

B O A R D O F S T U D I E S
NEW SOUTH WALES

2010

**HIGHER SCHOOL CERTIFICATE
EXAMINATION**

Electrotechnology

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black or blue pen
- Board-approved calculators may be used
- Write your Centre Number and Student Number at the top of pages 9, 11, 13 and 15

Total marks – 80

Section I Pages 2–5

15 marks

- Attempt Questions 1–15
- Allow about 20 minutes for this section

Section II Pages 9–15

35 marks

- Attempt Questions 16–20
- Allow about 50 minutes for this section

Section III Page 17

15 marks

- Attempt Question 21
- Allow about 25 minutes for this section

Section IV Page 18

15 marks

- Attempt Question 22
- Allow about 25 minutes for this section

Section I

15 marks

Attempt Questions 1–15

Allow about 20 minutes for this section

Use the multiple-choice answer sheet for Questions 1–15.

- 1** Which document should be read by everyone who uses chemicals in the workplace?

 - (A) Materials Safety Data Sheet
 - (B) Standard Operating Procedures
 - (C) Employee Induction Workbook
 - (D) Manufacturer Safety Description Sheet

- 2** What is the best type of drilling tool to use when drilling a 25 mm hole in timber framing?

 - (A) Bradawl
 - (B) Hole saw
 - (C) Spade bit
 - (D) Twist

- 3** How should the load be connected when measuring the voltage across it?

 - (A) In series with a voltmeter
 - (B) In series with an ammeter
 - (C) In parallel with a voltmeter
 - (D) In parallel with an ammeter

- 4** What type of wall construction is most suited to using a hollow wall anchor?

 - (A) Gyprock
 - (B) Masonry
 - (C) Steel
 - (D) Timber

- 5 A chemical reaction occurs when current flows through
- (A) a solid conductor.
 - (B) an electrolyte.
 - (C) an inductor.
 - (D) a capacitor.
- 6 What makes an electrical motor rotate?
- (A) The load driving it
 - (B) The applied voltage
 - (C) The magnetic effect of the current
 - (D) The chemical effect of the current
- 7 Which type of fire extinguisher should be used on an electrical fire?
- (A) Foam
 - (B) Water
 - (C) Wet Chemical
 - (D) Carbon Dioxide
- 8 What is the most accurate type of caliper to measure the internal diameter of a conduit?
- (A) Inside
 - (B) Jenny
 - (C) Outside
 - (D) Vernier
- 9 How is power defined?
- (A) The rate at which the resistance of a resistor changes
 - (B) The rate at which a quantity of electricity is produced
 - (C) The rate at which current changes
 - (D) The rate of doing work

10 Which effect of an electrical current will cause a fuse to blow?

- (A) Chemical
- (B) Heat
- (C) Magnetic
- (D) Physiological

11 The supply current in a parallel circuit is equal to the

- (A) sum of the branch currents.
- (B) ratio of the branch currents.
- (C) total power times the supply voltage.
- (D) supply voltage divided by the resistance of any one branch.

12 Three $30\mu\text{F}$ capacitors are connected in series.

What is the total capacitance?

- (A) $10\mu\text{F}$
- (B) $30\mu\text{F}$
- (C) $60\mu\text{F}$
- (D) $90\mu\text{F}$

13 Five lamps are connected in parallel to a supply.

What happens if lamp 3 becomes open circuit?

- (A) No lamps will be lit.
- (B) All lamps except 3 will be lit.
- (C) Lamps 1, 2 and 5 will be lit.
- (D) Lamps 4 and 5 will be lit.

- 14** What must be reduced to increase the efficiency of an electrical system?
- (A) The input to the system
 - (B) The losses of the system
 - (C) The output from the system
 - (D) The amount of time the system operates
- 15** As the temperature surrounding a positive temperature coefficient (PTC) thermistor rises within its targeted range, the current in the circuit will
- (A) remain constant.
 - (B) cease flowing.
 - (C) decrease.
 - (D) increase.

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Centre Number

Section II

35 marks

Attempt Questions 16–20

Allow about 50 minutes for this section

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Student Number

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

Question 16 (7 marks)

- (a) What are TWO features of sustainable power generation that distinguish it from other methods of power generation? 2

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Question 16 continues on page 10

Question 16 (continued)

Photovoltaic (PV) cells convert light from the sun directly into electricity. The photovoltaic process occurs when radiant energy strikes the join between certain materials to produce a small voltage.

- (b) Excluding PV cells, list THREE other sustainable methods of producing electricity.
- (i) 1
 - (ii) 1
 - (iii) 1
- (c) From the three methods you have listed in part (b), briefly explain ONE of the methods for sustainably producing electricity. 2

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2010 HIGHER SCHOOL CERTIFICATE EXAMINATION

Electrotechnology

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Centre Number

Section II (continued)

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Student Number

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Question 17 (8 marks)

Figures 1 and 2 represent 3 cell batteries.

