



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

ELECTRICAL SERVICE TECHNICIAN "A" EXAMINATION

3 May 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 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) What current will be drawn by a 230/240 volt electric soldering iron with a resistance of 626Ω when operating at 240 volts:

1. 0.38 amps
2. 0.25 amps
3. 4 amps
4. 0.5 amps

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

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

(c) A 230V, Class I portable electrical appliance has a phase to framework fault and a broken protective earthing conductor. If it is used outdoors, which of the following 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 simmerstat switch

(turn over)

Question 1 continued

(d) 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. 10A
3. 15A
4. 16A

(e) 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. One element only across the supply
4. Two elements in parallel across the supply

(f) What power is dissipated by an electrical appliance with a resistance of 50Ω when drawing a current of 6 amps?

1. 0.3 kW
2. 15 kW
3. 1.5 kW
4. 1.8 kW

(turn over)

Question 1 continued

(g) 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

(h) Under which of the following circuit conditions is the thermal overload mechanism of an MCB specifically designed to operate (trip)?

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

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

1. Halved
2. Doubled
3. Four times greater
4. The same

(turn over)

Question 1 continued

(j) The maximum current a flexible cord can carry safely without overheating depends mainly on:

1. The type of supply, a.c. or d.c.
2. The cross-sectional area of the flexible cord conductors
3. The length of flexible cord used
4. The number of cores in the flexible cord



(turn over)

Question 2

An ohmmeter is to be used to measure the resistance of a plug-in electrical appliance designed for use on 230V supply. The appliance has two elements of 40Ω and 50Ω connected in parallel.

- (a) Calculate the current that the appliance will draw when it is turned on.
(4 marks)

- (b) Calculate the power (watts) the appliance will dissipate when it is turned on.
(2 marks)

(turn over)

Question 2 continued

- (c) Calculate the difference in the power (watts) the appliance will dissipate when it is turned on but the 50Ω resistor is open-circuited.

(3 marks)

- (d) With all elements working, would the power the appliance dissipate increase if the supply voltage was increased to 240 V? Give **ONE** reason to support your answer.

(1 mark)

(turn over)

Question 3

You have to fit a new three-pin plug to a three-core PVC sheathed flexible cord supplying a Class I security alarm panel.

- (a) Briefly state the main sequence of actions involved in fitting the three-pin. (2 marks)

(1) _____

(2) _____

(3) _____

(4) _____

- (b) State the visual inspections you would make before fitting the cover to the plug. (2½ marks)

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

- (c) State the visual inspection you would make after fitting the cover to the plug. (½ mark)

(turn over)

Question 4

(a) The Electricity Act requires that a registered electrical service technician who works for payment of 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 does the licence expire?

(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 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

In an office in a sawmill, a 20A HRC with a fusing factor of 1.5 protects a final subcircuit consisting of two plug sockets supplying various 230V plug-in electrical appliances. The fuse has blown. When the fuse is replaced, it blows again when the supply is restored to the circuit.

- **The fuse is correctly rated for the circuit and is not faulty.**
- **The circuit has been tested and found to be clear of faults.**

There are **TWO** possible causes of this fault, one of which requires the use of a test instrument to locate the fault.

(a) The first possible cause of the fault does not require the use of a test instrument to locate the fault.

(i) State the type of fault that has occurred.

(1 mark)

(ii) State the action you would take to establish the cause of the fault.

(2 marks)

(iii) State the action taken to fix the fault.

(1 mark)

(turn over)

Question 5 continued

(b) The second possible cause of the fault requires the use of a test instrument to locate the fault.

(i) State the type of fault that has occurred.

(1 mark)

(ii) State the action you would take to establish the cause of the fault. Include in your answer:

- The type of test
- The type of test instrument used
- The test voltage
- The likely test result if a fault has occurred.

(4 marks)

(iii) State the action taken to fix the fault.

(1 mark)

(turn over)

Question 6

(a) A 230 V plug-in, Class I, 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 the insulation resistance test voltage that should be applied.
(1 mark)

Ref:

(ii) State the acceptable test result from the insulation resistance test.
(1 mark)

Ref:

(b) A 230 V plug-in, Class I, electrical appliance has MOV surge protection fitted. You have repaired the appliance **but you do not want to** carry out an insulation resistance test. Refer to AS/NZS 3760 and answer the following:

(i) State the type of test that can be carried out instead of an insulation resistance test.
(1 mark)

Ref:

(ii) State the acceptable test result from the test you have stated in (b)(i).
(1 mark)

Ref:

(turn over)

Question 6 continued

- (c) 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) _____

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

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

(1 mark)

- (ii) State the acceptable result for this test.

