V3-ESTA 1047 - Electrical Service Technician "A"
Answer Schedule

Notes:1. (1 mark) means that the preceding statement/answer earns 1 mark.

2. 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.

3. Symbols and terms - alternatives

Power	W or P
Voltage	V or E or U
Phase	Active

4. 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

5. 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 current

multi-choice answer – (4)

(b) $4.02

multi-choice answer – (2)

(c) Damage could occur to the circuit wiring

multi-choice answer – (3)

(d) 1 Megohm

multi-choice answer – (4)

(e) Highest resistance

multi-choice answer – (1)

(f) Reverse the connections of the run winding

multi-choice answer – (3)

(g) Current and resistance

multi-choice answer – (2)

(h) 1.89 kW

multi-choice answer – (3)

(i) Disconnect a large fault current

multi-choice answer – (4)

(j) Reverse the connections of the armature

multi-choice answer – (4)

Question 2

(a) $R_T = \frac{\text{Product}}{\text{Sum}}$

(½ mark)

$= \frac{52 \times 52}{52 + 52}$

(½ mark)

$= 26\Omega$

(1 mark)

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

(½ mark)

$= \frac{230 \times 230}{26}$

(½ mark)

$= 2034.66W$

(1 mark)

(b) $P = \frac{V^2}{R}$

$= \frac{230 \times 230}{52}$

(½ mark)

$= 1017.31W$

(1 mark)

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

(½ mark)

$= \frac{230}{104}$

(½ mark)

$= 2.21A$

(1 mark)

(d) 230×0.95

(½ mark)

$= 218.5V$

(½ mark)

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

$= \frac{218.5 \times 218.5}{26}$

(½ mark)

$= 1836.24W$

(1 mark)

Question 3

(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 could allow the circuit current to 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.
- 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.
- Discrimination is easier to achieve.
- 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 <u>not</u> generally available.
- Fuse holder is not fire proof.
- Slower operation/acting.
- The utilisation category (fusing factor) is most likely changed.

(3 marks)

(d) (i) An overload

(1 mark)

(ii) A short circuit

(1 mark)

Question 4

(a) (i) An ohmmeter
or
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 components could be damaged.
(1 mark)

Question 5

(a) (i) Overload caused by too many appliances in use.

(1 mark)

(ii) Total up the rating of appliances from their name-plates (or similar method)

(1 mark)

To establish that the total loading exceeds 20A.

(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:

- A short to earth in an appliance.
- A short between active and neutral in an appliance.

(1 mark)

(ii) Any ONE of the following:

- A short to earth in an appliance.

  - On each appliance, carry out an insulation resistance test between active the frame of the appliance.

    (2 marks)
  - Use an insulation resistance tester.

    (½ mark)
  - The test voltage is 500V d.c.

    (½ mark)
  - The test result should read 0Ω.

    (1 mark)

- A short to earth in an appliance.

  - On each appliance, carry out a resistance test between active the frame of the appliance.

    (2 marks)
  - Use an Ohmmeter

    (1 mark)
  - The test result should be significantly less than 1 MΩ.

    (1 mark)

- A short between active and neutral in an appliance.

- On each appliance, carry out a resistance test between phase and neutral of the appliance.

(2 marks)

- Use an Ohmmeter

(1 mark)

- The test result should be significantly less than the resistance of the appliance.

(1 mark)

(iii) Repair the faulty appliance
or
Put an "out-of-service tag" on the appliance while awaiting repair.

(1 mark)

Question 6

(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 to the eyes if the fuse "blows" again
- Wear safety glasses or a face shield to avoid burns from molten metal if the fuse "blows" again
- Ensure that all loads has been removed from the circuit

(2 marks)

(b) (i) An appliance that has been isolated cannot be switched on accidentally

(2 marks)

(ii) Any ONE of:

- Attaching a safety warning tag.
- Fit a lockable cover to the plug.

(1 mark)

(c)
- Ensure the correct instrument for the conditions is used.
- Inspect instrument, clips, leads and probes to ensure they are in good condition.
- Ensure correct range is selected on the instrument.
- Ensure leads are correctly connected.

(4 marks)

(d) 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
(1 mark)

Question 7

(a) (i) Any ONE of:

- 250 V d.c.
- 500V d.c. If the MOV is triggered carry out the test using 250V d.c

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

(ii) Any ONE of:

- 1 MΩ or greater
- 10,000 Ω or greater

AS/NZS 3760: Table 2
(1 mark)

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 MΩ 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.

(2 marks)

Question 8

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

(½ mark)

$= \frac{230}{10.6}$

(½ mark)

= 21.69 fault current

(1 mark)

(ii) Fusing current of the fuse is 16 x 1.5 = 24 amps.

(1 mark)

The fuse will not operate
or
The fuse may take a long time to operate

(1 mark)

(iii) P = V x I

(½ mark)

= 230 x 21.69

(½ mark)

= 4988.7W

(1 mark)

(b) (i)
- The neutral conductor has been connected to the supply side of the switch instead of the phase conductor
- The phase and neutral have been transposed at the plug on the flexible cord
- The neutral conductor has been connected to the phase terminal on the terminal block that precedes the switch

(3 marks)

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

(1 mark)

Question 9

(a) (i) $R_T = \frac{R_1 \times R_2}{R_1 + R_2}$

(½ mark)

$= \frac{40 \times 50}{40 + 50}$

(½ mark)

$= 22.22\Omega$

(1 mark)

$I = \frac{V}{R}$

(½ mark)

$= \frac{230}{22.22}$

(½ mark)

$= 10.35A$

(1 mark)

(ii) $P = VA$

(½ mark)

$= 230 \times 10.35$

(½ mark)

$= 2380.5\ W$

(1 mark)

(iii) $P = \frac{V^2}{R}$

(½ mark)

$= \frac{230 \times 230}{40}$

(½ mark)

$= 1322.5W$

(1 mark)

2380.5 – 1322.5

The power dissipated would drop 1058W

(1 mark)

(b) Yes. It would rise to 2590 W because the power dissipated is proportional to the square of the supply voltage.

(1 mark)