

## HSC Trial Examination 2020

# Biology

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**General  
Instructions**

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Draw diagrams using pencil
- Calculators approved by NESA may be used

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**Total marks:  
100****Section I – 20 marks (pages 2–9)**

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

**Section II – 80 marks (pages 10–26)**

- Attempt Questions 21–34
- Allow about 2 hours and 25 minutes for this section

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2020 HSC Biology Examination.

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## Section I

**20 marks****Attempt Questions 1–20****Allow about 35 minutes for this section**

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

1. Bacteria reproduce by binary fission.

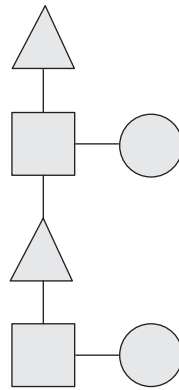
Which row of the table correctly assesses binary fission in relation to survival of the species?

	<i>Advantage</i>	<i>Disadvantage</i>
(A)	A large number of bacterial cells can be produced in a short time span.	The cells produced by binary fission are genetically identical, resulting in a lack of diversity.
(B)	Only a small amount of energy is required to produce offspring.	Cells undergo meiosis to increase genetic variation.
(C)	Binary fission can only occur in eukaryotic cells.	Strains of bacteria are resistant to superbugs.
(D)	Only two cells are needed for offspring to be produced.	The two cells produced are genetically identical.













2. Which hormone is responsible for preparing mammalian reproductive tissue for pregnancy?

- (A) oxytocin
- (B) oestrogen
- (C) progesterone
- (D) luteinising hormone

3. The diagram shows a model of DNA.

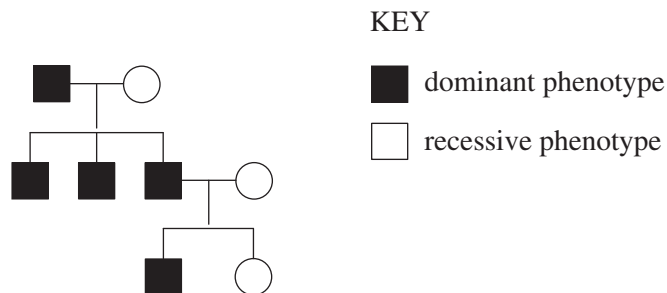


Which key correctly shows the parts of a nucleotide?

(A)		phosphate		sugar		base
(B)		sugar		phosphate		base
(C)		sugar		base		phosphate
(D)		base		phosphate		sugar

4. Which of the following statements about the crossing over of chromosomes is INCORRECT?
- (A) Crossing over occurs between two homologous chromosomes.
  - (B) Crossing over may produce mutations, resulting in cell death.
  - (C) Crossing over can increase genetic variation in a population.
  - (D) Crossing over produces combinations of new alleles that will benefit the offspring.

5. Consider the following pedigree.



Which of the following statements about the pedigree is correct?

- (A) The trait is sex-linked as only males have the trait in their phenotype.  
(B) The male in the third generation must be heterozygous for the trait.  
(C) The alleles are co-dominant.  
(D) The male in the first generation must be homozygous for the dominant allele.
6. Which of the following best describes a mutagen?
- (A) A mutagen is a strand of DNA that has a mutation.  
(B) A mutagen is a peptide chain with an incorrect amino acid.  
(C) A mutagen is a tRNA molecule that has misread an mRNA strand.  
(D) A mutagen is anything that causes a mutation.
7. Which of the following best describes the outcomes of artificial insemination of cattle?
- (A) Artificial insemination produces genetically modified calves that may not be safe for human consumption.  
(B) Artificial insemination produces genetically identical offspring.  
(C) Artificial insemination increases genetic diversity by passing on genes through different populations on different farms.  
(D) Artificial insemination enables a large number of cows to be inseminated with sperm from a bull that has optimal characteristics.
8. For centuries, genetically identical plants have been produced by taking multiple cuttings from one plant and growing them into another plant.

