

Version 2 - ESTA 1022- 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) Doubled
multi-choice answer – (2)
- (b) Light duty two core tough plastic sheathed
multi-choice answer – (4)
- (c) 0V - 50V a.c.
0V - 120V ripple-free d.c.
multi-choice answer – (1)
- (d) One element only across the supply
multi-choice answer –(3)
- (e) No additional protection
multi-choice answer – (2)
- (f) Disconnect a large fault current
multi-choice answer –(4)
- (g) 1 Megohm
multi-choice answer – (1)

(h) It could cause damage to the circuit wiring

multi-choice answer – (3)

(i) Verify that the insulation of current carrying components is capable of withstanding the normal supply voltage

multi-choice answer – (2)

(j) 4A

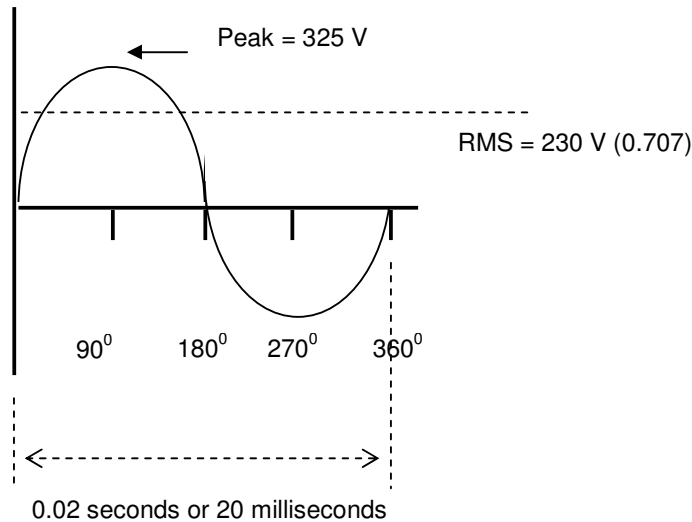
multi-choice answer – (2)

Question 2

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

(1 mark)

(b)



- Time interval correctly shown (1 mark)
- Peak voltage correctly shown (1 mark)
- RMS voltage correctly shown (1 mark)
- Axis's symmetrical and wave the correct shape (1 mark)

(c) In respect of electricity supplied by either as single-phase MEN system or multiple-phase MEN system, a nominal voltage of 230 volts a.c. between phase and neutral

ER2
(1 mark)

(d) (i) Means any voltage exceeding 50 volts a.c. or 120 volts ripple free d.c. but not exceeding 1,000 volts a.c. or 1,500 volts d.c.

(ER2)
(1 mark)

(ii) Means contact, by any person or animal, with live parts, including contact by any thing being carried or worn by that person or animal

(ER2)
(1 mark)

(iii) In relation to fittings or electrical appliances, means that the fittings or appliances are deliberately disconnected from any source of electricity

(ER2)
(1 mark)

- (iv) Means contact, by a person or animal, with exposed conductive parts that are live under fault conditions, including contact by any thing being carried or worn by that person or animal

(ER2)
(1 mark)

Question 3

(a) (i) Current flowing I = $\frac{V}{R}$ (1/2 mark)

= $\frac{230}{20}$ (1/2 mark)

= 11.5 A fault current would flow (1 mark)

(ii) W = V x I (1/2 mark)

= 230 x 11.5A (1/2 mark)

= 2645 W (1 mark)

(iii) • The minimum fusing current of the fuse = 15 x 1.25 = 18.75A (1 mark)

- The fuse will not operate because the fault current is only 11.5A (1 mark)

(b) Any THREE of:

- The neutral conductor was connected to the switch instead of the phase conductor
- The phase and neutral can be transposed at the plug on the flexible cord
- The phase and neutral can be transposed at the internal terminals in the appliance (other than at the switch)
- The phase and neutral can be transposed at the socket outlet supplying the appliance.
- The phase and neutral can be transposed at in an extension cord supplying the appliance.

(3 marks)

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

(1 mark)

Question 4

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

Question 5

(a) 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
(5 marks)

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)

- (b) (i) Any meter that can accurately read values of 1 ohm or less. (2 marks)
- (ii) Measure the resistance between the earth pin and the exposed metal of the appliance frame. (2 marks)
- (iii) (i) 1 ohm (½ mark)
- (iii) (i) Maximum (½ mark)

Question 6

(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) Any ONE of:

- To ensure that the Protective Earthing conductor is continuous and of a resistance less than 1 ohm.
- To ensure that a false reading is not obtained if the Protective Earthing Conductor resistance is very high or is open-circuited.

