Neap

Trial Examination 2023

HSC Year 12 Biology

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

Total Marks: 100

Section I – 20 marks (pages 2–11)

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

Section II – 80 marks (pages 13–30)

- 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 2023 HSC Year 12 Biology examination.

SECTION I

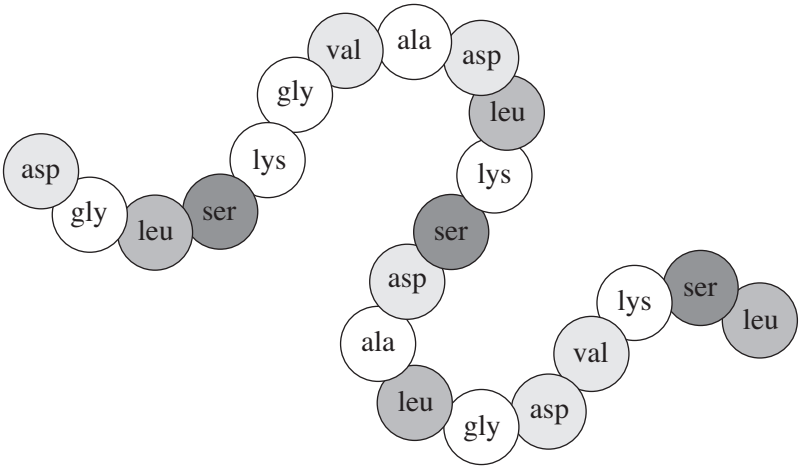
20 marks
Attempt Questions 1–20
Allow about 35 minutes for this section

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

1 Dialysis is

A. a surgical procedure.
B. used to filter blood through a machine.
C. used to diagnose how well a kidney functions.
D. used to repair kidneys that have lost some of their functions.

2 Consider the diagram.



Which of the following structures does the diagram model?

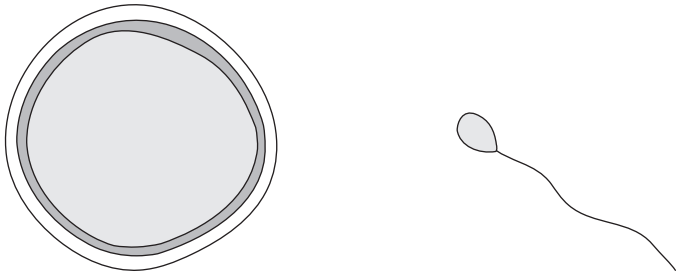
A. polypeptide
B. amino acid
C. nucleotide
D. ribonucleic acid (RNA)

3 In animals, gametes can join via either external or internal fertilisation.
Which of the following statements about fertilisation is correct?

A. External and internal fertilisation are asexual processes.
B. External fertilisation is most approriate for animals in wet environments.
C. External fertilisation produces fewer gametes than internal fertilisation.
D. Internal fertilisation produces offspring that develop outside the parent.

4 The diagram shows two mammalian gametes at different magnifications.

Mammalian gametes



ovum ×200 sperm ×2000

If the sperm is 0.02 mm long, the diameter of the ovum is closest to

A. 0.002 mm
B. 0.02 mm
C. 0.2 mm
D. 2 mm

5 The events that occur during mitosis are listed in the incorrect order.

I Each chromosome doubles and lines up along the centre of the cell.
II Pairs of chromosomes become visible.
III The parent cell rests and no chromosomes are visible.
IV Each new daughter cell has the same chromosome number as the parent cell.
V The cell starts to divide and the chromosomes split.

What is the correct order in which the events occur?

A. V, IV, I, II, III
B. III, II, V, I, IV
C. III, II, I, V, IV
D. IV, III, V, II, I

6 There are two alleles for the shape of peas: round and wrinkled. The allele for a round pea is dominant and represented by R. The allele for a wrinkled pea is recessive and represented by r.

A student was asked to draw a Punnett square to represent a cross between a homozygous round pea and a homozygous wrinkled pea.

Which of the following Punnett squares represents the cross?

A.

	R	R
r	Rr	Rr
r	Rr	Rr

B.