Which term describes this process?

- (A) gene cloning  
(B) whole organism cloning  
(C) genetically modified plants  
(D) agriculture

9. Which of the following contributes to genetic variation achieved through fertilisation?

- (A) increased rate of migration
- (B) mutagens producing beneficial alleles
- (C) males producing a large number of sperm
- (D) only one sperm entering an ova

10. Which of the following correctly describes a transgenic species?

- (A) A transgenic species has people who identify as male or female.
- (B) A transgenic species has DNA from two different species.
- (C) A transgenic species is produced through agriculture.
- (D) A transgenic species produces unsafe products.

11. Consider the following definition.

a chemical produced by an organ in the body that is transported to another part of the body where it causes a change in other cells, tissues or organs

This describes

- (A) a gland.
- (B) a hormone.
- (C) an effector.
- (D) a receptor.

12. Cigarettes sold in Australia have carried health warnings since 1973. Over many years, huge quantities of data on cancer patients have been collected and analysed to see if there are any common factors in populations affected by the disease. Tobacco has been confirmed as a major cause of lung cancer and other cancers.

The process of identifying tobacco as a cause of cancers is an example of

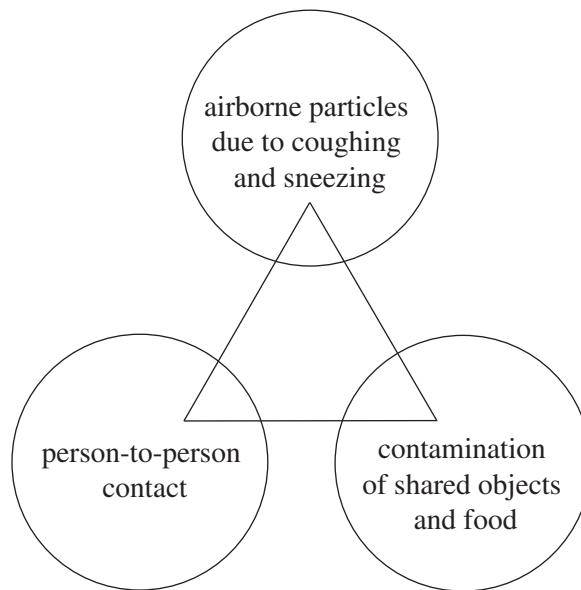
- (A) advertising.
- (B) disease management.
- (C) statistics.
- (D) epidemiology.

13. Dengue fever is not endemic in Australia, which means the pathogen causing the disease isn't permanently located in the country. However, over 1000 cases of dengue fever were reported in Australia in 2019.

Which of the following statements about the disease is correct?

- (A) Dengue fever is caused by a bacterium.
- (B) Cases of dengue fever in Australia can arise from people travelling to Australia from regions affected by the disease.
- (C) Dengue fever is caused by indirect contact.
- (D) Cases of dengue fever around the world are decreasing.

14. The diagram shows how influenza (the flu) is transmitted.



Based on this diagram, which of the following situations would LEAST likely result in the transmission of the flu virus from one person to another?

- (A) A fly landing on an infected person, then landing on an uninfected person.
- (B) Drinking from an unwashed cup previously used by an infected person.
- (C) Being in the same room with someone showing flu symptoms.
- (D) Eating food prepared by an infected person.

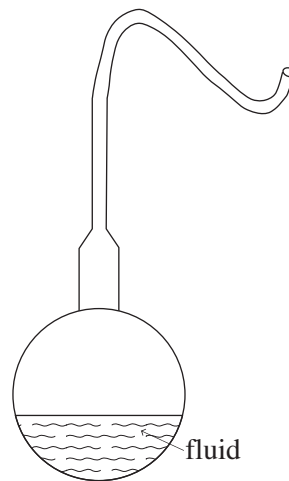
15. Which row of the table is correct for non-cellular pathogens?

