

ESTA 1040 - 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) Exceeding 50V a.c. or 120V ripple-free d.c. but not exceeding 1,000V a.c. or 1,500V d.c.
multi-choice answer – (2)
- (b) Two elements in series
multi-choice answer – (1)
- (c) 1 Megohm
multi-choice answer – (3)
- (d) 24 months
multi-choice answer – (3)
- (e) Reverse the connections of the field windings
multi-choice answer – (4)
- (f) Lowest current
multi-choice answer – (2)
- (g) To minimise the possibility of electric shock.
multi-choice answer – (4)

(h) 2645 watts

multi-choice answer – (1)

(i) Contact by any person or animal with live parts

multi-choice answer – (3)

(j) Current and resistance

multi-choice answer –(4)

Question 2

~~(a) Any TWO of:~~

- ~~• Avoid contact with a live terminal when removing or replacing the fuse carrier~~
- ~~• Turn your face away to avoid flash burns from the fuse if it "blows" again~~
- ~~• Ensure that all load has been removed from the circuit~~

~~(4 marks)~~

~~(b) (i) There is a fault in the fixed wiring~~

~~(1 mark)~~

~~(ii) A registered electrician~~

~~(1 mark)~~

~~(c) An appliance that has been isolated has been deliberately disconnected from the supply.~~

~~(2 marks)~~

~~(d) Any TWO of:~~

- ~~• Attach a danger tag or out of service tag~~
- ~~• Put a lockable cover on the plug~~
- ~~• Remove the plug~~

~~(2 marks)~~

(a) Any TWO of:

- Avoid contact with a live terminal when removing or replacing the fuse carrier**
- Turn your face away to avoid flash burns from the fuse if it "blows" again**
- Ensure that all load has been removed from the circuit**
- Use personal protective equipment**

(4 marks)

(b) (i) There is a fault in the fixed (permanent) wiring

(1 mark)

(ii) A electrician

(1 mark)

(c) • An appliance that has been "isolated" has been deliberately disconnected from the supply.

(1 mark)

- An appliance that has been "switched off" can be turned on at any time by anyone.**

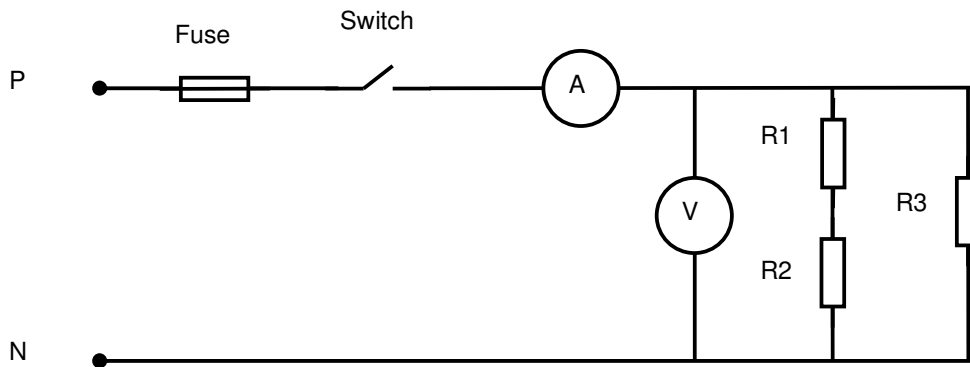
(d) Any TWO of:

- ***Attach a danger tag or out-of-service tag***
- ***Put a lockable cover on the plug***
- ***Remove the plug from the appliance***

(2 marks)

Question 3

(a)



- Fuse connected in the active (1/2 mark)
- Fuse protects all of the circuit and components (1/2 mark)
- Switch connected in the active (1/2 mark)
- Switch controls all the components (1/2 mark)
- Correctly connected voltmeter (1/2 mark)
- Correctly connected ammeter (1/2 mark)
- Correctly connected series resistors. (1/2 mark)
- Correctly connected parallel resistors. (1/2 mark)

(Total 4 marks)

(b) $R_t = \frac{\text{Product}}{\text{Sum}}$

$$= \frac{(150 + 100) \times (70)}{(150 + 100) + (70)}$$

(1/2 mark)

$$= \frac{17500}{320}$$

(1/2 mark)

$$= 54.69\Omega$$

(1 mark)

$$\begin{aligned} \text{(c)} \quad V &= I \times R && \text{(1/2 mark)} \\ &= 4.2 \times 54.69 && \text{(1/2 mark)} \\ &= 229.69\text{V} && \text{(1 mark)} \end{aligned}$$

$$\begin{aligned} \text{(d)} \quad P &= VI && \text{(1/2 mark)} \\ &= 229.69 \times 4.2 && \text{(1/2 mark)} \\ &= 964.7\text{W} && \text{(1 mark)} \end{aligned}$$

Or

$$\begin{aligned} P &= VI \\ &= 230 \times 4.2 \\ &= 966\text{W} \end{aligned}$$

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.~~
- **Use a 250V d.c. insulation resistance tester.**

(2 marks)

(b) (i) An insulation resistance tester.

