

## ESTA 1048 - 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) 24 months  
**multi-choice answer – (3)**
- (b) 10 metres of 0.75mm<sup>2</sup> cord  
**multi-choice answer – (1)**
- (c) Class II  
**multi-choice answer – (2)**
- (d) To minimise the possibility of electric shock.  
**multi-choice answer – (4)**
- (e) The cross sectional area of the flexible cord conductors  
**multi-choice answer – (2)**
- (f) AS /NZS 3760  
**multi-choice answer – (1)**

(g) Two elements in parallel across the supply

**multi-choice answer –(4)**

(h) 10,000 ohms

**multi-choice answer – (3)**

(i) No earthing facility

**multi-choice answer –(2)**

(j) Water - gas expelled

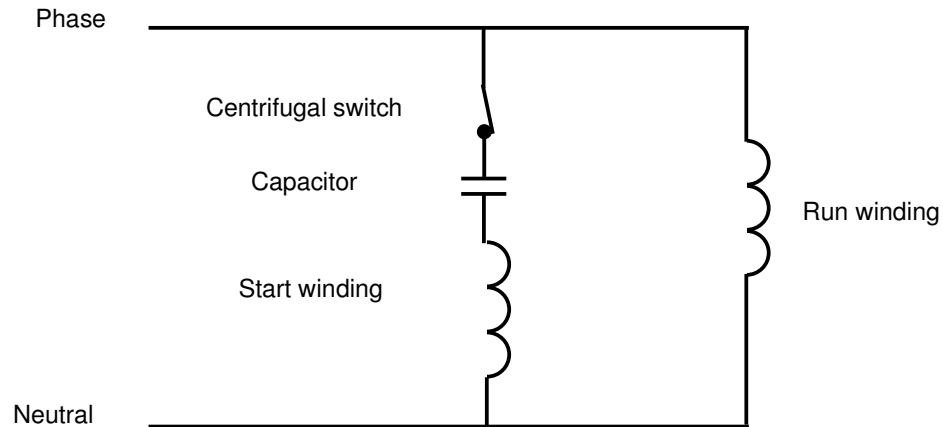
**multi-choice answer – (1)**

## Question 2

- (a) (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  
(1 mark)
- (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)
- (b) (i)
  - An isolating transformer
  - An RCD rated for personal protection(2 marks)
- (ii) An isolating transformer  
(1 mark)
- (c) If there is a faulty bonding conductor; and  
(1 mark)
- a phase to frame fault on one appliance, and  
(1 mark)
  - a neutral to frame fault on the other appliance, and  
(1 mark)
  - simultaneous contact with both appliances when switched "on" can result in severe electric shock.  
(1 mark)

### Question 3

(a) (i)



- Correctly connected run winding (½ mark)
  - Correctly connected start winding (½ mark)
  - Correctly connected capacitor (½ mark)
  - Correctly connected centrifugal switch (½ mark)
  - Working circuit (1 mark)
- (ii) Reverse the connections to the start winding or Reverse the connections to the run winding. (1 mark)
- (iii) A centrifugal switch or a relay opens. (1 mark)
- (iv) • The motor would not start because there is no rotating magnetic field. (1 mark)
- And no current will be induced in the rotor. (1 mark)
- (b) (i) Reverse connections to the field windings or armature windings (or brush-holder connections). (1 mark)
- (ii) Any TWO of:
- Vacuum cleaner

- Sewing machine
- Powered portable hand tools
- Variable speed

(2 marks)

#### Question 4

- (a) (i) When the selector switch is on "low" the elements are in the "high" setting.  
or  
When the selector switch is on "high" the elements are in the "low" setting.

(1 mark)

- (ii) One element is open-circuited

(1 mark)

$$(b) R_t = \frac{\text{Product}}{\text{Sum}}$$

(1/2 mark)

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

(1/2 mark)

$$= 20 \text{ ohms}$$

(1 mark)

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

(1/2 mark)

$$= \frac{230 \times 230}{20}$$

(1/2 mark)

$$= 2645 \text{ W}$$

(1 mark)

- (c) Maximum voltage drop

$$= \frac{230 \times 5}{100}$$

(1/2 mark)

$$= 11.5\text{V}$$

(1/2 mark)

Power dissipated at full voltage drop

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

(1/2 mark)

$$= \frac{218.5 \times 218.5}{20}$$

(1/2 mark)

$$= 2387.11\text{W}$$

(1 mark)

Difference in power dissipated

$$= 2645 - 2387.11$$

(½ mark)

$$= 257.89 \text{ W}$$

(½ mark)

## Question 5

(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 M $\Omega$  or greater
- 10,000  $\Omega$  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 $\Omega$  or greater

(1 mark)

