

Trial Examination 2022

## HSC Year 12 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 2–7)

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

#### SECTION II – 80 marks (pages 9–24)

- Attempt Questions 21–35
- Allow about 2 hours and 25 minutes for this section

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Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2022 HSC Year 12 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.

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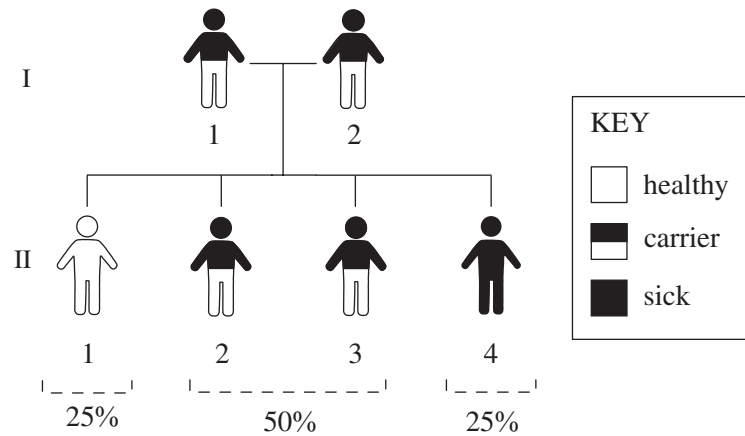
- 1** Gene cloning
- A. occurs in nature.
  - B. gives multiple copies of the same gene.
  - C. gives multiple copies of different genes.
  - D. is a simple, one-stage process.

- 2** Which row of the table correctly describes mitosis and meiosis?

	<i>Mitosis</i>	<i>Meiosis</i>
A.	produces genetically identical cells	produces genetically unique cells
B.	results in haploid cells	results in diploid cells
C.	involved in sexual reproduction	involved in asexual reproduction
D.	forms four daughter cells	forms two daughter cells



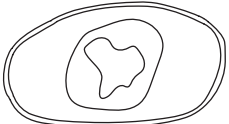

- 3** External fertilisation
- A. is a type of asexual reproduction.
  - B. involves a great deal of parental care for subsequent offspring.
  - C. mainly occurs in terrestrial animals.
  - D. only occurs in aquatic environments.

- 4 Two parents are carriers for a particular disease. The diagram shows the relative percentages of the chances of the parents' offspring being healthy, carriers of the disease or sick with the disease.



Which of the following types of inheritance is shown in the diagram?

- A. incomplete dominance
  - B. co-dominance
  - C. autosomal recessive
  - D. autosomal dominant
- 5 Which of the following diagrams best represents the arrangement of DNA in a prokaryotic cell?

<p>A.  single loop of DNA no nucleus</p>	<p>B.  strands of DNA has a nucleus</p>
<p>C.  single loop of DNA has a nucleus</p>	<p>D.  strands of DNA no nucleus</p>

- 6 Which of the following statements about chromosomal mutations is correct?
- A. They are relatively small-scale changes.
  - B. Only specific gene sequences are changed.
  - C. The number of chromosomes in the genome often changes.
  - D. They involve a single nucleotide variation.

- 7 The diagram shows the original sequence of a stretch of a chromosome and four possible types of mutation (*P*, *Q*, *R* and *S*).

original sequence	Leu	Pro	Thr	Phe	Cys	
mutation <i>P</i>	Leu	Thr	Pro	Phe	Cys	
mutation <i>Q</i>	Leu	Pro	Thr	Phe	Phe	Cys
mutation <i>R</i>	Leu	Pro	Thr	Cys		
mutation <i>S</i>	Leu	Glu	Thr	Phe	Cys	

Which row of the table correctly identifies each type of mutation?

	<i>Mutation P</i>	<i>Mutation Q</i>	<i>Mutation R</i>	<i>Mutation S</i>
A.	translocation	duplication	deletion	inversion
B.	inversion	duplication	deletion	translocation
C.	translocation	inversion	deletion	duplication
D.	inversion	duplication	translocation	deletion

- 8 Consider the following definition.

It makes up over 90% of the human genome, most of it lies between genes on the chromosomes and it has few known functions.

Which of the following is referred to by the definition?

- A. messenger RNA (mRNA)  
 B. autosomal DNA  
 C. mitochondrial DNA  
 D. non-coding DNA
- 9 Gene flow
- A. mainly occurs when organisms are exposed to mutagens.  
 B. maintains the genetic stability of a group of organisms.  
 C. can introduce new genetic material to a population.  
 D. only occurs in animals.

- 10** A single nucleotide polymorphism (SNP) is a small genetic change, or variation, that can occur within a DNA sequence.

