BOARD OF STUDIES
NEW SOUTH WALES

2010

HIGHER SCHOOL CERTIFICATE EXAMINATION

Senior Science

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- Write your Centre Number and Student Number at the top of pages 9, 11, 13, 15 and 17

Total marks – 100

Section I Pages 2–18

75 marks

This section has two parts, Part A and Part B

Part A – 20 marks

- Attempt Questions 1–20
- Allow about 35 minutes for this part

Part B – 55 marks

- Attempt Questions 21–30
- Allow about 1 hour and 40 minutes for this part

Section II Pages 19–24

25 marks

- Attempt ONE question from Questions 31–35
- Allow about 45 minutes for this section

Section I
75 marks

Part A – 20 marks
Attempt Questions 1–20
Allow about 35 minutes for this part

Use the multiple-choice answer sheet for Questions 1–20.

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1 Whipped cream is an example of what type of mixture?

(A) Water in oil

(B) Oil in water

(C) Liquid in gas

(D) Gas in liquid

2 What is the function of the stomach?

(A) To emulsify and digest fats

(B) To digest proteins and store food

(C) To absorb water before food is digested

(D) To break down carbohydrates and absorb glucose

3 What is a function of the skin?

(A) To regulate water levels

(B) To regulate waste levels

(C) To regulate body temperature

(D) To regulate carbon dioxide levels

4 Which of the following instructions always applies when working with household pesticides?

(A) Do not use indoors.

(B) Wash hands after use.

(C) Store in a cool dark place.

(D) Keep away from naked flames.

5 The composition of detergents has changed since the 1950s.

What feature of earlier detergents was a major reason for this change?

(A) They were too expensive.

(B) They were not soluble in water.

(C) They reacted with chemicals in hard water.

(D) They could not be broken down by microbes.

6 Which option correctly relates the form of medication to the rate at which it completely dissolves in the stomach?

	Rate of dissolving →			
	Fastest			*Slowest*
(A)	Tablets	Capsules	Slow-release tablets	Enteric-coated tablets
(B)	Capsules	Tablets	Slow-release tablets	Enteric-coated tablets
(C)	Enteric-coated tablets	Tablets	Capsules	Slow-release tablets
(D)	Enteric-coated tablets	Capsules	Tablets	Slow-release tablets

7 When land-connected telephones are being used, which energy transformation occurs?

(A) Electrical → microwaves

(B) Electrical → sound waves

(C) Microwaves → sound waves

(D) Sound waves → microwaves

8 Which of the following shows the basic pattern of the information transfer process?

(A) Encode → transmit → decode

(B) Encode → decode → transmit

(C) Transmit → encode → decode

(D) Transmit → decode → encode

9 What is the purpose of the frequency modulation (FM) of radio waves?

(A) To allow the radio waves to carry information

(B) To increase the speed of transmission of information

(C) To increase the distance over which the waves can travel

(D) To make communication clearer than using AM radio waves

10 What is the main advantage of digital technologies that scan images along very thin lines?

(A) They convert analogue data into digital data.

(B) They decrease the time taken to scan the image.

(C) They convert data from the image into electrical signals.

(D) They maximise the amount of information extracted from the image.

11 What feature of electromagnetic waves allows them to be used for communication?

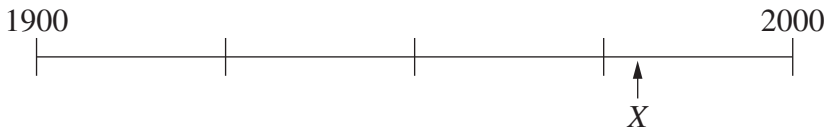
(A) They can be used in optical fibres.

(B) They can travel at a very high speed.

(C) They can be detected using a simple antenna.

(D) They can pass through the atmosphere without interference.