(1 mark)

(ii) 500 V d.c.

(1 mark)

(iii) 1 M Ω .

(1 mark)

(iv) Test between the phase/neutral and the earth on the plug.

(2 marks)

(c) The output voltage of the multimeter is insufficient to stress the insulation

(1 mark)

And detect any weaknesses

(1 mark)

(d) Any ONE of:

- Leakage current test
- PAT test

(1 mark)

Question 5

(a) (i) Earthed electrical appliance

(A) 3

(1/2 mark)

~~(B) Red~~ ~~Brown~~

~~(1/2 mark)~~

~~(C) Black~~ ~~Light blue or Blue~~

~~(1/2 mark)~~

~~(D) Green~~ ~~Green/Yellow~~

~~(1/2 mark)~~

(B) Brown

(1/2 mark)

(C) Light blue or Blue

(1/2 mark)

(D) Green/Yellow

(1/2 mark)

Or

(B) Red

(C) Black

(D) Green/Yellow

(E) Protective earthing conductor test

(1/2 mark)

Insulation resistance test

(1/2 mark)

(F) PEC test 1Ω maximum

(1 mark)

IR test 1MΩ minimum

(1 mark)

(ii) Double insulated electrical appliance

(A) 2

(1/2 mark)

~~(B) Red~~ ~~Brown~~

~~(1/2 mark)~~

~~(C) Black~~ ~~Light blue or Blue~~

~~(1/2 mark)~~

(B) Brown

(1/2 mark)

(C) Light blue or Blue

(½ mark)

Or

(B) Red

(C) Black

(D) None

(½ mark)

(E) Insulation resistance test

(½ mark)

(F) IR test 1MΩ minimum

(1 mark)

(b) Voltage is dropped as the load current passes through the conductor resistance

(1½ marks)

Question 6

(a) Any **FOUR** 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

Or

Any **FOUR** 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
(4 marks)

(b) Any ONE of:

- The d.c. load current is likely to arc across the micro gap as the switch contacts are opened and damage them.
- Breaking a d.c. current often results in a build-up of contact material which eventually shorts-out the contacts

(1 mark)

(c) • So that it is first to make contact when inserted,

(1 mark)

- And the last to break contact when the plug is withdrawn,

(1 mark)

- (d) • No guarantee of polarity
- No earthing facility
 - Insufficient current rating

(3 marks)

Question 7

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

$= \frac{230}{7}$ (1/2 mark)

~~$= 32.88 \text{ A}$~~
 $= \mathbf{32.86 \text{ A}}$ (1 mark)

- (ii) • The fusing current = $10 \times 1.5 = 15\text{A}$ (1 mark)

- ~~• The fault current of 32.88 would operate the fuse.~~
• **The fault current of 32.86 would operate the fuse.** (1 mark)

- (b) (i) The internal wiring will be alive at 230V to earth with the switch in the "OFF" position. (1 mark)

- (ii) • At the plug on the flexible cord
• At the internal terminals in the appliance
• At the appliance switch (3 marks)

- (c) 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. (2 marks)

Question 8

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

$$= \frac{230}{92} \quad (1/2 \text{ mark})$$

$$= 2.5 \text{ amps} \quad (1 \text{ mark})$$

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

$$= 2.5 \times 2.5 \times 92 \quad (1/2 \text{ mark})$$

$$= 575 \text{ watts} \quad (1 \text{ mark})$$

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

$$= \frac{46 \times 46}{46 + 46} \quad (1/2 \text{ mark})$$

$$= 23 \text{ ohms} \quad (1 \text{ mark})$$

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

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

$$= 10A \quad (1 \text{ mark})$$

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

$$= 10 \times 10 \times 23 \quad (1/2 \text{ mark})$$

$$= 2300 \text{ watts} \quad (1 \text{ mark})$$

Question 9

(a) The method has to show:

- Testing to detect source of high resistance. (1 mark)
- Repairing faulty terminations or replacing faulty cord or replacement of faulty plug. (1 mark)
- Re-testing of the protective earthing conductor to ensure resistance is less than 1 Ω . (2 marks)

(b) (i) A flashover or tracking could occur (1 mark)
Due to moisture inside the appliance. (1 mark)

~~(ii) Under fault conditions, decreased resistance to earth (1 mark)~~
~~Increases the risk of shock hazard. (1 mark)~~

(ii) Under fault conditions, moisture decreases the resistance to earth (1 mark)
Increases the risk of shock hazard. (1 mark)

(c) Any TWO of:

- ~~• High electrical resistance or dielectric strength~~
- **High dielectric strength**
- Good flexibility
- Non absorbent
- Can withstand mechanical stress
- Can withstand corrosive environments in which it will be used
- Can withstand the temperature range of environment in which it will be used.
- Can withstand heat from the circuit conductors. (2 marks)