

ESTA 1031 - 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) A sustained overload
multi-choice answer – (1)
- (b) Attaching an out-of-service tag to the electrical appliance
multi-choice answer – (1)
- (c) 3.8A
multi-choice answer – (2)
- (d) Two elements in series
multi-choice answer – (4)
- (e) 230V
multi-choice answer – (3)

(f) AS/NZS 3760

multi-choice answer – (4)

(g) 7.36 kWh

multi-choice answer – (2)

(h) Just up to the terminals

multi-choice answer – (1)

(i) Decrease

multi-choice answer – (4)

(j) 250 volts

multi-choice answer – (2)

Question 2

(a) (i) Earthed electrical appliance

(A) 3 (½ mark)

(B) Red Brown (½ mark)

(C) Black Light blue or Blue (½ mark)

(D) Green Green/Yellow (½ mark)

(E) Protective earthing conductor test/earth continuity test (½ mark)

Insulation resistance test (½ mark)

(F) PEC test 1Ω maximum (1 mark)

IR test $1M\Omega$ minimum (1 mark)

(ii) Double insulated electrical appliance

(A) 2 (½ mark)

(B) Red Brown (½ mark)

(C) Black Light blue or Blue (½ mark)

(D) None (½ mark)

(E) Insulation resistance test (½ mark)

(F) IR test $1M\Omega$ minimum (1 mark)

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

(1½ marks)

Question 3

(a) (i) Current flowing I = $\frac{V}{R}$ (1/2 mark)
= $\frac{230}{10.6 + 2}$ (1/2 mark)
= 18.25A fault current (1 mark)

(ii) Fusing current of the fuse is $16 \times 1.5 = 24$ amps. (1 mark)

The fuse will not operate because the fault current is 18.25 amps. (1 mark)

(iii) W = V x I (1/2 mark)
= 230×18.25 (1/2 mark)
= 4197.5W (1 mark)

- (b) (i) • 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
Also accept faults within socket outlet/power supply etc

(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 4

(a) (i) Any ONE of:

- To establish that a low resistance exists of no greater than 1 ohm.
- To ensure the appliance is effectively earthed.
- To ensure no potential difference can develop across the protective earthing conductor.
- To ensure the appliance frame is held at 0 V and no shock hazard exists.
- To ensure the protection will operate.

(1 mark)

(ii) Any ONE of:

- To ensure that the phase, neutral and earth conductors are terminated at the correct terminals.
- To ensure that a switch is in the phase (active) conductor.

(1 mark)

(iii) Any ONE of:

- To ensure the insulation resistance is not less than 1 M Ω .
or
To ensure the insulation resistance is not less than 10,000 ohms.
- To see if the insulation can withstand the voltage pressure

(1 mark)

(b) The protective earthing conductor is less than 1 ohm to ensure that no false reading is obtained in the insulation resistance test.

(2 marks)

(c) Any TWO of:

- Connect phase and neutral together, and test between this linked pair and earth.

(1 mark)

Test voltage - 500V d.c.

(1/2 mark)

Test result - 1 M Ω minimum

(1 mark)

(GK)

- Bridge out the semi-conductors before testing.

(1 mark)

Test voltage - 500V d.c.

(1/2 mark)

Test result - 1 M Ω minimum

(1 mark)

(GK)

- An insulation resistance test with the voltage applied being 250V d.c.
1 M Ω minimum
(1½ marks)
(1 mark)
- A leakage test in the protective earth conductor
5mA leakage current - maximum
(1½ marks)
(1 mark)
AS/NZS 3760: 2.3.3.2(a)

Question 5

(a) (i) a.c.

