

## ESTA 1027 - 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)            20A  
**multi-choice answer – (3)**
- (b)            5 metres of 1.0mm<sup>2</sup> cord  
**multi-choice answer – (3)**
- (c)            1 Megohm  
**multi-choice answer – (1)**
- (d)            250 volts  
**multi-choice answer – (2)**
- (e)            Lowest current  
**multi-choice answer – (3)**
- (f)            0V - 50V a.c.  
                 0V - 120V ripple-free d.c.  
**multi-choice answer – (1)**
- (g)            Current and resistance  
**multi-choice answer –(2)**

(h) 0.4A

**multi-choice answer – (1)**

(i) Two elements in series

**multi-choice answer – (4)**

(j) Reverse the connections of the start windings or the run windings

**multi-choice answer – (3)**

## Question 2

- (a) • Neutral current out of balance with the 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 circuit (1 mark)
- (b) Portable Residual Current Device (1 mark)
- (c) Any FOUR 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.
- (4 marks)
- (d) It could cause damage to the circuit wiring (1 mark)

### Question 3

(a) (i) Current flowing I =  $\frac{V}{R}$  (1/2 mark)

=  $\frac{230}{17}$  (1/2 mark)

= 13.5 A fault current would flow (1 mark)

(ii) W = V x I (1/2 mark)

= 230 x 13.5 A (1/2 mark)

= 3110 W (1 mark)

(iii) • 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) • The neutral conductor was connected to the switch instead of the phase conductor on the supply side of the terminal block
- The neutral conductor was connected to the switch instead of the phase conductor on the load side of the terminal block
  - The phase and neutral can be transposed at the plug on the flexible cord

(3 marks)

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

(1 mark)

#### Question 4

(a) Any TWO of:

- Connect phase and neutral together, and test between this linked pair and earth.
- Bridge out the semi-conductor devices before testing.
- Test between phase and earth and neutral and earth.

(b) (i) An insulation resistance tester.

(1 mark)

(ii) 500 V d.c.

(1 mark)

(iii) A minimum value of 1 MΩ.

(1 mark)

(iv) Test between the phase/neutral and the frame of the appliance or the earth on the plug.

(2 marks)

(c) (i) 250 V d.c.

AS/NZS 3760:2001 2.3.3.2(d) Note (1)

AS/NZS 3760:2003 2.3.3.2(b)

(1 mark)

- (ii)
- To avoid triggering the MOV
  - To ensure the equipment does not fail the test

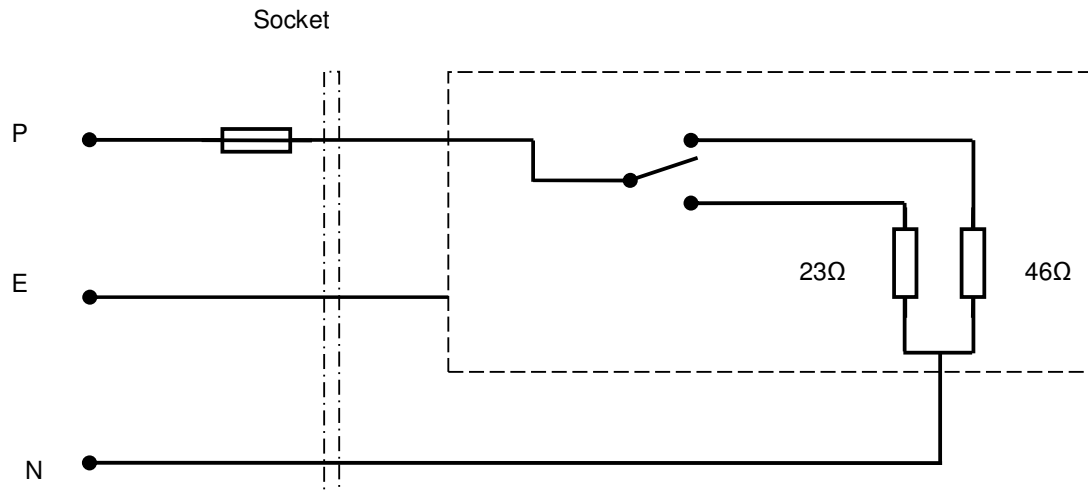
AS/NZS 3760:2001 2.3.3.2(d) Note (1)

AS/NZS 3760:2003 2.3.3.2(b)

(2 marks)

### Question 5

(a)



- Correct polarity (1 mark)
- The fuse is in the phase and protects the entire circuit. (1 mark)
- The two-position selector switch has two distinct positions. (1 mark)
- The resistors are connected so two different load settings are achieved. (1 mark)

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

$= \frac{230}{46}$  (1/2 mark)

$= 5A$  (1 mark)

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

$= \frac{230 \times 230}{23}$  (1/2 mark)

$= 2300W$  (1 mark)

$$\begin{aligned} \text{(d) } P &= \frac{V^2}{R} \\ &= \frac{230 \times 230}{69} \end{aligned}$$

(1/2 mark)

$$= 767\text{W}$$

(1/2 mark)

The power dissipated would decrease

(1 mark)

## Question 6

(a) Any **FIVE** of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or insulation tape are not in evidence.
- Check that any controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that safety facilities and devices are in good working order.
- Check that ventilation inlets and exhausts are unobstructed.

