

Electrotechnology

General Instructions

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

Total marks: **80**

Section I – 15 marks (pages 2–6)

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

Section II – 35 marks (pages 9–17)

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

Section III – 15 marks (pages 19–20)

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

Section IV – 15 marks (page 21)

- 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 What is the most suitable equipment to use when replacing multiple light fittings in a factory with a ceiling height of between 4 metres and 5 metres?
- A. Fork lift
 - B. Scissor lift
 - C. Fibreglass A-frame ladder
 - D. Aluminium extension ladder

- 2 What is the name of the tool shown?



- A. Pipe cutter
 - B. Cable shear
 - C. Ratchet shear
 - D. Conduit cutter
- 3 Which tool is the best to use when roughing in TPS cable in a timber frame wall?
- A. Hole saw
 - B. Spade bit
 - C. Tenon saw
 - D. Diamond tip bit

- 4 Which unit is used when measuring the capacity of a rechargeable AA battery?
- A. mAh
 - B. mVA
 - C. mW
 - D. mWH
- 5 Which of the following is a potential cause of psychological stress in the workplace?
- A. Commuting
 - B. Harassment
 - C. Heavy lifting
 - D. Exposure to sunlight
- 6 Which of the following is a non-renewable source of energy?
- A. Biomass
 - B. Geothermal
 - C. Nuclear
 - D. Tidal
- 7 A residual current device (RCD) is primarily designed to protect
- A. people.
 - B. appliances.
 - C. electrical cables.
 - D. the power supply.
- 8 Who issues a NSW electrical licence?
- A. Service NSW
 - B. NSW Fair Trading
 - C. Training Services NSW
 - D. SafeWork NSW (formerly WorkCover)

- 9 Three $30\ \Omega$ resistors are connected in parallel with each other.

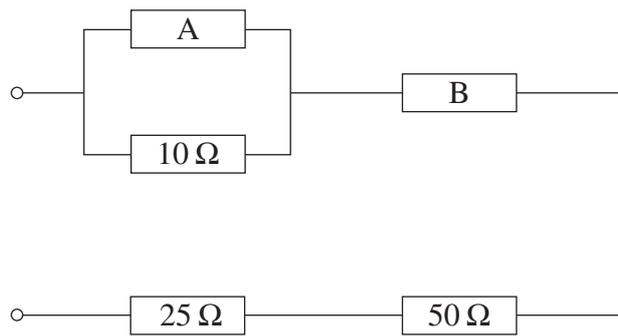
Which action would create a circuit resistance of $30\ \Omega$?

- A. Add $30\ \Omega$ in parallel
 - B. Add $60\ \Omega$ in parallel
 - C. Remove one $30\ \Omega$ resistor
 - D. Remove two $30\ \Omega$ resistors
- 10 What reading would be displayed on a meter that is used to measure potential difference across a closed switch in a live circuit?
- A. Zero volts
 - B. Zero ohms
 - C. Infinite ohms
 - D. Power supply voltage
- 11 Recent technological developments mean that smaller-sized batteries with higher output capacity can be installed in domestic dwellings to store energy.

Which type of battery makes the best use of limited space in this situation?

- A. LiO (lithium ion)
- B. SLA (sealed lead acid)
- C. NiCad (nickel cadmium)
- D. NiMH (nickel metal hydride)

- 12 The diagram shows a series-parallel circuit.



If 10 Ω and 20 Ω resistors are available for components A and B, which combination would give a total circuit resistance of 100 Ω?

	A	B
A.	10 Ω	10 Ω
B.	20 Ω	10 Ω
C.	10 Ω	20 Ω
D.	20 Ω	20 Ω

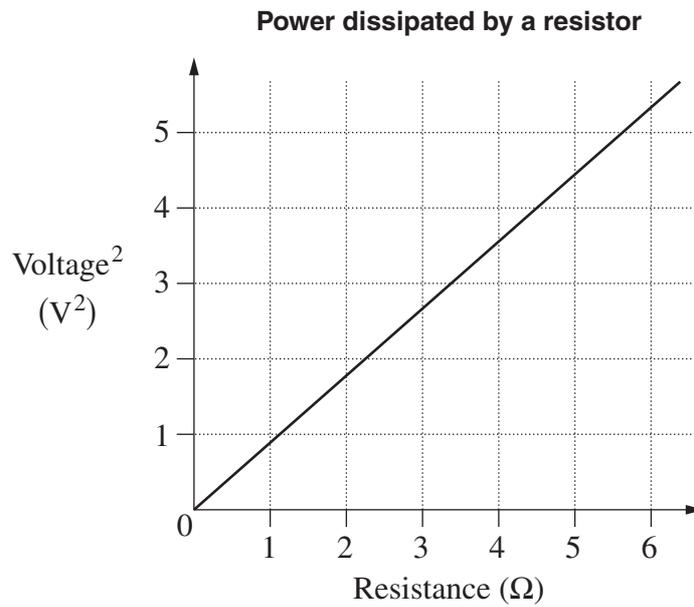
- 13 Which conductor is terminated in the 'loop' connection in a batten holder?

