

(h) Removing the plug from the plug socket

multi-choice answer – (4)

(i) 250 volts

multi-choice answer – (4)

(j) 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 – (2)

Question 2

(a) Any TWO of:

- Connect phase and neutral together, and test between this linked pair and earth.
- Bridge out the semi-conductor devices before testing.
- Use a 250V d.c. insulation resistance tester.

(2 marks)

(b) (i) An insulation resistance tester.

(1 mark)

(ii) 500 V d.c.

(1 mark)

(iii) ANY one of:

- 1 M Ω
- 0.01 Ω OR 10,000 Ω

(1 mark)

(iv) Test between the phase/neutral and the earth on the plug.

(2 marks)

(c) The output voltage of the multimeter is insufficient to stress the insulation

(1 mark)

And detect any weaknesses

(1 mark)

(d) Any ONE of:

- Leakage current test
- PAT test

(1 mark)

Question 3

- (a) Failure will be by melting of sheath and/or insulation deterioration due to heat build-up
(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) Current and resistance
(2 marks)
- (d) (i) Voltage is dropped as the load current passes through the conductor resistance
(1 mark)
- (ii) • Use a flexible cord with an increased cross-sectional area
(1 mark)
- Reduce the length of the cord
(1 mark)
- (e) It is the maximum current that a flexible cord is designed to carry safely
(2 marks)

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 method has to show:
- Finding the source of high resistance. (1 mark)
 - Repairing the fault. (1 mark)
 - Re-testing of the protective earthing conductor to ensure resistance is less than 1 Ω . (2 marks)
- (c) Any ONE of:
- High dielectric strength
 - Good flexibility
 - Non absorbent
 - Can withstand mechanical stress
 - Can withstand corrosive environments in which it will be used
 - Can withstand the temperature range of environment in which it will be used.
 - Can withstand heat from the circuit conductors. (1 mark)

Question 5

(a) (i) Any THREE of:

From AS/NZS 3760:2001: 2.3.2

- Check for obvious damage or defects in the plug.
- 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.

From AS/NZS 3760:2003: 2.3.2

- Check for obvious damage or defects in the plug
- 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.
- The pins of insulated pin plugs should be inspected for damage to the insulation of the pins.

(3 marks)

(ii) Any TWO of:

From AS/NZS 3760:2001: 2.3.2

- 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.

From AS/NZS 3760:2003: 2.3.2

- 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.
- (2 marks)

(b) Any ONE of:

- The load current is likely to arc across the micro gap as the switch contacts are opened and damage them.
 - Breaking current with d.c. often results in a build-up of contact material which eventually shorts-out the contacts
- (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 TWO of:

- No guarantee of polarity
 - No earthing facility
 - Insufficient current rating
- (2 marks)

Question 6

(a) (i) = 5% of 230 V (½ mark)

= 11.5V (1 mark)

(ii) Minimum permitted voltage is

= 230V - 11.5 (½ mark)

= 218.5V (1 mark)

(b) (i) $W = \frac{V^2}{R}$ (½ mark)

= $\frac{230 \times 230}{24}$ (½ mark)

= 2204.16 W (1 mark)

(ii) $W = \frac{V^2}{R}$ (½ mark)

= $\frac{218.5 \times 218.5}{24}$ (½ mark)

= 1989.26 W (1 mark)

(iii) 2204.16 - 1989.26 (½ mark)

= 214.9W (1 mark)

= $\frac{214.9}{2204.16} \times \frac{100}{1}$ (½ mark)

= 9.75% (1 mark)

Question 7

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

$= \frac{230}{7}$ (1/2 mark)

$= 32.86 \text{ A}$ (1 mark)

(ii) • The fusing current = $10 \times 1.5 = 15\text{A}$ (1 mark)

• The fault current of 32.86 would operate the fuse. (1 mark)

(b) (i) The internal wiring will be alive at 230V to earth with the switch in the "OFF" position. (1 mark)

(ii) • At the plug on the flexible cord
• At the internal terminals in the appliance
• At the appliance switch
• At the internal connections of the appliance (3 marks)

(c) A low protective earthing conductor resistance ensures:
• The appliance frame is held at about 0 V and no shock hazard exists.
• The protection will operate. (2 marks)

Question 8

(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 the circuit current could 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 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)

(d) (i) A sustained overload

(1 mark)

(ii) A short circuit

(1 mark)

Question 9

(a) Any THREE of:

- Ensure the correct instrument 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.

(3 marks)

(b) • To ensure that no voltage can occur between the two appliances under fault conditions.
• To ensure sufficient current will flow under fault conditions to operate the protection in the secondary circuit.

(2 marks)

(c) Any TWO of:

- Avoid contact with a live terminal when removing or replacing the fuse carrier
- Turn your face away to avoid flash burns from the fuse if it "blows" again
- Ensure that all loads has been removed from the circuit

(4 marks)

(d) There is a fault in the fixed wiring

(1 mark)