



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

2010 HSC Electrotechnology Sample Answers

This document contains ‘sample answers’, or, in the case of some questions, ‘answers could include’. These are developed by the examination committee for two purposes. The committee does this:

- (a) as part of the development of the examination paper to ensure the questions will effectively assess students’ knowledge and skills, and
- (b) in order to provide some advice to the Supervisor of Marking about the nature and scope of the responses expected of students.

The ‘sample answers’ or similar advice are not intended to be exemplary or even complete answers or responses. As they are part of the examination committee’s ‘working document’, they may contain typographical errors, omissions, or only some of the possible correct answers.

Section II

Question 16 (b)

Answers could include:

- Solar thermal
- Solar
- Geothermal
- Hydro
- Tidal
- Biofuel
- Landfill reclamation/Gas
- Wind
- Fuel cell
- Wave
- NOT Solar photovoltaic

Question 16 (c)

Answers could include:

Solar Thermal	<ul style="list-style-type: none">• Solar collectors concentrate the sun's rays to treat a fluid• Steam produced to drive turbine attached to electrical generator
Tidal/Wave	<ul style="list-style-type: none">• Captures the (kinetic) energy from ocean or river tides or currents• Volumes of water flow through turbines and produce electricity
Geothermal	<ul style="list-style-type: none">• Utilises the heat from within the earth• Heat used various ways to produce steam and turn turbines electrical generators
Hydro	<ul style="list-style-type: none">• Stored water uses gravity to turn turbines• Generators connected to turbines
Biofuel	<ul style="list-style-type: none">• Fuels produced from organic sources• Used similarly to fossil fuels
Landfill gas	<ul style="list-style-type: none">• Gases produced from decomposition of waste materials• Used to power turbines/generators
Fuel Cells	<ul style="list-style-type: none">• Oxidation of hydrogen produces current• Safety and cost associated with Hydrogen
Wind Turbines	<ul style="list-style-type: none">• Utilises (Kinetic) energy from wind• Turns turbine attached to generator



Question 17 (a) (i)

Sample answer:

Series

Question 17 (a) (ii)

Sample answer:

Voltage rises, current remains the same

Question 17 (a) (iii)

Sample answer:

Zero, no voltage will flow if one cell becomes open circuit

Question 17 (b) (i)

Sample answer:

Parallel

Question 17 (b) (ii)

Sample answer:

Current rises and the voltage remains the same

Question 17 (a) (iii)

Sample answer:

2 volts will be present (but less current)

Question 18 (a)

Sample answer:

$$\begin{aligned} P &= VI \\ &= 24 \times 5 \times 10^{-3} && 24 \times .005 \\ &= 120\text{mW} && 0.12\text{W or } 120\text{mW} \end{aligned}$$

**Question 18 (b)***Sample answer:*

$$R = \frac{V}{I} = \frac{24}{5} = 4.8 \text{ K}\Omega$$

$$P = VI = 48 \times 10 \text{ mA} = 480 \text{ mW}$$

$$I = \frac{V}{R}$$

$$\frac{48}{4.8 \text{ K}\Omega} = 10 \text{ mA}$$

Power increases four fold, current doubles.

Question 19 (a)*Sample answer:*

Step 1

$$R_1 \text{ in parallel with } R_2 = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}} = \frac{1}{\frac{1}{12} + \frac{1}{18}} = 7.2 \text{ }\Omega$$

Step 2

$$R_4 \text{ in series with } R_5 = R + R_5 = 10 + 6 = 16 \text{ }\Omega$$

Step 3

$$R_3 \text{ in parallel with } (R_4 + R_5) = \frac{1}{\frac{1}{R_3} + \frac{1}{R_4 + R_5}} = \frac{1}{\frac{1}{6} + \frac{1}{16}} = 4.36 \text{ }\Omega$$

Step 4

$$R \text{ total} = R_{\text{step 1}} + R_{\text{step 3}} + R_6 = 7.2 + 4.36 + 33 = 44.56 \text{ }\Omega$$

Question 19 (b)*Sample answer:*

$$\begin{aligned} R_1 &= R_1 + R_4 + R_5 + R_6 \\ &= 12 + 10 + 6 + 33 \\ &= 61 \text{ }\Omega \end{aligned}$$

$$I_t = \frac{V}{I} = \frac{20}{61} = 0.3274 \text{ A or } 327 \text{ mA}$$



Section III

Question 21

Answers could include:

- Customer relations/liaise with manager
- Site inspection
- Work method statement
- Isolation procedures/electrical and physical
- OH&S practices: manual handling must be observed/noted
- Tools and processes of mounting
 - PPE
 - Tools (power and/or hand)
- Testing procedures
- Completion of appropriate and relevant paperwork
- Liaise on exit

Section IV

Question 22 (a)

Answers could include:

- Identify risks associated with tools, processes and materials
 - hand tools
 - power tools
 - fixed machines
 - PPE
- Apply the hierarchy of control to appropriate process
- Follow relevant OH&S practice ie S.O.P.

Question 22(b)

Answers could include:

List of tools and equipment required

- Rule
- Scribe
- Punch
- Hammer
- Drilling machine
- 10 mm drill bit
- Tap handle
- M12X1.5 taper tap
- Thread cutting lubricant
- Vice
- Square
- File/grinder/pedestal grinder
- Dividers
- Hacksaw/cold cut saw/high speed saw/metal bandsaw
- PPE

List of procedures

- Mark out material (scribe, rule, punch, hammer)
- Vice material
- Cut using saw
- Drill hole + hole for thread
- Lube tap, begin tapping operation using square to ensure thread squareness
- Scribe and cut tangential lines between holes or chain drilling for slot and clean up