12 Identify the communication technology that was introduced to consumers at *X* on the timeline.



(A) Internet

(B) Land-connected telephone

(C) Mobile telephone

(D) Television

13 The following list contains some of the steps involved in planning and performing a first-hand investigation. The steps in the list are not in correct order.

1. Write a procedure
2. Choose equipment
3. Write a hypothesis
4. Modify the procedure and try again
5. Determine what data must be collected
6. Trial the procedure
7. Assess the risk of potential hazards

Which option shows the correct order in which the steps should be carried out?

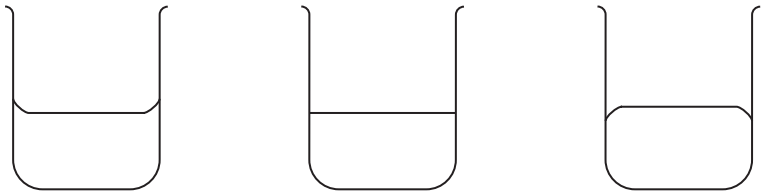
(A) 5, 1, 2, 7, 3, 6, 4

(B) 3, 5, 2, 7, 1, 6, 4

(C) 5, 1, 2, 6, 3, 7, 4

(D) 3, 5, 2, 1, 6, 7, 4

14 The diagram below shows the menisci of three liquids in beakers.



X *Y* *Z*

Adhesion is the force of attraction between the liquid molecules and the glass.

Which of the following statements is correct?

(A) The surface tension of liquid *Y* is stronger than the adhesion forces.

(B) The adhesion forces in liquid *Z* are stronger than the surface tension.

(C) The adhesion forces of liquid *X* are stronger than the surface tension.

(D) The menisci are produced because the surface tension is stronger than the adhesion forces.

15 Which of the following would be part of a life support system?

(A) A respirator

(B) A defibrillator

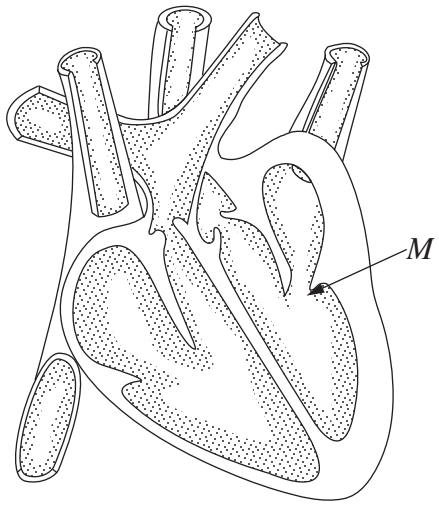
(C) Artificial valves

(D) Cochlear implants

16 Which of the following correctly relates a structure of the respiratory system to its function?

	Structure	*Function*
(A)	Trachea	Allows air to be carried in and out of the lungs
(B)	Bronchi	Allows oxygen to move into the bloodstream
(C)	Alveoli	Allows air to be carried in and out of the lungs
(D)	Capillary network around alveoli	Allows oxygen to move out of the blood into the lungs

17 The diagram shows a heart, with a valve labelled *M*.



What is the result of this valve becoming faulty?

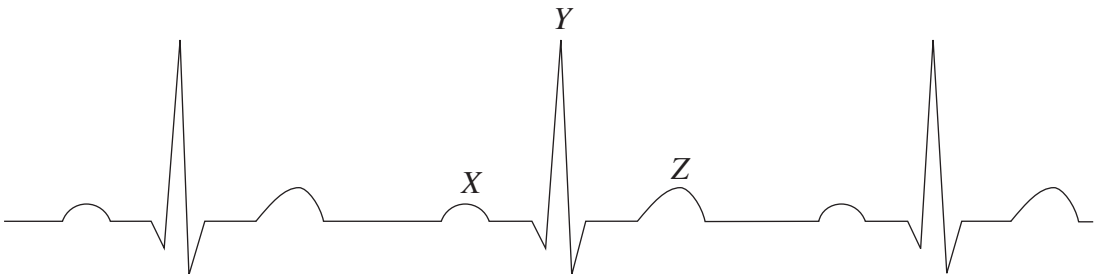
(A) The heart rate decreases to compensate.