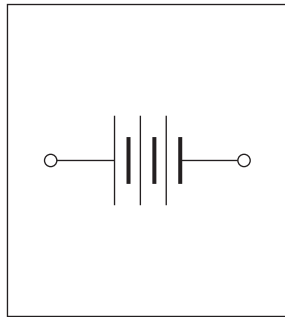


Figure 1

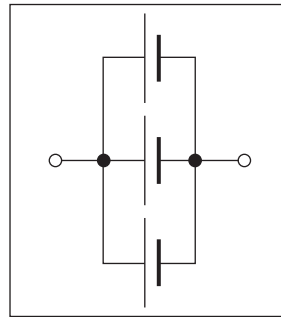


Figure 2

- (a) (i) Identify the type of connection of cells in Figure 1. 1

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- (ii) What is the effect on output voltage and current of connecting cells as shown in Figure 1? 2

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- (iii) The output voltage of each cell is 2 volts. 1

What is the output voltage of Figure 1 if one cell becomes open circuit?

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- (b) (i) Identify the type of connection of cells in Figure 2. 1

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- (ii) What is the effect on output voltage and current of connecting cells as shown in Figure 2? 2

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- (iii) The output voltage of each cell is 2 volts. 1

What is the output voltage of Figure 2 if one cell becomes open circuit?

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End of Question 17

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Centre Number

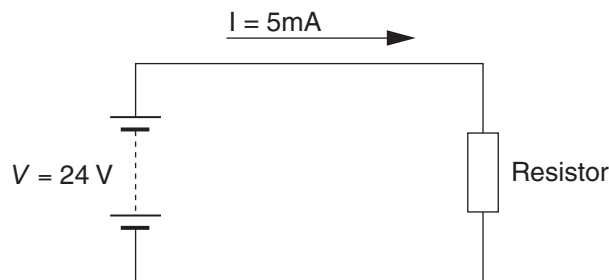
Section II (continued)

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Student Number

Question 18 (6 marks)

An electrical circuit is shown.



- (a) Calculate the power consumed by the resistor. Show all working. 2

Answer:

- (b) If the circuit supply voltage is doubled from 24Vdc to 48Vdc, what effect will this have on the current and power values in the circuit? 4

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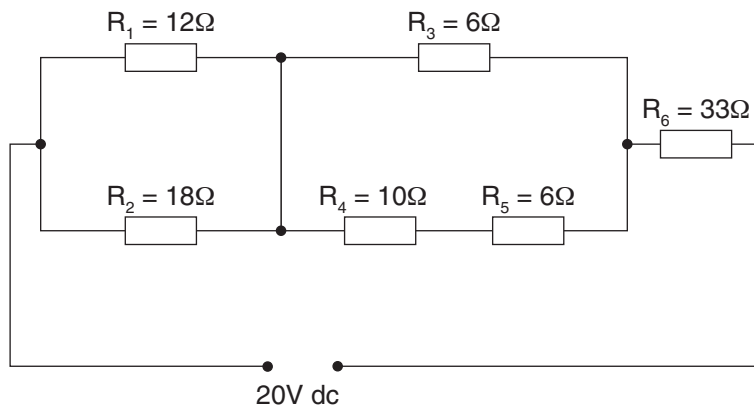
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Question 19 (6 marks)

An electrical circuit is shown.



- (a) Calculate the equivalent resistance of the circuit. Show all working.

4

Answer:

- (b) Calculate the circuit current if resistors R_2 and R_3 become open circuit. Show all working.

2

Answer:

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Centre Number

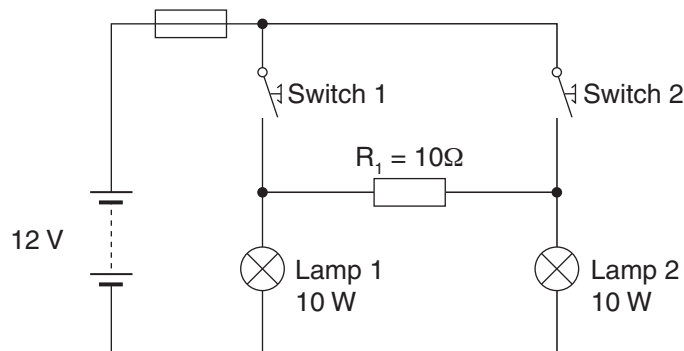
Section II (continued)

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Student Number

Question 20 (8 marks)

An electrical circuit is shown.



- (a) Describe what will happen if Switch 1 and Switch 2 are closed. 3

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- (b) Describe what will happen if Switch 1 is closed and Switch 2 is open. 3

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- (c) Switch 1 and Switch 2 are closed.
- (i) What current would flow through R_1 ? 1

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- (ii) What would the voltage be across R_1 ? 1

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Electrotechnology

Section III

15 marks

Attempt Question 21

Allow about 25 minutes for this section

Answer the question in a writing booklet. Extra writing booklets are available.

