



Candidate Code No.	
For Board Use Only	
Result	Result
Date	Date
Int	Int

ELECTRICAL WORKERS REGISTRATION BOARD
ELECTRICAL SERVICE TECHNICIAN “A” EXAMINATION
17 June 2006
QUESTION AND ANSWER BOOKLET

Time Allowed: 2 Hours

INSTRUCTIONS – READ CAREFULLY

You have 10 minutes to read this paper but do not start writing until instructed to do so by the supervisor.

Write your Candidate Code Number in the box provided above. Your name must NOT appear anywhere in this paper.

Answer all questions.

The pass mark for this examination is 60 marks.

Use a pen for written answers. **Do not** use a pencil or a red pen.

Drawing instruments and pencils may be used when diagrams are required. Marks are allocated on the basis of correctness.

Do not use correcting fluid or correcting tape.

Non-programmable calculators may be used.

It is recommended that the reference source for your answers be included in the space provided if a question can be answered from the Act, Regulations, Standard or Code. However, just stating a reference only will earn no marks.

For calculation questions all workings, including formulae, must be shown to gain full marks. Show all working to TWO decimal places.

Warning – You could get 0 marks for any question, or part of a question, if you show anything hazardous or dangerous in your answer.

You may need to use the following documents in this examination:

- The Electricity Act 1992 and amendments or The Electricity Act 1992 reprint dated 19 August 2005.
- The Electricity Regulations 1997 reprint dated 5 September 2005.
- AS 60529 or AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1, 2, A and 3); AS/NZS 3760:2001 or AS/NZS 3760:2003.

PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM

(turn over)

Question 1

Each part in this question is worth 2 marks. Write your answer for each part in the box provided

(a) What power is dissipated by an electrical appliance with a resistance of 20 ohms when supplied at 230V?

1. 4600 watts
2. 115 watts
3. 264.5 watts
4. 2645 watts

(b) What is the power output of a small electric motor with a nameplate that reads:

Voltage	230
Phases	1
Horsepower	0.75
Speed	1425 r.p.m.

1. 373.3 watts
2. 375.5 watts
3. 559.5 watts
4. 750.3 watts

(c) An HRC type fuse is used in a circuit primarily to:

1. Disconnect a large fault current
2. Reduce the possibility of electric shock
3. Prevent an unauthorised increase in fuse rating
4. Disconnect an overload

(turn over)

Question 1 continued

(d) A portable isolating transformer designed for personal protection is required to be tested after a new flexible cord has been fitted. What is the minimum insulation resistance test value which would be acceptable for the transformer when measured between the supply conductors and its metal case?

1. 0.5 ohm
2. 1 Megohm
3. 50 Megohms
4. 1 ohm

(e) Select from the single core flexible cords listed below, the cord which would have the most electrical resistance.

1. 10 metres of 1.0mm² cord
2. 3 metres of 1.0mm² cord
3. 10 metres of 0.75mm² cord
4. 3 metres of 0.75mm² cord

(f) A small electric heating element is rated at 230 volts, 100 watts. The current drawn by this element when operating will be:

1. 2.3 A
2. 435 mA
3. 230 mA
4. 4.35 A

(g) When turned to the low position, the three heat switch controlling a small domestic oven will connect the electrical supply to:

1. Two elements in series
2. Two elements in parallel
3. One element only
4. One element in series with a suitable resistor

(turn over)

Question 1 continued

(h) When preparing flexible cord conductors for termination in a portable electric heating oven, the insulation should be removed:

1. Just up to the terminals
2. Only far enough to prevent heat deterioration of the insulation
3. At least 10mm from the terminal post
4. And replaced by vulcanised rubber tape

(i) An HRC fuse has a minimum fusing current of 12.5 amps and a Utilisation category (fusing factor) of 1.25. The current rating of this fuse is:

1. 25A
2. 13.75A
3. 15.625
4. 10A

(j) In a parallel circuit, the section which has the highest resistance also has the:

1. Lowest voltage drop
2. Highest heating effect
3. Lowest current
4. Highest voltage drop

(turn over)

Question 2

(a) Refer the Electricity Regulations and define the following terms:

(i) Low voltage

(1 mark)

Ref:

(ii) Direct contact

(2 marks)

Ref:

(iii) Isolated

(2 marks)

Ref:

(turn over)

Question 2 continued

- (b) Electrical appliances are often used in an "earthed situation". Give an example of an "earthed situation".

(2 marks)

- (c) Briefly describe **THREE** dangers that may exist for an operator who uses a Class I electrical appliance in a damp situation

(3 marks)

(1) _____

(2) _____

(3) _____

(turn over)

Question 3

An ohmmeter is to be used to measure the resistance of a plug-in heater designed for use on 230V supply. When connected to the heater's flexible cord plug-top the ohmmeter gives a reading of 24 ohms.

(a) (i) Calculate the current drawn by the heater draw on the 230 V supply?
(2 marks)

(ii) Calculate the power (watts) the heater will dissipate on the 230 V supply?
(2 marks)

(b) Electrical installations normally operate at standard low voltage, that is, 230 V. If the the voltage at a socket outlet in an electrical installation is permitted to vary between 230V minus 11% and 230V plus 6%:

(i) Calculate the maximum permitted voltage and the minimum permitted voltage
(2 marks)

(turn over)

Question 3 continued

- (ii) Calculate the power (watts) dissipated by the heater when the voltage variation is at the maximum permitted voltage.

