

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

**2008**

**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, 13, 15 and 17

**Total marks – 100**

**Section I** Pages 2–20

**75 marks**

This section has two parts, Part A and Part B

Part A – 15 marks

- Attempt Questions 1–15
- Allow about 30 minutes for this part

Part B – 60 marks

- Attempt Questions 16–26
- Allow about 1 hour and 45 minutes for this part

**Section II** Pages 22–28

**25 marks**

- Attempt ONE question from Questions 27–31
- Allow about 45 minutes for this section

## Section I

75 marks

Part A – 15 marks

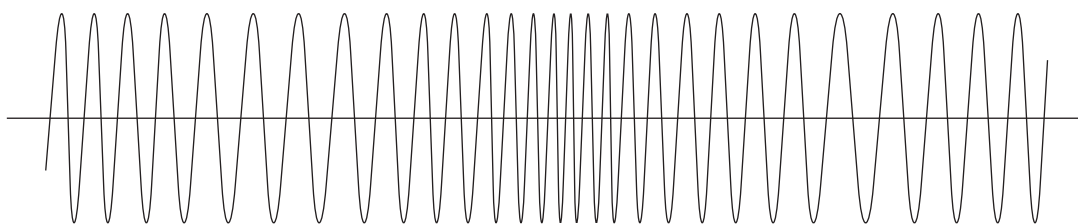
Attempt Questions 1–15

Allow about 30 minutes for this part

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

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- 1 The diagram shows a modulated electromagnetic wave used in a communication system.



- Which communication system uses this type of electromagnetic wave?
- (A) AM radio  
(B) FM radio  
(C) Compact disc players  
(D) Fibre optics
- 2 Which energy transformation sequence best represents what happens when one person on a mobile phone is talking to another on a mobile phone?
- (A) Sound → Electrical → Infrared → Electrical → Sound  
(B) Sound → Electrical → Microwave → Electrical → Sound  
(C) Electrical → Sound → Infrared → Sound → Electrical  
(D) Electrical → Sound → Microwave → Sound → Electrical
- 3 What are the properties of AM radio waves that make them useful for communication?
- (A) Ability to be reflected, speed, security  
(B) Speed, security, ability to travel in a straight line  
(C) Ability to be reflected, speed, ability to travel in a straight line  
(D) Ability to be reflected, security, ability to travel in a straight line

- 4 A geostationary satellite orbits the Earth 36 000 km above the equator. It sends television signals to a satellite dish located in NSW.

Which of the following correctly shows the features of this geostationary satellite?

	<i>Period of revolution (hrs)</i>	<i>Direction of the satellite from Dish</i>	<i>Dish position</i>
(A)	24	North	Fixed
(B)	12	North	Changes during the year
(C)	24	South	Fixed
(D)	12	South	Changes during the year

- 5 Digital technologies use zeros and ones for the coding and decoding of information. A four digit binary code can be used to represent numbers. This process is shown in the following examples.

$$0101 = 0 + 4 + 0 + 1 = 5$$

$$1010 = 8 + 0 + 2 + 0 = 10$$

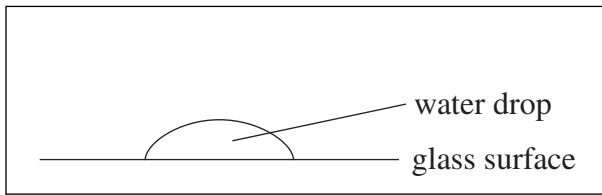
$$1111 = 8 + 4 + 2 + 1 = 15$$

What number is represented by the four digit code 1011?

- (A) 3  
(B) 6  
(C) 11  
(D) 13
- 6 During normal breathing, what makes exhalation occur?
- (A) The chest cavity expands.  
(B) The diaphragm relaxes and moves upwards.  
(C) The rib muscles contract and the rib cage expands.  
(D) The air pressure in the lungs is lower than external air pressure.