In your answer you will be assessed on how well you:

- demonstrate knowledge and understanding relevant to the question
 - communicate ideas and information using relevant workplace examples and industry terminology
 - present a logical and cohesive response
-

Question 21 (15 marks)

A 17 kg hand dryer with a blower fan has been installed in a restaurant washroom. The restaurant manager has requested that the hand dryer be relocated within the same washroom facility. It is attached to a masonry wall and is supplied by a 15 ampere socket outlet which does not need to be relocated and will continue to supply power to the dryer.

Provide a detailed explanation of the process that should be used to relocate this appliance. In your response, refer to customer service and safe working methods of fixing and securing the hand dryer.

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Section IV

15 marks

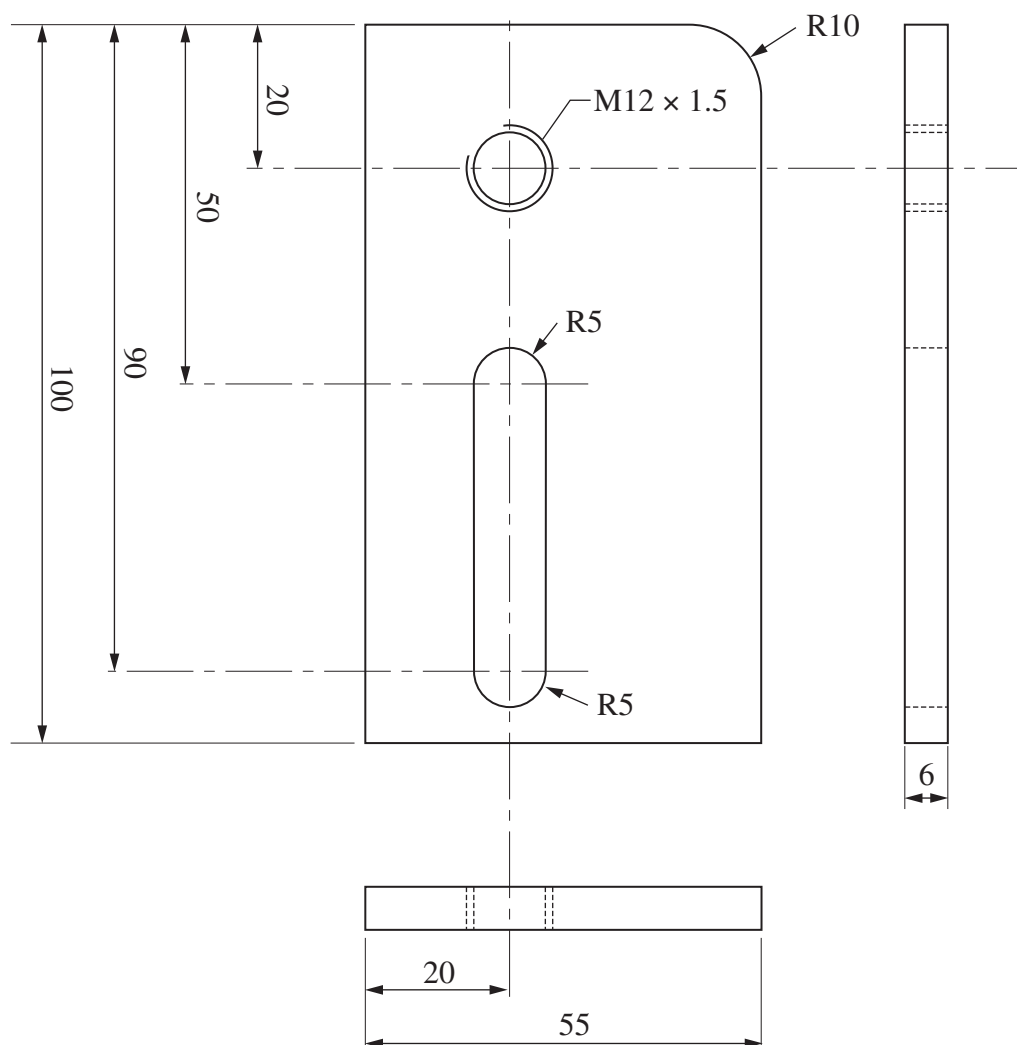
Attempt Question 22

Allow about 25 minutes for this section

Answer the question in a SEPARATE writing booklet. Extra writing booklets are available.

Question 22 (15 marks)

The bracket shown is to be manufactured in the workshop from mild steel stock sized $300 \times 55 \times 6$ mm.



- (a) Produce a risk assessment for the process of manufacturing this bracket. 5
- (b) Produce a job diary entry identifying the tools, processes and equipment required to complete this task. 10

End of paper

- 18 -