(B) The heart shrinks to maintain normal function.

(C) Pumping is less efficient due to back flow of blood.

(D) Blood flows through the affected side rapidly and continuously.

18 An electrocardiograph (ECG) measures the electrical activity of the heart. This allows individual aspects of the heartbeat to be displayed, as shown in the diagram.



What is happening at *X*, *Y* and Z?

	X	*Y*	Z
(A)	atria are contracting	ventricles are contracting	ventricles are relaxing
(B)	atria are contracting	ventricles are relaxing	ventricles are contracting
(C)	ventricles are contracting	atria are contracting	atria are relaxing
(D)	ventricles are contracting	ventricles are relaxing	atria are contracting

Use the following table to answer Questions 19–20.

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19 What is the relationship between the proportion of carbon dioxide in air breathed out and the level of activity?

(A) The rate of production of carbon dioxide is proportional to the rate of activity.

(B) The proportion of carbon dioxide in the air breathed out decreases as you exercise harder.

(C) The proportion of carbon dioxide in the air breathed out is not affected by the level of activity.

(D) The more exercise you are doing, the higher the proportion of carbon dioxide in the air you breathe out.

20 One hundred people are in a cinema for two hours watching a movie.

Approximately how much carbon dioxide will they emit?

(A) 0.02 m^3

(B) 0.5 m^3

(C) 4.0 m^3

(D) 100 m^3

Senior Science

Centre Number

Student Number

Section I (continued)

Part B – 55 marks
Attempt Questions 21–30
Allow about 1 hour and 40 minutes for this part

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

Question 21 (4 marks)

(a) What is the difference between a *colloid* and a *suspension*? **2**

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(b) What type of mixture is mayonnaise? **1**

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(c) What is ONE advantage of mayonnaise being this type of mixture? **1**

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Question 22 (8 marks)

(a) What does pH measure? **1**

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(b) How can you measure pH in a school laboratory? **1**

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(c) Why are internal and external organs of the body maintained at specific pH values? Use examples in your answer. **6**

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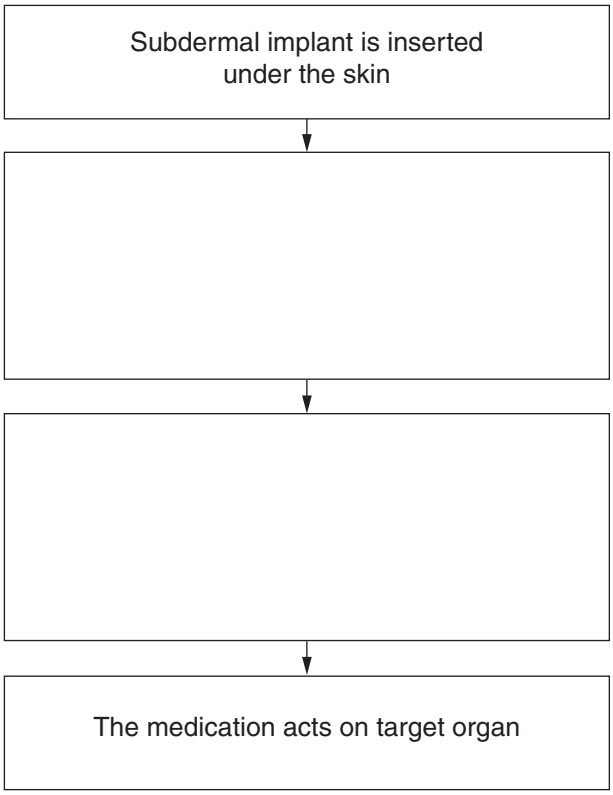
Question 23 (5 marks)

