



<b>Candidate Code No.</b>	
<b>For Board Use Only</b>	
Result	Result
Date	Date
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# **ELECTRICAL WORKERS REGISTRATION BOARD**

## **ELECTRICAL SERVICE TECHNICIAN “A” EXAMINATION**

**20 November 2004**

### **QUESTION AND ANSWER BOOKLET**

Time Allowed: 1.5 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 and you must get at least 25 marks in section 2**

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.

**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 will need to use the following documents in this examination:**

- The Electricity Act 1992 and amendments
- The Electricity Regulations 1997 and the Electricity Amendment Regulations 1999, Electricity Amendment Regulations 2002 and the Electricity Amendment Regulations 2003; or  
The Electricity Regulations Compilation 2003 and the Electricity Amendment Regulations 2003; or  
The Integrated Electricity Regulations 1997
- AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1, 2, 3 and A); NZS 3019 (Int):2002; AS/NZS 3760:2001 or AS/NZS 3760:2003

**PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM**

**(turn over)**

## **SECTION 1**

Each question in this section is worth 5 marks

Write your answer for each question in the box provided

### **Question 1**

A registered electrical service technician is requested by a neighbour to check and test an electrical concrete mixer to ensure it is safe to use after carrying out repairs.

Which document details the specific tests which must be carried out after fitting a new flexible cord and plug to an electrical motor?

- a AS/NZS 3760
- b AS 6370
- c ECP 50
- d ECP 11

### **Question 2**

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

- a 10 metres of 1.0mm<sup>2</sup> cord
- b 3 metres of 1.0mm<sup>2</sup> cord
- c 10 metres of 0.75mm<sup>2</sup> cord
- d 3 metres of 0.75mm<sup>2</sup> cord

### **Question 3**

A fuse blows at 25 amps and has a Utilisation category (fusing factor) of 1.25. The rated current for this fuse is:-

- a 12.5A
- b 20A
- c 10A
- d 31.25A

**(turn over)**

#### Question 4

Which of the following voltage ranges defines the **extra-low voltage** in accordance with the Electricity Regulations 1997?

- a 0 V to 120V a.c.  
0 V to 32V ripple-free d.c.
- b 0 V to 50V a.c.  
0 V to 120V ripple-free d.c.
- c 50 V to 115V a.c.  
50 V to 115V d.c.
- d 50 V to 120 V a.c.  
12 V to 50V ripple-free d.c.

#### Question 5

To determine the voltage drop in a flexible cord the values required are: -

- a Voltage and cross-sectional area
- b Current and voltage
- c Current and resistance
- d Resistance and cross-sectional area

#### Question 6

To carry out mouth to mouth rescue breathing it is necessary to tilt the patient's head backwards and lift the chin. This action ensures:-

- a A quick changeover between two rescuers
- b A clear airway to the patients lungs
- c An unrestricted path for blood to flow to the patients brain
- d A clear view of the patients chest rise and fall

**(turn over)**

### Question 7

The flexible cord supplying a double insulated 230V a.c. electric clock from a three pin socket is to be replaced. The most appropriate type of flexible cord to use would be: -

- a Twisted conductor three core unsheathed
- b Two single core conductors, unsheathed
- c Ordinary duty three core tough plastic sheathed
- d Light duty two core tough plastic sheathed

### Question 8

The maximum permitted resistance of the protective earthing conductor (earth continuity conductor) when measured between the earth pin of the supply plug and the metal framework of a class I electrical appliance is?

- a 1 Megohm
- b 1.25 ohms
- c 1.5 ohms
- d 1 ohm

### Question 9

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

- a Just up to the terminals
- b Only far enough to prevent heat deterioration of the insulation
- c At least 10mm from the terminal post
- d And replaced by vulcanised rubber tape

**(turn over)**

### Question 10

If the resistance in a circuit is doubled and the current flowing is halved, the applied voltage will now be: -

- a Halved
- b Doubled
- c Four times greater
- d The same



(turn over)

## SECTION TWO

### Question 11

It is necessary to have a reliable protective earthing conductor (earth continuity conductor) for a class 1 electrical appliance.