	<i>Living</i>	<i>Can replicate outside host cell</i>	<i>Can infect many types of organisms</i>	<i>Example</i>
(A)	Yes	No	Yes	Prion
(B)	No	Yes	No	Bacterium
(C)	No	No	Yes	Virus
(D)	Yes	Yes	No	Protozoa

16. Neurofibromatosis is a disorder that causes tumours to grow on nerves throughout the body that affects one in 3000 people. The tumours are usually non-cancerous, and the condition is caused by cells that can no longer further cell reproduction. A person who is affected has a 50% chance of passing the disease onto their offspring.

Which of the following terms best classifies this disease?

- (A) infectious
  - (B) non-infectious
  - (C) environmental
  - (D) deficiency-related
17. Louis Pasteur (1822–1895) gave a famous demonstration in which he set up 60 glass flasks, each containing water, yeast and sugar. All of the flasks were boiled for two minutes, then 56 flasks were sealed. The four unsealed flasks were formed into goose-neck flasks; this was done by melting and shaping the necks of the flasks.



goose-neck flask

The goose-necked flasks were then boiled, and steam came out of the neck of each flask. The sealed flasks were divided into three groups. Each of the 60 flasks was opened in various locations and then re-sealed. Then they were left for several days. There was no growth of micro-organisms (microbes) in the four flasks with open, curved necks. The other groups had some flasks that remained sterile while others had micro-organisms growing.

The most likely hypothesis that Pasteur was testing was that microbes

- (A) come from cells of organisms in the air.
- (B) can be generated spontaneously from non-living matter.
- (C) can only grow in a medium that has been sterilised.
- (D) cause diseases.

18. The following is an extract from a newspaper article.

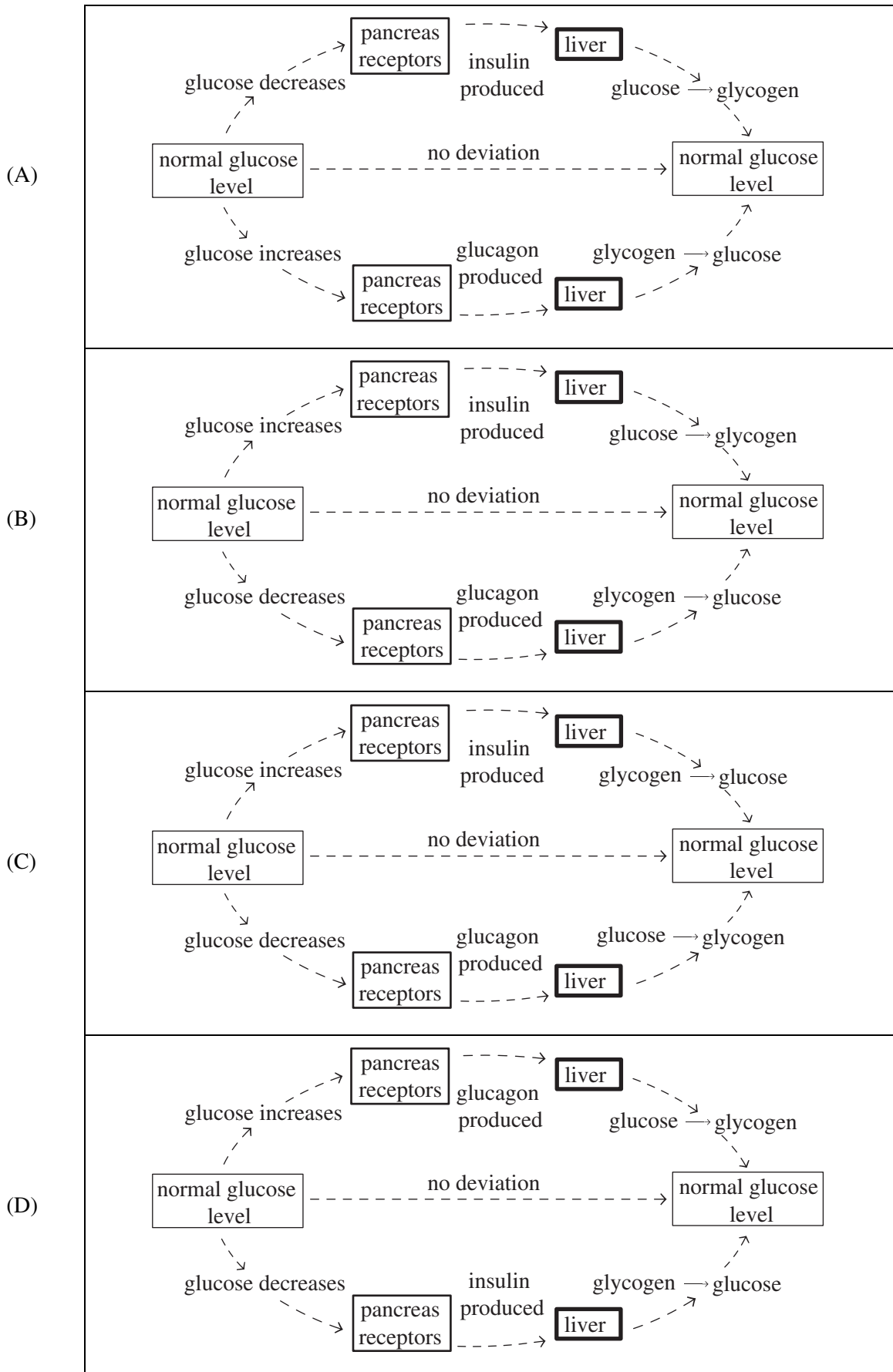
Severe combined immunodeficiency disease (SCID) is also known as the 'bubble boy disease'. SCID causes babies to be born with minimal immune protection, making them susceptible to developing life-threatening infections. The name 'bubble boy disease' came about due to sufferers needing to live in a sterile environment, which were originally plastic spheres ('bubbles'), to avoid infection. The latest treatment for SCID uses an altered version of HIV (that doesn't cause the disease AIDS) to replace the non-functioning part of the body that causes SCID with a functional copy. When the treatment is successful, the patient's immune system functions normally.

