

ER 16 – Electrician Regulations Answer Schedule

- Notes:1. (1 mark) means that the preceding statement/answer earns 1 mark.
2. 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.
3. Symbols and terms - alternatives
Power W or P
Voltage V or E or U
Phase Active
4. 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

Question 1

- Results in serious injury to, or the death of, any person.
- Every accident that consists of or includes an electrically initiated fire, where that fire results in damage to any place or part of a place that renders that place or that part of that place unusable for any purpose for which it was used or designed to be before that accident.

EA 16 (1) (a)(ii), (b)
(2 marks)

Question 2

Any TWO of:

- The person shall be limited to such work as the Board may specify, and in imposing such a limitation the Board may also impose limitations on the circumstances in which that person may do the work.
- The person shall be limited to work only on approved premises.
- The person shall be limited to work only in the employ of an approved employer.

EA 86 (1) (a) (b) (c)
(2 marks)

Question 3

- (a) In relation to fittings or electrical appliances, means that the fittings or appliances are deliberately disconnected from any source of electricity
- (b) Means those fittings forming part of an electrical installation that are used for the supply of electricity to the main switchboard of that installation

ER2
(2 marks)

Question 4

- A registered electrical inspector or
- A person authorised under an employer licence.

ER 43A(a)
(2 marks)

Question 5

Any FOUR of:

- High voltage electrical installations, and high voltage electrical appliances except for (HV discharge lighting installed in accordance with AS/NZS 3832)
- Hazardous areas.
- Medical electrical locations.
- Caravan Parks.
- Boat marinas.
- Construction and demolition sites.
- Carnivals and fair grounds.
- Areas where electrical animal stunning or electrical meat conditioning occurs

ER 46(1)(a) & (b)
(2 marks)

Question 6

AS/NZS 3016

ER 69C(c)
(2 marks)

Question 7

Any ONE of:

- The handheld appliance is being used when the operator is partly immersed in a conductive substance.
- The handheld appliance is being used when the operator is in a substantially conductive location.

ER 77 (3)
(2 marks)

Question 8

Must have a rating that does not exceed the rating of the socket outlet.

(2 marks)
ER 98(4)

Question 9

- Sheathed and armoured and served cables.
Note: some versions of AS/NZS 3000 state this as “Sheathed and armoured and ved cables”
- Neutral screen cable suitable for underground.

AS/NZS 3000: Tables 3.6 & 3.7
(2 marks)

Question 10

Any TWO of:

- Aerial conductors.
- Flat braided conductors.
- Busbars.
- Sheaths of MIMS cable.
- Catenary supports.
- Metallic wiring enclosures deemed to be an earthing conductor in accordance with Clause 5.6.7.5.
- Copper earthing conductors buried direct in the ground in accordance with Clause 5.5.4.5.

AS/NZS 3000: 5.5.3.1
(2 marks)

Question 11

To prevent damage to the surge protection devices or electronic equipment.

AS/NZS 3000: 6.3.3.3.1 (Note)
(2 marks)

Question 12

- (a) 1 Megohm
- (b) 500V d.c.

AS/NZS 3000: 6.3.3.3.2
(2 marks)

Question 13

Any TWO of:

- Shall not be enclosed with the conductors of evacuation equipment and lifts or with conductors of any other system unless approval is obtained from the authorities responsible for the systems.
- If a duct or trunking is divided into separate channels by means of fixed and continuous barriers that provide effective segregation, each channel may be regarded as a separate enclosure.
- Wiring systems complying with Clause 7.10.7.2 may be considered to provide effective segregation.
- Wiring systems within switchboards shall be segregated from all other wiring systems by suitable barriers or a physical separation of at least 50 mm.

(2 marks)

AS/NZS 3000: 7.10.8.1

Question 14

Any TWO of:

- A manually operated isolating switch shall be connected on the supply side of the pump motor controller.
- The isolating switch shall comply with the general requirements of Clause 2.8.
- The isolating switch shall be installed adjacent to or on the pump motor controller.
- The isolating switch shall be provided with a device for locking the switch in the closed position.

(2 marks)

AS/NZS 3000: 7.10.9.1

Question 15

0.92 ohms

AS/NZS 3000: Table B4.1

(2 marks)

Question 16

Must be controlled by a switch installed on or adjacent to the appliance.

