

(d) Thermal overload

(2 marks)

- (e)
- A symbol of a square within a square
 - The words "Class II"

(2 marks)

Question 2

(a) The sequence of actions has to show:

- Removal of the cable sheath. (½ mark)
- Removal of the basic insulation from conductors. (½ mark)
- Applying cord clamp to sheath (½ mark)
- Terminating conductors at terminals. (½ mark)

- (b)
- Ensure there is no damage to the conductor cores (½ mark)
 - Ensure the basic insulation is up to the terminals. (½ mark)
 - Ensure the clamp secures the sheath of the cable and not the conductors (½ mark)
 - Ensure the conductors are terminated to the correct terminals. (½ mark)
 - Ensure that the protective earthing conductor is longer than the other conductors. (½ mark)

(c) Ensure there are no exposed conductors or basic insulation. (½ mark)

- (d)
- Protective earthing conductor test. (½ mark)
 - Any instrument that can accurately read values of less than 1Ω . (½ mark)
 - 1Ω maximum (½ mark)
 - Test between the earth pin of the plug and the frame of the appliance. (½ mark)
 - Insulation resistance test. (½ mark)
 - Insulation resistance tester (½ mark)
 - 500V d.c (½ mark)
 - $1\text{ M}\Omega$ minimum (½ mark)
 - Bridge out the phase and neutral pins of the plug and test between that bridge and the earth pin. (1 mark)

Question 3

- (a) In case the fault is in the wiring, not the panel. (1 mark)
- (b) • Current (load)
• Length of run or volt drop (2 marks)
- (c) (i) An appliance that has been isolated 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 4

- (a) (i) 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 output voltage of the ohmmeter is insufficient to stress the insulation (2 marks)
- (c) • The supply and/or the appliance would be short-circuited. (2 marks)
- Meter protection would operate,
or
The circuit protection would operate.
or
A personal hazard – flash burns.
or
Meter and/or appliance components could be damaged. (1 mark)

Question 5

(a) Carrying out a checking or testing procedure with or without test instruments in order to prove that it is safe and has been wired correctly
(2 marks)

(b) (i) Insulation Resistance

- Test between phase/neutral and earth
- Meter: Insulation resistance tester 500V d.c.
- Minimum reading $1\text{M}\Omega$

(3 marks)

(ii) Polarity
Check visually and with instruments that all phase conductors are switched and that all conductors go to the right terminals
(1 mark)

(iii) Protective earth continuity

- Test between the earth contact on the new socket outlet and the end of the cable
- Meter: Any instrument that can accurately read values of 1Ω or less.
- Acceptable reading: 0.5Ω or 1Ω

(3 marks)

(iv) Visual check

Any ONE of:

- No access to live parts without the use of a tool
- Covers are all on
- Connections properly terminated
- Correct colour code

(1 mark)

Question 6

(a) Any ONE of:

- A supervisor of electrical work whose registration allows that supervisor to do the work
- A registered person whose registration allows that person to do the work, where the registered person is under the supervision of a supervisor of electrical work whose registration allows that supervisor to do the work

ER 23(a),(b)
(2 marks)

(b) (i) Red and any colour except Black, Light Blue, Green or Green/Yellow.
AS/NZS 3000:2000: 3.8.1

Or

Any colour except green, yellow, green/yellow Black or Light Blue
AS/NZS 3000:2007 Table 3.4
(1 mark)

(ii) Green or Green/Yellow combination.

AS/NZS 3000:2000: 3.8.1

Or

Green/Yellow
AS/NZS 3000:2007 Table 3.4
(1 mark)

(c) (i) A nominal voltage of 230 volts between phase and neutral.
(1 mark)

(ii) Means any voltage exceeding 50 volts a.c. or 120 volts ripple free d.c. but not exceeding 1000 volts a.c. or 1500 volts d.c.

(1 mark)
ER 2

(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) • The cords must 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)

Question 7

(a) AS: /N/ZS 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/N/ZS 3760: Table 2
(4 marks)

(c) Any **FIVE** of – from AS/N/ZS 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/N/ZS 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

Question 8

(a) Any FOUR of:

From AS/NZS 3000:2000: 6.3.3.1

- Continuity of the earthing system
- Insulation resistance
- Polarity
- Correct circuit connections

or

From AS/NZS 3000:2007: 8.3.3

- Continuity of the earthing system
- Insulation resistance
- Polarity
- Correct circuit connections
- Verification of impedance required for automatic disconnection of supply
- Operation of RCDs

(2 marks)

(b) 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)

(c) 500 V d.c.

AS/NZS 3000:2000: 6.3.3.3.1

AS/NZS 3000:2007: 8.3.6.1

(1 mark)

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

(1 mark)

When measuring a resistance of 1 M Ω on the 500 V d.c. range or 10 M Ω on the 1000 V d.c. range.

AS/NZS 3000:2000: 6.3.3.3.1

AS/NZS 3000:2007: 8.3.6.1

(1 mark)

(e) 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)

- (f)
- To ensure that the earthing system 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)

Question 9

- (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.
 - A registered electrician
- 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 10

- (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)