(1 mark)

(ii) 1 • Peak value/maximum value

(½ mark)

• 325V

(½ mark)

2. • RMS value

(½ mark)

• 230V

(½ mark)

3. • Periodic time or time interval or cycle

(½ mark)

• 0.02s (20 ms)

(½ mark)

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

(1 mark)

(c) (i) Any TWO of:

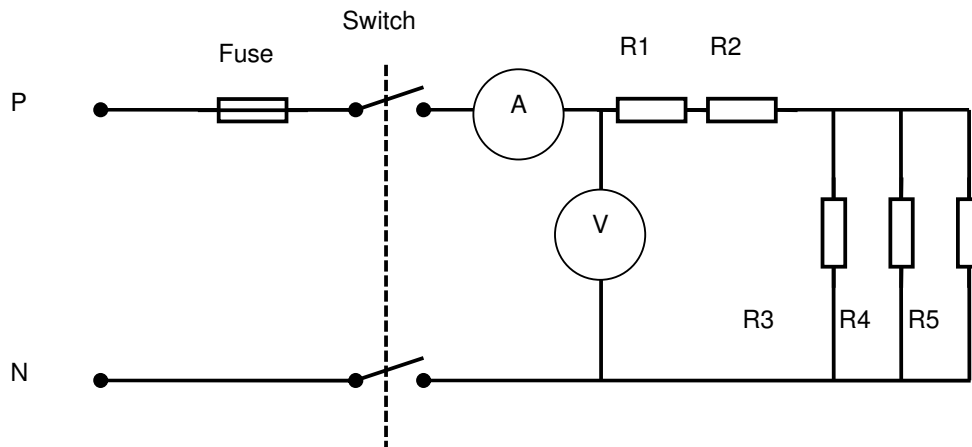
- It maintains the voltage of the frame of the appliance to about 0 volts.
 - It provides a low resistance path for the fault current.
 - Ensures sufficient fault current can flow to operate the protection.
- (2 marks)

(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)

Question 6

(a)



- Correct polarity (1 mark)
- Correctly connected fuse (1/2 mark)
- Correctly connected switch (1/2 mark)
- Correctly connected voltmeter (1/2 mark)
- Correctly connected ammeter (1/2 mark)
- Correctly connected resistors. (1 mark)

(b) $\frac{1}{R_T} = \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5}$ (1/2 mark)

$\frac{1}{R_p} = \frac{1}{20} + \frac{1}{25} + \frac{1}{50}$ (1/2 mark)

$= \frac{11}{100}$ (1/2 mark)

$R_p = 9.09\Omega$ (1/2 mark)

$R_t = 50 + 10 + 9.09$ (1/2 mark)

$= 69.09 \Omega$ (1/2 mark)

$$\begin{aligned} I &= \frac{V}{R} \\ &= \frac{230}{69.09} \\ &= 3.33\text{A} \end{aligned}$$

(½ mark)

(½ mark)

(1 mark)

(c) There would be no change/ 230V on the voltmeter.

(1 mark)

Question 7

(a) • 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)

(b) Any ONE of:

- Iron
 - Oven
 - Heater
 - Water heater
 - Refrigeration
 - Air conditioning
- or similar

(1 mark)

(c) (i) Simmerstat

The bi-metal strip heats up and controls load by switching on and off on a time basis.

(2 marks)

(ii) Thermostat

Opens/closes by the temperature of the environment

(2 marks)

Question 8

(a) (i) A practising licence

EA 95(1)
(1 mark)

(ii) 30 June of the year it is stated to expire.
(also accept 1 July)

Electricity Amendment Act 1997 4(2)(b)
(1 mark)

(iii) The Registrar

EA 96(1) or 100(4)
(1 mark)

(b) Any THREE of:

- Registered electricians
- Registered line mechanics
- Registered electrical inspectors
- Persons who are authorised to carry out such work under a provisional licence
- Trainees
- Qualified engineers

EA 108 (2)
(3 marks)

(c)

- Safe working practices
- Testing
- CPR
- Basic first aid

ER 25
(4 marks)

Question 9

- (a)
- Neutral current imbalance 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) Any THREE of:-

- It cannot safely interrupt high short circuit currents
- The fuse element is not sealed and may not eliminate arcing.
- It is not obtainable in a range of Utilisation category (fusing factors).
- The current rating is not clearly marked.
- Has no reliable operation within prescribed limits.
- Good discrimination.
- Inconsistent fusing characteristics.
- Slower operation/acting.
- Deteriorates 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)