AS/NZS 3001: 3.7.1

(2 marks)

Question 17

(a) 1 ohm

AS/NZS 3760
2001: 2.3.3.1
2003: 2.3.3.1
(1 mark)

(b) 1 Megohm

AS/NZS 3760
2001: 2.3.3.2
2003: Table 2
(1 mark)

Section 2

Question 18

- (a)
 - The new internal mains and mains entry box.
 - The new main earth lead.
 - The lights and power points installed in 2 new bedrooms.
 - The light and permanently connected heated towel in the new bathroom.

ER39(1),(2)
(4 marks)
- (b) All of the work.

ER37(3)
(1 mark)
- (c) The new internal mains and mains entry box.

ER41(1)(c)(iii)
(1 mark)

Question 19

Any TWO of:

- The exposed conductive part of any electrical equipment in the pool zone.
- Any exposed conductive parts of electrical equipment which are not separated from live parts by double insulation and which are in contact with the pool water, including water in the circulation or filtering system.
- Any fixed extraneous conductive parts of the pool structure, including the reinforcing metal of the pool shell and deck.
- Any metallic fittings within or attached to the pool structure, such as pool ladders and diving boards.
- Any fixed metal within arm's reach of the pool edge, such as metal fences, lamp standards and pipework.

AS/NZS 3000: 5.8.2.5
(2 marks)

- (b) Under water luminaires shall not be provided with a protective earthing conductor.

AS/NZS 3000: 7.2.4.5
AS/NZS 3000: 5.7.3.3

(1 mark)

- (c)
- Zone 0 IPX8.
 - Zone 1 IPX5.
 - Zone 2 IPX4.

AS/NZS 3000: 7.2.4.1
(2 marks)

Question 20

(a) (i) Any TWO of:

- Domestic installations
- Residential type areas of residential institutions
- Residential type areas of hotels
- Residential type areas of boarding houses
- Residential type areas of hospitals
- Residential type areas of accommodation houses
- Residential type areas of motels
- Residential type areas of hostels

AS/NZS 3000: 2.5.3.1, 2.5.3.2
(2 marks)

(ii) • Final sub-circuits of socket outlets

AS/NZS 3000: 2.5.3.1, 2.5.3.2

- Final subcircuits of lighting

AS/NZS 3000: 2.5.3.1
(2 marks)

- (b)
- When an earth fault occurs, some current is diverted to earth (1 mark)
 - This causes an imbalance between phase and neutral currents (1 mark)
 - Which is detected by the RCD sensing coil. (1 mark)
 - Which trips the RCD and disconnects the supply to the load (1 mark)

Question 21

- (a) "Site" means an area intended for the placement of one or more relocatable premises under the control of one occupier and requiring an electrical supply. Includes caravan park sites and tent sites.

AS/NZS 3001: 1.4.12
(1 mark)

- (b)
- 15 amps
 - 16 amps
 - 32 amps

AS/NZS 3001: 2.3.2.4.2
(2 marks)

- (c) Comply with AS 1939 with a minimum degree of protection – IP24.

AS/NZS 3001: 3.6.3.4
(1 mark)

- (d)
- Shall have their voltage rating conspicuously marked adjacent to them.
 - Corresponding plugs cannot be inserted into socket outlets connected to circuits of higher voltages.

AS/NZS 3001: 3.6.3.3
(2 marks)

Question 22

(a) (i) 1 ohm

AS/NZS 3760:2001: 2.3.3.1

AS/NZS 3760:2003: 2.3.3.1

(1 mark)

- (ii) • 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

or

- 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

(2 marks)

- (b) • Disconnect the protective earthing conductor from the appliance and test (½ mark)
- If the resistance of protective earthing conductor is more than 1 Ω, replace the flexible cord. (1 mark)
 - If the resistance of protective earthing conductor is less than 1 Ω, re-terminate protective earthing conductor, ensuring that the termination is sound and clean. (1 mark)
 - Re-test the protective earthing conductor to ensure resistance is 1 Ω, or less (½ mark)

Question 23

(a) $V_d = \frac{mV \times A \times m}{1000}$ (½ mark)

$= \frac{9.71 \times 26.5 \times 60}{1000}$ (½ mark)

$= 15.44 \text{ volts}$ (1 mark)

The cable meets the voltage drop requirements because the maximum V_d permitted is 4% of 400 = 16V. (1 mark)

(b) From Table 12, column 10, current rating for a 4 mm² cable is 25 amps (½ mark)

From Table 27(1) the rating for 20°C is 1.12 (½ mark)

Therefore, the maximum load = 25 x 1.12 (1 mark)

= 28 amps

The load is 26.5 amps; therefore the cable satisfies the load requirements (1 mark)

