

- (c) (i) Earth leakage. (1 mark)
- (ii) 300 ms (1 mark)
- (d) An effective earth means the frame of the appliance remains at earth potential under fault condition. (2 marks)
- (e) A certificate of compliance (2 marks)

Question 2

- (a) (i) Fault current $I = \frac{V}{R}$ (1/2 mark)
- $= \frac{230}{7}$ (1/2 mark)
- $= 32.86A$ (1 mark)
- (ii) • The fusing current = $10 \times 1.5 = 15A$ (1 mark)
- The fault current of 32.86 would operate the fuse. (1 mark)
- (b) (i) Most of the internal wiring will be alive at 230V to earth with the switch in the "OFF" position. (2 marks)
- (ii) Any TWO of:
- 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 in the circuit supplying the appliance. (2 marks)
- (c) The output voltage of the ohmmeter is insufficient to stress the insulation. (2 marks)

Question 3

- (a) A sustained overload (1 mark)
- (b)
- Current rating (1 mark)
 - Voltage rating (1 mark)
 - Category of duty (Rupturing Capacity) (1 mark)
 - Utilisation category (fusing factor) (Class) (1 mark)
- (c)
- Neutral current out of balance 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)
- (d) Portable Residual Current Device (1 mark)

Question 4

(a) To prevent the risk of arcing or flashover if there is load still connected to the circuit.

(1 mark)

- (b) • Current (load)
• Length of run or volt drop

(2 marks)

(c) (i) An appliance that has been isolated so that it cannot be switched on accidentally

(2 marks)

(ii) Any ONE of:

- Attach a safety warning tag
- Remove the plug
- Use a locking device

(1 mark)

(d) Any FOUR of:

- Inspect instrument, clips, leads and probes to ensure they are in good condition.
- Don't energise circuit until all connections have been completed.
- Don't make any changes to circuit while power is on.
- Ensure correct range is selected on the instrument.
- Ensure leads are correctly connected.
- Instrument must be of the appropriate fault duty rating

(4 marks)

Question 5

(a) (i) Danger Tag

Where is a possibility of personal danger through someone turning on the electricity or a faulty machine, a Danger Tag must be fastened to the relevant isolating switch.

(2 marks)

(ii) Out-of-Service Tags

Where equipment is faulty or damaged and using that equipment would cause damage or injury an Out-of-Service Tag must be fastened to it.

(2 marks)

(iii) Any THREE of:

- Make sure the tag is applied to the correct switch.
- Make sure the switch is in the "OFF" position before it is tagged
- Fasten the Danger Tag securely so that it will not come off.
- Ensure your tag is fastened even though other may also be attached
- Ensure the tag can be easily seen.

(3 marks)

- (b)
- The test instrument is checked to be operating correctly on a known live source.
 - The equipment is tested to confirm (or otherwise) that it is isolated.
 - The test instrument is again checked on a known live source to ensure is still operates correctly.

(3 marks)

Question 6

- (a) 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
(2 marks)

- (b) Any TWO of:

- Fittings that in normal use, or in the event of abnormal operation, function unsafely so as to cause danger to persons, property, or animals.

ER76A (1)(a)

- Fittings that have inadequate protection against direct contact or indirect contact.

ER76A (1)(b)

- Fittings that have unearthed conductive parts separated from live parts only by basic insulation.

ER76A (1)(c)

- Fittings that are installed in such a way that any designed cooling conditions are impaired.

ER87(1)(d)

- Fittings which cause or are subject to high temperatures or electric arcs are placed in such a position or are unguarded so as to create a risk of ignition of flammable materials or of injury to persons or damage to property.

ER87(1)(e)

- Cables, including underground cables, are not adequately protected against the risk of damage by nature of their covering or their method of installation.

ER87(1)(f)

- Cables are bent beyond their design criteria.

ER87(1)(g)
(2 marks)

- (c) • The cords shall be of a heavy-duty type or a non-heavy duty type installed in a suitable wiring enclosure.

AS/NZS 3000:2000: 3.9.8.4

or

- Shall be of a heavy-duty sheathed type and installed in the same manner as insulated sheathed cables.

AS/NZS 3000:2007: 3.9.7.4
(2 marks)

(d) Any TWO of:

From AS/NZS 3000:2000

- Automatic disconnection of the supply in accordance with clause 1.7.4.3
- The use of Class II equipment or equivalent insulation, in accordance with clause 1.7.4.4
- Electrical separation in accordance with clause 1.7.4.5
AS/NZS 3000: 1.7.4.2
- Protection may be provided by the use of separated extra-low voltage (SELV)
- Protection may be provided by the use of protected extra-low voltage (PELV)
AS/NZS 3000: 1.7.2

From AS/NZS 3000:2007: 1.5.5.2

- Automatically disconnect the supply on the occurrence of a fault likely to cause a current flow through a body in contact with exposed conductive parts.
- Prevent a fault current from passing through a body by use of Class II equipment or equivalent insulation.
- Prevent a fault current from passing through a body by electrical separation of the system.
- Limit the fault current that can pass through a body to a value lower than the shock current.
(2 marks)

(e) (i) Red and any colour except Black, Light Blue, Green or Green/Yellow.
AS/NZS 3000: 3.8.1
AS/NZS 3000: Table 3.5
(1 mark)

(ii) Green or Green/Yellow combination.
AS/NZS 3000: 3.8.1
AS/NZS 3000: Table 3.5
(1 mark)

Question 7

- (a) To ensure that the insulation resistance between all live conductors and earth and all live parts and earth is adequate.