	R	R
r	Rr	Rr
r	RR	rr

C.

	R	r
R	RR	Rr
r	Rr	rr

D.

	R	r
R	Rr	Rr
r	Rr	Rr

7 When molecules of DNA from two different species are inserted into a host organism, the new genetic combinations produced are of great value to science, medicine and agriculture.

This describes the process of

A. transplanting.

B. mutation.

C. conservation management.

D. recombinant DNA technology.

8 Human DNA can be divided into coding and non-coding DNA.
Which row of the table outlines the characteristics of coding and non-coding DNA?

	Coding DNA	*Non-coding DNA*
A.	makes up approximately 98.5% of human DNA	makes up approximately 1.55% of human DNA
B.	codes for proteins	is important to the structure, function and regulation of a cell
C.	can mutate, which often changes the sequences of amino acids	mutations can only be inherited from a parent
D.	can mutate, which often results in phenotypic changes	does not directly code for proteins

9 Artificial insemination is often used in the cattle farming industry.
Which of the following statements about artificial insemination is correct?

A. It is a technically simple process and requires little skill.
B. It has a success rate of nearly 100%.
C. It allows farmers access to the genetics of bulls that are too expensive to buy.
D. It can be carried out at any time in a cow's life.

10 A germ cell

A. is involved in sexual reproduction.
B. is diploid.
C. resists disease.
D. causes disease.

11 The steps in a biological process are listed.

I The nucleus of an unfertilised egg cell from individual A is removed.

II The nucleus of a body cell from individual B is inserted into the egg cell from individual A.

III The egg cell is stimulated so it divides and forms an embryo.

IV Once the embryo has developed, it is inserted into the womb of an adult individual and continues to develop.

Which of the following statements about this process is correct?

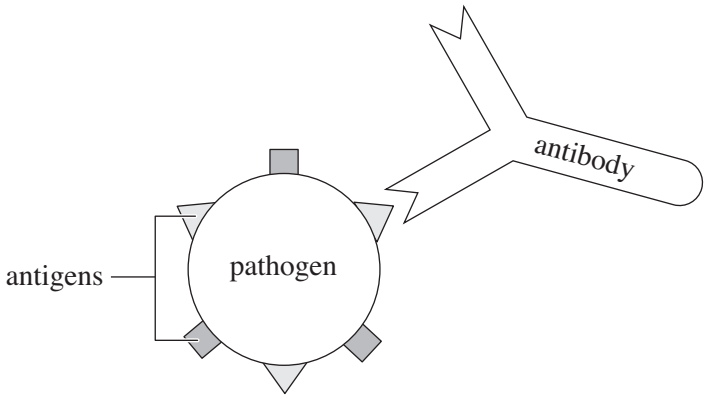
A. It is the process through which new varieties of plants are developed.

B. It is a fully developed process that is commonly used with a large variety of mammals.

C. It results in an individual that is genetically identical to individual A.

D. It results in an individual that is genetically identical to individual B.

12 The diagram shows some of the components involved in the human immune response.



Which row of the table describes the characteristics of the components shown?

	Antibodies	*Antigens*	*Pathogens*
A.	can cause disease	trigger the immune response	assist the immune system
B.	trigger an immune response	can attack bacteria and viruses	can cause disease
C.	are produced by the body	trigger an immune response	can cause disease
D.	assist the immune system	are produced by the body	can be bacteria or viruses

