



Candidate Code No.	
For Board Use Only	
Result	Result
Date	Date
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ELECTRICAL WORKERS REGISTRATION BOARD TRADESPERSON ELECTRICAL WORK CERTIFICATE EXAMINATION

26 November 2005

PLUMBERS ***OR*** GASFITTERS QUESTION AND ANSWER BOOKLET

Time Allowed Two hours and 30 minutes

INSTRUCTIONS – READ CAREFULLY

You have 10 minutes to read this paper but do not start writing until you are told to do so by the supervisor.

Write your Candidate Code Number in the box provided above. Your name must NOT appear anywhere on this paper

The pass mark for this examination is 60 marks.

Plumbers must attempt all questions in Sections 1 and 2.

Gasfitters must attempt all questions in Sections 1 and 3.

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 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 or
The Electricity Regulations 1997 reprint dated 5 September 2005.
- AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1, 2, 3 and A); NZS 3019 (Int):2002 or NZS 3019:2004; AS/NZS 3760:2001 or AS/NZS 3760:2003.

PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM

(turn over)

SECTION 1 – ALL CANDIDATES

Question 1

(a) Draw circuit symbols illustrating:

(i) A single pole switch in the **off** position.

(1 mark)

(ii) A double pole switch in the **on** position.

(1 mark)

(b) State **ONE** reason why two electrical appliances should not be used from the same isolating transformer at the same time.

(2 marks)

(c) Repairs have been carried out on a fixed wired electrical appliance rated at 1500W, 230V. Calculate the current drawn by the appliance.

(2 marks)

(turn over)

Question 1 continued

- (d) A handheld electrical appliance used on a building or structure under construction must be used in conjunction with an appropriate safeguard. Refer to the Electricity Regulations and state **TWO** such safeguards.

(2 marks)

(1) _____

(2) _____

Ref:

- (e) List **TWO** examples of what could be an earthed situation.

(2 marks)

(1) _____

(2) _____

- (f) State the meaning of the term breaking capacity for fuses or circuit breakers.

(2 marks)

- (g) State **TWO** reasons why covers must be in place and secured before returning a repaired appliance to a customer.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 1 continued

(h) Draw circuit symbols illustrating:

(i) A single pole switch in the **on** position.

(1 mark)

(ii) A double pole switch in the **off** position.

(1 mark)

(i) State **TWO** ways of identifying a double insulated appliance.

(2 marks)

(1) _____

(2) _____

(j) Briefly describe the difference between the protection provided by a fusible link and the protection provided by a fuse.

(2 marks)

(turn over)

Question 2

(a) Each HRC cartridge fuse carries a label bearing information about its manufacture and operating characteristics. A new fuse carries the following information:

- 45 A.
- 415 V.
- AC 46.

Briefly describe the meaning of each of these items of information.

(3 marks)

45 A _____

415 V _____

AC 46 _____

(b) State **TWO** reasons why it is important to thread the fuse wire from terminal to terminal through the **tortuous path** in the fuse carrier when reloading a rewirable fuse.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 2 continued

- (c) Briefly state **THREE** 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.

(3 marks)

(1) _____

(2) _____

(3) _____

- (d) State **TWO** technical advantages which HRC fuses have over rewirable fuses.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 3

- (a) State **THREE** different characteristics an insulating material must possess to be suitable for use as insulation in a flexible cord.

(5 marks)

(1) _____

(2) _____

(3) _____

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

- (i) Explain the meaning of the term **current rating** as it applies to flexible cords

(2 marks)

- (ii) What could happen if the flexible cord was used to supply an electrical appliance that draws a current in excess of the cord's rating?

(3 marks)

- (c) Refer to the Electricity Regulations and briefly explain what the term **insulated** means.

(2 marks)

(turn over)

Question 4 continued

(b) Calculate the total power used by the resistors.

(2 marks)

(c) What size HRC fuse should be used to protect the circuit?

(1 mark)

(d) What is the reading on the voltmeter, with the circuit live?

(1 mark)

(turn over)

SECTION 2 - PLUMBERS ONLY

Question 5

(a) In a single phase double insulated electrical appliance:

(i) What is the minimum number of cores required in the flexible cord? (1 mark)

(ii) State the polarity and colour coding for the cores. (2 marks)

(b) When a three core flexible cord is fitted to an appliance, it is recommended that the protective earthing conductor (earth continuity conductor) should be left longer than the phase and neutral conductors.