The development of a cure for SCID is an example of

- (A) hygiene.
  - (B) improved pharmaceuticals.
  - (C) body part transplant.
  - (D) genetic engineering.
19. Which of the following is an example of physiological adaptation in an endotherm that assists in maintaining homeostasis?
- (A) a dog moving into the shade to keep cool on a hot day
  - (B) lizards moving into sunlight to raise body temperature
  - (C) surface blood vessels in a human constricting on a cold day
  - (D) animals in cold climates having thick fur coats



20. Which diagram correctly represents a negative feedback loop controlling the level of glucose in the bloodstream of a healthy human?



## Section II

**80 marks**

**Attempt Questions 21–34**

**Allow about 2 hours and 25 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.

Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

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### **Question 21** (3 marks)

Fertilisation in animals depends on a watery environment, to enable sperm to swim to ova.

**3**

Explain how terrestrial animals overcame the challenge of fertilisation on land AND describe ONE advantage of this process.

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**Question 22** (4 marks)

A female who is heterozygous for a trait reproduces with a male who has the dominant allele for that trait. The likelihood of producing a female with a dominant trait expressed in the phenotype is 100%. The likelihood of producing a male with the dominant trait expressed in the phenotype is 50%.

- (a) Identify the pattern of inheritance in this example. **1**

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- (b) Construct a model to support your answer to part (a). **3**

**Question 23** (4 marks)

A gene has three alleles in a population: G1, G2 and G3. The frequency of G1 in that population is 60% or 0.6. G2 has a frequency of 0.25.

- (a) What is the frequency of G3? **1**

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- (b) A person who is homozygous for the G2 trait reproduces with a person who is homozygous for the G3 trait. It was stated that they have a 25% chance of producing a person with the G2 trait in their phenotype. **3**

Determine the validity of this analysis. Provide evidence to support your answer.

