

# TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

# DO NOT REMOVE PAPER FROM EXAMINATION ROOM

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			1					
Student Number								

# Biology (taylor's version)

Whenever you want Before the HSC

# General Instructions

- Reading time 5 minutes
- Working time 3 hours
- Write using black pen
- Draw diagrams using pencil
- NESA-approved calculators may be used
- Use the Multiple Choice Answer Sheet provided
- Write your Centre Number and Student Number on the top of this page

# **Total marks:** 100

## Section I - 20 marks (pages 2-12)

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

## Section II - 80 marks (pages 13-35)

- Attempt Questions 21-33
- Allow about 2 hours and 25 minutes for this section

THANK U PAPI ETHANNNN. Not a real trial exam or accurate emulation of the HSC. Never said it was. I don't own this. This is a scan of the CSSA paper for all you know. All sources are slay. Good luck. This one is for the boys with the booming system Top down, AC with the cooler system When he come up in the club, he be blazin' up Got stacks on deck like he savin' up And he ill, he real, he might gotta deal He pop bottles and he got the right kind of build He cold, he dope, he might sell coke He always in the air, but he never fly coach He a motherfuckin' trip, trip, sailor of the ship, ship When he make it drip, drip kiss him on the lip, lip That's the kind of dude was lookin' for And, yes, you'll get slapped if you're lookin ho I said, excuse me you're a hell of a guy! nean my, my, my, my ou're like elicen fly I mean, you're so shy and I'm loving your the You're like slicker than the guy with the thing on his combination of the Help of the file is an Micki Minaj, I mack them dudes up Back coupes up nad chuck the deuce up Boy, you got my heartheat runnin' away Beating like a drum and it's coming your way Can't you hear that Boom, badoom, boom, badoom, boom, bass? He got that super bass Boom, boom, boom, badoom, boom, bass Yeah that's that super bass Boom, boom, boom, boom (bass, bass) Boom, boom (boom, boom (bass, bass) Boom, boom (boom, boom, badoom, boom, bass He got that super bass Boom, boom, boom, badoom, boom, bass He got that super bass Boom, boom, boom, badoom, boom, bass He got that super bass Boom, boom, badoom, boom, bass He got that super bass Boom, boom, boom, bass He got that super bass Boom, boom, badoom, boom, bass He got that super bass Boom, boom, badoom, boom, bass He got that super bass Boom, boom, badoom, boom, badoom, boom, bass He got that super bass Boom, boom, badoom, boom, badoom, boom, bass He got that super bass Boom, boom, badoom, boom, badoom, boom, badoom, boom, bass He got that super bass Boom, boom, badoom, boom, badoom, boom, badoom, boom, badoom, boom, badoom, boom, badoon, boo

# 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

In artificial asexual reproduction of plants, parts of the parent plant are used to generate a new plant.

Which of the following statements about artificial asexual reproduction is correct?

- A. Reproduction is efficient, using minimal time and energy.
- B. Cuttings taken from a parent plant show increased resistance to disease.
- C. It allows rapid population growth, leading to reduced competition for resources.
- D. The lack of genetic variation within the population can be advantageous if the environmental conditions change suddenly.
- 2 The diagram below is a model of the protein haemoglobin.

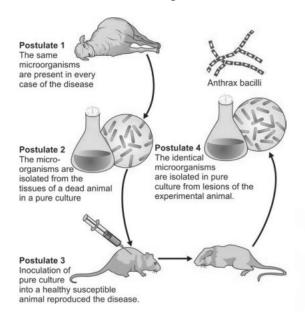


Identify the level of structure of haemoglobin.

- A. Primary
- B. Quaternary
- C. Secondary
- D. Tertiary

Refer to the following information to answer Questions 3-4

In the late 1800s Robert Koch conducted investigations to determine the cause of the bacterial disease anthrax. He used the following criteria.



What could be concluded from Koch's investigations?

- A. Anthrax is a non-infectious disease.
- B. Boiling of liquids prevents microbial decay.
- C. Each disease is caused by a specific microbe.
- D. Disease is not caused by spontaneous generation.
- 4 Through Koch's investigations, it was determined that anthrax bacteria can lay dormant in soil as spores once they leave an infected host. They can then re-infect other hosts that inhale the spores from the soil.

What is the mode of transmission of anthrax?

- A. Direct contact
- B. Indirect contact
- C. Vector transmission
- D. Droplet transmission through inhalation

5 The photo below shows an Eastern Grey Kangaroo (Macropus giganteus).



Which of the following statements most accurately describes a *structural* adaptation of the Eastern Grey Kangaroo that assists in temperature regulation?

- A. Fur reflects sunlight during the day
- B. Foraging for food during the night
- C. Lying under a gum tree or scrub during the day
- D. vasodilation of blood vessels near the skin surface
- 6 Clindamycin is a medication that can be used to treat disease. It functions by binding to bacterial ribosomes. Affected bacteria are unable to undergo protein synthesis and are eventually destroyed. Non-bacterial organisms are not adversely affected by clindamycin.

