



<b>Candidate Code No.</b>	
<b>For Board Use Only</b>	
Result	Result
Date	Date
Int	Int

**ELECTRICAL WORKERS REGISTRATION BOARD**  
**ELECTRICAL SERVICE TECHNICIAN “A” EXAMINATION**  
**9 September 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) To comply with the Electricity Regulations, the maximum voltage to earth which can be used to supply a handheld electrical appliance is?

1. 230 Volts
2. 32 Volts
3. 400 Volts
4. 250 Volts

(b) To determine the voltage drop in a flexible cord, the information required is:

1. Voltage and cross-sectional area
2. Current and resistance
3. Current and voltage
4. Resistance and cross-sectional area

(c) An HRC fuse with a Utilisation category (fusing factor) of 1.5 has a minimum fusing current of 9 amps. The current rating of this fuse is:

1. 5A
2. 9A
3. 6A
4. 11A

(d) When fighting a fire in live electrical equipment, which of the following fire extinguishers **should not** be used?

1. Water - gas expelled
2. Dry powder
3. Vaporising liquid
4. Carbon dioxide

(turn over)

## Question 1 continued

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

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

(f) In a circuit, the effect of doubling of the current is:

1. Lowering of the heating effect
2. No increase in the heating effect
3. Heating effect doubles
4. Heating effect increases four times

(g) If a 230V, Class I, portable electrical appliance with a phase to framework fault and broken protective earthing conductor (earth continuity conductor) is being used outdoors, which of the following protection devices will prevent the passage of an electric current through the operator's body?

1. An HRC fuse
2. A 230/230 volt isolating transformer
3. An overload relay
4. A Residual Current Device (RCD)

(h) Which of the following three core flexible cords has the least conductor resistance?

1. 5 metres of 0.75mm<sup>2</sup> cord
2. 10 metres of 1.0mm<sup>2</sup> cord
3. 5 metres of 1.0mm<sup>2</sup> cord
4. 10 metres of 0.75mm<sup>2</sup> cord

(turn over)

## Question 1 continued

(i) It is recommended that not more than one portable electrical appliance is used at any one time from an isolating transformer. The reason for this is to:

1. Prevent transformer overloading.
2. Minimise the possibility of electric shock.
3. Minimise the problem of excessive voltage drop.
4. Prevent polarity interchange.

(j) When the medium position is selected on a three-heat switch controlling heating elements, it will connect:

1. Two elements in series with the supply
2. One element in series with a suitable resistance
3. Two elements in parallel across the supply
4. One element only across the supply

(turn over)

## Question 2

An ohmmeter is 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 power dissipated by the heater when used on the 230V supply.  
(2 marks)

- (ii) Calculate the current drawn by the heater when used on the 230V supply.  
(2 marks)

**(turn over)**

## Question 2 continued

(b) The Electricity Regulations permit a maximum voltage drop of 5% at the socket outlet into which the heater is connected.

(i) Calculate the current drawn when operating at the maximum voltage drop  
(3 marks)

(ii) (1) Calculate the power dissipated by the heater when operating at the maximum voltage drop.  
(2 marks)

(2) Compare this to your answer in (a)(i) above, and calculate the difference in power dissipated between the heater operating at 230V and the heater operating at the maximum voltage drop.  
(1 mark)

**(turn over)**

### Question 3

- (a) After repairs have been carried out to a Class I plug-in heater, a **visual** inspection should be carried out in addition to the prescribed electrical tests. Refer to AS/NZS 3760 and describe **FIVE** visual checks that should be carried out.

(5 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(3) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(4) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(5) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Ref: .....

- (b) State **TWO** reasons why a bayonet cap adaptor must not be used to supply the Class I plug-in heater.

(2 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

(turn over)

### Question 3 continued

- (c) Explain why the earth pin of a standard New Zealand 3 pin 10 amp plug used to supply the Class I heater is longer than the phase or neutral pins.

(2 marks)

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- (d) A microgap switch, rated at 10 amp 230V a.c. only, is used as the control switch on the Class I heater. State **ONE** reason why this switch would not be suitable for use on a d.c. circuit of similar current and voltage.

(1 mark)

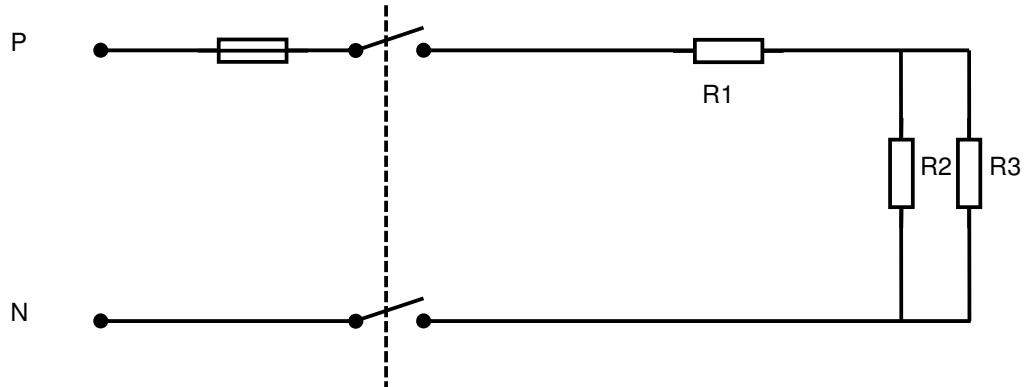
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(turn over)

## Question 4

The figure below represents a 230V circuit with 3 resistances controlled by a double pole switch and protected by a fuse.



