ESTA 1026 - 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 accepted 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) 10A

multi-choice answer – (4)

(b) 10 metres of 0.75mm^2 cord

multi-choice answer – (3)

(c) 1 ohm

multi-choice answer – (4)

(d) A 230/230 volt isolating transformer

multi-choice answer – (2)

(e) Highest current

multi-choice answer – (2)

(f) 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 – (1)

(g) The cross sectional area of the flexible cord conductors

multi-choice answer – (2)

(h) 4A

multi-choice answer – (2)

(i) One element only across the supply

multi-choice answer –(3)

(j) 559.5 watts

multi-choice answer – (3)

Question 2

(a)
- Current rating (1 mark)
- Voltage rating (1 mark)
- Category of duty (Rupturing Capacity) (1 mark)
- Utilisation category (fusing factor) (Class) (1 mark)

(b) (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)

(c) Any FOUR 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.

(4 marks)

Question 3

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

(½ mark)

$= \frac{230}{35}$

(½ mark)

$= 6.57A$

(1 mark)

(ii) The high resistance protective earthing conductor will mean that:

- A potential difference will develop across the protective earthing conductor.
- A shock hazard will exist because the appliance frame will be live.
- The protection will not operate in the required manner.

(3 marks)

(iii) $V = IR$

(1 mark)

$= 6.57 \times 35$

(1 mark)

$= 230$ volts

(1 mark)

(b)
- With the switch off the appliance is safe.
- When the appliance is switch on a potential difference will develop across the protective earthing conductor.
- A shock hazard may exist because the appliance frame will be live or the protection will not operate in the required manner.

(3 marks)

Question 4

(a) The output voltage of the ohmmeter is insufficient to stress the insulation
(2 marks)

(b) (i) Any meter that can accurately read values of less than 1 ohm.
(2 marks)

(ii) Measure the resistance between the earth pin and all of the exposed metal of the appliance frame.
(2 marks)

(iii) (1) 1 ohm
(½ mark)

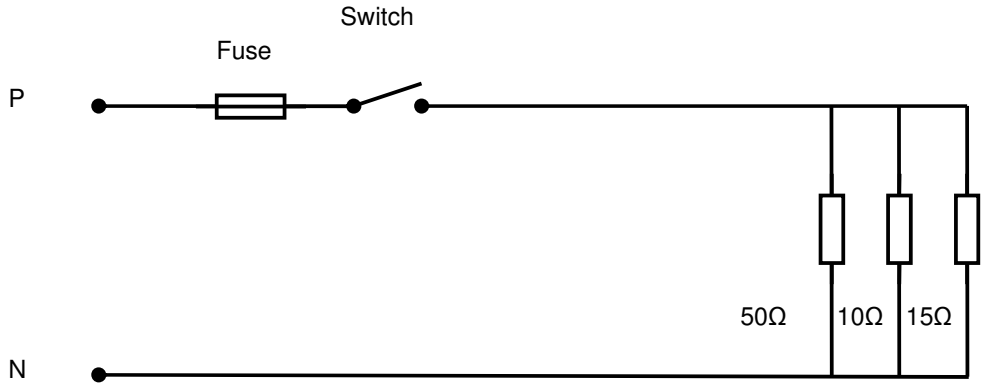
(2) Maximum

(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 and/or appliance components could be damaged.
(1 mark)

Question 5

(a)



- Correct polarity
  (½ mark)
- Fuse is in the phase and protects the entire circuit
  (1 mark)
- Switch is in the phase and controls the entire circuit (except the fuse)
  (1 mark)
- Correctly connected resistors.
  (½ mark)

(Total 3 marks)

(b) (i) $\frac{1}{R_T} = \frac{1}{R_1} \quad \frac{1}{R_2} \quad \frac{1}{R_3}$

(½ mark)

$\frac{1}{R_T} = \frac{1}{50} \quad \frac{1}{10} \quad \frac{1}{15}$

(½ mark)