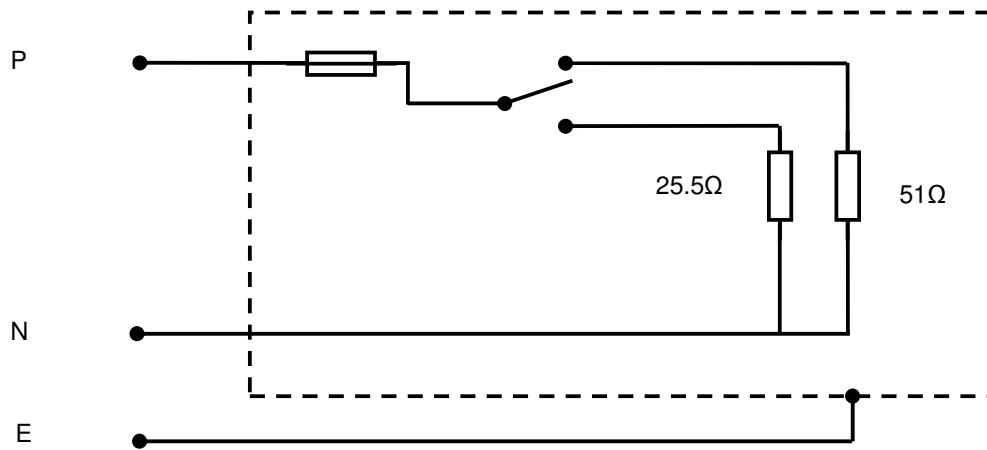
(iii) Any ONE of:

- Bridge phase and neutral, and test between the bridge and earth.
- Test between phase and earth and neutral and earth.

(2 marks)

### Question 6

(a)



- Correct polarity (1½ marks)
- The fuse is in the phase and protects all the heater components. (½ mark)
- The selector switch and resistors are connected so two different load settings can be achieved. (2 marks)
- Fully correct diagram (2 marks)

(b)  $W = \frac{V^2}{R}$  (½ mark)

$= \frac{230 \times 230}{25.5}$  (½ mark)

$= 2074.51W$  (1 mark)

(c)  $I = \frac{V}{R}$  (½ mark)

$= \frac{230}{51}$  (½ mark)

$= 4.51A$  (1 mark)

## Question 7

- (a) (i) An overload because too many appliances are 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) Only the solution relating to the answer provided in (b)(i) is required

### **A short to earth in an appliance**

#### Solution 1

##### Type of test

Insulation resistance test (1/2 mark)

##### How the test is carried out

On each appliance, (1 mark)

Test between the active pin of the plug and the frame of the appliance. (1 mark)

##### Instrument used

Insulation resistance tester (1/2 mark)

##### Expected test result when the fault is located.

The test result should read be low enough to cause a short circuit current. (1 mark)

Solution 2

Type of test

Resistance test

(½ mark)

How the test is carried out

On each appliance,

(1 mark)

Test between the active pin of the plug and the frame of the appliance.

(1 mark)

Instrument used

Ohmmeter

(½ mark)

Expected test result when the fault is located.

The test result should read be low enough to cause a short circuit current.

(1 mark)

**A short between active and neutral in an appliance**

Solution 3

Type of test

Resistance test

(½ mark)

How the test is carried out

On each appliance,

(1 mark)

Test between phase and neutral of the appliance.

(1 mark)

Instrument used

Ohmmeter

(½ mark)

Expected test result when the fault is located.

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 8

(a) Set 1

|                       |         |          |
|-----------------------|---------|----------|
| Brown                 | Phase   | (1 mark) |
| Blue                  | Neutral | (1 mark) |
| Green or Green/Yellow | Earth   | (1 mark) |

Set 2

|       |         |          |
|-------|---------|----------|
| Red   | Phase   | (1 mark) |
| Black | Neutral | (1 mark) |
| Green | Earth   | (1 mark) |

- (b)
  - Fully unwind the cord from the drum, or
  - Ensure that load is not greater than the de-rated current carrying capacity of the cord when wound on the drum (2 marks)

- (c) The current rating of the cord. (1 mark)

- (d) Voltage is dropped as the load current passes through the conductor resistance (1 mark)

### Question 9

(a) (i) a.c.

(1 mark)

(ii)

| Item | Name   | Value                    |          |
|------|--|--------------------------|----------|
| 1    | Peak value   | 325V                     | (1 mark) |
| 2    | RMS value  | 230V                     | (1 mark) |
| 3    | Periodic time or time interval or cycle for a 50 Hz waveform | 0.02s or 20 milliseconds | (1 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 the 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  $\Omega$ , (1 mark)

**Note: to gain the mark for the last bullet point, the re-tested resistance of the protective earthing conductor must be stated.**