AS/NZS 3000:2000: 6.3.3.3.1

AS/NZS 3000:2007: 8.3.6.1

(2 marks)

- (b) 500 V d.c.

AS/NZS 3000:2000: 6.3.3.3.1

AS/NZS 3000:2007: 8.3.6.1

(1 mark)

- (c) Maintain its terminal voltage with +20%, -10% of the nominal open circuit terminal voltage.

AS/NZS 3000:2000: 6.3.3.3.1

AS/NZS 3000:2007: 8.3.6.1

(2 marks)

- (d) (i) Any ONE of:

From AS/NZS 3000:2000

- To ensure protective earthing conductors do not normally carry current.

AS/NZS 3000: 6.3.3.5.1(a)

- To ensure no short circuit exists

AS/NZS 3000: 6.3.3.5.1(b)

AS/NZS 3000: 6.3.3.4.1(a)

- To ensure no conductive parts become energised.

AS/NZS 3000: 6.3.3.5.2(b)

AS/NZS 3000: 6.3.3.4.1(b)

- To ensure there is no interconnection of conductors between different circuits

AS/NZS 3000: 6.3.3.4.1(b)

- To prevent the connection of switches in neutral conductors.

AS/NZS 3000: 6.3.3.4.1(c)

or

From AS/NZS 3000:2007: 8.3.8.1

- To ensure protective earthing conductors do not normally carry current.

- To ensure no short circuit exists

(1 mark)

- (ii) An ohmmeter or any other meter with a low ohms range

(1 mark)

- (e) • To ensure that the earthing systems has been installed in a manner that will cause circuit protective devices to operate if there is a fault between live parts, other than the neutral, and the mass of earth.

- Will ensure that electrical equipment parts that are earthed do not reach dangerous voltages when earth faults occur.
AS/NZS 3000:2000: 6.3.3.2.1
AS/NZS 3000:2007: 8.3.5.1
(2 marks)

(f) Any FOUR of:

From AS/NZS 3000:2000: 6.3.3.1

- Operation of RCDs
- Visual inspection

or

From AS/NZS 3000:2007: 8.3.3

- Visual inspection
- Verification of impedance required for automatic disconnection of supply
- Operation of RCDs

(1 mark)

Question 8

- (a) (1) Safe working practices appropriate to the work being undertaken.
(2) Testing to ensure safety before/during and after completion of the work.
(3) Basic first aid
(4) CPR

ER 26(2)
(2 marks)

- (b) At intervals not exceeding 24 months.

ER 26(3)
(2 marks)

- (c) Must take all practicable steps to:
- Ensure employees are competent to do the work
 - or
 - Are under the supervision of a person competent to do that work

ER 25(3)
(2 marks)

- (d) The owner or occupier of the property and the Secretary of Commerce

ER 50
(2 marks)

- (e) Any TWO of:

- The name of the person so notifying and the place at which that person may be contacted (including where possible a telephone number and facsimile number):
- The place, date, and time of the accident:
- A complete description of the accident:
- A description of any injuries, damage, or losses resulting from the accident:
- Where known, the names and contact information of any witness, investigator at the scene, or other person who could provide cogent information on the accident:
- Possible causative factors (if any are known):
- Any resuscitation applied, including the method, the length of time applied, the reason for discontinuing, and the person that applied the resuscitation:
- Any associated equipment involved, including the type, whether or not it operated correctly, and any reasons why it did not operate correctly:
- The condition of the associated equipment involved, including its age:
- Where known, the name, age, sex, occupation, and residential address of the victim.

ER 106(1)
(2 marks)

Question 9

- (a) (i) A practising licence
EA 95(1)
(1 mark)
- (ii) 30 June.
(also accept 1 July)
EA 100
(1 mark)
- (iii) The Registrar
100(4)
(1 mark)
- (b) 1 year
GK
(1 mark)
- (c) Any TWO of:
- Registered line mechanics
 - Registered electrical inspectors
 - Persons who are authorised to carry out such work under a provisional licence
 - Trainees
 - Qualified engineers
- EA 108 (2)
(2 marks)

(d) Any TWO of:

- The appliance is fixed wired and connected through a continuous flexible cord to a supply of electricity from a source isolated from earth with a voltage between conductors not exceeding 250 volts:
ER 77(3)(a)
- The appliance is supplied with electricity from a safety extra-low voltage source:
ER 77(3)(b)
- The appliance is double-insulated and is supplied with electricity through a residual current device.
ER 77(3)(c)
- The appliance is supplied with electricity from a monitored earth circuit where the supply to the appliance is automatically disconnected if the earth to the appliance is broken or disconnected:
ER 77(4)(b)
- The appliance is supplied with electricity from a source connected to earth so that the voltage to earth will not be greater than 55 volts a.c.:
ER 77(4)(c)
- The appliance is supplied with electricity through a residual current device:
ER 77(4)(d)
- The appliance is supplied with electricity from a source isolated from earth with a voltage between conductors not exceeding 250 volts
ER 77(4)(e)
- The appliance is double insulated.
ER 77(4)(f)
(4 marks)

Question 10

(a) AS: /Nzs 3760

ER 38(3)
(1 mark)

(b)

| (i) Type of test | (ii) Type of instrument | (iii) Test result |
|---------------------------------|---|--------------------------|
| Protective conductor continuity | Meter that will accurately read values of less than 1 ohm | 1 ohm - maximum |
| Insulation resistance test | Insulation resistance tester | 1 Megohm - minimum |

- 1 mark for column (i)
- 1 mark for column (ii)
- 2 marks for column (iii)

AS/Nzs 3760: Table 2
(4 marks)

(c) 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.

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 and 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.

AS/NZS 3760: 2.3.2

