BOARD OF STUDIES
NEW SOUTH WALES

2013

HIGHER SCHOOL CERTIFICATE EXAMINATION

Electrotechnology

General Instructions

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

Total marks – 80

Section I Pages 2–6

15 marks

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

Section II Pages 9–14

35 marks

- Attempt Questions 16–19
- Allow about 50 minutes for this section

Section III Page 15

15 marks

- Attempt Question 20
- Allow about 25 minutes for this section

Section IV Page 16

15 marks

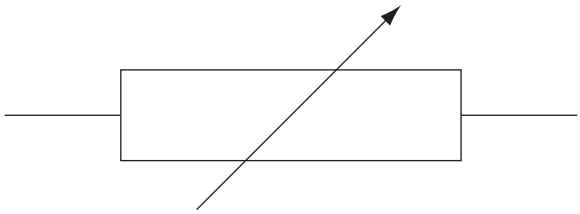
- Attempt Question 21
- Allow about 25 minutes for this section

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



What component does the circuit symbol shown represent?

(A) Diode

(B) Variable resistor

(C) Integrated circuit

(D) Variable capacitor

2 An employee sees a damaged electrical socket at a work site.

What is the first thing that the employee should do?

(A) Inform a workmate

(B) Affix a handwritten label

(C) Attempt to repair it

(D) Isolate, lock out and safety tag

3 What must be done before using a new chemical on a work site?

(A) Consult the material safety data sheet (MSDS).

(B) Use personal protective equipment (PPE).

(C) Locate a chemical spill kit, in case of an accident.

(D) Ask a workmate how it should be used.

4 An electrical appliance is connected to a 230 volt AC power source. It draws a current of 5 amps.

What is the power consumption of this appliance?

(A) 960 watts

(B) 1150 watts

(C) 2300 watts

(D) 4600 watts

5 What is the purpose of connecting solar panels electrically in parallel?

(A) To decrease the voltage

(B) To decrease the current

(C) To increase the voltage

(D) To increase the current

6 A drum of cable weighing 40 kg needs to be lifted into the rear of a truck.

What is the safest way to do this?

(A) Use a hoist

(B) Roll the drum up a ramp

(C) Call another employee for assistance

(D) Keep a straight back, bending the knees

7 A resistor colour code chart is shown.

Colour	*Value*	*Multiplying factor*	*Tolerance*
Black	0	1	–
Brown	1	10	1%
Red	2	100	2%
Orange	3	1 000	–
Yellow	4	10 000	–
Green	5	100 000	0.5%
Blue	6	1 000 000	0.25%
Violet	7	–	0.1%
Grey	8	–	–
White	9	–	–
Gold	–	0.1	5%
Silver	–	0.01	10%

A four-band resistor has the colour code of brown-black-green-gold.

What is the resistance value of this resistor?

(A) 100 Ω

(B) 106 Ω

(C) 10 kΩ

(D) 1 MΩ

8 Which of the following would be the most effective insulator when using low voltage?

(A) Aluminium

(B) Brass

(C) Glass

(D) Saline water

9 Material is required to fill an excavation hole which measures 2 m long, 1.5 m wide and 0.5 m deep.

How much material is required?

(A) 1.5 m^3

(B) 2.5 m^3

(C) 3.5 m^3

(D) 4.5 m^3

10 Which of the following is equivalent to one microfarad?

(A) 1×10^6 farad

(B) 1×10^3 farad

(C) 1×10^{-3} farad

(D) 1×10^{-6} farad

11 A circuit has three resistors of equal value connected in parallel. If one of these resistors becomes open circuit, the circuit current will

(A) decrease.

(B) increase.

(C) become zero.

(D) remain the same.

12 The cross-sectional area of a conductor is doubled. As a result, the current-carrying capacity

(A) is halved.

(B) is doubled.

(C) falls to zero.

(D) remains the same.

13 What will be the total voltage if four AA batteries are connected in series?

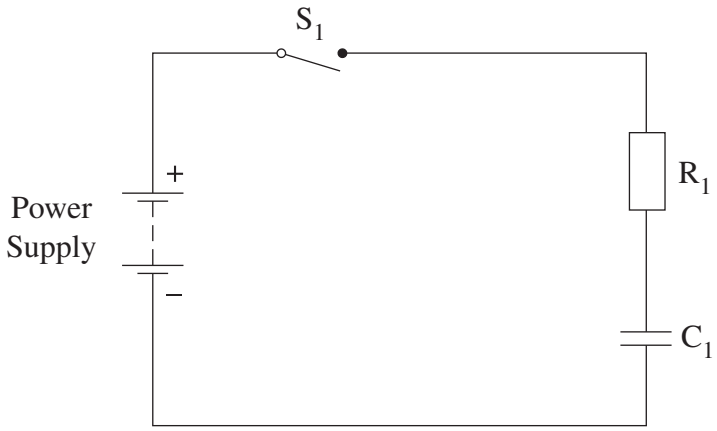
(A) 2

(B) 4

(C) 6

(D) 8

14



What is the function of the capacitor in the circuit shown?

(A) To filter unwanted frequencies

(B) To build up an electrostatic charge

(C) To guard against voltage fluctuation

(D) To deliver instantaneous high voltage

15 An electronic device has a standby current of 500 mA. When in full operation, it uses 1.5 A.

What is the most suitable fuse to protect this device?