- (a) State the maximum resistance value permissible for this conductor. (1 mark)

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- (b) Briefly describe how this conductor contributes to the electrical safety of the appliance. (2 marks)

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- (c) Briefly describe the actions you would take if the protective earthing conductor test on a Class I electrical appliance you have repaired is  $15\Omega$ . (2 marks)

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## Question 12

The test report for a class I, 230V, 2000W fan heater states the following:

- Protective earthing conductor (earth continuity conductor) resistance of 22.6  $\Omega$ .
- The insulation resistance test shows a phase to frame short circuit with the heater switch on and with the switch off.

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

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

(2 marks)

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

(3 marks)

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(turn over)

**Question 13**

(a) When fitting replacement flexible cords to Class I electrical appliances:

(i) How many cores are required?

(1 mark)

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(ii) What colour coding is required for the cores?

(3 marks)

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(b) Single-phase plug-in electrical appliances normally operate at standard low voltage. Refer to the Electricity Regulations and define the term standard low voltage as it applies to single-phase plug-in electrical appliances.

(1 mark)

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Ref: .....

**(turn over)**

## Question 14

The test report for a class 1 fan heater rated at 2000W at 230V states the following:

- Earth continuity resistance 23 ohms.
- Insulation resistance with the switch off – phase to frame short circuit.  
Insulation resistance with the switch on – phase to frame short circuit.

(a) Sketch a circuit diagram to illustrate this fault condition that includes:

- The heater
- A switch controlling the circuit
- A fuse protecting the circuit

(2 marks)

(b) Explain the sequence of technical events that will happen when this heater in its present condition, with the switch on, is plugged into a live 230V socket protected by a 10A HRC fuse with a Utilisation category (fusing factor) of 1.5.  
(3 marks)

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### Question 15

- (a) The New Zealand single phase 230V a.c. supply operates at a frequency of 50 Hz. Briefly describe the meaning of the term Hz.

(1 mark)

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- (b) Sketch one cycle of the 230V a.c. supply voltage wave form, showing the values for the time interval and peak voltage.

(4 marks)

**(turn over)**

### Question 16

When connecting test instruments to measure voltage and current values of 230V electrical appliances it is important to observe set procedures to ensure personal safety. Briefly describe **FOUR** important precautions which will promote personal safety.

(5 marks)

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

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

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

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### Question 17

All flexible cords are given a **current rating**.

(a) What does **current rating** mean?

(2 marks)

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(b) What could happen if the flexible cord was used to supply a current in excess of its **current rating**?

(3 marks)

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### Question 18

- (a) Sketch the circuit diagram of a single phase circuit protected by a fuse, controlled by a single pole switch and supplying three resistors connected in parallel.

Resistor 1 is  $150\ \Omega$

Resistor 2 is  $100\ \Omega$

Resistor 3 is  $70\ \Omega$

Include an ammeter to measure the total circuit current and a voltmeter to measure the voltage across the resistors.

(3 marks)

- (b) If the voltmeter reads 230V, what is:

(i) The reading on the ammeter?

(1 mark)

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(ii) The total power dissipated by the resistors?

(1 mark)

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### Question 19

Explain *why* the earth pin of a standard New Zealand 3 pin 10 amp plug is longer than the phase or neutral pins and *how* this contributes to electrical safety.

(5 marks)

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(turn over)

## Question 20

(a) Sketch a circuit diagram using all of the following electrical components connected to a 230V a.c. supply:

- Two load resistors, one of 23 ohms and the other of 46 ohms.
- A two-position selector switch to connect the supply to either of the load resistors.
- A fuse.

(4 marks)

(b) Calculate the current flow in the circuit when the selector switch connects the supply to the 46 ohm resistor.

(1 mark)

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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

<b>For Examiner's Use Only</b>		
<b>Questions Answered</b>	<b>Marks</b>	
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