- 7 Which biomaterial is most suitable for use in an artificial toe joint?
- (A) Titanium alloy
  - (B) Teflon
  - (C) Stainless steel
  - (D) Silicone
- 8 Where in the body would you find a pivot joint?
- (A) Hip
  - (B) Knee
  - (C) Neck
  - (D) Shoulder
- 9 Which of the following health problems can be reduced by angioplasty?
- (A) Hole in the heart
  - (B) Leaky valves within the heart
  - (C) Irregular electric impulses to the heart
  - (D) Plaque deposits that have built up inside arteries

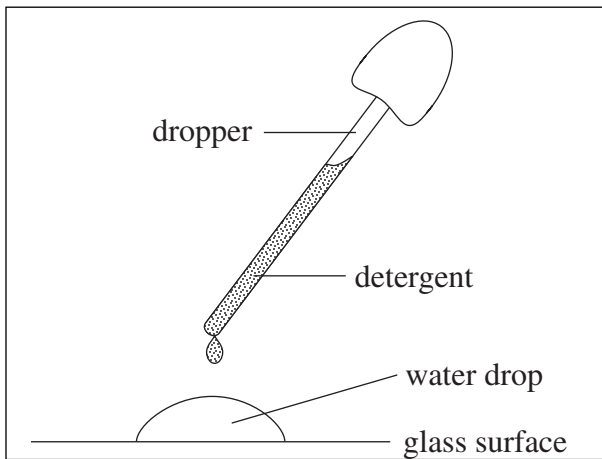
10 This diagram shows a drop of water on a glass surface.



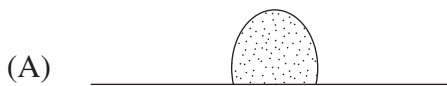
Which two factors are mainly responsible for the shape of the water drop?

- (A) Air pressure and gravity
- (B) Gravity and surface tension
- (C) Water pressure and air pressure
- (D) Surface tension and water pressure

11 This diagram shows a drop of detergent being added to a drop of water.



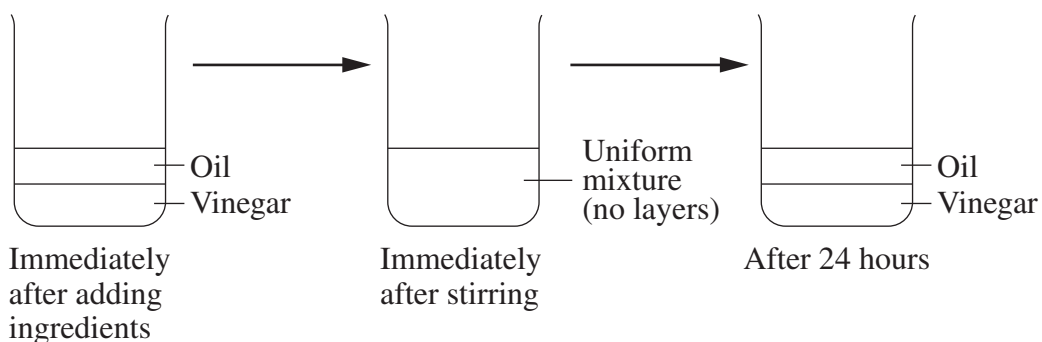
Which diagram best represents what happens to the water drop when a drop of detergent is added to it?