- A. Earth
- B. Neutral
- C. Switched active
- D. Permanent active

- 14 Which equation is used to calculate the energy stored in a capacitor?

- A. $W = CV$
- B. $W = \frac{1}{4}CV^2$
- C. $W = \frac{1}{2}CV^2$
- D. $W = CV^2$

15 Refer to the graph.



If the resistance of a conductor is 4.5Ω , what is the applied voltage?

- A. 0.5 V
- B. 1 V
- C. 2 V
- D. 4 V

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Section II

35 marks

Attempt Questions 16–20

Allow about 50 minutes for this section

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

Show all relevant working in questions involving calculations.

Question 16 (5 marks)

- (a) Outline ONE advantage of each of the following when joining or terminating conductors. 2

Soft soldering
Screw terminal

- (b) Describe the safety issues to consider when soldering using resin core solder. 3

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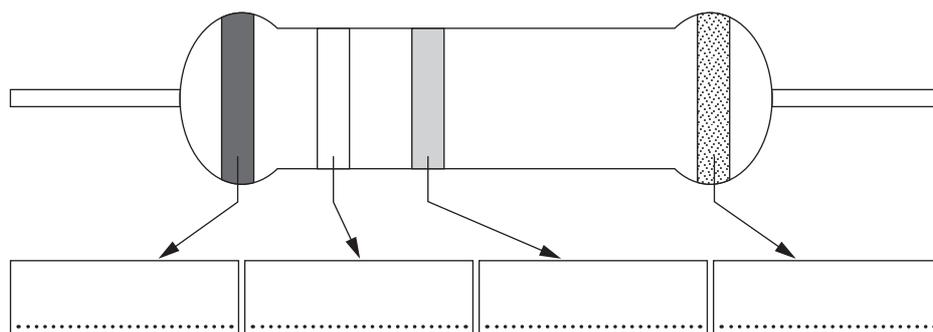
Question 17 (8 marks)

(a) A resistor colour code chart is shown.

<i>Colour</i>	<i>Value</i>	<i>Multiplying factor</i>	<i>Tolerance</i>
Black	0	1	–
Brown	1	10	1%
Red	2	100	2%
Orange	3	1000	–
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%

Determine the colour code of the $1.2 \text{ M}\Omega \pm 5\%$ resistor shown below, writing the colour of each band in the corresponding box.

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Question 17 continues on page 11

Question 17 (continued)

- (b) List the factors that affect the resistance of a conductor. **3**

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- (c) Determine the maximum and minimum values of a $470\ \mu\text{F} \pm 15\%$ capacitor. **2**

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End of Question 17

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Section II (continued)

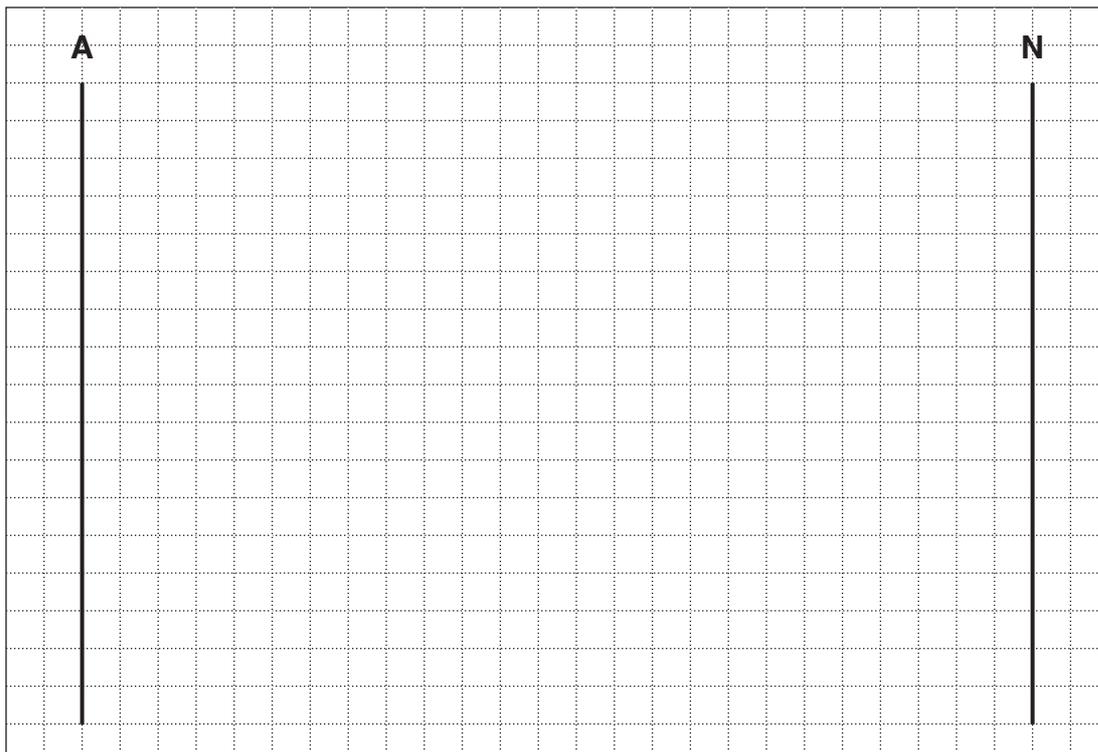
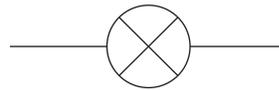
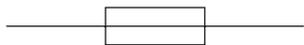
Question 18 (4 marks)