13 Which of the following are non-cellular pathogens?

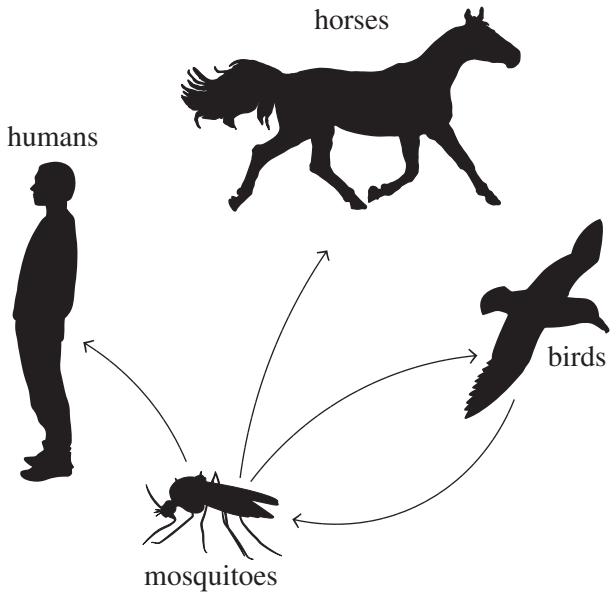
A. prions and viruses

B. bacteria and fungi

C. protozoa and viruses

D. bacteria and prions

14 The diagram shows the transmission of the West Nile virus between various organisms.



Which organism is the vector for the disease?

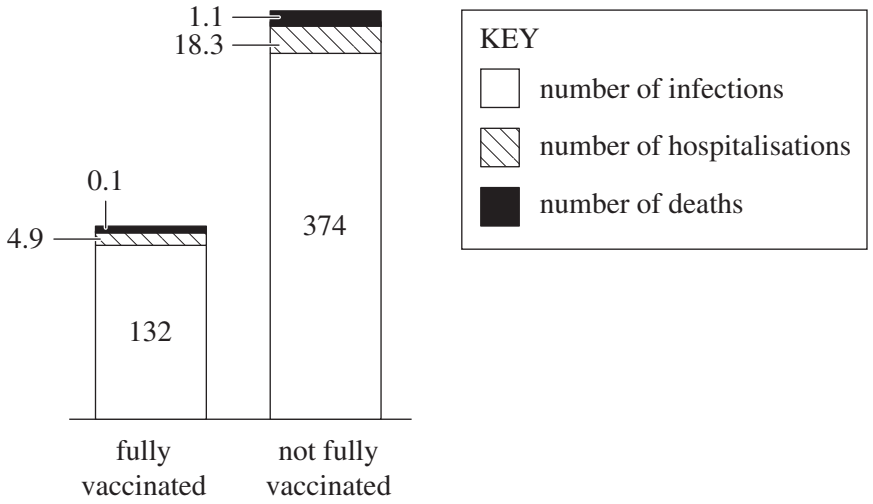
A. birds

B. horses

C. humans

D. mosquitoes

15 A group of epidemiologists undertook a study to compare the effects of COVID-19 on individuals who were fully vaccinated with individuals who were not fully vaccinated. The not fully vaccinated group included individuals who had not completed the full course of vaccinations and individuals who had not been vaccinated at all. The graph shows the results of the study, where the data is represented as a proportion of each 100 000 individuals in the population.



Which of the following statements about the study is correct?

A. There were more individuals in the not fully vaccinated group than the fully vaccinated group.

B. No individual who had a full course of vaccination died due to COVID-19.

C. In this study, there were a total of 506 individuals who were infected with COVID-19.

D. Individuals in the fully vaccinated group were approximately 10 times less likely to die than individuals in the not fully vaccinated group.

16 Which of the following mechanisms allows the water balance in plants to be maintained?

A. opening and closing of stomates

B. hormonal control

C. perspiration

D. photosynthesis

17 The table shows the mortality rates resulting from the major causes of death in Australia in 2021. The data was gathered and averaged from a range of sources and the numbers have been rounded to the nearest hundred.

Females		*Males*	
Disease	*Number of deaths*	*Disease*	*Number of deaths*
dementia/Alzheimer's disease	9500	coronary heart disease	11 000
coronary heart disease	6700	dementia/Alzheimer's disease	5600
cardiovascular disease	5800	lung cancer	4600
lung cancer	3400	cardiovascular disease	4100
breast cancer	3200	prostate cancer	3700

Which statement could be made about the data?