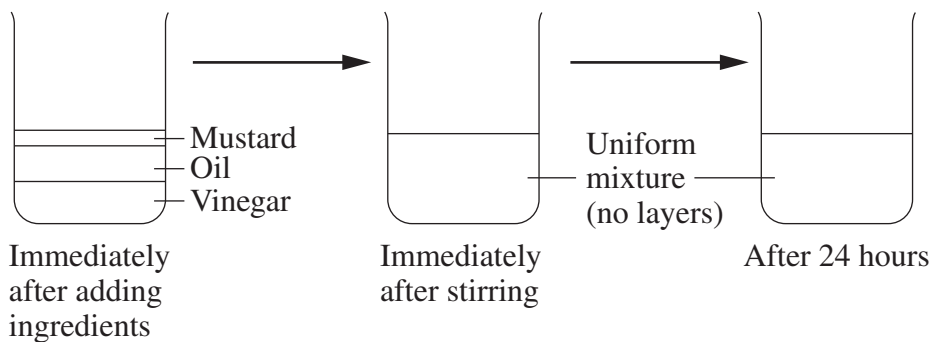
- 12** Which of the following is one role of the skin?
- (A) To help maintain a constant body temperature
  - (B) To keep beneficial micro-organisms inside the body
  - (C) To protect body organs from damaging UV radiation
  - (D) To help maintain the volume of water inside the body
- 13** Why are valves important structures in the circulatory system?
- (A) They ensure one-way blood flow.
  - (B) They prevent blood vessels from collapsing.
  - (C) They allow blood pressure to be maintained.
  - (D) They prevent leakage of blood from damaged blood vessels.
- 14** What characteristic of water allows it to be a common ingredient in cosmetics and external medications?
- (A) Water acts as a solvent.
  - (B) Water acts as a surfactant.
  - (C) Water acts as a colloidal agent.
  - (D) Water acts as an emulsifying agent.

- 15 During an investigation of mixtures, students drew the following diagrams of their observations.

**Test 1**



**Test 2**



What is a valid conclusion based on these observations?

- (A) In Test 2, the ingredients have reacted with each other to form a new substance.
- (B) In Test 1, stirring the ingredients has allowed them to become a solution.
- (C) In Test 2, the mustard appears to have acted as an emulsifier.
- (D) In Test 2, the mustard has dissolved the oil and vinegar.

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Senior Science

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Centre Number

Section I (continued)

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Student Number

Part B – 60 marks

Attempt Questions 16–26

Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

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Marks

Question 16 (6 marks)

- (a) Nail polish has to be shaken in its container before it is painted onto nails.

Explain why nail polish needs to be shaken.

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- (b) Nail polish remover is a type of solvent.

- (i) Explain how nail polish remover takes nail polish off the nails.

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- (ii) Explain one precaution that may be needed when using and handling solvents.

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**Question 17** (8 marks)

A student investigated the effect of pH on the solubility of a range of medications. Each medication was placed in 200 mL of liquid. The student’s results are shown.

Medication	Type	<i>Time to dissolve</i> (minutes)		
		pH 3	pH 7	pH 9
<i>A</i>	Tablet	10	25	30
<i>B</i>	Capsule	10	not soluble	not soluble
<i>C</i>	Enteric coated capsule	not soluble	not soluble	5

(a) How would the student measure the pH of the liquid? **1**

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(b) What is the dependent variable in this investigation? **1**

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**Question 17 continues on page 11**

Question 17 (continued)

- (c) Explain one way the student could improve the reliability of their results. **2**

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- (d) From these results, the student concluded that medication *C* would be absorbed into the bloodstream from the digestive system faster than medication *A* or *B*. Assess this conclusion. **4**

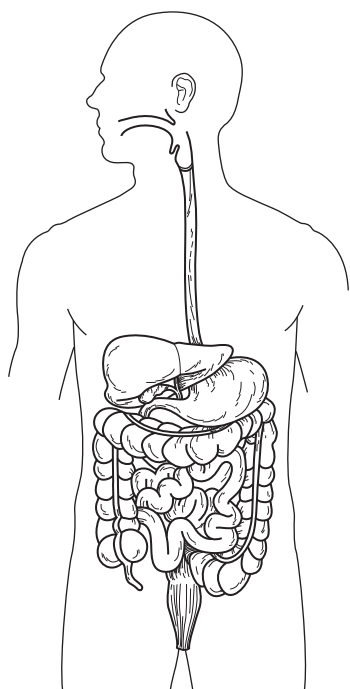
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**End of Question 17**

**Question 18** (3 marks)

(a) Label the stomach on this diagram.