$= \frac{28}{150}$

(½ mark)

$= 5.36\Omega$

(½ mark)

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

(½ mark)

$= \frac{230}{5.36}$

(½ mark)

$= 42.9$ amps

(1 mark)

(ii) $\frac{1}{R_T} = \frac{1}{R_1} \quad \frac{1}{R_3}$

$\frac{1}{R_T} = \frac{1}{50} \quad \frac{1}{15}$

$= \frac{13}{150}$

(½ mark)

$= 11.5\Omega$

(½ mark)

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

(½ mark)

$= \frac{230}{11.5}$

(½ mark)

$= 20$ amps

(1 mark)

Question 6

(a)

Test	***Test instrument***	***Acceptable test result value***
Earth continuity	Any instrument that will accurately read values of less than 1 ohm	Max 1 ohm
Insulation resistance	Insulation resistance tester	Min 10,000 ohms

(6 marks)

(b)
- Phase (active) pin on the plug is connected to the phase terminal of the appliance.
- Neutral pin on the plug is connected to the neutral terminal of the appliance.
- Earth pin on the plug is connected to the frame of the appliance.
- The appliance switch actually switches the phase (active).

(4 marks)

Question 7

(a) If strain is applied to the flexible cord the PEC will be the last to pull away from the terminals.

(1 mark)

(b)
- No provision for the earthing of the drill.

(1 mark)

- Insufficient current carrying capacity

(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)

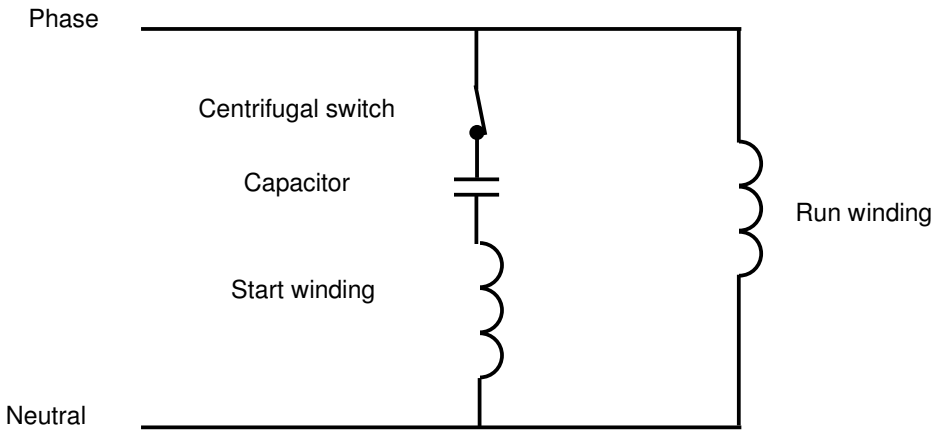
(d) Any FIVE of:

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

(5 marks)

Question 8

(a) (i)



- Correctly connected start winding (1 mark)
- Correctly connected capacitor (½ mark)
- Correctly connected centrifugal switch (½ mark)
- Correctly connected run winding (1 mark)

(ii) Reverse the connections on the start winding or the run winding. (2 marks)

(iii) A centrifugal switch or a relay opens. (1 mark)

(iv) Any TWO of:

- Open-circuited capacitor
- Faulty centrifugal switch
- Open-circuited start winding.
- Motor load may be jammed

(2 marks)

(b) Reverse connections to the field windings or armature windings (or brush-holder connections). (2 marks)

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)

$= 22.2\Omega$

(1 mark)

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

(½ mark)

$= \frac{230}{22.2}$

(½ mark)

$= 10.4A$

(1 mark)

(ii) $P = VA$

(½ mark)

$= 230 \times 10.4$

(½ mark)

$= 2390\ W$

(1 mark)

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

(½ mark)

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

(½ mark)

$= 1320W$

(1 mark)

The power dissipated would drop 1070W

(1 mark)

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