(i) State the reason why this is recommended. (2 marks)

(ii) Explain how this recommendation contributes to electrical safety. (2 marks)

(turn over)

Question 5 continued

- (c) A flexible cord is to be fitted to a single phase electrical appliance. List **THREE** considerations which may influence the selection of the cord.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 6

Note: Read the entire question, including parts (a), (b) and (c), before answering.

A single-phase electric hot water cylinder in a small factory is to be replaced with a new cylinder by a plumber. The wiring between the cylinder and isolating switch is also to be replaced. The cylinder is supplied from a fuse on a three-phase switchboard and the isolating switch is located adjacent to the cylinder.

You have been requested by the Supervisor to:

- Disconnect the element and control thermostat and wiring between the isolator and cylinder.
- Ensure that an electrician can safely connect the new cylinder wiring.

You do not need to contact the Supervisor before starting the work.

Warning: If any part of your answer is dangerous or hazardous, you will get no marks for this question.

(a) Describe how you would safely **isolate** the hot water cylinder.

(5 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(turn over)

Question 6 continued

(b) Describe the work the Supervisor requested you to do.

(2 marks)

(1) _____

(2) _____

(c) Describe what you would do to leave the site safe.

(3 marks)

(1) _____

(2) _____

(turn over)

Question 7

(a) A plumber is requested to replace an existing 1500W, 230V element in storage water heater with a new 3000W, 230V element to reduce the recovery time. The permanent connection unit supplying the storage water heater is rated at 230V, 10A.

(i) Determine, by calculation, if the permanent connection unit has an adequate current rating to supply the 3000 watt element.

(3 marks)

(ii) State **TWO** other considerations that the plumber needs to consider before installing the new 3000 watt element?

(2 marks)

(1) _____

(2) _____

(iii) Who is responsible for checking and testing of the storage water heater for electrical safety when a replacement element is fitted?

(1 mark)

(turn over)

Question 7 continued

- (b) A 230V a.c. fixed wired appliance supplied via a junction box has been disconnected to permit mechanical repairs. The appliance conductor colours are brown, blue, and yellow/green. Complete the chart to show the correct colour sequence for reconnection to the fixed wiring conductors.

(2 marks)

Fixed Wiring Colours	Polarity	Appliance Conductor Colours
	Phase	
Black	Neutral	
Green	Earth	

- (c) State **TWO** reasons why it is not permitted to complete a permanent isolation of a circuit by only removing the carrier of a fuse.

(2 marks)

- (1) _____

- (2) _____

(turn over)

Question 8

- (a) A domestic storage water heater is supplied via a TPS cable, surface mounted isolating switch and PVC conduit wire enclosed in flexible steel conduit. Describe **THREE** different situations where either live terminals or basic insulation could be exposed to touch.

(3 marks)

(1) _____

(2) _____

(3) _____

- (b) Give **TWO** reasons why the flexible cord used to supply a domestic storage water heater must be securely clamped.

(2 marks)

(1) _____

(2) _____

- (c) A Class I, single phase plug-in electrical appliance has been repaired. There is a single pole control switch on the appliance and the repairer has mistakenly connected the neutral through this switch.

- (i) State the undesirable effect the switching of the neutral will have on the appliance.

(1 mark)

- (ii) Describe **TWO** situations (other than connecting the neutral to the switch as stated above) where an error can cause the neutral to be switched.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 8 continued

- (d) A switch adjacent to single-phase, fixed-wired appliance has been turned off. It is found, when testing for isolation, that some terminals on the appliance are still alive. State **TWO** reasons why the terminals are live.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 9

(a) A protective earthing conductor resistance test is being carried out on the exposed metal parts of an electrical appliance with a multimeter. State:

(i) Why it is necessary to select the appropriate ohms range?

(1 mark)

(ii) Why it is necessary to first touch the meter probes together?

(2 marks)

(iii) What may occur if an incorrect range is selected on the multimeter?

(2 marks)

(b) A multimeter has been connected in parallel with an electric heating element to measure the single phase supply voltage. The multimeter has accidentally been left on the 10A a.c. range. Describe what will happen, and why, when the power is switched on.

(3 marks)

(turn over)

Question 9 continued

- (c) State why an ohmmeter or a multimeter is unsuitable to carry out an insulation resistance test on a 230V water heater.