Question 24

Group A		
Lighting - 20 pts	3 A	(½ mark)
Lighting - 12 pts	2 A	(½ mark)
75% of 3 kW of outdoor lighting	9.8 A	(1 mark)
Group B		
Socket outlets - 43 pts		
20 pts	10A	(½ mark)
20 pts	5A	(½ mark)
3 pts	5A	(½ mark)
Group C		
Electric Range		
50% of 12 kW	26.1 A	(1 mark)
Total	60.9 A	(1½ marks)

AS/NZS 3000: Table C1

Question 25

- (a)
- Main switchboards.
 - Switchboards from which emergency systems originate in accordance with Clause 7.10.

AS/NZS 3000: 2.9.8.4(h)
(2 marks)

- (b) Any THREE of:

- Of adequate current-carrying capacity
- Located in an accessible position to allow all conductors to be safely connected without moving other cables or isolating the supply to the switchboard.
- Designed such that the incoming neutral conductor cannot be inadvertently disconnected from the bar or link.
- Provided with a separate terminal for –
 - the incoming neutral conductor terminating at the switchboard; and
 - the neutral conductor(s) associated with each outgoing circuit originating at the switchboard.

AS/NZS 3000: 2.9.3.2
(3 marks)

- (c) The switchboard is installed in an area which is accessible only to authorised persons and the means of access to such areas is provided with facilities for locking.

AS/NZS 3000: 2.9.6
(1 mark)

Question 26

(a) Any ONE of:

- 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: 6.3.3.2.1
(2 marks)

(b) To ensure that the insulation resistance between all live conductors and earth, or, as the case may be, all live parts and earth is adequate to ensure the integrity of the insulation.

AS/NZS 3000: 6.3.3.3.1
(1 mark)

(c) • Check from machine frame to known good earth (not own protective earth conductor)
• If above 1 ohm, check security of earth connections.

(2 marks)

Question 27

(a) Any TWO of:

- Repair or replacement of a faulty or damaged conductor
- Of the same size, type, and rating (that is, “like for like”).
- Of the same or higher prospective short-circuit current duty, provided that the fitting that was removed was of an appropriate size, type, and rating for the electrical circuit.
- The replacement of a fuse carrier with a circuit-breaker appropriate to the rating of the electrical circuit.
- The installation of revenue meters and associated load control fittings of mains.

ER 39(2)
(2 marks)

(b) Any FOUR of:

- Work on electrical installations that operate at high voltages (other than high voltage discharge lighting, where that lighting was installed in accordance with AS/NZS 3832):
- Work in hazardous areas:
- The mains, main switchboards, or main earthing systems of an electrical installation that is to be connected to a power supply for the first time.
- The replacement of existing mains with mains comprising larger conductors.
- The extension, shortening, or replacement of mains due to the relocation of a main switchboard or point of supply.
- The alteration of mains or a main switchboard for the purpose of relocating metering and associated load control fittings.
- The replacement of a main switchboard with a main switchboard of a different size or type.
- The alteration of a main switchboard to increase the current rating of that switchboard.
- The relocation of a main switchboard
- Work on the installation of mains parallel generation systems:
- Work on the installation of medical fittings and medical electrical appliances in patient care areas of hospitals and patient care premises:
- Work on fittings of animal stunning electrical appliances or meat conditioning electrical appliances.

ER 41(1) (a) –(f)
(2 marks)

(c) Any TWO of:

- Where the fittings have been tested and certified but no inspection is required.

ER 41(1)

- Where the fittings or conductors have been tested but no certification is required.

ER 39(2)

- To enable any testing or certification to be carried out.

ER 45

Question 28

- Used an insulation resistance tester at a test voltage of 500V d.c to obtain a whole of installation reading of 600,000Ω.

(1 mark)

- Disconnected the water heater cylinder and the two ranges from the installation. Conducted an insulation resistance test on the water heating cylinder and each of the ranges.

(1 mark)

The resistance between live parts and earthed parts on each appliance was not less than 10,000 Ω.

(1 mark)

- Conducted an insulation resistance test on the installation with the water heating cylinders and ranges disconnected.

(1 mark)

The resistance between live and earthed parts was not less than 1 MΩ.

(1 mark)

- Reconnected the water heating cylinder and the two ranges to the installation and conducted an insulation resistance test on the installation. The resistance between live and earthed parts was not less than 600,000Ω.

(1 mark)

GK

AS/NZS 3000: 6.3.3.3.2

(6 marks)