "OFF" position.
- If there was a phase to frame fault, and the switch was in the open position, the frame would be live.

(1 mark)

### Question 6

- (a) (i) 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 7

(a) Resistance of circuit

$$\frac{1}{R_T} = \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5} \quad (\frac{1}{2} \text{ mark})$$

$$\frac{1}{R_p} = \frac{1}{25} + \frac{1}{25} + \frac{1}{50} \quad (\frac{1}{2} \text{ mark})$$

$$= \frac{10}{100} \quad (\frac{1}{2} \text{ mark})$$

$$= 10\Omega \quad (\frac{1}{2} \text{ mark})$$

$$R_t = 70 + 10 + 10 \quad (\frac{1}{2} \text{ mark})$$

$$= 90\Omega \quad (\frac{1}{2} \text{ mark})$$

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

$$= \frac{230 \times 230}{90} \quad (\frac{1}{2} \text{ mark})$$

$$= 587.78W \quad (1 \text{ mark})$$

(b) Resistance of circuit

$$\frac{1}{R_p} = \frac{1}{25} + \frac{1}{50} \quad (\frac{1}{2} \text{ mark})$$

$$= \frac{6}{100} \quad (\frac{1}{2} \text{ mark})$$

$$= 16.67\Omega \quad (\frac{1}{2} \text{ mark})$$

$$R_t = 70 + 10 + 16.67 \quad (\frac{1}{2} \text{ mark})$$

$$= 96.67 \quad (\frac{1}{2} \text{ mark})$$

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

$$= \frac{230}{96.67} \quad (\frac{1}{2} \text{ mark})$$

$$= 2.38A \quad (\frac{1}{2} \text{ mark})$$

(c) 230V (1 mark)

(1/2 mark)

## Question 8

(a) 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)

(b) Any TWO 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.

(2 marks)

- (c)
- There is an imbalance between the neutral current and phase current. (1 mark)
  - A magnetic field is induced into the iron core. (1 mark)
  - The induced magnetic field induces a current in the sensing coil (1 mark)
  - The tripping coil is energised, isolating the supply circuit (1 mark)

(d) Portable Residual Current Device

(1 mark)

### Question 9

- (a) (i) • To avoid possible contact with a live terminal when removing or replacing the fuse carrier (1 mark)
- To avoid flash burns from the fuse if it "blows" again because the initial fault has not been cleared (1 mark)
- (ii) There is a fault in the fixed wiring (1 mark)
- (b) Any ONE of
- Attach a danger tag or out-of-service tag
  - Put a lockable cover on the plug (1 mark)
- (c) An appliance that has been isolated has been deliberately disconnected from the supply. (2 marks)
- (d) (1) Before beginning the work, to check that any associated equipment and personal protective equipment to be used by that person is in good order and condition, and is safe for its intended use ER 36(2)(a)  
(2 marks)
- (2) To use the associated equipment and the personal protective equipment provided in a competent manner. ER 36(2)(c)  
(2 marks)