A circuit consists of:

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- ONE lamp (L_1) controlled by two-way switching
- TWO lamps (L_2) and (L_3) controlled by one-way switching
- ONE fuse for protection of the entire circuit.

Complete a ladder diagram using the symbols provided. Each symbol may be used more than once.



Question 19 (5 marks)

An electrician is purchasing FOUR different battery-powered tools for their apprentice.

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Outline the key features to consider when choosing each tool.

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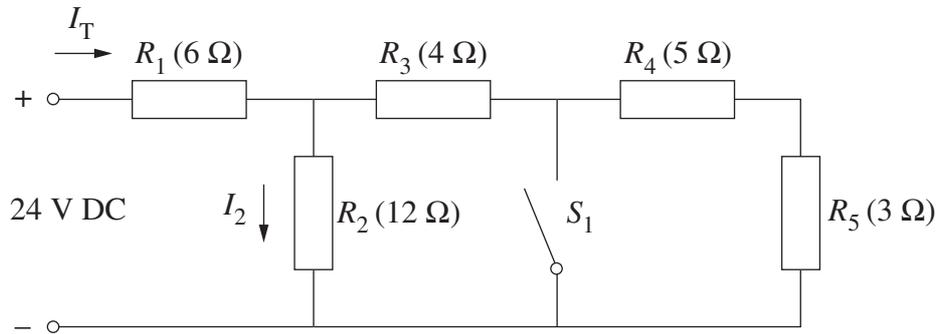
Section II (continued)

Question 20 (13 marks)

Please turn over

Question 20 (13 marks)

Use the diagram to answer parts (a)–(e).



- (a) Explain what happens to current flow through resistors R_4 and R_5 when switch S_1 is closed. **2**

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- (b) Calculate the value of total circuit resistance with S_1 open. **2**

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- (c) Calculate the value of the current through resistor R_2 with S_1 open. **3**

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Question 20 continues on page 17

Question 20 (continued)

- (d) Calculate the voltage drop across R_3 with S_1 closed. **3**

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- (e) Calculate the total power dissipated by the whole circuit with S_1 closed. **3**

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End of Question 20

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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.

Your answer 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
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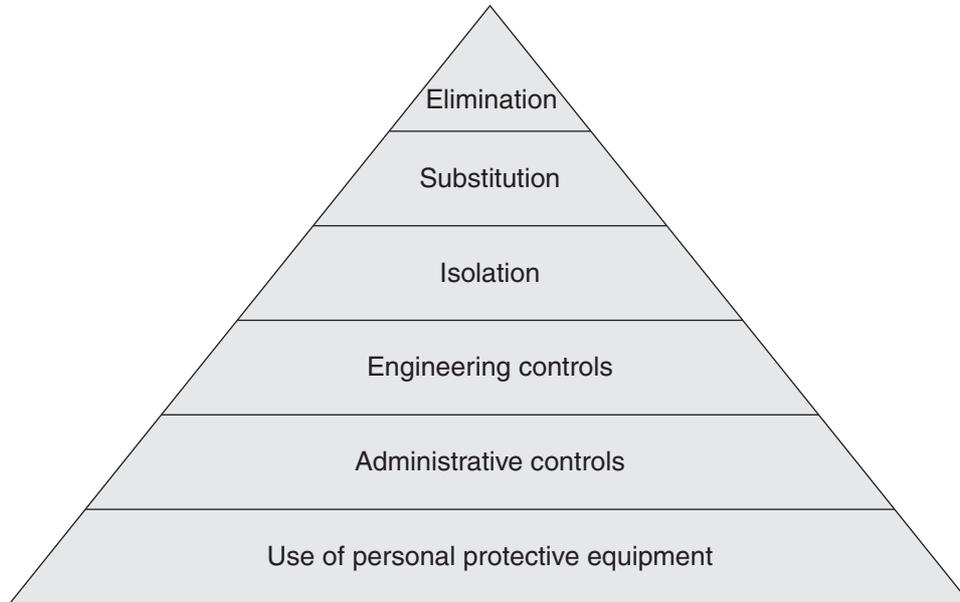
Question 21 (15 marks)

Please turn over

Question 21 (15 marks)

SafeWork NSW (formerly WorkCover) statistics state that between 2003 and 2014 electricians had the highest number of fatalities and the third highest number of injuries in the construction industry.