1



(b) Outline TWO roles of the stomach in the breakdown of food.

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**Question 19** (3 marks)

Describe the advantages of using a sub-dermal implant to administer a drug.

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Section I – Part B (continued)

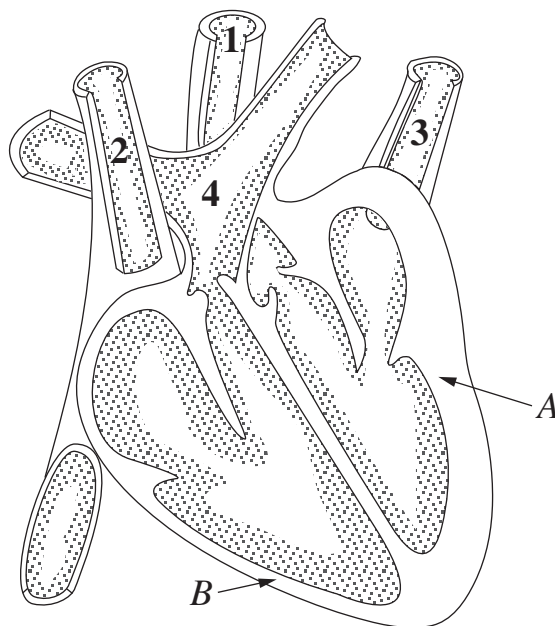
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Student Number

Marks

Question 20 (4 marks)

This is a diagram of a human heart.



(a) On the diagram draw the letter 'X' inside the left atrium. 1

(b) Which numbers on this diagram represent blood vessels that carry deoxygenated blood? 1

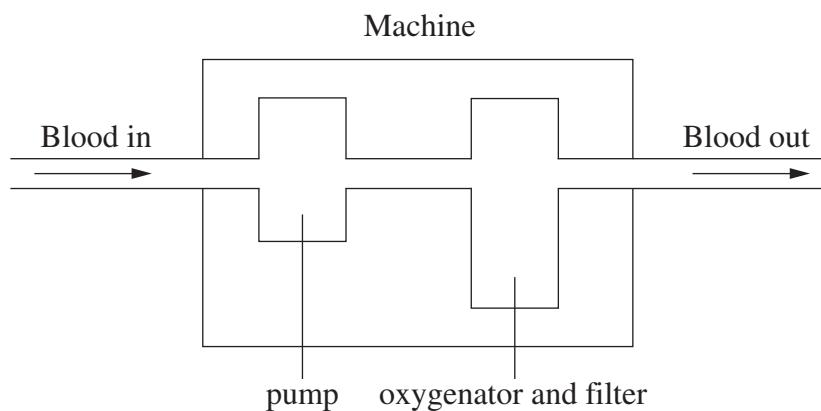
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(c) Explain the difference in thickness of the walls at point A and point B. 2

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**Question 21** (3 marks)

The diagram represents a machine that is used in hospital operating theatres.



Explain the role of this machine in sustaining life during heart transplants.

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Centre Number

Section I – Part B (continued)

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Student Number

**Marks**

**Question 22** (6 marks)

Identify ONE non-invasive and ONE minimally invasive medical technique. For each of the techniques identified, outline an advantage and a disadvantage.

**6**

	Non-invasive technique	Minimally invasive technique
Example		
Advantage		
Disadvantage		

**Question 23** (6 marks)

Discuss the use of visible light in communication systems.

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Centre Number

Section I – Part B (continued)

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Student Number

**Marks**

**Question 24** (4 marks)

- (a) Complete the following table to compare the features of these information systems. **2**

<i>Communication system</i>	<i>Type of energy used</i>	<i>Medium of transmission</i>
Television	Radio waves	
Land connected telephones		Copper cables

- (b) Outline TWO advantages of using a range of information systems. **2**

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**Question 25** (10 marks)

(a) A student conducted an investigation of AM and FM radio waves. As part of their investigation, the student gathered and processed information about AM and FM radio waves from secondary sources.