(1 mark)

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

(2 marks)

(turn over)

Question 7

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

- Two load resistors, one of 19 ohms and the other of 75.9 ohms.
- A two-position selector switch to connect the supply to either of the load resistors.
- A fuse.

(3 marks)

(b) Calculate the current flow in the circuit when the selector switch connects the supply to the 75.9 ohm resistor.

(2 marks)

(turn over)

Question 7 continued

- (c) Calculate the current flow in the circuit when the selector switch connects the supply to the 19 ohm resistor.

(2 marks)

- (d) Calculate the power dissipated in the circuit when the selector switch connects the supply to the 75.9 ohm resistor.

(2 marks)

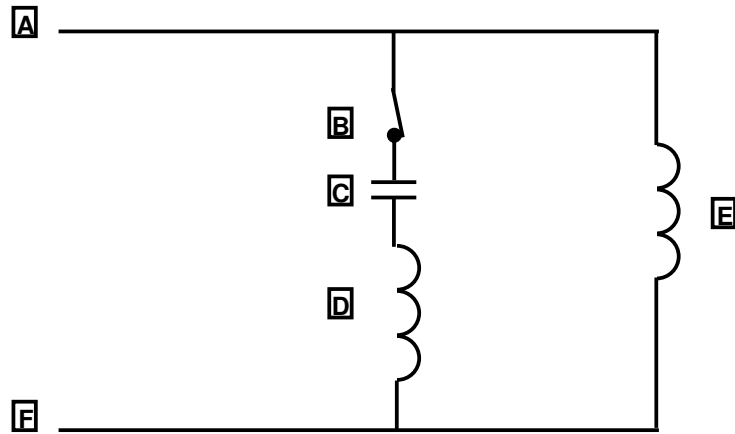
- (e) Will the power dissipated in the circuit when the selector switch connects the supply to the 19 ohm resistor be more or less than when connected to the 75.9 ohm resistor?

(1 mark)

(turn over)

Question 8

The following is an unlabelled circuit diagram of a 230V single-phase induction motor.



(a) Name the parts of the diagram

(3 marks)

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____

(b) How would you change the direction of rotation of this type of induction motor? Name the part or parts on which you would alter the connections.

(1 mark)

(turn over)

Question 8 continued

(c) What would be the affect on the performance of the motor if part "C" 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)

(d) What would be the affect on the performance of the motor if part "E" was open-circuited:

(i) And the motor was switched on whilst on no-load? (1 mark)

(ii) While the motor was running whilst on no-load? (3 marks)

(turn over)

Question 9

- (a) 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)

Ref:

- (b) Refer the Electricity Regulations and define the following terms:

- (i) Low voltage

(1 mark)

Ref:

- (ii) Direct contact

(1 mark)

Ref:

(turn over)

Question 9 continued

(iii) Isolated

(1 mark)

Ref:

(iv) Indirect contact

(1 mark)

Ref:

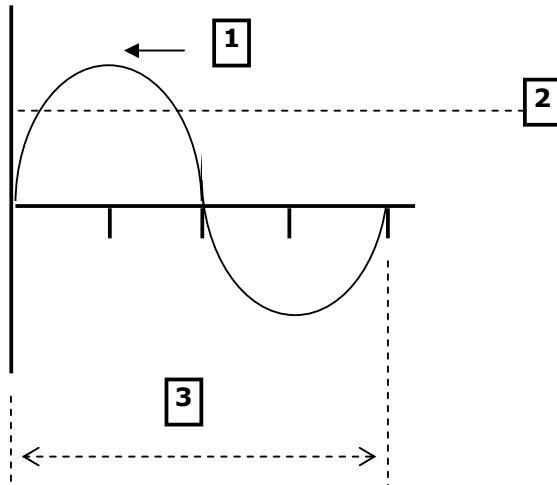
(c) The New Zealand single phase 230V a.c. supply operates at a frequency of 50 Hz. Briefly describe the meaning of the term Hz.

(1 mark)

(turn over)

Question 9 continued

- (d) The following diagram shows a wave form for single-phase standard low voltage in New Zealand.



- (i) Is it an a.c. voltage or d.c. voltage waveform?

(1 mark)

- (ii) Name the numbered items and state the value that applies to each item

(3 marks)

1. _____

2. _____

3. _____

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	
1		
2		
3		
4		
5		
6		
7		
8		
9		
TOTAL		