A. The data is not useful because it was gathered from a range of sources.

B. Overall, coronary heart disease was the leading cause of death in 2021.

C. The data is not useful because it is not current.

D. It is not useful to compare the mortality rates of men and women separately.

18 Which of the following statements about epidemiology is correct?

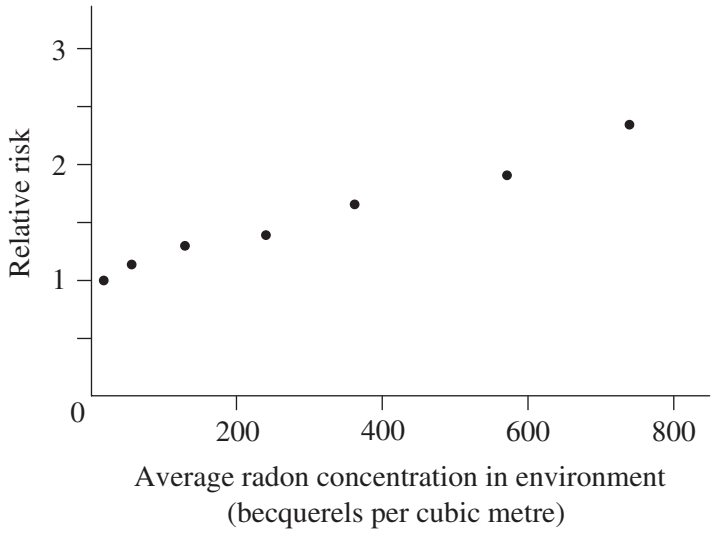
A. It is mainly concerned with developing new cures for diseases.

B. It investigates infectious diseases only.

C. It determines the causes of diseases and identifies who is affected by them.

D. It makes little use of statistics.

19 Radon is an invisible, odourless gas that occurs naturally in Earth's atmosphere. The concentration of this gas can build up gradually in buildings. A group of scientists decided to investigate the concentration of radon in certain buildings and the incidence of lung cancer in the individuals who lived or worked in these buildings. The graph shows the results of their investigation.



What conclusion can be drawn from the graph?

A. If no radon is present in an individual's surroundings, they are at no risk of developing lung cancer.

B. Smokers are more likely to develop lung cancer than non-smokers.

C. There is a correlation between the amount of radon in an individual's surroundings and their risk of developing lung cancer.

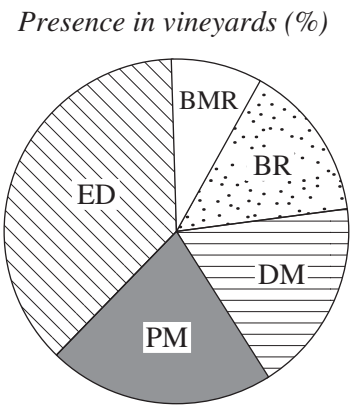
D. The concentration of radon in a particular area increases as time passes.

20 A study was conducted to investigate the incidence of pathogens on vineyard grapes. The passage represents an extract of the results.

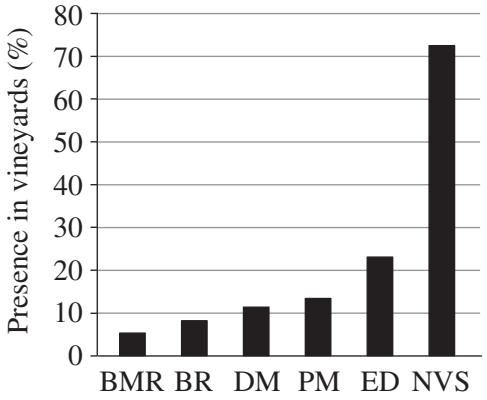
> Of the vineyards studied, we found that 5% had some cases of blue mould rot (BMR), 9% had black rot (BR), 11% had downy mildew (DM), 13% had powdery mildew (PM) and 23% showed eutypa dieback (ED). There were no visible signs (NVS) of pathogens in 72% of the vineyards studied.

Which of the following graphs best represents these results?