(i) Identify TWO resources that could be used to gather information from secondary sources. **1**

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(ii) Outline TWO reasons for using information from more than one source. **2**

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A copy of the student’s first-hand investigation is shown.

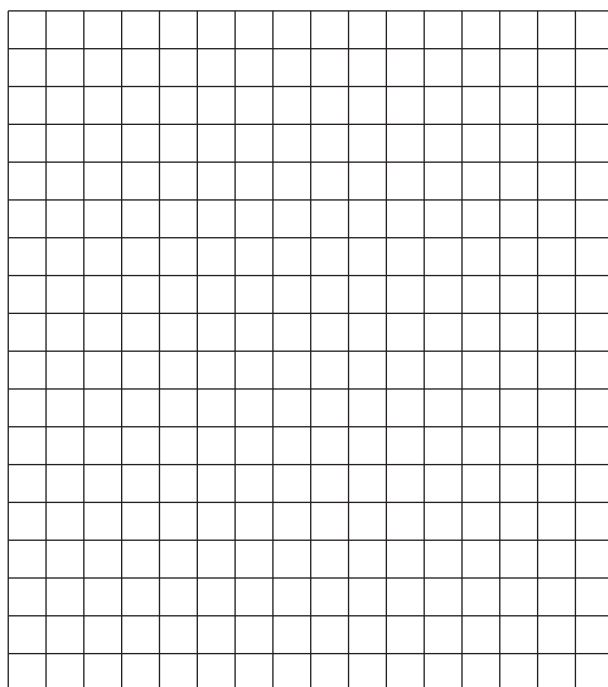
<b>Aim:</b> To compare the quality of AM and FM reception near overhead power lines.		
<b>Method:</b>		
1. A radio was tuned to an AM station away from overhead power lines.		
2. The radio was placed underneath overhead power lines.		
3. The station was listened to for 20 seconds and the reception rated on a scale of 1 to 10.		
4. Repeat steps 1–3 for an FM station.		
<b>Results:</b>		
Type of Station	News	Music
Band	AM	FM
Quality of reception ( /10)	6	8
<b>Conclusion:</b>		
FM reception is better quality than AM reception near overhead power lines.		

**Question 25 continues on page 19**

Question 25 (continued)

(b) Graph the student's results from the table.

3



(c) When the student's teacher marked the investigation, the teacher wrote "This conclusion is not scientifically valid. The variables in this experiment have not been controlled".

4

Evaluate the importance of controlling variables in this investigation.

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End of Question 25

**Question 26** (7 marks)

Interruptions to rhythmic contractions and faulty valves are two health problems associated with the heart.

**7**

Analyse the biomaterials used in the devices designed to solve these health problems.

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# Senior Science

## Section II

**25 marks**

**Attempt ONE question from Questions 27–31**

**Allow about 45 minutes for this section**

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

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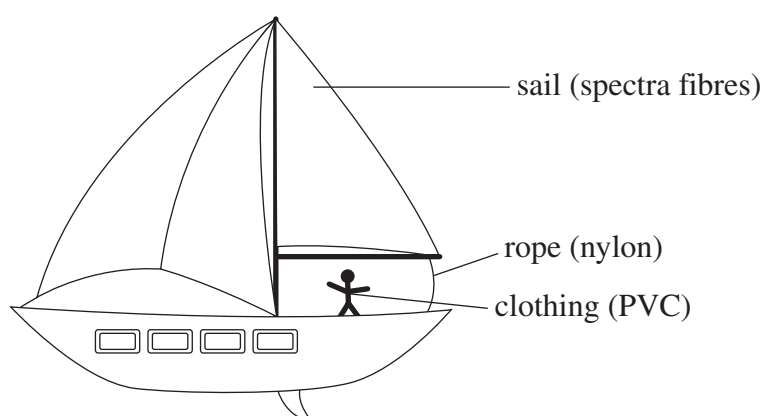
	Pages
Question 27 Polymers .....	22
Question 28 Preservatives and Additives .....	23
Question 29 Pharmaceuticals .....	24
Question 30 Disasters .....	25–26
Question 31 Space Science .....	27–28