(a) Complete the flowchart below to show how subdermal implants act in the body. **2**



(b) Why would medication be prescribed in the form of a subdermal implant instead of an oral tablet? **3**

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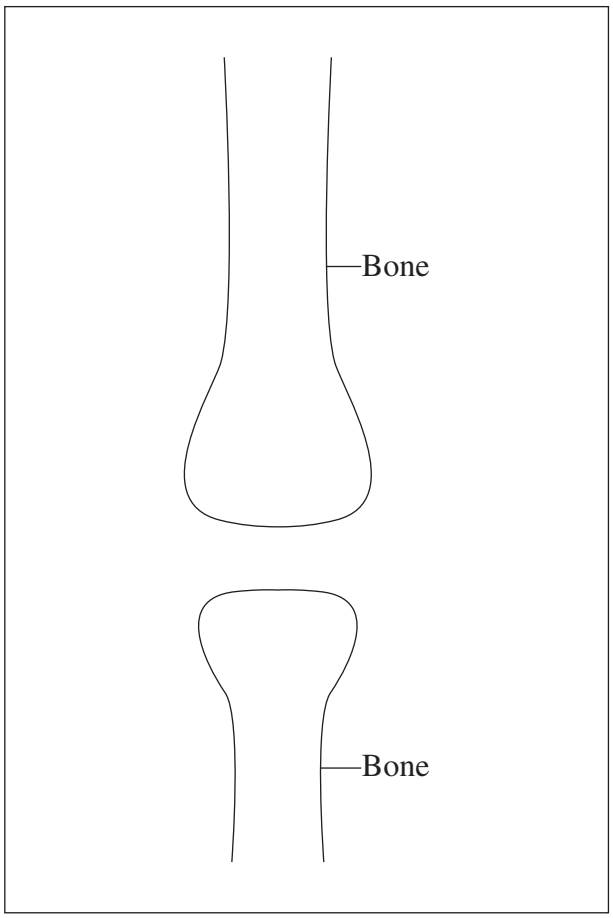
Question 24 (6 marks)

(a) Complete the diagram to show the position of cartilage, bone, tendon and muscle in an animal limb. **4**



(b) Contrast the functions of cartilage and tendons in joints. **2**

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Question 25 (4 marks)

The table shows some properties of two biomaterials. **4**

Property	*Biomaterial P*	*Biomaterial Q*
Biocompatibility	good	good
Tensile strength (MPa)	900	20
Surface friction	moderate	low

An artificial hip joint consists of a shaft and ball made of one biomaterial, and a socket made of a different biomaterial.

Biomaterials *P* and *Q* are used to make an artificial hip. Which material would be used for the shaft and ball, and which for the socket? Justify your answer.

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Question 26 (6 marks)

Explain how scientific understanding of different energy forms has led to the development of modern technologies in communications and medicine. **6**

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Question 27 (4 marks)

Analyse the advantages of using a range of communication devices to send and receive information. In your answer, refer to at least TWO different technologies. **4**

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Question 28 (6 marks)

(a) What features of its orbit cause a satellite to be geostationary? **2**

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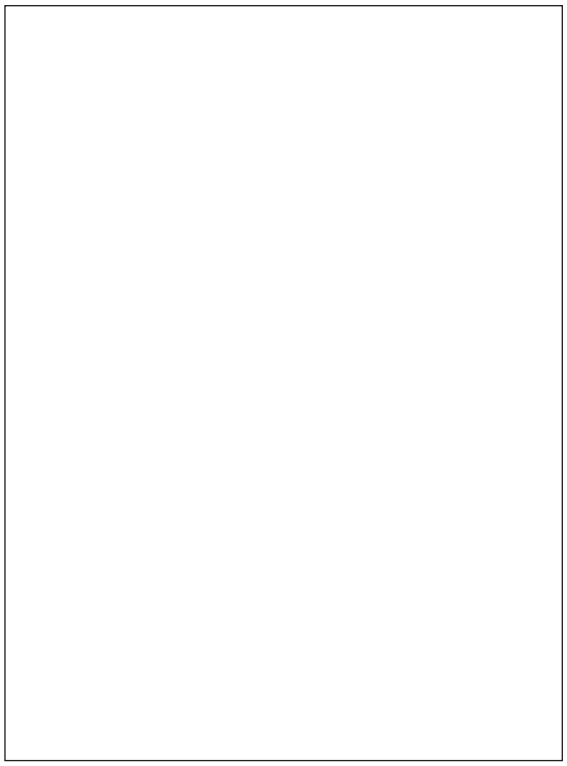
(b) Explain why an Earth-based satellite dish in Australia must always face north when communicating with a geostationary satellite. Include a diagram in your answer. **4**



