



- (d) As current through the protective device increases the time taken to operate decreases.

Note: A drawn representation of the characteristic is acceptable.  
(2 marks)

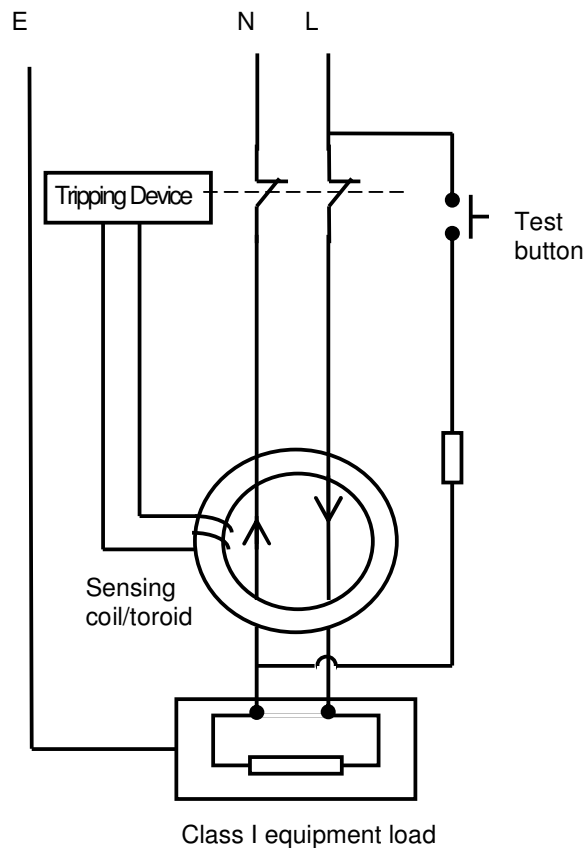
- (e) Any ONE of:

- Maximum voltage applied to the device in the reverse bias condition without damage.
- Maximum voltage able to be applied in the reverse current flow direction without damage.

(2 marks)

## Question 2

(a)



- Correctly connected test circuit and resistance (1 mark)
  - Correctly connected sensing coil/toroid (1 mark)
  - Correctly connected phase, neutral and earth. (1 mark)
  - Correctly connected tripping circuit (1 mark)
  - Correctly connected Class I appliance (1 mark)
- (b)
- 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)

- (c) RCBO Residual current-operated circuit breaker with over current protection (1 mark)

### Question 3

- (a)
- Attach an out-of-service tag to the permanent connection unit.
  - Insulate the bare end of each conductor of the flexible cable.
  - Mechanically protect the cable.
  - Make provision to prevent access to the cable.

(4 marks)

- (b) (i) Switched off    Electricity ceases to be supplied to the appliance  
(1 mark)
- (ii) Isolated        The electricity supply has been deliberately disconnected and precautions taken to prevent reconnection

(2 marks)

- (c) Any THREE of:

- Attach a safety warning tag
- Lock open the isolating switch.
- Lock open the circuit breaker controlling the circuit supplying the security control panel.
- Move the fuse carriers of the fuses controlling the circuit supplying the security control panel to a safe location.
- Use an access permit or "hold card" system.
- Disconnect the circuit supplying the security control panel at source.

(3 marks)

#### Question 4

- (a) • Overload caused by too many appliances in use.  
• A faulty appliance  
• A faulty circuit.

(3 marks)

- (b) (i) Overload caused by too many appliances in use.

Action taken to establish that this is the cause

- Total up the rating of appliances from their name-plates (1 mark)

Remedial action taken or recommended

- Use fewer appliances. (1 mark)

- (ii) A faulty appliance.

Action taken to establish that this is the cause

- Carry out an insulation resistance test of the security alarm panel (1 mark)

Remedial action taken or recommended

- Repair the security alarm panel (if this is the cause of the fault).  
or
- Send appliance for repair (if one of these is the cause of the fault) (1 mark)

- (iii) A faulty circuit.

Action taken to establish that this is the cause

- Disconnect circuit at the first socket outlet after the switchboard. (1 mark)
- Carry out an insulation resistance test of the circuit from the first power point to the end of the circuit to establish the fault. (1 mark)

Remedial action taken or recommended

- Call in an electrician if the fault is between the switchboard and the first socket outlet.  
or
- Repair or replace the faulty circuit component if the fault is beyond the first socket outlet. (1 mark)

## Question 5

(a) (i) Any ONE of:

- Ensures adequate earthing connections
  - To test the impedance of the fault circuit
  - Determine if the protection will operate within the required time.
- (1 mark)

(ii) Any ONE of:

- A single-phase plug from the tester is plugged into a socket outlet.
- Phase is connected to phase, neutral is connected to neutral and earth is connected to earth.
- Phase is connected to phase and earth is connected to earth.

(1 mark)

(b) (i) To prove the RCD operates within the specified current and time limits.

(1 mark)

(ii) Plug the RCD into a socket outlet and the RCD tester into the RCD being tested.