The study of SNPs in a population of organisms could be used to gain information on

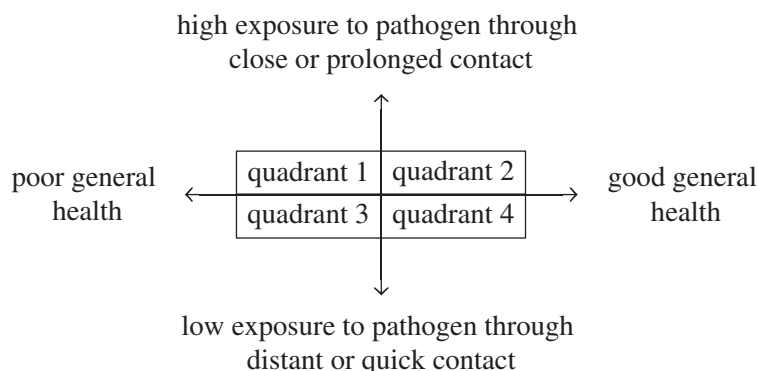
- A. physical variations in the population.
- B. relationships between organisms in the population.
- C. the effect of the environment on physical characteristics.
- D. the physical shape of the DNA present in this organism.

- 11** Prions and viruses are both non-cellular pathogens.

Which row of the table correctly identifies the characteristics of viruses and prions?

	<i>Virus</i>	<i>Prion</i>
A.	eukaryotic	prokaryotic
B.	chain of nucleotides	chain of polypeptides
C.	bases that have folded incorrectly	chain of amino acid that has folded into an incorrect form
D.	microscopic	macroscopic

- 12** A medical team is assessing the number of people in a population who are likely to get the symptoms of a disease as a result of exposure to a pathogen. Members of the population are allocated to the quadrants shown in the diagram.



Which row of the table gives the correct assessment of who is most and least likely to get symptoms?

	<i>Most likely to get symptoms</i>	<i>Least likely to get symptoms</i>
A.	quadrant 2	quadrant 3
B.	quadrant 1	quadrant 4
C.	quadrant 1	quadrant 2
D.	quadrant 3	quadrant 2

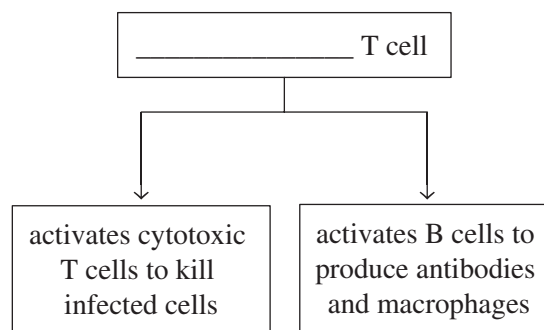
- 13** Robert Koch developed postulates for disease.

Which of the following statements best describes the purpose of Koch's postulates?

- A. The microorganism that causes a specific disease can be identified.
- B. Healthy organisms can become sick when infected with a microorganism.
- C. Cultures of a disease-causing pathogen can always be grown from samples of unhealthy animals.

- D. Microbes from the air were trapped in glass tubing during Koch's famous experiments.
- 14 One parent and one child from the same family tested positive for an infectious disease. While they were sick, the infected parent and child decided to stay in their caravan in the backyard, and the rest of the family stayed inside the house. Which of the following terms describes this behaviour?
- A. public health campaign  
B. vaccination  
C. hygiene  
D. quarantine

- 15 The diagram shows the function of a T cell.



- Which type of T cell triggers this response in T cells and B cells, increasing the body's response to infection?
- A. helper T cells  
B. cytotoxic T cells  
C. suppressor T cells  
D. memory T cells
- 16 Haemophilia is a disease that is caused by a mutation on the X chromosome. It can be passed on to offspring. What type of disease is haemophilia?
- A. cancer  
B. environmental  
C. nutritional  
D. genetic
- 17 Which of the following best describes the term 'prevalence of a disease'?
- A. the proportion of people in a population who have a disease at a given time  
B. the rate at which people develop a disease in a given time  
C. the number of people who die from a disease on a given day  
D. the number of people hospitalised due to a disease on a given day

- 18** Governments invest in education programs to reduce the incidence of childhood obesity, as a rise in childhood obesity has been linked to higher rates of type 2 diabetes in children. The purpose of these education programs is to
- prevent the occurrence of obesity.
  - cure children with type 2 diabetes.
  - make children aware of the treatments for diabetes.
  - prevent discrimination against children who are overweight or obese.
- 19** Which of the following organs could be treated with a cochlear implant?
- eye
  - heart
  - ear
  - kidney
- 20** The table shows the changes in the human body when an individual begins exercising.