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Question 29 (4 marks)

A student conducts a first-hand investigation and completes the following report. **4**

AM and FM Reception

Aim:

To investigate the effect of household appliances on AM and FM reception

Method:

1. A radio was placed 1 m from a hair dryer and tuned to an AM station.
2. The hair dryer was switched on and the change in the radio reception was described.
3. Steps 1 and 2 were repeated using an FM station.

Results:

Station	*Change in reception*
AM	Loud buzzing noise, voice distorted
FM	Music is less clear

Conclusion:

FM stations are less affected by household appliances.

Outline FOUR changes to the method of investigation that would provide more valid and reliable results. Include at least ONE strategy in each column in the table below.

Change(s) to improve validity	Change(s) to improve reliability

Question 30 (8 marks)

'Technological advances have provided more options for maintaining humans as functioning organisms.' **8**

Assess the impact of technological advances on both the individual and society. In your answer, include specific examples.

Senior Science

Section II

25 marks
Attempt ONE question from Questions 31–35
Allow about 45 minutes for this section

Answer parts (a)–(c) of the question in a writing booklet. Answer parts (d)–(e) of the question in a SEPARATE writing booklet. Extra writing booklets are available.

Question 31 — Polymers (25 marks)

Answer parts (a)–(c) in a writing booklet.

(a) (i) Define the term *polymerisation*. **1**

(ii) Compare the properties of TWO named natural polymers. **3**

(b) All the waste materials from a town are collected without sorting and sent to the local landfill site. At current levels of use the landfill site will be full, and therefore closed, in five years' time.

(i) State a problem that is evident in the scenario outlined above. **1**

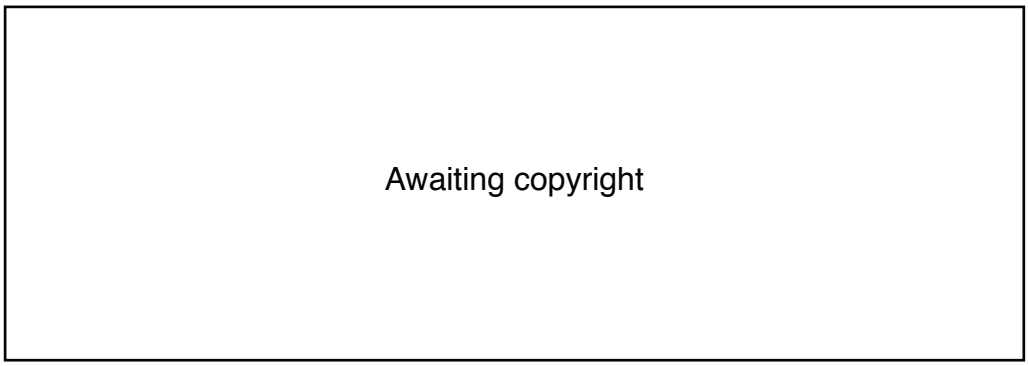
(ii) Propose and justify a possible strategy that could be used to solve the problem you identified in part (i). **3**

(c) (i) Describe the results of a first-hand investigation to identify the effects of temperature on different polymers. **2**

(ii) Explain how risks would be managed when investigating the effects of temperature on polymers. **3**

Answer parts (d)–(e) in a SEPARATE writing booklet.