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**Question 25** (5 marks)

Aneuploidy occurs when an extra copy of a chromosome, or only one copy of a chromosome, is found in cells.

(a) Construct a diagram to show the gametes produced as a result of a chromosomal mutation. **2**

(b) Describe how the gametes form. **3**

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**Question 26** (5 marks)

Two different mutations are shown. It is possible that each mutation may harm the cell or have no impact on the cell.

A T A C T C A G A T T A C G T

A T A C T C A G A T T A C G T

Mutation I  
↓

Mutation II  
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A T A C T C A A A T T A C G T

A T A C T C A A G A T T A C G

- (a) Outline the difference between the two mutations. **2**

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- (b) Which mutation is most likely to have the greater effect on a cell? Give evidence to support your answer. **3**

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**Question 28** (4 marks)

Describe ONE technique that uses recombinant DNA technology AND outline the applications of this technique. **4**

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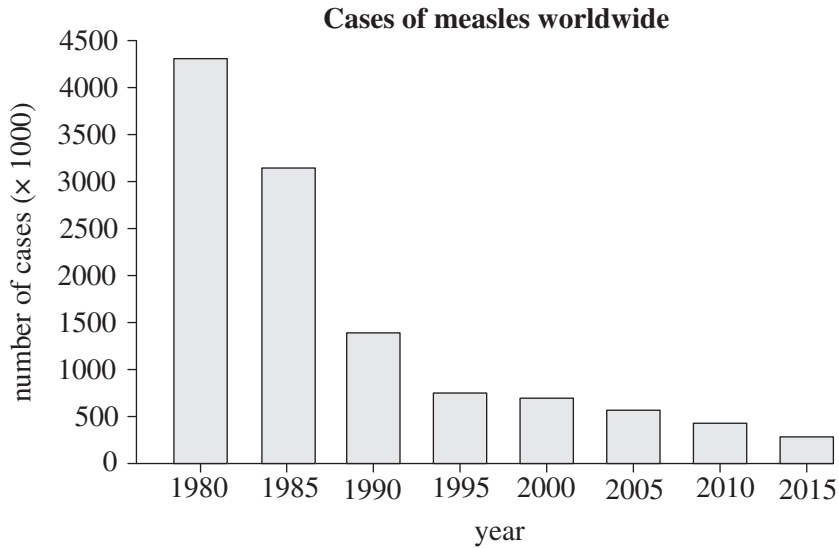
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**Question 29** (11 marks)

A researcher gathered data from many sources to study the worldwide incidence of cases of measles every five years for the period 1980–2015. The findings are represented in the graph.



- (a) Describe the trend of cases AND give ONE likely cause for this. **1**

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- (b) Many health authorities reported a surge in measles in 2018 and 2019. **1**

Give ONE likely cause for this increase.

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**Question 29 continues on page 19**

Question 29 (continued)

(c) The mortality rates for measles range from 0.1% in some countries up to 10% in others.

(i) Explain what is meant by mortality rates. 2

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(ii) Give TWO likely reasons for the range in measles mortality rates around the world. 2

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(d) Antibiotics do NOT cure measles. 1

What does this indicate about the cause of measles?

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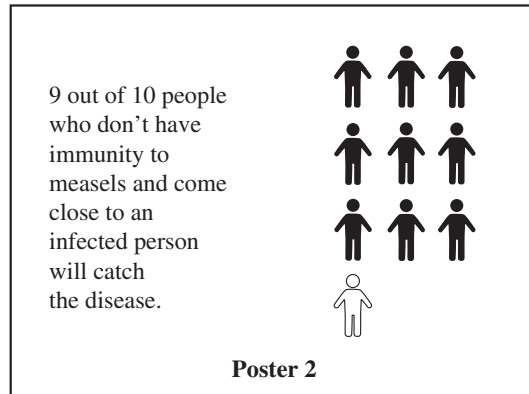
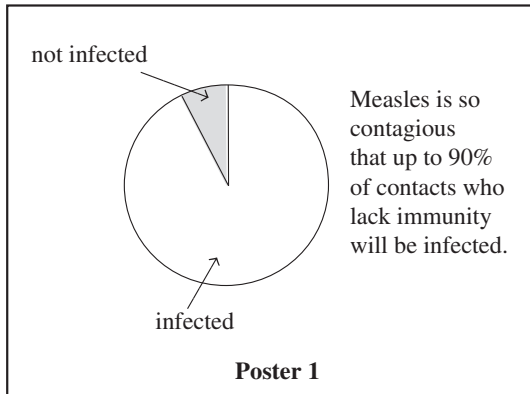
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**Question 29 continues on page 20**

