

ESTA 1025 - Electrical Service Technician "A" Answer Schedule

- Notes:
- (1 mark) means that the preceding statement/answer earns 1 mark.
 - This schedule sets out the accepted answers to the examination questions. A 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
 - Those parts of an answer that are under-lined indicate the parts required to be covered by a candidate.

Question 1

Each part in this question is worth 2 marks.

- (a) 16A **multi-choice answer – (3)**
- (b) Withdraw the appliance plug from the socket **multi-choice answer – (1)**
- (c) AS/NZS 3760 **multi-choice answer – (4)**
- (d) A Practising Licence **multi-choice answer – (2)**
- (e) 5 metres of 1.0mm² cord **multi-choice answer – (3)**
- (f) A double insulated electrical appliance **multi-choice answer – (4)**
- (g) Highest heating effect **multi-choice answer – (1)**

(h) A 230/230 volt isolating transformer

multi-choice answer – (4)

(i) A sustained overload

multi-choice answer – (3)

(j) To minimise the possibility of electric shock.

multi-choice answer – (2)

Question 2

- (a) • The neutral conductor was connected to the switch instead of the phase conductor
• The phase and neutral can be transposed at the plug on the flexible cord
• The phase and neutral can be transposed at the internal terminals in the appliance (other than at the switch)

(3 marks)

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

(1 mark)

(c) (i) Current flowing I = $\frac{V}{R}$

(½ mark)

$$= \frac{230}{7}$$

(½ mark)

$$= 32.86 \text{ A fault current would flow}$$

(1 mark)

(ii) W = V x I

(½ mark)

$$= 230 \times 32.86 \text{ A}$$

(½ mark)

$$= 7557.8 \text{ W}$$

(1 mark)

- (iii) • The minimum fusing current of the fuse = $15 \times 1.5 = 22.5\text{A}$

(1 mark)

- The fuse will operate because the fault current is 32.86A

(1 mark)

Question 3

- (a) (i) Three (1 marks)
- (ii) • Brown, light blue (or blue) and green/yellow
or
• Red, black, green (3 marks)
- (iii) Two (1 marks)
- (iv) • Brown and light blue (or blue)
or
• Red and black (2 marks)
- (b) (i) Failure will be by melting of sheath and/or insulation deterioration due to heat build-up (1 mark)
- (ii) • 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) 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) Any ONE of:

- The load current is likely to arc across the micro gap as the switch contacts are opened and damage them.
- It is easier to extinguish an a.c. arc as the current goes through zero in each half-cycle.
- Breaking current with d.c. 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) Any TWO of:

- No guarantee of polarity
- No earthing facility
- Insufficient current rating

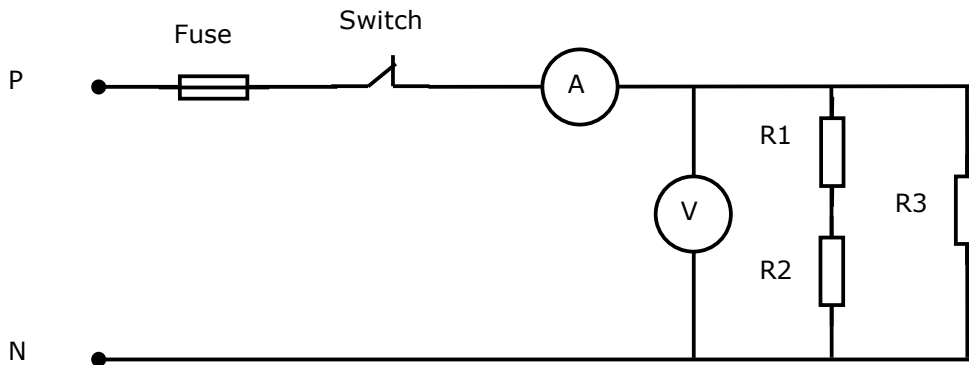
(2 marks)

Question 5

- (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) Attach a danger tag or out-of-service tag (1 mark)
- (c) An appliance that has been isolated cannot be switched on accidentally (2 marks)
- (d) (i) Items of apparel and equipment worn by a person that are intended either to prevent the occurrence of harm to the person or to minimise any harm that may occur from hazards that are present in the workplace or hazards that may arise in the course of work ER 2 (2 marks)
- (ii) (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) (1 mark)
- (2) To use the associated equipment and the personal protective equipment provided in a competent manner. ER 36(2)(c) (1 mark)