**Question 27 — Polymers (25 marks)**

- (a) Copy the table into your writing booklet and complete. 4

Polymer	Natural or Synthetic	One ingredient
Slime		
Playdough		

- (b) (i) Identify ONE example of a thermoplastic and ONE example of a thermoset plastic. 2
- (ii) Outline TWO observations you made from the investigation where you identified the effect of heat on different plastics. 2
- (iii) What type of plastic would be most suitable for a kitchen benchtop? Justify your answer. 3
- (c) Discuss the future of the production of polymers from petrochemicals. 6
- (d) A sail boat uses many different synthetic polymers. Some uses are identified in the diagram.



Relate the properties of TWO synthetic polymers to their use on boats. 4

- (e) Assess the viability of recycling different types of plastics. 4

**End of Question 27**

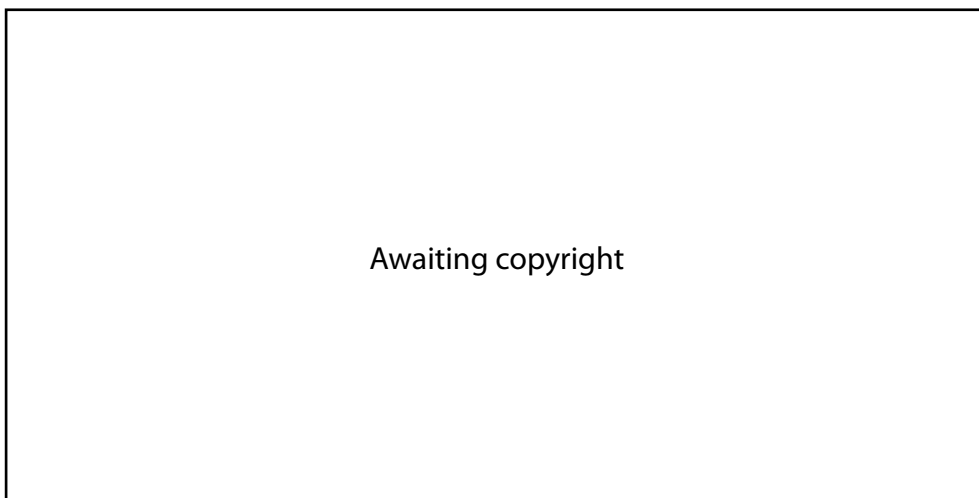
**Question 28 — Preservatives and Additives (25 marks)**

- (a) (i) Name TWO microbes that cause food spoilage. **2**
- (ii) Identify ONE symptom of and ONE treatment for food poisoning. **2**
- (b) (i) Outline the method and results of a first-hand investigation to model osmosis. **4**
- (ii) Identify a preservation technique that uses the process of osmosis and explain how this process helps preserve food. **3**
- (c) Not all food additives are designed to preserve food. **6**
- Using examples, describe other uses of food additives.
- (d) Outline TWO methods that use high temperatures to prevent food spoilage. **2**
- (e) Explain how a chemical additive preserves food. **2**
- (f) Explain TWO ways that food additives have had a negative impact on human health. **4**

**End of Question 28**

**Question 29 — Pharmaceuticals (25 marks)**

The diagram shows a smear of human blood as viewed using a microscope.