(A) 500 mA

(B) 1 A

(C) 1.5 A

(D) 2 A

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Electrotechnology

Centre Number

Section II

Student Number

35 marks
Attempt Questions 16–19
Allow about 50 minutes for this section

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

Question 16 (8 marks)

(a) Identify an appropriate fastener to join two pieces of 1.6 mm sheet metal, and justify this selection. **4**

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(b) Outline the pre-operational checks and personal protective equipment (PPE) required before using an angle grinder to cut 1.6 mm sheet metal. **4**

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Question 17 (8 marks)

(a) Describe good housekeeping practices that contribute to workplace health and safety in a workshop. **4**

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(b) Explain safety measures that should be taken to reduce the risks associated with working in a ceiling cavity. **4**

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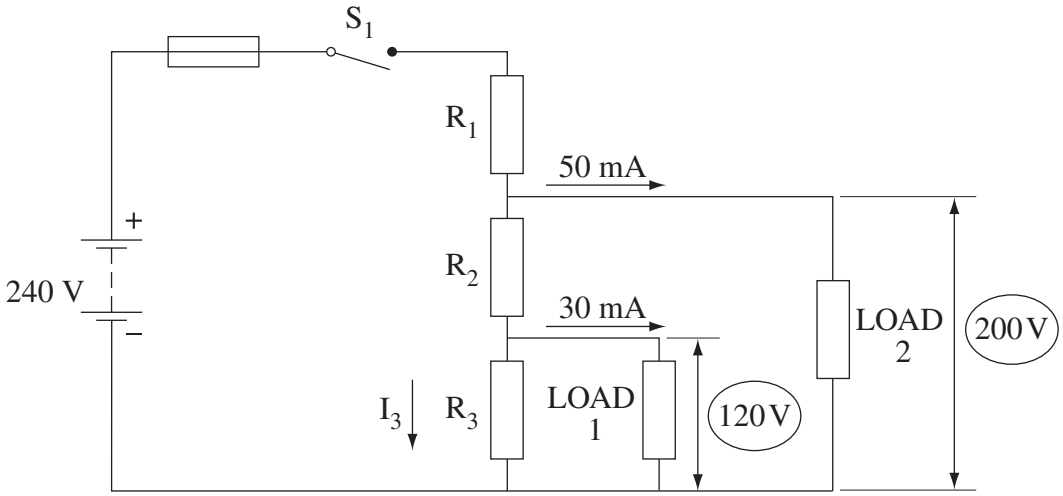
Question 18 (8 marks)

A circuit is shown.



Load 1: 120 V at 30 mA
Load 2: 200 V at 50 mA
I_3 is 10% of total current of load 1 and load 2.

In parts (a)–(d), show all relevant working.

(a) Calculate the total circuit current. **3**

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Question 18 continues on page 12

(b) Calculate the voltage drop across R_1. **1**

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(c) Calculate the resistance of R_2. **2**

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(d) Calculate the resistance of R_3. **2**

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End of Question 18

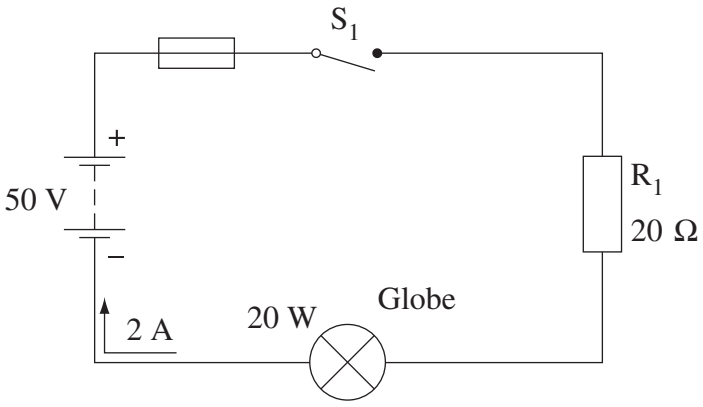
Centre Number

Section II (continued)

Student Number

Question 19 (11 marks)

A circuit is shown.



In parts (a) and (b), show all relevant working.

(a) (i) Calculate the total resistance of the circuit. **3**

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Question 19 continues on page 14

Question 19 (continued)

(ii) Calculate the voltage drop across R_1. **3**

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(b) The circuit is altered by adding a 100 mΩ resistor connected in parallel with the globe.

(i) Calculate the new circuit current. **4**

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(ii) What effect will this have on the globe? **1**

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End of Question 19

Section III

15 marks
Attempt Question 20
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 20 (15 marks)

An underground cable is to be installed to replace an existing overhead supply. It will run under a two-lane driveway that is in use 24 hours a day.

Explain the planning and preparation needed to ensure the successful completion of this project, considering work, health and safety issues and electrical requirements.

Please turn over

Section IV

15 marks
Attempt Question 21
Allow about 25 minutes for this section

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

Question 21 (15 marks)

A workgroup has been given the task of replacing a faulty mains isolator in an electrical sub-board.

(a) Explain the safe work practices that should be followed to perform this task. **5**

(b) After repairs have been completed, the sub-board is re-energised. However, a colleague touches the frame of the switchboard and receives an electric shock. Soon afterwards, a small fire starts inside the board.

Explain the sequence of actions that should now be taken. **10**

End of paper