

ESTA 1041 - 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) 0V - 50V a.c.
0V - 120V ripple-free d.c. **multi-choice answer – (3)**
- (b) One element only across the supply **multi-choice answer –(1)**
- (c) AS/NZS 3760 **multi-choice answer – (2)**
- (d) A Practising Licence **multi-choice answer – (4)**
- (e) Reverse the connections of the run winding **multi-choice answer – (1)**
- (f) Highest heating effect **multi-choice answer – (2)**
- (g) 250 volts **multi-choice answer – (4)**

(h) 2 kW

multi-choice answer – (3)

(i) 230V

multi-choice answer – (4)

(j) 20A

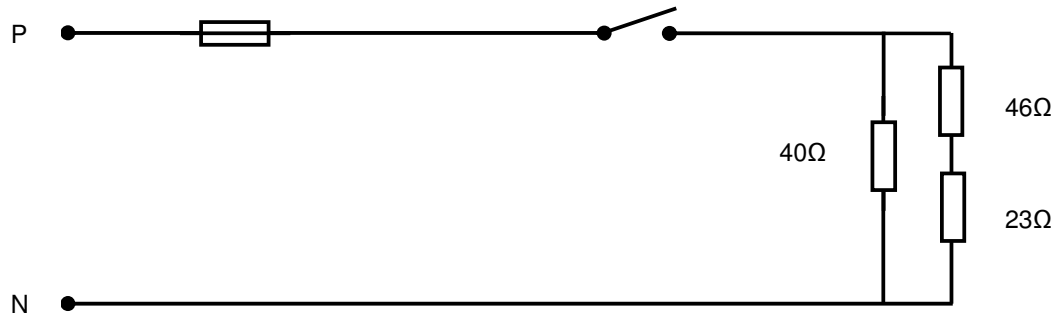
multi-choice answer – (1)

Question 2

- (a) • Inspect instrument, clips, leads and probes to ensure they are in good condition.
• Don't energise circuit until all connections have been completed.
• Ensure correct range is selected on the instrument. (3 marks)
- (b) • To ensure that no voltage can occur between the two appliances under fault conditions.
• To ensure sufficient current will flow under fault conditions to operate the protection in the secondary circuit. (2 marks)
- (c) 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 loads has been removed from the circuit (4 marks)
- (d) There is a fault in the fixed wiring (1 mark)

Question 3

(a)



- Correct polarity (1 mark)
- The fuse protects the entire circuit (½ mark)
- The switch switched all resistors. (½ mark)
- The resistors are connected as per instructions (1 mark)

(b) $W = \frac{V^2}{R}$ (½ mark)

$= \frac{230 \times 230}{40}$ (½ mark)

$= 1322.5W$ (1 mark)

(c) $I = \frac{V}{R}$ (½ mark)

$= \frac{230}{69}$ (½ mark)

$= 3.33A$ (1 mark)

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

$$= \frac{23 \times 40}{23 + 40} \quad (1/2 \text{ mark})$$

$$= 14.6\Omega \quad (1 \text{ mark})$$

$$W = \frac{V^2}{R}$$

$$= \frac{230 \times 230}{14.6}$$

$$= 3623.29W \quad (1 \text{ mark})$$

Question 4

- (a) (i) Any ohmmeter 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) 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

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)

Question 5

- (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)

Question 6

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

AS/NZS 3760: 2.3.3.2(b)
(1 mark)

(ii) 1 M Ω or greater

AS/NZS 3760: Table 2
(1 mark)

(b) (i) Leakage current test

AS/NZS 3760: 2.3.3.2(a)
(1 mark)

(ii) 5 mA or less

AS/NZS 3760: Table 1
(1 mark)

(c) Any TWO of:

- Bridge phase and neutral, and test between the bridge and earth.
- Bridge out the semi-conductor devices before testing.
- Use a 250V d.c. insulation resistance tester if the appliance contains MOVs and or EMIs

(2 marks)

(d) (i) 500 V d.c..

(1 mark)

(ii) 1 M Ω or greater

(1 mark)

(iii) Any ONE of:

- Bridge phase and neutral, and test between the bridge and earth.
- Test between phase and earth and neutral and earth.
- A leakage current test in accordance with AS/NZS 3760

(2 marks)

Question 7

- (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 8

(a) (i) = 5% of 230 V (½ mark)

= 11.5V (1 mark)

(ii) Minimum permitted voltage is

= 230V - 11.5 (½ mark)

= 218.5V (1 mark)

(b) (i) $W = \frac{V^2}{R}$ (½ mark)

= $\frac{230 \times 230}{24}$ (½ mark)

= 2204.16 W (1 mark)

(ii) $W = \frac{V^2}{R}$ (½ mark)

= $\frac{218.5 \times 218.5}{24}$ (½ mark)

= 1989.26 W (1 mark)

(iii) 2204.16 - 1989.26 (½ mark)

= 214.9W (1 mark)

= $\frac{214.9}{2204.16} \times \frac{100}{1}$ (½ mark)

= 9.75% (1 mark)

Question 9

- (a) (i) a.c. waveform (1 mark)
- (ii) 1 Peak value (1/2 mark)
325V or (1/2 mark)
2. RMS value (1/2 mark)
230V (1/2 mark)
3. Periodic time or time interval or cycle (1/2 mark)
0.02s or 20 milliseconds (1/2 mark)
- (b) The number of complete changes/cycles per second. (1 mark)
- (c) (i) 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)
- (ii) The method has to show:
- Testing to detect source of high resistance. (1 mark)
 - Repair faulty terminations or replace faulty cord or replacement of faulty plug. (1 mark)
 - Re-testing of the protective earthing conductor to ensure resistance is less than 1 Ω , (1 mark)