Question 29 (continued)

(e) Discuss the purpose of the TWO posters AND assess their effectiveness.

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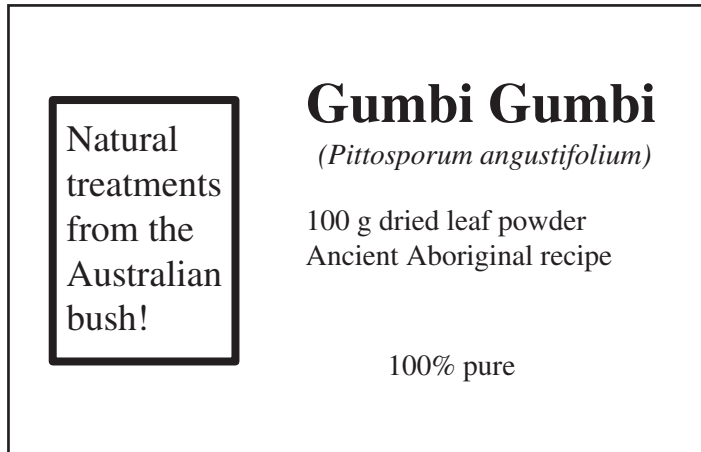
**End of Question 29**



**Question 31** (3 marks)

Gumbi Gumbi (Gumby Gumby) is an Aboriginal Australian bush medicine traditionally used to treat coughs and colds. Traditional bush medicines such as Gumbi Gumbi are sold and used by non-Indigenous individuals. The illustration shows a typical label for this product.

**3**



Outline what is meant by the term ‘bush medicine’ AND explain why the recognition and protection of Aboriginal Australian cultural and intellectual property is important.

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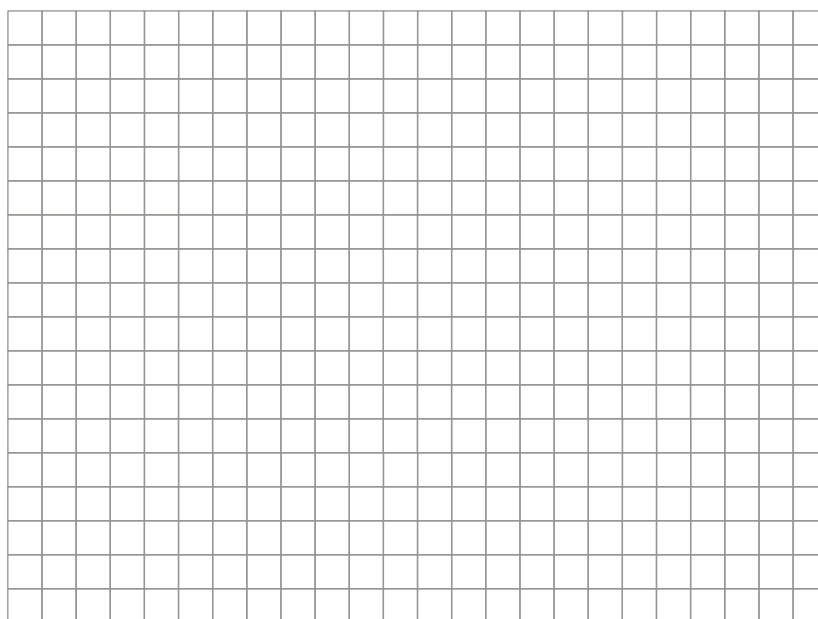
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**Question 32** (6 marks)

A researcher investigated the rate of transpiration in wheat plants at various temperatures. The results are shown in the table.