Explain how work carried out in the electrotechnology industry can be made safer. In your response, refer to how the aids below can be used in specific workplace examples.



		Likelihood			
		Very Likely May happen any time	Likely May happen some time	Unlikely May happen	Very Unlikely May happen, but probably never will
Consequences	Catastrophic Kill or cause permanent disability or death	1	1	2	3
	Major Long term illness or serious injury	1	2	3	4
	Moderate Medical attention and several days off work	2	3	4	5
	Minimal First aid needed	3	4	5	6

Section IV

15 marks

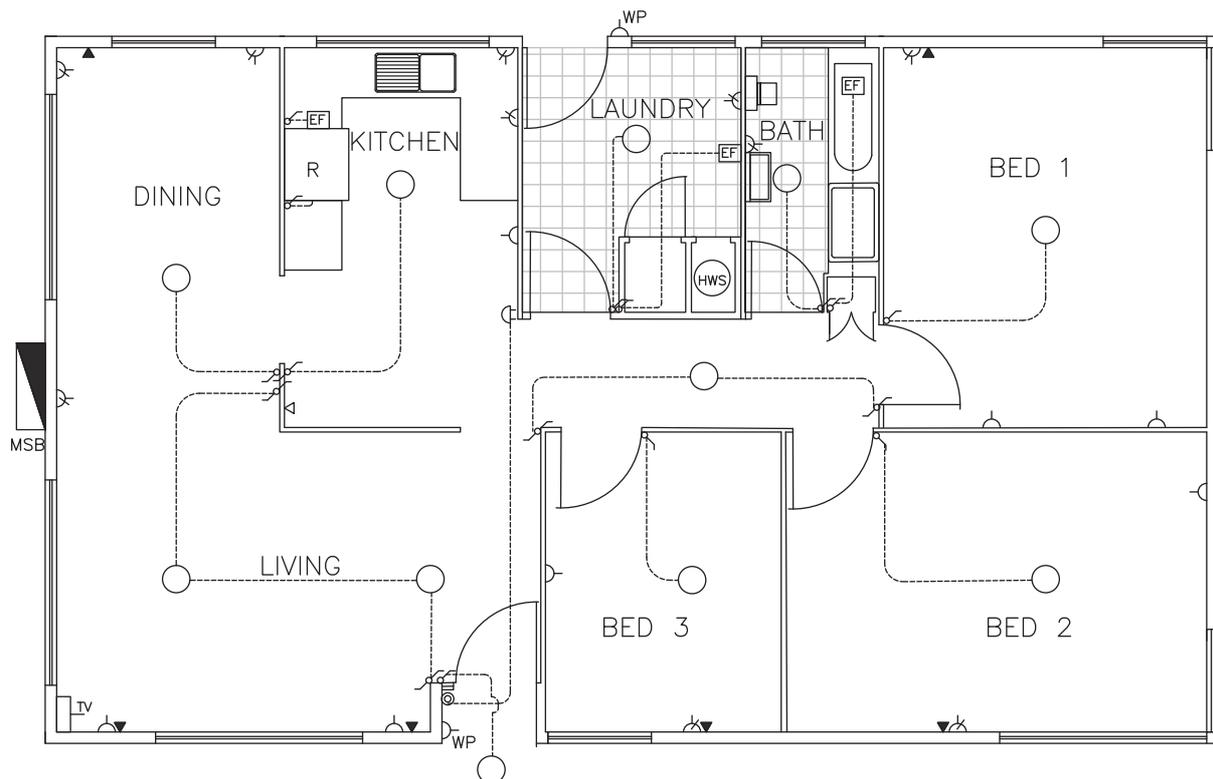
Attempt Question 22

Allow about 25 minutes for this section

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

Question 22 (15 marks)

Refer to the floor plan below to answer part (a).



- (a) Using the electrical symbols on the floor plan, develop a quantities schedule for the electrical fittings required for the dwelling. Include the name of each item and the quantity required. **6**
- (b) Explain effective work practices that lead to the efficient completion of electrical work in the construction of domestic dwellings. **9**

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