Question 6

(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) (i) $R_t = \frac{\text{Product}}{\text{Sum}}$
 $= \frac{(150 + 100) \times (75)}{(150 + 100) + (75)}$ (1/2 mark)
 $= \frac{18750}{325}$ (1/2 mark)
 $= 57.69\Omega$ (1 mark)

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

$$= \frac{230}{57.69} \quad (1/2 \text{ mark})$$

$$= 3.99\text{A} \quad (1 \text{ mark})$$

$$(ii) P = VI \quad (1/2 \text{ mark})$$

$$= 230 \times 3.99 \quad (1/2 \text{ mark})$$

$$= 917.7\text{W} \quad (1 \text{ mark})$$

Question 7

- (a) Voltage is dropped as the load current passes through the conductor resistance (1 mark)
- (b) • Use a flexible cord with an increased cross-sectional area (1 mark)
- Reduce the length of the cord (1 mark)
- (c) It is the maximum current that a flexible cord is designed to carry safely (2 marks)
- (d) • Any FOUR of:
- Remove sheath without damage to the conductor cores
 - Ensure conductor insulation is up to the terminals.
 - Apply cord clamp to sheath
 - Terminate conductors to correct terminals or correct colour coding.
 - Assemble plug ensuring there are no exposed conductors or basic insulation.
 - Protective earthing conductor is longer than the other conductors.

And

- Carry out tests to ensure appliance is safe to put back in service. (this can include polarity, earth continuity, insulation resistance or visual or a combination of any).

Note: Failure to test the appliance after the fitting of the plug is considered dangerous and no marks are to be awarded for this part of question 5, if testing is not shown.

(5 marks)

Question 8

(a) Any FIVE of:

- Number of cores required
- Mechanical strength of sheath and conductors
- Operating environment
- Flexibility needed
- Application temperature at point of entry to appliance
- Colour coding
- Voltage rating
- Current rating
- Length
- Cross-sectional area

(5 marks)

(b)

Test or check	Type of test instrument	Minimum or maximum result value
<i>Protective earthing</i>	<i>Any instrument that can accurately read values of 1 ohm or less</i>	<i>Max 1 ohm</i>
<i>Insulation resistance</i>	<i>Insulation resistance tester</i>	<i>Min 10,000 ohms</i>

(3 marks)

(c) (i) Plug the flexible lead into a live socket outlet and plug the RCD tester into the lead.

(1 mark)

(ii) 30 mA and 300 mS

(1 mark)

AS/NZS 3760: 2.3.3.4.1

Question 9

(a) (i) a.c. (1 mark)

(ii) 1 Peak value of voltage or current (1 mark)

2. RMS value of voltage or current (1 mark)

3. Periodic time or time interval (1 mark)

(b) The number of complete changes/cycles per second. (1 mark)

(c) Any TWO of:

- It maintains the voltage of the frame of the appliance to about 0 volts.
- It provides a low resistance path for the fault current.
- Ensures sufficient fault current can flow to operate the protection. (2 marks)

(d) Any ONE of the following methods:

Method 1

• Disconnect the protective earthing conductor from the appliance and test (1/2 mark)

• If the resistance of protective earthing conductor is more than 1Ω , replace the flexible cord. (1 mark)

• If the resistance of protective earthing conductor is less than 1Ω , re-terminate protective earthing conductor, ensuring that the termination is sound and clean. (1 mark)

• Re-test the protective earthing conductor to ensure resistance is 1Ω , or less (1/2 mark)

Method 2

- Ensure all earth terminations and connections are tight and properly installed and/or, (1 mark)
- Replace supply lead and plug, (1½ marks)
- In order to get a result of 1Ω or less. (½ mark)

Method 3

- Clip one terminal of ohm-meter to the plug earth pin and test between this reference and points along the earth circuit to identify the high resistance. (1 mark)
- Repair faulty terminations or replace faulty cord. (1½ marks)
- Retest between plug earth and appliance frame to ensure $<1.0\Omega$. (½ mark)