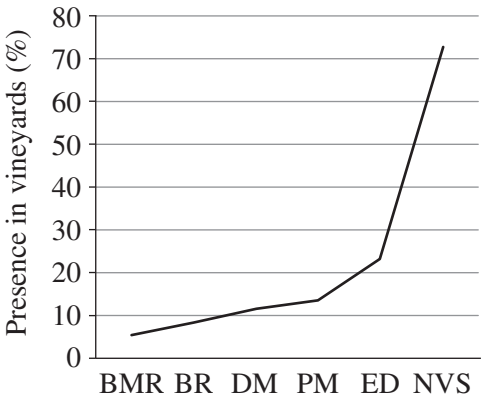
A.



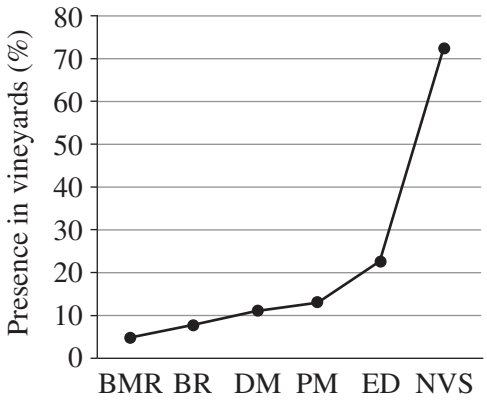
B.



C.



D.



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HSC Year 12 Biology

Section II Answer Booklet

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

Instructions

- 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.

Please turn over

Question 21 (6 marks)
RNA and DNA have closely related structures and compositions.

(a) Draw a table that shows the similarities and differences between the structure of RNA and DNA. **4**

(b) Identify ONE role of mRNA. **1**

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(c) Identify ONE role of tRNA. **1**

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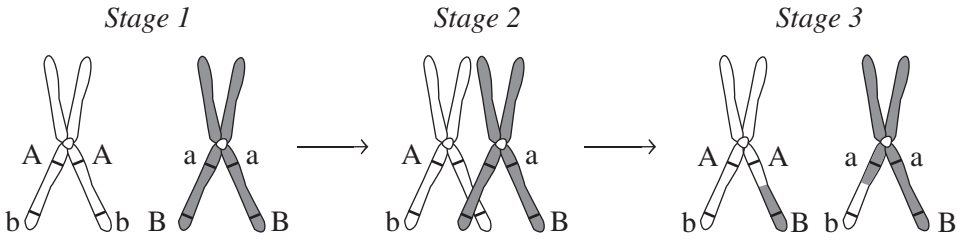
Question 22 (5 marks)

The diagram shows the process of meiosis.



(a) Name the structures shown in the diagram. **1**

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(b) Outline what occurs during each of the three stages shown in the diagram. **3**

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(c) What effect does meiosis have on the genetic variation of the offspring produced? **1**

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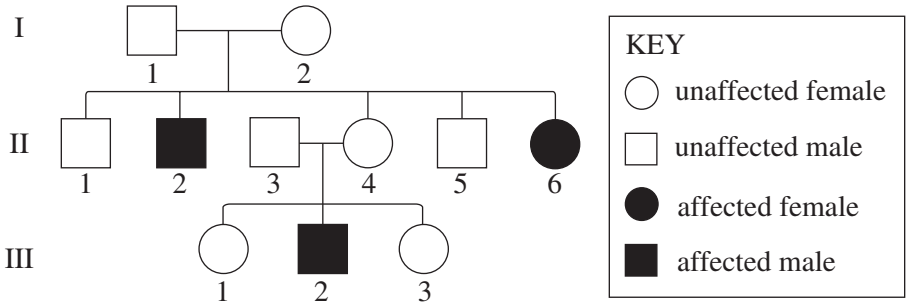
Question 23 (9 marks)

Cystic fibrosis is a rare, autosomal recessive genetic disorder that involves large amounts of extremely viscous mucus growing in the lungs, airways and digestive system. This mucus damages the digestive functions of the pancreas and causes bacteria to become trapped in the lungs. Recurrent infections occur as a result, leading to irreversible damage. The pedigree shows the inheritance of cystic fibrosis in a family within three generations.



(a) Outline what is meant by autosomal recessive. **2**

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Question 23 continues on page 17

Question 23 (continued)

(b) Identify TWO individuals from the pedigree chart that are heterozygous for the cystic fibrosis genotype. Explain your answer. **6**

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(c) There is no cure for cystic fibrosis. **1**

Why are antibiotics often used to treat individuals with cystic fibrosis?

