



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

ELECTRICAL SERVICE TECHNICIAN "A" EXAMINATION

23 June 2007

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 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 THREE significant figures.

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) An HRC fuse with a Utilisation category (fusing factor) of 1.5 has a minimum fusing current of 30 amps. The current rating of this fuse is:

1. 45A
2. 31.5A
3. 20A
4. 30A

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

1. 5 metres of 0.75mm² cord
2. 10 metres of 1.0mm² cord
3. 5 metres of 1.0mm² cord
4. 10 metres of 0.75mm² cord

(c) The minimum permitted insulation resistance of a Class I electrical appliance when measured between the earth and phase/neutral pins of the supply plug is:

1. 1 Megohm
2. 1.25 ohms
3. 1.5 ohms
4. 1 ohm

(turn over)

Question 1 continued

(d) 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. 250 Volts
3. 400 Volts
4. 32 Volts

(e) 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

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

1. 0 V to 50V a.c.
0 V to 120V ripple-free d.c.
2. 0 V to 120V a.c.
0 V to 32V ripple-free d.c.
3. 50 V to 115V a.c.
50 V to 115V d.c.
4. 50 V to 120 V a.c.
12 V to 50V ripple-free d.c.

(turn over)

Question 1 continued

(g) 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

(h) The current drawn by an electric soldering iron rated at 92 watts when operating from a 230 Volt supply is :-

1. 0.4 amps
2. 0.25 amps
3. 4 amps
4. 0.5 amps

(i) 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

(turn over)

Question 1 continued

(j) Which of the following wiring changes would reverse the direction of rotation of a single phase a.c. induction motor?

1. Reverse the phase and neutral supply conductor connections at the motor terminal block.
2. Reverse the connections of the start windings and the run windings
3. Reverse the connections of the start windings or the run windings
4. None of the above, as the direction of rotation cannot be changed on this type of motor.



(turn over)

Question 2 continued

(c) Briefly state **FOUR** 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.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(d) A sub circuit fuse blows when correctly specified fuse links are inserted. What could happen if the fuse link is replaced with one of a larger current rating?

(1 mark)

(turn over)

Question 3

- (a) A protective earthing conductor test was carried out on Class I, 230 V single-phase plug-in dish washer. The test result was a reading of 17Ω .

The dish washer was put back into service without being repaired. It was plugged into a live socket outlet, but was not operated. The outlet is protected by a 15A HRC fuse with a 1.5 Utilisation category (fusing factor).

If a short-circuit occurred before the switch and between the incoming phase conductor and the frame of the dishwasher:

- (i) Calculate the current that would flow in the protective earthing conductor.

(2 marks)

- (ii) Calculate the power that would dissipate in the protective earthing conductor.

(2 marks)

(turn over)

Question 3 continued

- (iii) Determine by calculation whether or not the fuse would operate.
(2 marks)

- (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 in the 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 4

- (a) You are carrying out an insulation resistance test on an electrical appliance that has semi-conductor devices used in its internal the circuitry. It is impractical to disconnect the semi-conductors.

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 4 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 5

(a) Draw and label circuit diagram of a plug-in Class I electric heater plugged into a 230V socket outlet. The circuit must show:

- The heater with two elements, one of 23 ohms and the other of 46 ohms.
- The heater with a two-position selector switch that connects the supply to either of the elements.
- A fuse that protects the socket outlet circuit.

You must show the polarity of the supply.
You do not need to show the socket outlet.

(4 marks)

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

(2 marks)

(turn over)

Question 5 continued

(c) Calculate the maximum power the heater can dissipate

(2 marks)

(d) Find by calculation whether the power dissipated would increase or decrease if the elements were connected in series.

(2 marks)

(turn over)

Question 6

- (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

Note: The answers must relate only to the Class I plug-in heater
(5 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

(turn over)

Question 6 continued

(b) Following repairs to the electric motor and flexible supply cord of a concrete mixer, a test of its protective earthing conductor must be carried out.

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

(1 mark)

(ii) State the acceptable maximum resistance *value* for the protective earthing conductor.

(1 mark)

(iii) State **TWO** reasons why a low protective earthing conductor resistance value contributes to the electrical safety of the appliance when a fault occurs between the phase and exposed metal.

(3 marks)

(1) _____

(2) _____

(turn over)

Question 7

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

(i) What does the term **current rating** mean when applied to flexible cords?

(2 marks)

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

(3 marks)

(b) A 230V, single phase, three-core flexible cord supplying a Class I electrical appliance is required to be replaced. In the table below, state the colour coding and the polarity for the replacement cord.

(5 marks)

Existing cord conductor colours	Alternative Colours	Polarity
Green		
Black		
Red		Phase or Active or Live

(turn over)

Question 8

(a) (i) Sketch a circuit diagram of a single-phase split-phase motor.

(2 marks)

(ii) Describe how the direction of rotation can be reversed for a single-phase split-phase motor

(2 marks)

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

(1 mark)

(iv) A single-phase split-phase motor has been running normally for 1 hour but then starts to slow. Once it slows down, it starts again. It keeps slowing down, then starting again until it is switched off. State the cause of the fault.

(1 mark)

(turn over)

Question 8 continued

- (b) (i) Describe how the direction of rotation can be reversed for a Universal (series) motor

(2 marks)

- (ii) State **TWO** typical applications for a Universal (series) motor

(2 marks)

(1) _____

(2) _____

(turn over)

Question 9

A 230V portable water heater has two elements controlled by a three-heat switch. Each element has a resistance of 50 ohms.

- (a) If the heater switch is set in the "low" position, calculate the power dissipated in the heater.

(2 marks)

- (b) If the heater switch is set in the "high" position, calculate the current drawn from the supply

(4 marks)

(turn over)

Question 9 continued

- (c) If the heater switch is set in the "medium" position, calculate the power dissipated in the heater.

(2 marks)

- (d) The heater works when the switch is in the medium position. When the switch is switched to the high position, the fuse protecting the water heater blows. Describe the likely cause of the fault.

(2 marks)

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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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7		
8		
9		
TOTAL		