(d) The following information refers to the work of an Australian scientist. **5**



Assess the contribution that scientific investigation of polymers makes to society using the information above to illustrate your answer.

(e) Justify the continued use of plastics by society despite their significant environmental impact. In your answer, refer to the properties of plastics. **7**

Question 32 — Preservatives and Additives (25 marks)

Answer parts (a)–(c) in a writing booklet.

(a) (i) Name a food additive that is not a preservative. **1**

(ii) Contrast the roles of preservatives and other additives used in foods. **3**

(b) Homemade jam was prepared from fruit and stored in screw top glass jars. After a few months, colonies of microbes started to grow on the surface of the jam.

(i) State a problem that is evident in the scenario outlined above. **1**

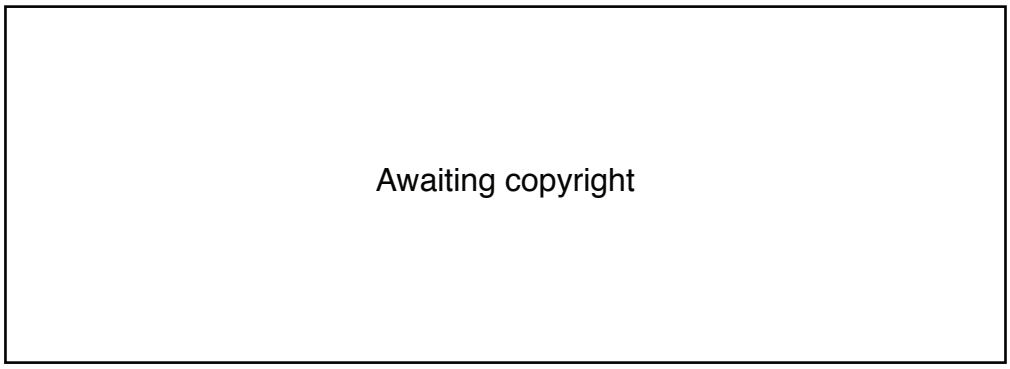
(ii) Propose and justify a possible strategy that could be used to solve the problem you identified in part (i). **3**

(c) (i) Describe the results of a first-hand investigation to demonstrate the solubilities in water of nitrates, nitrites and sulfites. **2**

(ii) Relate the solubilities of nitrates, nitrites and sulfites to their roles as preservatives in meats. **3**

Answer parts (d)–(e) in a SEPARATE writing booklet.

(d) The following information refers to the work of an Australian scientist. **5**



Assess the contribution that scientific investigation of preservatives and additives makes to society using the information above to illustrate your answer.

(e) Assess the need to control both the use of additives and their labelling in food. **7**

Question 33 — Pharmaceuticals (25 marks)

Answer parts (a)–(c) in a writing booklet.

(a) (i) Name THREE types of blood vessels. **2**

(ii) Contrast the structures and blood carrying capacities of TWO of the vessels named in part (i). **2**

(b) Antibiotics are sometimes prescribed by doctors for patients with colds and flu caused by viruses. The antibiotic has no effect on the viruses. Later, if people contract a bacterial disease, the antibiotic may not be able to kill the bacteria.

(i) State a problem that is evident in the scenario outlined above. **1**

(ii) Propose and justify a possible strategy that could be used to solve the problem you identified in part (i). **3**

(c) (i) Describe the results of a first-hand investigation to culture bacteria from everyday surroundings. **2**

(ii) Explain how risks would be managed when culturing bacteria. **3**

Answer parts (d)–(e) in a SEPARATE writing booklet.