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End of Question 23

Question 24 (5 marks)
Mutations are important factors in genetics.

(a) Identify TWO types of mutagens. **1**

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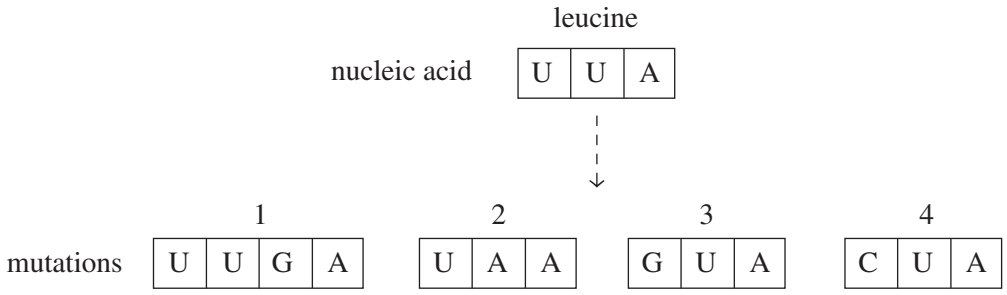
The diagram shows four examples of a particular type of mutation. The effects of each example are shown in the table.



Mutation	*Effect*
1	alters all following amino acids in the sequence
2	acts as a ‘stop’ codon
3	forms valine
4	forms leucine

(b) Identify the type of mutation shown in the diagram. Explain your answer. **2**

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(c) Why will mutation 1 alter all subsequent amino acids? **2**

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Question 25 (5 marks)

Consider the journal article extract. **5**

> Eighty percent of flowering plants, including many of the food crops we eat, require the help of animal pollinators such as bees to reproduce. Various factors, such as a decline in bee health and numbers in some areas, have led growers to consider artificial pollination.

Compare the processes and effects of natural and artificial pollination in agriculture.

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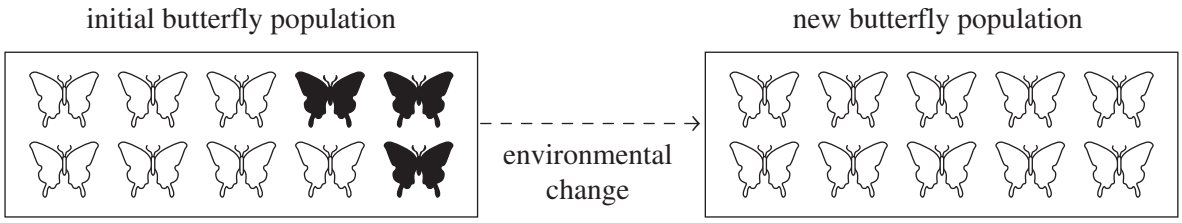
Question 26 (7 marks)

Using examples, analyse the social implications and ethical uses of biotechnology. **7**

Question 27 (5 marks)

A student was asked to submit a report evaluating the effect of genetic drift on the gene pool of a population. The student submitted the response shown. **5**

> Genetic drift occurs as a result of random events and is a change in allele frequency within a population (the number of organisms of the same species that live in a particular geographic area at the same time).
>
> This occurs due to a random selection of certain genes, which means the characteristics passed on to an organism's offspring do not necessarily affect their fitness. Genetic drift can also be defined as the transfer of alleles or gametes from one population to another, which lessens the gene pool of the original population. The gene pool is the sum of all the different genes in that population.
>
> The diagram shows how a butterfly population can change over time.
>
> 
>
>
> The different phenotypes, and hence genotypes, are represented by the light and dark butterflies. When the butterfly population moves to another environment, some of the butterflies die (the dark ones) and only the light ones are left to breed.
>
> Genetic drift occurs in both small and large populations. However, its effects are likely to have a greater impact on small populations. This is because the smaller the number of organisms there are in a population, the greater the chances of losing alleles completely. This decreases the size of the gene pool. Mutation and gene flow can also have an effect on the gene pool of a population.