(2 marks)

- (c)
- 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)

(d) (i) Any meter that can accurately read values of 1 ohm or less.

(1/2 mark)

(ii) Lowest ohms range

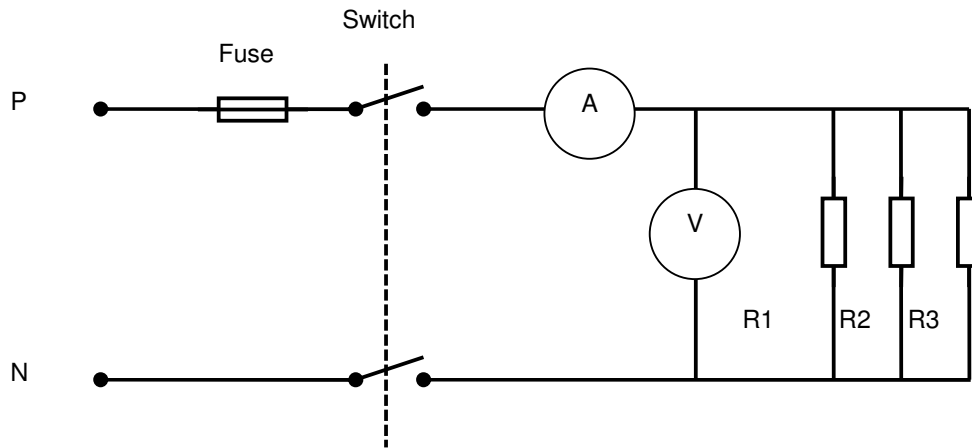
(1/2 mark)

Question 7

- (a) (i) Three (1 marks)
- (ii) • Brown, light blue (or blue) and green/yellow
or
• Red, black, green (3 marks)
- (iii) Two (1 marks)
- (iv) • Brown and light blue (or blue)
or
• Red and black (2 marks)
- (b) (i) Any ONE of:
- Fully unwind the cord from the drum, or
 - Reduce the load to under the de-rated current carrying capacity for the cord
 - Install mechanical protection for the cord. (2 marks)
- (ii) Failure will be by melting of sheath and/or insulation deterioration due to heat build-up (1 mark)

Question 8

(a)



- Correct polarity (1/2 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. (1/2 mark)
- (Total 3 marks)

(b) (i) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ (1/2 mark)

$\frac{1}{R_T} = \frac{1}{50} + \frac{1}{10} + \frac{1}{15}$ (1/2 mark)

$= \frac{28}{150}$ (1/2 mark)

$= 5.36\Omega$ (1/2 mark)

$$I = \frac{V}{R} \quad (\frac{1}{2} \text{ mark})$$

$$= \frac{230}{5.36} \quad (\frac{1}{2} \text{ mark})$$

$$= 42.91 \text{ amps} \quad (1 \text{ mark})$$

$$(ii) \quad W = V \times A \quad (\frac{1}{2} \text{ mark})$$

$$= 230 \times 42.91 \quad (\frac{1}{2} \text{ mark})$$

$$= 9.87\text{kW or } 9869\text{W} \quad (1 \text{ mark})$$

(c) Less (1 mark)

Question 9

$$(a) \quad (i) \quad I = \frac{V}{R} \quad (1/2 \text{ mark})$$

$$= \frac{230}{92} \quad (1/2 \text{ mark})$$

$$= 2.5 \text{ amps} \quad (1 \text{ mark})$$

$$(ii) \quad W = I^2 R \quad (1/2 \text{ mark})$$

$$= 2.5 \times 2.5 \times 92 \quad (1/2 \text{ mark})$$

$$= 575 \text{ watts} \quad (1 \text{ mark})$$

$$(b) \quad (i) \quad R_t = \frac{\text{Product}}{\text{Sum}} \quad (1/2 \text{ mark})$$

$$= \frac{46 \times 46}{46 + 46} \quad (1/2 \text{ mark})$$

$$= 23 \text{ ohms} \quad (1 \text{ mark})$$

$$(ii) \quad I = \frac{V}{R} \quad (1/2 \text{ mark})$$

$$= \frac{230}{23} \quad (1/2 \text{ mark})$$

$$= 10A \quad (1 \text{ mark})$$

$$(iii) \quad W = I^2 R \quad (1/2 \text{ mark})$$

$$= 10 \times 10 \times 23 \quad (1/2 \text{ mark})$$

$$= 2300 \text{ watts} \quad (1 \text{ mark})$$