<i>Internal coordination systems in response to breathing</i>				
<i>Rate of cellular respiration</i>	<i>Concentration of carbon dioxide in the blood</i>	<i>Concentration of oxygen in the blood</i>	<i>pH of blood</i>	<i>Rate of breathing</i>
increase	increase	decrease	decrease	increase

The following steps are processes in the stimulus response pathway.

- Nerves send a signal about lower blood pH to the brain.
- Nerves send a signal to an effector.
- Chemoreceptors detect a decrease in blood pH.
- Muscles in the pulmonary system (diaphragm) contract and relax at a faster rate, returning oxygen and carbon dioxide to optimum levels.

What is the correct order of steps to explain the changes in the human body when an individual begins exercising?

- III, IV, I, II
- I, II, III, IV
- III, I, II, IV
- III, II, I, IV

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# HSC Year 12 Biology

## Section II Answer Booklet

**80 marks**

**Attempt Questions 21–35**

**Allow about 2 hours and 25 minutes for this section**

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**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.
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**Please turn over**

**Question 21** (4 marks)

Somatic mutations and germ-line mutations are often confused.

- (a) In genetic terms, define somatic cells and germ cells. **2**

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- (b) Outline the differences in the effects of somatic mutations and germ-line mutations on an organism. **2**

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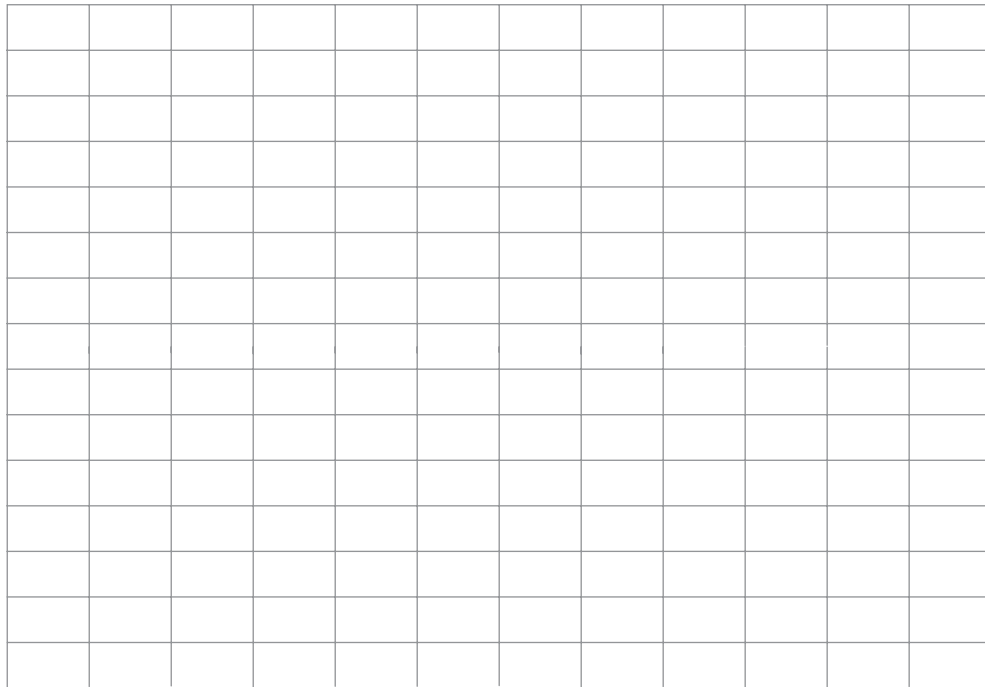
**Question 22** (6 marks)

A conservation organisation used population genetics to study the genetic variation between different populations of a species. They compared the mitochondrial DNA (mtDNA) of various populations at different distances from a central point. The organisation used this data to calculate the fixation index (FST), which is a measure of population differentiation due to genetic structure. The larger the value of the FST, the greater the genetic difference. A section of the data is reproduced in the table.

<i>Geographical distance (km)</i>	100	300	500	700	900	1000
<i>FST (arbitrary units)</i>	0.015	0.024	0.050	0.105	0.081	0.112

- (a) Using the data, draw and label an appropriate graph.

**4**



- (b) Identify the outlier in the data provided and state ONE method that could be used to check if this outlier was accurate.

**1**

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- (c) What conclusion can be drawn from the data?

**1**

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**Question 23** (6 marks)

Animals and plants reproduce in different ways.

- (a) Hormones play an important role in the pregnancy of mammals. **3**

Outline the role of a named hormone in pregnancy and how the hormone's level changes during pregnancy.