(d) The following information refers to the work of an Australian scientist. **5**

> John Eccles was awarded the Nobel Prize in Medicine in 1963 for work done at the Australian National University. His lifelong interest was in the relationship between the mind and the brain. He performed pioneering experiments using microelectrodes attached to individual nerve cells. With this equipment he demonstrated that transmission of impulses at the synapses between nerve cells was a chemical rather than electrical process.

Assess the contribution that scientific investigation of pharmaceuticals makes to society using the information above to illustrate your answer.

(e) Analyse the role of the nervous system in detecting and responding to pain. **7**

Question 34 — Disasters (25 marks)

Answer parts (a)–(c) in a writing booklet.

(a) (i) Identify a community organisation that would be actively involved in disaster relief. **1**

(ii) Compare and contrast the roles of the State Emergency Service and the Rural Fire Service. **3**

(b) When the alarm was sounded for an emergency evacuation from a factory, a number of workers left the building and went home.

(i) State a problem that is evident in the scenario outlined above. **1**

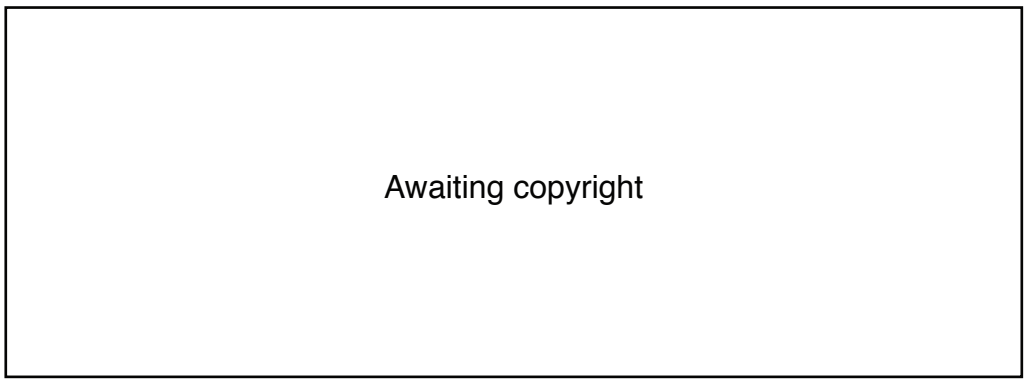
(ii) Propose and justify a possible strategy that could be used to solve the problem you identified in part (i). **3**

(c) (i) Describe the results of a first-hand investigation to compare the flammability of dry and fresh leaves. **2**

(ii) How could information from the investigation in part (i) be used to reduce the risk of bushfires in rural areas? **3**

Answer parts (d)–(e) in a SEPARATE writing booklet.

(d) The following information refers to the work of an Australian scientist. **5**



Assess the contribution that scientific investigation of disasters makes to society using the information above to illustrate your answer.

(e) Some natural disasters are caused by changes in atmospheric pressure. **7**

Explain how these disasters occur and how atmospheric pressure is monitored.

Question 35 — Space Science (25 marks)

Answer parts (a)–(c) in a writing booklet.

(a) Some consumer products are spin-offs from technologies that were originally developed for space exploration.

(i) Name TWO of these spin-offs. **2**

(ii) For ONE of the named spin-offs, describe its original use and its current use in society. **2**

(b) In an orbiting space station astronauts are effectively weightless, and do not have to move their bodies against gravity.

(i) State a problem that is evident in the scenario outlined above. **1**

(ii) Propose and justify a possible strategy that could be used to solve the problem you identified in part (i). **3**

(c) (i) Describe a system used for astronauts to travel in space before the space shuttle. **2**

(ii) Outline advantages and disadvantages of using the space shuttle instead of the system described in part (i). **3**

Answer parts (d)–(e) in a SEPARATE writing booklet.

(d) The following information refers to the work of an Australian scientist. **5**

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Assess the contribution that scientific investigation of space makes to society using the information above to illustrate your answer.

(e) Evaluate the strategies and materials used by space scientists to ensure that astronauts complete a mission safely and in good health. **7**

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