(2 marks)

(1) _____

(2) _____

Section 3 – Gasfitters Only

Question 10

- (a) Metallic gas reticulation pipes are required to be bonded (joined) electrically to other metallic pipe services such as water pipes. Explain why this bonding is necessary. (3 marks)

- (b) A gas appliance is being installed in a factory that has a concrete floor and a structure of steel supports and cross beams. Refer to AS/NZS 3000 and state **TWO** reasons why this environment is considered to be an **earthed situation**. (2 marks)

(1) _____

(2) _____

Ref:

(turn over)

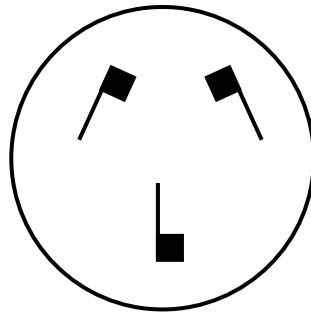
Question 10 continued

- (c) Explain why the earth pin of a standard New Zealand 3 pin 10 amp plug is longer than the phase and neutral pins.

(2 marks)

- (d) The figure below represents the rear of an appliance plug after the cover has been removed. Indicate on the figure the active (phase), neutral and earth terminals.

(3 marks)



(turn over)

Question 11

- (a) A domestic storage water heater is supplied via a TPS cable, surface mounted isolating switch and PVC conduit wire enclosed in flexible steel conduit. Describe **THREE** different situations where either live terminals or basic insulation could be exposed to touch.

(3 marks)

(1) _____

(2) _____

(3) _____

- (b) Give **TWO** reasons why the flexible cord used to supply a domestic storage water heater must be securely clamped.

(2 marks)

(1) _____

(2) _____

- (c) A Class I, single phase plug-in electrical appliance has been repaired. There is a single pole control switch on the appliance and the repairer has mistakenly connected the neutral through this switch.

- (i) State the undesirable effect the switching of the neutral will have on the appliance.

(1 mark)

- (ii) Describe **TWO** situations (other than connecting the neutral to the switch as stated above) where an error can cause the neutral to be switched.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 11 continued

- (d) A switch adjacent to single-phase, fixed-wired appliance has been turned off. It is found, when testing for isolation, that some terminals on the appliance are still alive. State **TWO** reasons why the terminals are live.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 12

(a) A protective earthing conductor resistance test is being carried out on the exposed metal parts of an electrical appliance with a multimeter. State:

(i) Why it is necessary to select the appropriate ohms range? (1 mark)

(ii) Why it is necessary to first touch the meter probes together? (2 marks)

(iii) What may occur if an incorrect range is selected on the multimeter? (2 marks)

(b) A multimeter has been connected in parallel with an electric heating element to measure the single phase supply voltage. The multimeter has accidentally been left on the 10A a.c. range. Describe what will happen, and why, when the power is switched on. (3 marks)

(turn over)

Question 12 continued

- (c) State why an ohmmeter or a multimeter is unsuitable to carry out an insulation resistance test on a 230V water heater.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 13

Note: Read the entire question, including parts (a), (b) and (c), before answering.

A single-phase electric hot water cylinder in a small factory is to be replaced with a new cylinder by a plumber. The wiring between the cylinder and isolating switch is also to be replaced. The cylinder is supplied from a fuse on a three-phase switchboard and the isolating switch is located adjacent to the cylinder.

You have been requested by the Supervisor to:

- Disconnect the element and control thermostat and wiring between the isolator and cylinder.
- Ensure that an electrician can safely connect the new cylinder wiring.

You do not need to contact the Supervisor before starting the work.

Warning: If any part of your answer is dangerous or hazardous, you will get no marks for this question.

(a) Describe how you would safely **isolate** the hot water cylinder.

(5 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(turn over)

Question 13 continued

(b) Describe the work the Supervisor requested you to do.

(2 marks)

(1) _____

(2) _____

(c) Describe what you would do to leave the site safe.

(3 marks)

(1) _____

(2) _____

(turn over)

Question 14

- (a) A new fuse needs to be inserted into a fuse carrier to replace a blown fuse on a switchboard. Briefly explain the **TWO** main safety reasons why the main switch should be turned off before removing the fuse carrier from, or replacing it into, the fuse base.

(2 marks)

(1) _____

(2) _____

- (b) Circuit protection at a switchboard may be by means of fuses. When it is not practical to turn off the switch that supplies the fuses, what precautions should be taken before and during the replacement of a fuse carrier in its fuse base?

(3 marks)

(turn over)

Question 14 continued

- (c) The **prove-test-prove** method is recommended for checking that isolation has been achieved. Explain how this test is carried out.

(5 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		
<u>Total Section 1</u>		
5		
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<u>Total section 2</u>		
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14		
<u>Total section 3</u>		
TOTAL SECTIONS 1 & 2		
OR		
TOTAL SECTIONS 1 & 3		