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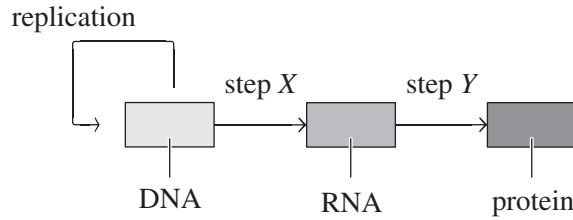
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- (b) Plants can reproduce either sexually or asexually. **3**

Draw a table that contrasts these reproduction methods by providing at least **THREE** characteristics for each type of reproduction.

**Question 24** (9 marks)

The diagram shows a simplified overview of polypeptide synthesis.



(a) Identify steps *X* and *Y* in the diagram and outline what occurs during these stages.

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(b) Assess the importance of polypeptides.

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**Question 27** (4 marks)

Describe the effectiveness of whole organism cloning. Refer to ONE example in your response.

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**Question 28** (3 marks)

On the first exposure to a pathogen, an individual will experience signs and symptoms of the corresponding disease.

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Explain why an individual does not usually experience signs or symptoms of a disease on the second exposure to the pathogen.

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**Question 29** (6 marks)

A doctor is discussing the signs and symptoms of an illness with a patient.

Patient: I have been feeling really tired for two or three days.  
Doctor: Have you noticed any other changes?  
Patient: I've had some aches and pains and a sore throat.  
Doctor: What about a fever?  
Patient: I have a fever now. It started this morning.  
Doctor: Good! Your body is doing its job.

- (a) Explain why the doctor thinks that developing a fever can be good for the patient. **2**

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- (b) After a full examination of the patient, the doctor decides the pathogen is viral and there are no signs of bacteria. **1**

Should the doctor prescribe antibiotics to the patient? Give a reason for your answer.

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- (c) Briefly assess the use of antibiotics since they were first used on a large scale in the late 1930s to present day. **3**

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**Question 30** (5 marks)

In 2016, a small outbreak of anthrax occurred in Siberia. Anthrax is caused by the bacteria *Bacillus anthracis*. The source of the outbreak was reported to be a carcass of a reindeer that died over 75 years ago and froze shortly after death. Unusually high temperatures caused an increased thawing of the permafrost, resulting in the exposure of the reindeer carcass.

- (a) Describe the feature of some bacteria that enabled this pathogen to be transmitted. **3**

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- (b) Suggest why scientists who study infectious disease may be concerned about the impact of global warming on the transmission of disease. **2**

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**Question 31** (6 marks)

A student walked past a tree and a twig scratched their arm. A small trickle of blood appeared. The student wiped away the blood and felt a small, tingling sensation in their arm. After a few minutes, the scratch became swollen, red, hot and painful.

- (a) Describe TWO changes in the tissue around the scratch. **2**

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- (b) Explain how the changes in the tissue from part (a) were protecting the student. **2**

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- (c) Outline the difference between the response in the first 1–2 hours and the response in the first 1–2 days following the scratch. **2**

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**Question 32** (2 marks)

An epidemiologist intends to study stress-related diseases in students aged 10 to 14.

**2**

Describe ONE way the epidemiologist could avoid bias in their research.

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**Question 33** (6 marks)

The kidney is an important organ in vertebrates.

(a) Identify ONE function of the kidney.

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(b) Name and describe the technology that artificially performs the function of the kidney.

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(c) Describe ONE disadvantage of the technology from part (b).

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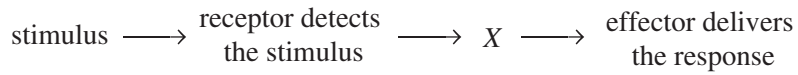
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**Question 34** (5 marks)

Part of a model of a negative feedback loop is shown.



(a) What occurs at X? **1**

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(b) If the effector is a gland, how will the effector respond? **1**

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(c) Using an example, describe how this pathway achieves a negative feedback loop. **3**

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**Question 35** (7 marks)

A student is investigating the relationship between soft drink and tooth decay. A friend tells the student that their cousin said drinking diet soft drink will not damage your teeth because it does not contain sugar.

- (a) Evaluate the information provided by the friend. **2**

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- (b) Describe how the student could collect primary evidence about soft drink and tooth decay. **2**

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- (c) Select ONE way the student could present their findings from part (b) and justify this choice of presentation of their primary data. **3**

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**End of paper**







# Neap Trial Examination 2022

## 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.

A  B  C  D   
*correct*  
 ↓

STUDENT NAME: \_\_\_\_\_

STUDENT NUMBER:

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<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3
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### SECTION I

#### MULTIPLE-CHOICE ANSWER SHEET

- A  B  C  D
- A  B  C  D
- A  B  C  D
- A  B  C  D
- A  B  C  D
- A  B  C  D
- A  B  C  D
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- A  B  C  D
- A  B  C  D
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- A  B  C  D
- A  B  C  D
- A  B  C  D

**STUDENTS SHOULD NOW CONTINUE  
WITH SECTION II**