



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

## ELECTRICAL SERVICE TECHNICIAN "A" EXAMINATION

**21 June 2008**

### 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.**

**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 some of 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) or AS/NZS 3000:2007; 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) In a parallel circuit, the section which has the highest resistance also has the:

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

(b) Under which of the following circuit conditions is the electro-magnetic mechanism of an MCB specifically designed to operate (trip)?

1. A short circuit
2. A small overload of short duration
3. A high motor starting current
4. A sustained overload

(c) To comply with AS/NZS 3760, the insulation resistance test of a repaired electrical appliance must not be less than:

1. 500 ohms
2. 0.5 ohms
3. 0.5 Megohms
4. 1 Megohm

**(turn over)**

## Question 1 continued

(d) Before carrying out repairs on a single phase plug-in electrical appliance, which of the following actions would be the most effective in ensuring safety against electric shock?

1. Tag the electrical appliance as unsafe
2. Withdraw the appliance plug from the socket
3. Turn off the main switch at the switchboard
4. Remove the fuse that protects the plug socket circuit

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

1. 5 metres of 0.75mm<sup>2</sup> flexible cord
2. 5 metres of 0.5mm<sup>2</sup> flexible cord
3. 5 metres of 1.5mm<sup>2</sup> flexible cord
4. 5 metres of 1.0mm<sup>2</sup> flexible cord

(f) 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. 1 Megohm
2. 0.5 ohm
3. 50 Megohms
4. 1 ohm

**(turn over)**

## Question 1 continued

(g) What current will be drawn by a 230/240 volt electric dryer rated at 920 watts when operating at 240 volts?

1. 2.5 amps
2. 3.8 amps
3. 0.25 amps
4. 0.4 amps

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

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

(i) At 10 cents per unit, what will be the cost of the electrical energy consumed in 5 hours by a heater which draws 10A from the 230V mains supply:

1. 115 cents
2. \$2.30
3. 2300 cents
4. 460 cents

**(turn over)**

## Question 1 continued

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

1. Only far enough so the insulation touches the terminal post.
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



**(turn over)**

## Question 2

(a) A digital ohmmeter measures the resistance of a 230V/240V plug-in heater as 26.45 ohms on the high position.

(i) The Electricity Regulations permit a maximum voltage drop of 5% at the socket outlet into which the heater is connected. The heater is operating at 230V

Calculate the difference in the power dissipated by the heater between when it is operating at full voltage and when it is operating at the maximum permissible volt drop.

(6 marks)

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

(2 marks)

**(turn over)**

## Question 2 continued

(b) Two faulty 230V plug-in portable heaters have been bought in for repair. Both heaters are identical and are controlled by a selector switch that gives three heat settings – “high”; “medium; and “low”. The insulation tests on both heaters are satisfactory.

(i) On heater 1, a continuity test shows the following readings:

- High  $40\Omega$
- Medium  $40\Omega$
- Low  $0\Omega$

What is the cause of the fault?

(1 mark)

---

(ii) On heater 2, a continuity test shows the following readings:

- High  $80\Omega$
- Medium  $40\Omega$
- Low  $20\Omega$

What is the cause of the fault?

(1 mark)

---

**(turn over)**

### Question 3

- (a) (i) Draw and label a circuit diagram of a single-phase capacitor start motor. (3 marks)

- (ii) How is the start winding in a single-phase capacitor start motor disconnected when the motor is up to speed? (1 mark)

---

- (b) What would be the affect on the performance of a single-phase capacitor start motor if the capacitor had become disconnected:

- (i) And the motor was switched on whilst connected to a load? (1 mark)

---

- (ii) While the motor was running whilst connected to a load? (1 mark)

---

**(turn over)**

### Question 3 continued

(c) What would be the effect on the performance of a single-phase capacitor start motor if the run winding was open-circuited:

(i) And the motor was switched on whilst connected to a load?

(1 mark)

---

---

---

(ii) While the motor was running whilst connected to a load?

(3 marks)

---

---

---

---

---

---

**(turn over)**

## Question 4

(a) The Electricity Act requires that a registered electrical service technician who works for payment or reward must hold an additional type of licence. Refer to the Act and state:

(i) The name of the licence?

(1 mark)

---

Ref: .....

(ii) The date in any year on which the licence expires?

(1 mark)

---

Ref: .....

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

(1 mark)

---

Ref: .....

(b) No electrical service technician shall assist to carry out prescribed electrical work unless they have completed refresher courses 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 4 continued**

- (c) Refer to the Electricity Regulations and state **THREE** details of an electrical accident that must included in a report to the Secretary. (3 marks)

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

Ref: .....

**(turn over)**

## Question 5

(a) Tests were carried out on Class I, 230 V single-phase plug-in dish washer. The test results were:

- Protective earthing conductor test             $17\Omega$ .
- Insulation resistance test  
short circuit between the phase conductor and the frame of the dishwasher with the dishwasher switch in the "off" position

(i) The dish washer was not repaired and was plugged into a live socket outlet.