Clindamycin can be considered to be

- A. an antiviral.
- B. an antibiotic.
- C. a passive vaccination.
- D. unsuitable to treat infectious disease.

Fevolution is occurring quickly in some cities around the world. The rats of New York City have started to form two distinct populations, one in Uptown New York City and the other in Downtown New York City. The rats are separated by Midtown New York City, a mainly commercial area that lacks the household rubbish the rats thrive on. There is no evidence that rats from Uptown New York City are mating with rats from Downtown New York City.

Which of the following best explains why the rat groups are diverging?

- A. Genetic flow
- B. Crossbreeding
- C. Genetic variation
- D. Geographic isolation
- 8 A feedback loop of hormones involved in the menstrual cycle is shown below.

# HYPOTHALAMUS GnRH ANTERIOR PITUITARY GLAND Low levels negative feedback High levels positive feedback OVARY ESTROGEN

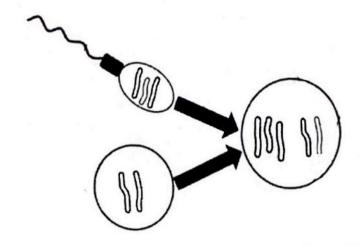
PROGESTERONE

# Overview of hormonal interaction in menstrual cycle

Which statement best describes the relationship between two of the hormones?

- A. LH stimulates production of GnRH.
- B. Progesterone inhibits production of FSH.
- C. FSH inhibits production of progesterone.
- D. Progesterone stimulates production of LH.

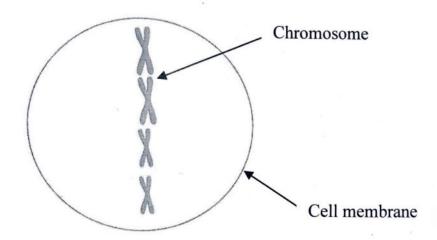
9 The diagram below shows a normal egg (n) combining with an abnormal sperm (n+1) and the resulting zygote (2n+1)



What is the likely outcome of this type of mutation?

- A. No effect on the zygote
- B. An extra nucleotide is inserted resulting in a change in one amino acid
- C. A large-scale change involving an abnormal number of chromosomes in every cell in the organism
- D. A large-scale change involving an abnormal number of chromosomes in one cell in the organism
- 10 What is the function of the stigma in flowering plants?
  - A. Produces haploid ovules
  - B. Protects unopened flower bud
  - C. Produced haploid pollen grains
  - D. Provides a sticky fluid to trap pollen grains

11 The diagram below shows a drawing of a cell undergoing mitosis.



Identify the mitotic stage indicated by the diagram

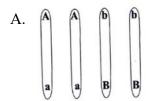
- A. Interphase
- B. Metaphase
- C. Prophase
- D. Telophase

Turn over the page

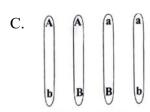
Which combination of alleles is possible after crossing-over during meiosis?

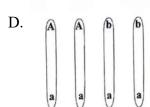












13 A farmer bred two speckled (black and white) chickens and recorded the number of offspring produced, as shown in the table below.

Feather colour of offspring	Number of offspring
Speckled (black and white)	26
Black	12
White	13

Based on the ratios of offspring recorded, it can be concluded that the inheritance pattern for the gene for feather colour is

- A. co-dominant
- B. autosomal recessive
- C. autosomal dominant
- D. incomplete dominant
- 14 The table below summarises the cause and treatment of tetanus.

Cause	Treatment
Clostridium tetani bacterial spores enter via a puncture wound through the skin.	Immediate treatment with tetanus Immune Globulin (Tig) formed by the extraction of antibodies taken from donated human blood.
	Drugs such as benzodiazepines to control spasma and rigidity in muscles.
	Aggressive wound care reducing infection.

What type of treatment is Tetanus Immune Globulin (Tig)?

- A. An antibiotic
- B. A disinfectant
- C. A passive acquired vaccine
- D. An active acquired vaccine

Refer to the following information to answer Questions 15-16

Data for the rate of hospitalisation for osteoporosis in males and females across a range of age groups is shown in the table below.