(2 marks)

- (iii) Calculate the power (watts) dissipated by the heater when the voltage variation is at the minimum permitted voltage.

(2 marks)

(turn over)

Question 4

- (a) When selecting a flexible cord for fitting to a single phase electrical appliance, it is necessary to consider its voltage and current ratings, length, cross-sectional area, and the effect these will have on the heating and voltage drop in the cord.

List **FOUR** other factors which may need to be considered when selecting the cord.
(4 marks)

- (1) _____

- (2) _____

- (3) _____

- (4) _____

- (b) New flexible cords are to be fitted to two different single-phase plug-in electrical appliances. Complete the following table.
(4 marks)

Type of appliance	Active colour (Phase)	Neutral colour	Earth colour	Minimum No. of cores required
Earthed electrical appliance				
Double insulated electrical appliance				

- (c) All flexible cords are given a **current rating**. What does **current rating** mean?
(2 marks)

(turn over)

Question 5

(a) Sketch and label a circuit diagram of a single phase circuit supplying three resistors. Include the following:

- A fuse that protects the entire circuit and all components.
- A single pole switch that controls the entire circuit and all components (except the fuse)
- An ammeter to measure the total circuit current
- A voltmeter to measure the voltage across the resistors

Resistor 1 (R1) is $150\ \Omega$

Resistor 2 (R2) is $100\ \Omega$

Resistor 3 (R3) is $70\ \Omega$

R1 and R2 are connected in series. R3 is connected in parallel with the series resistors.

(4 marks)

(turn over)

Question 5 continued

(b) If the voltmeter reads 230V, determine by calculation:

(i) The reading on the ammeter.

(4 marks)

(ii) The total power dissipated by the resistors?

(2 marks)

(turn over)

Question 6

- (a) Briefly describe the actions you would take if the protective earthing conductor test on a Class I electrical appliance you have repaired is 7Ω .

(3 marks)

- (b) List **TWO** electrical protective devices which could be used with a Class I electrical appliance to provide personal safety when **operating outdoors**.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 6 continued

(c) A new fuse needs to be inserted into a fuse carrier to replace a *blown* fuse on a domestic switchboard. The 230V electrical appliance supplied from the socket outlet has been removed from the supply.

(i) Briefly describe the **TWO** main safety reasons why it is recommended that the main switch should be turned off before removing the fuse carrier or replacing it into the fuse base.

(4 marks)

(1) _____

(2) _____

(ii) The electrical appliance has been disconnected. When the fuse is replaced and the main switch is turned on, the fuse blows again. What is the probable cause of the fault.

(1 mark)

(turn over)

Question 7

- (a) You have replaced the mineral insulated metal sheathed (MIMS) element and flexible cord in a Class I portable oven. The Electricity Regulations require certain checks and tests be carried out in accordance with AS/NZS 3760 before the oven is returned to service.

Refer to that Standard and complete the following table.

(5 marks)

Test	Type of test instrument	Minimum or maximum test result value
	Any instrument with a low reading ohms scale	

- (b) Briefly explain **ONE** reason for carrying out the following **tests** on an electrical appliance.

- (i) Protective earthing conductor (earth continuity conductor) resistance test (1 mark)

- (ii) Polarity test (1 mark)

- (iii) Insulation resistance test (1 mark)

(turn over)

Question 7 continued

- (c) Briefly explain why it is important to carry out a Protective Earthing conductor test on a Class I electrical appliance before carrying out an insulation resistance test (2 marks)

(turn over)

Question 8

- (a) Briefly explain how a Residual Current Device (RCD) disconnects the supply from an electrical appliance when an earth leakage fault occurs.

(4 marks)

- (b) What does the term “PRCD” stand for?

(1 mark)

- (c) State **THREE** advantages which HRC fuses have over rewirable fuses.

(3 marks)

(1) _____

(2) _____

(3) _____

(turn over)

Question 8 continued

- (d) Briefly state **TWO** safety reasons why it is not permitted to bridge the terminals of HRC fuse carriers with fuse wire of the same current rating as the blown cartridge. (2 marks)

(1) _____

(2) _____

(turn over)

Question 9

(a) The test report for a Class I, 230V, 2000W fan heater states that:

- Protective earthing conductor (earth continuity conductor) resistance is 7Ω .
- The insulation resistance test shows that there is a phase to frame fault with the appliance switch off.

The heater is plugged into a live socket outlet. The socket outlet is protected by a 10A HRC fuse with a 1.5 Utilisation category (fusing factor).

(i) Calculate the current flowing in the protective earthing (earth continuity) conductor.

(2 marks)

(ii) Explain the sequence of technical events that will happen when the heater is plugged in.

(2 marks)

(turn over)

Question 9 continued

(b) A 230V, Class I, plug-in electrical appliance is controlled by a single pole switch. Following repairs, the internal conductors were transposed, with the neutral conductor connected to the switch instead of the phase conductor.

(i) State **ONE** effect on the safe operation of the electrical appliance this transposition could create.

(2 marks)

(ii) Describe **FOUR** other situations that would cause the neutral to be switched instead of the phase in such an appliance.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

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In the box, write the number of **EXTRA** sheets you have used. Write **NIL** if you have not used any

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Questions Answered	Marks	
1		
2		
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TOTAL MARKS		