<i>Leaf temperature</i> ( $^{\circ}\text{C}$ )	20	25	30	35	40	45
<i>Transpiration rate</i> ( $\text{mmol H}_2\text{O m}^{-2}\text{s}^{-1}$ )	2	8	12	16	23	31

(a) Using this data, draw and label an appropriate graph on the following grid.

**3**

(b) Give a conclusion that could be drawn from this graph.

**1**

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(c) Outline the role that transpiration plays in maintaining water balance in plants.

**2**

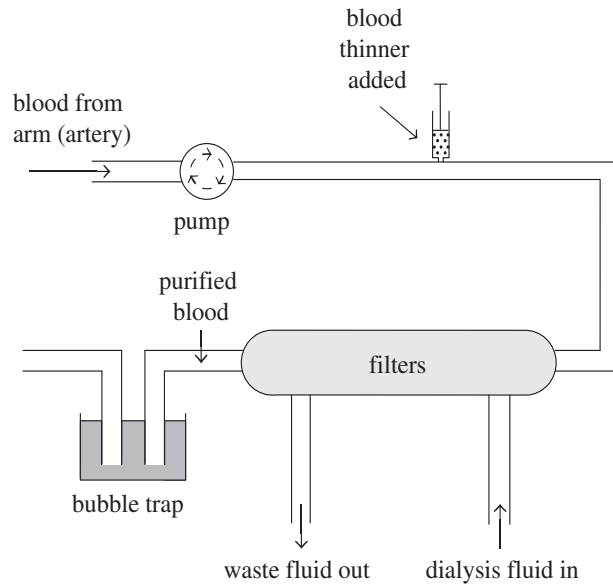
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**Question 33** (7 marks)

When human organs are damaged, sometimes it is possible to replace them using mechanical devices. The diagram shows a simplified version of a machine used to treat people who have kidney failure.



- (a) Identify and describe the process carried out by this machine. **4**

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**Question 33 continues on page 25**



Question 33 (continued)

- (b) Explain how well this technology replaces a human kidney. **3**

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**End of Question 33**

**Question 34** (7 marks)

Diabetes is a disease where a persons' blood glucose levels are not properly controlled in the body. A health authority published the following statistics for a specific population.

For this calendar year:

- population size (16 years and over): 6.1 million
- total cases of diabetes (includes new and existing cases): 192 760
- new cases of diabetes (in calendar year): 29 280

(a) Use these figures to calculate the following.

(i) incidence of the disease **1**

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(ii) prevalence of the disease **1**

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(b) Diabetes is a non-infectious disease. Nutritional diseases and diseases caused by the environment are also non-infectious diseases. **5**

Describe the cause, effect(s), treatment/management and means of prevention of a nutritional disease OR a disease caused by environmental exposure. Present your information in a table.

**End of paper**



### DIRECTIONS:

Write your name in the space provided.

Write your student number in the boxes provided below. Then, in the columns of digits below each box, fill in the oval which has the same number as you have written in the box. Fill in **one** oval only in each column.

Read each question and its suggested answers. Select the alternative A, B, C, or D that best answers the question. Fill in the response oval completely, using blue or black pen. Mark **only one** oval per question.

A  B  C  D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A  B  C  D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and draw an arrow as follows.

A  B  C  D

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## SECTION I MULTIPLE-CHOICE ANSWER SHEET

1. A  B  C  D
2. A  B  C  D
3. A  B  C  D
4. A  B  C  D
5. A  B  C  D
6. A  B  C  D
7. A  B  C  D
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11. A  B  C  D
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13. A  B  C  D
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16. A  B  C  D
17. A  B  C  D
18. A  B  C  D
19. A  B  C  D
20. A  B  C  D

**STUDENTS SHOULD NOW CONTINUE  
WITH SECTION II**