- R1 is 30 ohms
- R2 is 60 ohms
- R3 is 12 ohms

(a) Calculate the total power dissipated by the resistors.

(6 marks)

(turn over)

### Question 4 continued

(b) Calculate the current drawn by the circuit

(2 marks)

(c) Calculate the voltage drop across resistor R1

(2 marks)

(turn over)



### Question 5 continued

- (b) 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 **FIVE** other factors which may need to be considered when selecting the cord  
(5 marks)

- (1) \_\_\_\_\_  
\_\_\_\_\_
- (2) \_\_\_\_\_  
\_\_\_\_\_
- (3) \_\_\_\_\_  
\_\_\_\_\_
- (4) \_\_\_\_\_  
\_\_\_\_\_
- (5) \_\_\_\_\_  
\_\_\_\_\_

(turn over)

## Question 6

- (a) You are carrying out an insulation resistance test on an electrical appliance that has semi-conductor devices used in the internal circuitry. The semi-conductor devices cannot be disconnected.

State **TWO** methods of carrying out the insulation resistance test that will not cause damage to the semi conductor devices.

(2 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

- (b) Following repairs to the electric motor and flexible supply cord of a 230V, Class I, concrete mixer, an insulation resistance test must be carried out.

- (i) What instrument should be used to make this test?

(1 mark)

\_\_\_\_\_

- (ii) What is the test voltage used for the insulation resistance test.

(1 mark)

\_\_\_\_\_

- (iii) State the acceptable minimum insulation value for this test.

(1 mark)

\_\_\_\_\_

- (iv) Briefly describe how you would carry out this test.

(2 marks)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(turn over)

**Question 6 continued**

(c) A 230 V plug-in electrical appliance has MOV surge protection fitted. You have repaired the appliance and need to carry out an insulation resistance test. Refer to AS/NZS 3760 and answer the following:

(i) State insulation test voltage that should be applied. (1 mark)

\_\_\_\_\_

Ref: .....

(ii) State the **TWO** reasons why the test voltage you have stated in (i) is applied. (2 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

Ref: .....

**(turn over)**

## Question 7

(a) You have received a Class I, 230V, 2000W plug-in dehumidifier for repair. There is a single-pole control switch on the dehumidifier.

- The insulation resistance test you carried out shows that there is a phase to frame fault of zero ohms impedance with the dehumidifier switch on.
- The protective earthing conductor test you carried out showed a resistance of  $35\Omega$ .

(i) Explain the danger to the person using the dehumidifier if it is plugged in and turned on.

(3 marks)

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(ii) Calculate the current flowing in the protective earthing conductor.

(2 marks)

(turn over)

**Question 7 continued**

- (iii) Calculate the shock voltage that will appear on the frame of the dehumidifier. Assume there is no resistance in the phase to frame fault.

(2 marks)

- (b) State **TWO** possible effects on the safe operation of the dehumidifier if, after repair, the neutral conductor was connected to the supply side of the single-pole appliance switch and the phase connected to the neutral terminal.

(2 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

- (c) When a Class I electrical appliance is plugged in, the fuse blows. The appliance is then un-plugged and an Out-of-Service tag attached. It will be taken away for testing. The main switch is turned off and the fuse is replaced. When the main switch is turned on, the fuse blows again. What is the probable cause of the fault.

(1 mark)

\_\_\_\_\_

\_\_\_\_\_

**(turn over)**

### Question 8

(a) The Electricity Act requires that a registered electrical service technician who works for payment of reward must hold an additional type of licence.

(i) What is the name of the licence?

(1 mark)

\_\_\_\_\_

Ref: .....

(ii) On what date in any year does the licence expire?

(1 mark)

\_\_\_\_\_

Ref: .....

(iii) To whom must application be made for the licence?

(1 mark)

\_\_\_\_\_

Ref: .....

(b) Registered electrical service technicians are one of **SEVEN** classes of persons listed in the Electricity Act who may carry out prescribed electrical work. Refer to the Electricity Act and list **THREE** other classes of person who may do or assist in doing prescribed electrical work.

(3 marks)

(1) \_\_\_\_\_

(2) \_\_\_\_\_

(3) \_\_\_\_\_

Ref: .....

(turn over)

**Question 8 continued**

- (c) No electrical service technician shall assist to carry out prescribed electrical work unless they have completed safety tuition in **FOUR** specific subjects within the previous 24 months. Refer to the Electricity Regulations and state those **FOUR** subjects.

(4 marks)

(1) \_\_\_\_\_  
\_\_\_\_\_

(2) \_\_\_\_\_  
\_\_\_\_\_

(3) \_\_\_\_\_  
\_\_\_\_\_

(4) \_\_\_\_\_  
\_\_\_\_\_

Ref: .....

**(turn over)**

### Question 9

- (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.

(4 marks)

Test	Type of instrument	Acceptable result	State whether this is a minimum or maximum value

- (b) Briefly explain **TWO** reasons for carrying out a protective earthing conductor (earth continuity conductor) resistance test

(2 marks)

- (1) \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- (2) \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- (c) Briefly explain **ONE** reason for carrying out a polarity test

(1 mark)

- \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

(turn over)

**Question 9 continued**

- (d) Briefly explain **ONE** reason for carrying out an insulation resistance test (1 mark)

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- (e) 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)

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**For Candidate's Use**

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

**For Examiner's Use Only**

<b>Questions Answered</b>	<b>Marks</b>	
<b>1</b>		
<b>2</b>		
<b>3</b>		
<b>4</b>		
<b>5</b>		
<b>6</b>		
<b>7</b>		
<b>8</b>		
<b>9</b>		
<b>TOTAL MARKS</b>		