Using your knowledge of genetic drift, assess the student's report.

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Question 28 (5 marks)

Federal and state health authorities often run public health campaigns. **5**

Using examples of specific strategies, explain how public health campaigns can minimise the spread of infectious diseases.

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Question 29 (6 marks)

Pharmaceutical companies are constantly developing new medicines to help treat diseases. These include antivirals and antibiotics.

(a) Hua went to the doctor because she was experiencing a mild fever and aches and pains. She asked the doctor to prescribe antibiotics to combat her symptoms. After examining Hua, the doctor did not prescribe antibiotics and instead encouraged her to drink plenty of fluids and get plenty of rest. **2**

Outline ONE reason why the doctor may have decided NOT to prescribe antibiotics.

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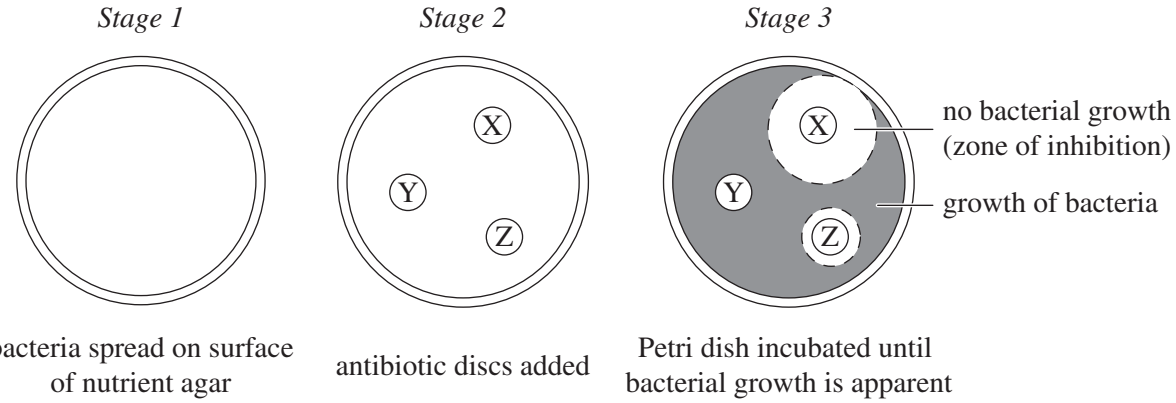
(b) A biologist wanted to investigate the properties of antibiotics. As part of their investigation, the biologist set up a Petri dish containing nutrient agar, which is a gel used as a medium for growing bacteria. The biologist spread a sample of a specific bacterium on the surface of the nutrient agar, then added small discs of paper, each soaked in one of three antibiotics, X, Y or Z. They incubated the Petri dish at 37°C until the growth of the bacterium could be observed. The diagram shows the process and results of the investigation. **4**



Outline the purpose of the investigation and, with reference to the diagram, provide a conclusion that can be drawn from the investigation.

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Question 30 (3 marks)

Consider the newspaper article excerpt. **3**

> When foot-and-mouth disease (FMD) was detected in Bali, Indonesia, last year, it caused alarm in the Australian livestock industry. FMD is a highly contagious viral infection. Although it is extremely rare, FMD can be transmitted to humans. The main cause for concern is that humans can carry the disease on their shoes and clothes and thus spread it to cattle, sheep and pigs. There is no cure for FMD. Infected animals must be humanely destroyed to prevent the spread of the disease. One prominent politician has called for the government to impose restrictions on international travel, including quarantine for passengers returning from Bali.

Outline why the politician suggested enforcing quarantine as a method of preventing FMD from arriving in Australia.

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Question 31 (5 marks)

When a pathogen enters an animal, the animal's cells and tissues respond to the pathogen. The response includes physical and chemical changes.