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|-----|---|----------|
| (a) | (i) What are <i>Y</i> and <i>Z</i> ?  | <b>2</b> |
|     | (ii) Outline two roles of <i>Y</i> .  | <b>2</b> |
| (b) | (i) Draw a flow chart to represent the nervous system pathway from the detection of a stimulus through to the response to the stimulus. | <b>3</b> |
|     | (ii) Outline the method and results of a first-hand investigation to demonstrate differences in people's reaction time to stimulus.     | <b>4</b> |
| (c) | Discuss the use of aspirin to treat inflammation in the human body.   | <b>6</b> |
| (d) | (i) Explain the action of penicillin on bacteria.   | <b>2</b> |
|     | (ii) Penicillin is transported around the human body by the circulatory system.   | <b>2</b> |
|     | What are the advantages of using the circulatory system for this purpose?   |          |
|     | (iii) Outline the events that led to the accidental identification of penicillin.   | <b>4</b> |

**End of Question 29**



**Question 30 — Disasters (25 marks)**

- (a) Copy the table into your writing booklet and complete. Identify Australian examples other than bushfire. **4**

	Disaster associated with nature and human activity	Disaster associated with human activity only
Australian example		
Consequence		

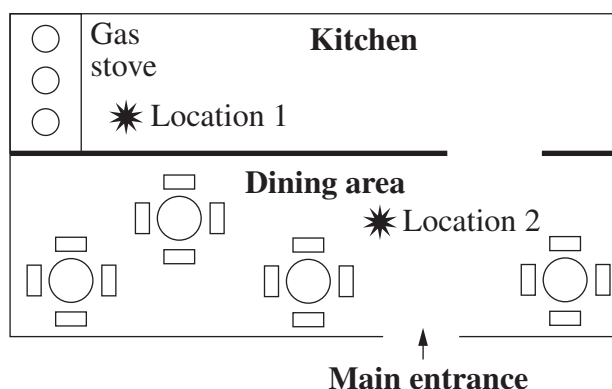
- (b) (i) Outline the method and results of a first-hand investigation to test the effect of differences in air pressure. **4**
- (ii) Explain how this investigation models atmospheric pressure and the formation of winds. **3**
- (c) Analyse the link between human activities and the severity of bushfires. **6**

**Question 30 continues on page 26**

Question 30 (continued)

- (d) (i) Draw a labelled diagram of the alarm or safety device that you constructed as part of your course. **2**
- (ii) The floor plan shows the possible locations of TWO smoke detectors in a restaurant. **2**

Which location is the most appropriate location for a smoke detector?  
Justify your answer.



- (e) In 1974, Cyclone Tracy, a Category 4 cyclone, resulted in 65 deaths but in 2006 Cyclone Larry, a Category 5 cyclone, did not result in any deaths. **4**

Account for the differences in the loss of life resulting from the 1974 cyclone and the 2006 cyclone.

**End of Question 30**

**Question 31 — Space Science (25 marks)**

- (a) (i) Why is the the gravitational pull of the Earth different to that of the moon? **2**
- (ii) Identify TWO situations where a person could experience weightlessness. **2**
- (b) The Saturn V was a multistage liquid-fuel expendable rocket used by NASA's Apollo missions to the moon between 1967 and 1973. The Saturn V rocket consisted of three stages and a spacecraft. The spacecraft contained the Command Module in which the astronauts returned to Earth.



- (i) Compare the functions of the components of the Saturn V rocket with those of the Space Transportation System (the shuttle). **4**
- (ii) Outline how the design of the Space Transportation System (shuttle) has reduced the dangers faced by astronauts during lift-off, in orbit and on re-entry. **3**

**Question 31 continues on page 28**

	<b>Marks</b>
Question 31 (continued)	
(c) Describe the short-term and long-term effects on human body functions when living in the International Space Station.	<b>6</b>
(d) Compare the original use of TWO materials developed for space programs with their current use in society.	<b>4</b>
(e) Assess the value of projects designed to identify life and advanced civilisations in the universe.	<b>4</b>

**End of paper**