AS/NZS 3760: 2.3.2  
(5 marks)

Or

Any **FIVE** of – from AS/NZS 3760:2003:

- Check for obvious damage or defects in the accessories or plugs.
- Check for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or banding insulation tape are not in evidence.
- Check that any operating controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that ventilation inlets and exhausts are unobstructed.
- The pins of insulated pin plugs should be inspected for damage to the insulation of the pins.

AS/NZS 3760: 2.3.2  
(5 marks)

- (b) (i) Any instrument that can accurately read values of less than  $1\Omega$ .  
(1 mark)
- (ii) A maximum value of 1 ohm.  
(1 mark)
- (iii) A low protective earthing conductor resistance ensures:
- The appliance frame is held at about 0 V and no shock hazard exists.
  - The protection will operate.
- (3 marks)

### Question 7

(a) (i) It is the maximum current that a flexible cord is designed to safely carry

(2 marks)

(ii) • Current flow in excess of the rating will produce excess heat and damage insulation

(1 mark)

• Which may cause the insulation to deteriorate and breakdown and create a fire risk

(2 marks)

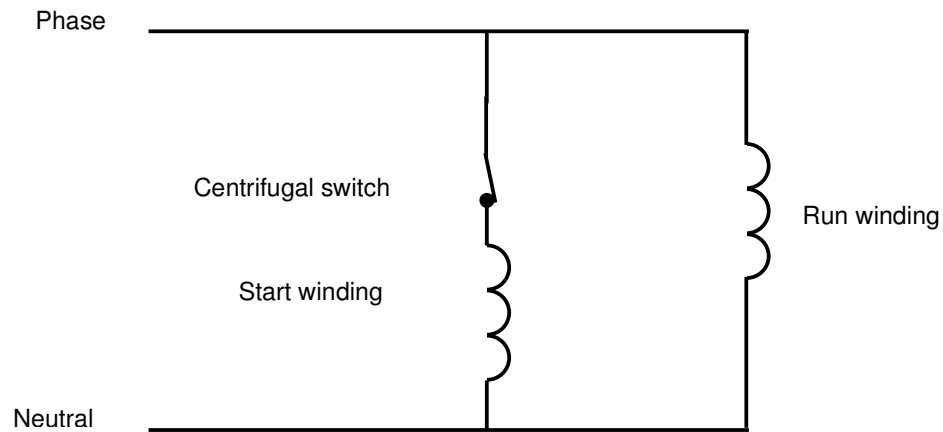
(b)

<b>Existing cord conductor colours</b>	<b>Alternative Colours</b>	<b>Polarity</b>
Green	<b><i>Green/Yellow</i></b>	<b><i>Earth</i></b>
Black	<b><i>Light Blue (or Blue)</i></b>	<b><i>Neutral</i></b>
Red	<b><i>Brown</i></b>	Phase or Active or Live

(5 marks)

### Question 8

(a) (i)



- Correctly connected start winding and centrifugal switch (1½ marks)
- Correctly connected run winding (½ mark)

(ii) Reverse the connections on the start winding or the run winding. (2 marks)

(iii) A centrifugal switch or a solid state relay opens. (1 mark)

(iv) An open-circuited run winding. (1 mark)

(b) (i) Reverse connections to the field windings or armature windings (or brush-holder connections). (2 marks)

(ii) Any TWO of:

- Vacuum cleaner
- Sewing machine
- Powered portable hand tools
- Variable speed

(2 marks)

### Question 9

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

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

$$= 529 \text{ W} \quad (1 \text{ mark})$$

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

$$= \frac{50 \times 50}{50 + 50} \quad (1/2 \text{ mark})$$

$$= 25 \text{ ohms} \quad (1 \text{ mark})$$

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

$$= \frac{230}{25} \quad (1/2 \text{ mark})$$

$$= 9.2 \text{ amps} \quad (1 \text{ mark})$$

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

$$= \frac{230 \times 230}{50} \quad (1/2 \text{ mark})$$

$$= 1060 \text{ W} \quad (1 \text{ mark})$$

(d) One of the elements has a short to earth. (2 marks)