(1 mark)

(c) Both tests are carried out on live circuits

(1 mark)

(d) (i) Prove the meter works on a known source

(1 mark)

Test the circuit for isolation

(1 mark)

Prove the meter works on a known source

(1 mark)

(ii) Because it proves the meter works before and after testing for isolation

(1 mark)

and that the circuit is isolated

(1 mark)

## Question 6

(a) Any TWO of:

- Registered line mechanics
- Registered electrical service technicians
- Persons authorised to carry out work under a provisional licence.
- Trainees
- Qualified engineers

EA: 108(2)  
(2 marks)

(b) (i) Effectively connected to the general mass of Earth

(1 mark)

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

(1 mark)

ER2

(c) Any TWO of:

Final subcircuits that supply:

- Socket-outlets having rated currents not exceeding 63A
- Hand-held Class I equipment
- Portable equipment intended for manual movement during use.

AS/NZS 3000: 1.7.4.3.4  
(2 marks)

(d) Any colour except Black, Light Blue, Green or Green/Yellow.

AS/NZS 3000: 3.8.1  
(2 marks)

(e) Any TWO of:

- Provided with adequate mechanical protection to prevent damage.  
AS/NZS 3000: 3.9.4.6
- Provided with earthed metallic armouring, screen, covering or enclosure.  
AS/NZS 3000: 3.9.4.6
- Protected by an RCD with a maximum rated residual current of 30 mA.  
AS/NZS 3000: 3.9.4.6  
(2 marks)

## Question 7

- (a) (i) Certificate of compliance (CoC) ER 39(1)  
(1 mark)
- (ii) Any ONE of:
- Within 1 day of the completion of the work
  - Within 1 day of the termination of the contract
- ER 39(5)  
(1 mark)
- (iii) The owner of the fittings or the occupier of the premises ER 40(2)  
(1 mark)
- (iv) Within 20 working days of completion ER 40(2)  
(1 mark)
- (v) 3 years ER 40(4)  
(1 mark)
- (vi) Copies of the certificate can be returned to the Board ER 40(5)  
(1 mark)
- (vii) Any ONE of:
- A registered electrical inspector:
  - A registered line mechanic:
  - A qualified engineer:
  - A provisional licence holder:
  - A person authorised to certify the prescribed electrical work under an employer licence.
- ER 39(4)  
(1 mark)
- (b) (i) Section 6 of AS/NZS 3000 ER 37(3)  
(1 mark)
- (ii) After the work is completed and before connection to the supply ER 37(3)  
(2 marks)

### Question 8

- (a)
- Insulation, in accordance with Clause 1.7.3.3.
  - Barriers or enclosures, in accordance with Clause 1.7.3.4.
  - Obstacles, in accordance with Clause 1.7.3.5.
  - Placing out of reach, in accordance with Clause 1.7.3.6.

AS/NZS 3000: 1.7.3.2  
(4 marks)

- (b) Any TWO of:

- IPXXB
- IP2X.
- IP4X for horizontal top surfaces that are readily accessible.

AS/NZS 3000: 1.7.3.4.1  
(2 mark)

- (c)
- The use of a key or tool
  - An interlocking device is fitted
  - An intermediate barrier is provided

AS/NZS 3000: 1.7.3.4.3  
(3 marks)

- (d) Two

(1 mark)

### Question 9

(a) (i) 1 ohm

AS/NZS 3760:2001: 2.3.3.1

AS/NZS 3760:2003: 2.3.3.1

(1 mark)

(ii) Any ONE of:

- The resistance to earth from protectively earthed parts in Class I equipment must be low enough to permit adequate fault current to flow to earth thereby ensuring that the overcurrent protective device opens quickly.

AS/NZS 3760:2001: Foreword

- To ensure that the resistance of the protective conductor is sufficiently low to ensure the operation of the circuit protecting the equipment.

AS/NZS 3760:2003: 2.3.3.1

- Holds the frame of the appliance at earth potential under fault conditions.

(2 marks)

(iii) 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  $\Omega$ , (1 mark)

(1 mark)

(b)

- |             |                    |
|-------------|--------------------|
| (i) Red     | (i) Brown          |
| (ii) Black  | (ii) Light Blue    |
| (iii) Green | (iii) Green/Yellow |

Accept answers from AS/NZS 3000 or AS/NZS 3760

(3 marks)

(c) Three

(1 mark)

## Question 10

(a) Lodge a written complaint with the Registrar

EA 119  
(2 marks)

(b) Any TWO of:

- Remove name from register
- Suspend the registration
- Restricted to such work as the Board may specify
- Restricted to work only on approved premises
- Restricted to work only in the employ of an approved employer
- Impose a fine
- Censure
- Take no action (make no order)

EA 127(2)  
(2 marks)

(c) (i) Practising licence

EA 95  
(1 mark)

(ii) The Registrar

EA 96(1)  
(1 mark)

(iii) When the holder ceases to be registered.

EA 138  
(2 marks)

(d) That consists of or includes loss of consciousness

or

That necessitates the person suffering the injury

- (i) Being admitted to hospital
- (ii) Receiving medical treatment from a health care professional

EA 16(2)(a)(b)  
(2 marks)