(1) Calculate the current that would flow in the protective earthing conductor. Assume there is no resistance in the short circuit.  
(2 marks)

(2) Calculate the power that would dissipate in the protective earthing conductor.  
(2 marks)

(ii) The socket outlet was protected by a 15A HRC fuse with a 1.5 Utilisation category (fusing factor). Determine by calculation whether or not the fuse would operate.  
(2 marks)

**(turn over)**

### Question 5 continued

- (b) A 230V, Class I, plug-in electrical appliance is controlled by a single pole switch. You are testing the appliance with an ohmmeter and find that the neutral is switched.

Describe the **THREE** situations that could cause the neutral to be switched instead of the phase appliance.

(3 marks)

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

- (c) State **ONE** unsafe effect on the operation of an electrical appliance a phase and neutral transposition could create.

(1 mark)

\_\_\_\_\_

\_\_\_\_\_

**(turn over)**

## Question 6

(a) You are required to carry out a protective earthing conductor test on a 230V, Class I plug-in electrical appliance.

(i) State the instrument that should be used for this test. (1 mark)

---

---

(ii) Briefly explain how the test should be carried out. (2 marks)

---

---

---

---

(iii) (1) What is the acceptable resistance for this test? (1 mark)

---

(2) Is this resistance a minimum or maximum value? (1 mark)

---

(b) Briefly explain why an ohmmeter is not the correct instrument to carry out an insulation resistance test on a portable electrical appliance. (2 marks)

---

---

---

---

**(turn over)**

## Question 6 continued

- (c) You are using an ammeter to measure the current drawn by an electrical appliance. Describe what would happen if you connected the ammeter in parallel with that appliance.

(3 marks)

---

---

---

---

---

---

---

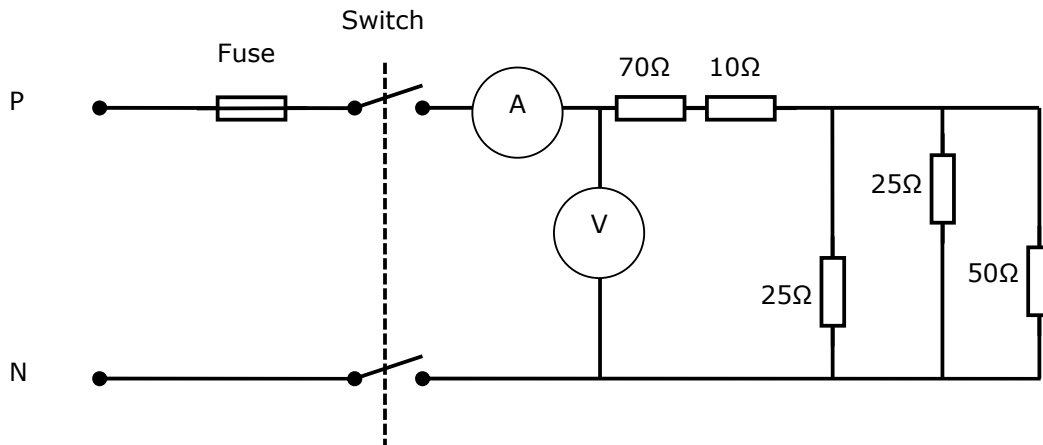
---

---

**(turn over)**

## Question 7

The circuit diagram below represents a 230V, single-phase circuit protected by a fuse, controlled by a double pole switch and supplying five resistors. The meters are all of the digital type.



(a) Calculate the total power dissipated in the circuit.

(5 marks)

(turn over)

## Question 7 continued

- (b) Calculate the current drawn by the circuit if **one** the  $25\Omega$  resistors were open circuited.

(4½ marks)

- (c) If the  $70\Omega$  resistor was open circuited what would be the reading on the voltmeter?

(½ mark)

---

**(turn over)**

## Question 8

- (a) State **THREE** advantages that HRC fuses have when compared to rewirable fuses.

(3 marks)

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

- (b) 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 8 continued

- (c) Briefly explain how a Residual Current Device (RCD) operates to provide safety to the user of an electrical appliance when an earth leakage fault occurs.

(4 marks)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

- (d) What does the term "PRCD" stand for?

(1 mark)

---

---

**(turn over)**

## Question 9

(a) A new fuse needs to be inserted into a fuse carrier to replace a *blown* fuse on a domestic switchboard. The circuit protected by the fuse supplies a 230V plug-in electrical appliance.

(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.

(2 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)

\_\_\_\_\_

\_\_\_\_\_

(b) Describe a method of safely ensuring the continued isolation of a plug-in electrical appliance.

(1 mark)

\_\_\_\_\_

**(turn over)**

**Question 9 continued**

(c) What is the essential safety difference between switching an electrical appliance off and isolating it?

(2 marks)

---

---

---

---

---

(d) Refer to the Electricity Regulations and state the **TWO** practical steps an employee must take when carrying out work requiring personal protective equipment.

(4 marks)

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

---

---

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

---

---

Ref: .....

### 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		
Questions Answered	Marks	
<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</b>		