(a) Define pathogen. **1**

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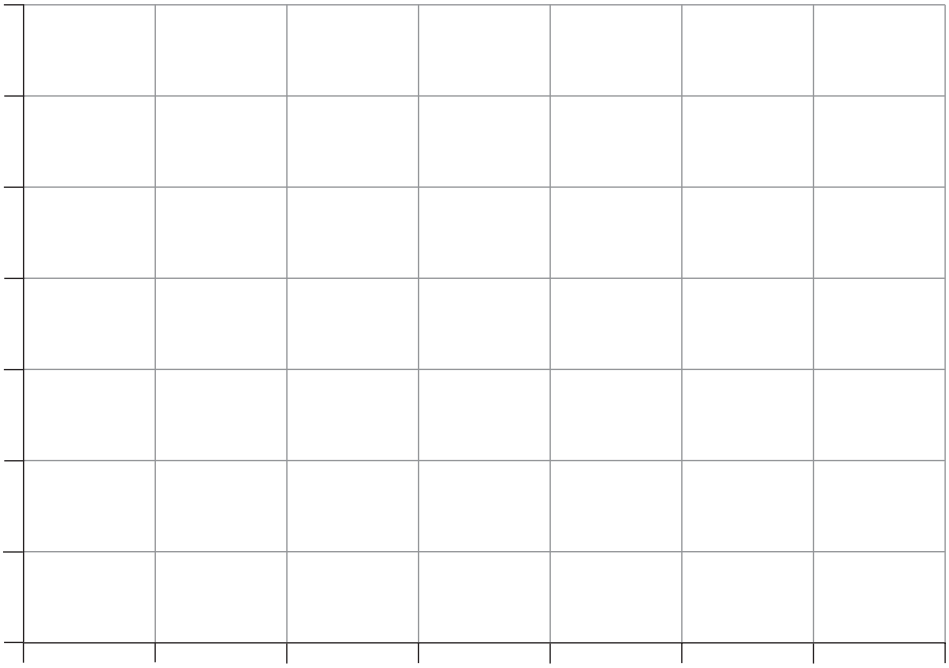
(b) Draw a table that identifies and describes TWO physical and TWO chemical changes that occur in animals as a response to pathogens. **4**

Question 32 (7 marks)

Glaucoma is a disease that damages the optic nerve in the eye. It usually occurs when fluid builds up and increases pressure inside the eye. A group of researchers conducted a study to investigate a potential link between type 1 diabetes and glaucoma. The researchers selected a sample of participants who have type 1 diabetes and recorded the duration of time that had passed since each participant was diagnosed with type 1 diabetes. They also recorded the percentage of participants who had experienced glaucoma. The results are shown in the table.

Duration of diabetes (years)	0	5	10	15	20	25	30	35
Percentage of participants with glaucoma	0	2	3	4	6	8	11	13

(a) On the axes provided, draw and label a graph of the data. **3**



Question 32 continues on page 27

Question 32 (continued)

(b) Construct a hypothesis for the investigation. **1**

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(c) Type 1 diabetes occurs when the level of glucose in the blood is not properly regulated. **3**
Construct a negative feedback loop that shows how glucose levels are regulated in humans.

End of Question 32

Question 33 (5 marks)

Genetic engineering is a method used to prevent a number of non-infectious diseases and has shown some success. **5**

Evaluate the effectiveness of genetic engineering in preventing a specific non-infectious disease.

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Question 34 (7 marks)

Roman began experiencing hearing loss, so he consulted a hearing specialist. He expected the hearing specialist to recommend that he start wearing hearing aids. Instead, the hearing specialist recommended an alternative technology. **7**

Identify a technology that the hearing specialist may have recommended to Roman and compare this technology to hearing aids.

End of paper

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

Trial Examination 2023

Neap HSC Year 12 Biology

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.

correct ↓

A ⊗ B ⊗ C ○ D ○

STUDENT NAME: _____

STUDENT NUMBER:

1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9
0	0	0	0	0	0	0	0	0

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 ○
8.	A ○	B ○	C ○	D ○
9.	A ○	B ○	C ○	D ○
10.	A ○	B ○	C ○	D ○
11.	A ○	B ○	C ○	D ○
12.	A ○	B ○	C ○	D ○
13.	A ○	B ○	C ○	D ○
14.	A ○	B ○	C ○	D ○
15.	A ○	B ○	C ○	D ○
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