Table 3.1: Rate of hospitalisations for osteoporosis, people aged 50 and over, by sex and

age, 2017-18

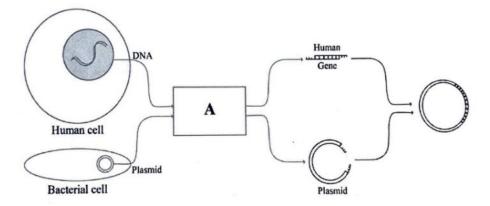
age, 2017-10		Males Females		Females				Persons	
Ago group	Number	Per cent	Rate*	Number	Per cent	Rate*	Number	Per cent	Rate*
Age group 50-54				135	2.6	17	214	3.1	14
55–59	79 149	4.9 9.2	11 20	280	5.4	36	429	6.3	28
60–64	169	10.4	26	489	9.4	71	658	9.6	49
65–69	229	14.2	39	574	11.0	94	803	11.7	67
70-74	193	11.9	40	687	13.2	137	880	12.9	89
75–79	205	12.7	63	798	15.3	221	1,003	14.7	146
80-84	253	15.6	118	825	15.8	314	1,078	15.8	226
85+	341	21.1	181	1,432	27.4	463	1,773	25.9	356
Total (50+)	1,618	100	41	5,220	100	122	6,838	100	83
Total (50+), ASR**	1,618	NA	41	5,220	NA	110	6,838	NA	78

<sup>\*</sup>Rate is per 100,000 population. For each sex, the age-specific rates are obtained by dividing the number of hospitalisations for each of the age groups by the population for that age group in December 2017.

- 15 Which of the following statements about the trends in the data is correct?
  - A. The rate of females hospitalised for osteoporosis is higher than males for all age groups.
  - B. The rate of males hospitalised for osteoporosis is higher than females for all age groups.
  - C. The percentage of females hospitalised for osteoporosis is higher than males for all age groups.
  - D. The percentage of males hospitalised for osteoporosis is higher than females for all age groups
- 16 Which of the following is a correct observation from the data?
  - A. Males are more susceptible to osteoporosis than females.
  - B. Females are more willing to receive hospital treatment than males.
  - C. Male participants make up about 23.66% of all individuals involved in the study.
  - D. Female participants make up about 23.66% of all individuals involved in the study.

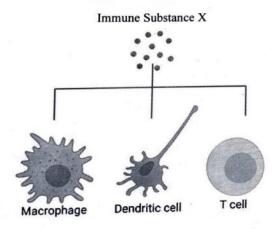
<sup>\*\*</sup> Age-standardised to the 2001 Australian population. Age groups: 50-54, 55-59, 60-64, 65-69, 70-74, 75+

17 The diagram below shows the process of recombinant DNA technology



What is the process labelled A?

- A. Treatment with helicase
- B. Treatment with DNA ligase
- C. Treatment with DNA polymerase
- D. Treatment with restriction enzyme
- **18** A flowchart illustrating the role of Immune *Substance X* is shown below.



Substance X is best described as a

- A. part of the innate immune system.
- B. part of the adaptive immune system.
- C. link between T cells and memory T cells.
- D. link between the innate and adaptive immune system.

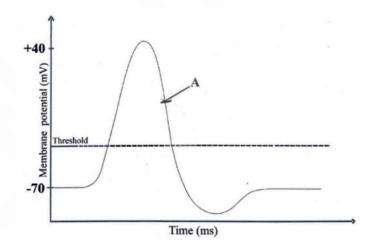
19 The table below shows an example of a mutation.

	Initial	Mutation		
DNA sequence	CGC TAA GGG GCC	CGC TAA GGG GCT		
Amino Acid Sequence	Alanine-isoleucine-Proline-Arginine	Alanine-isoleucine-Proline-Arginine		

What type of point mutation is indicated in the table above?

- A. Silent mutation
- B. Missense mutation
- C. Nonsense mutation
- D. Frameshift mutation
- 20 The graph below shows an action potential in a neuron.

Which statement best describes what is happening in the axon during period A?'



- A. Resting membrane potential all ion channels are closed.
- B. Depolarisation of the membrane both sodium and potassium channels are open.
- C. Hyperpolarisation of the membrane-potassium channels remain open and sodium ions are closed.
- D. Repolarisation of the membrane sodium ion channels are closing and potassium ion channels are opening.

# **Section II**

### 80 marks

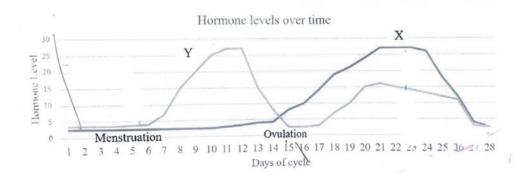
# **Attempt Questions 21-32**

# 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 end of this examination. If you use this space, clearly indicate which question you are answering.

# Question 21 (5 marks)

The graph below shows the levels of oestrogen and progesterone at different stages of a female's menstrual cycle.



(a)	With reference to the graph, identify and describe the function of <i>hormone X</i> in the menstrual cycle.	j

Question 21 continues on page 14

Question	21	(continue	ď

(b)	If fertilisation was to occur following ovulation, describe how the levels of oestrogen and progesterone would be different to those shown in the graph.	)
Que	stion 22 (3 marks)	
Belo	w is an image of two cacao pods infected with black pod rot.	3
	cacao tree, which grows in tropical regions, produces the cacao beans that are the raw rial of chocolate	
Expl	ain TWO ways that black pod rot could be transmitted between individual plants.	
•••••		
••••		

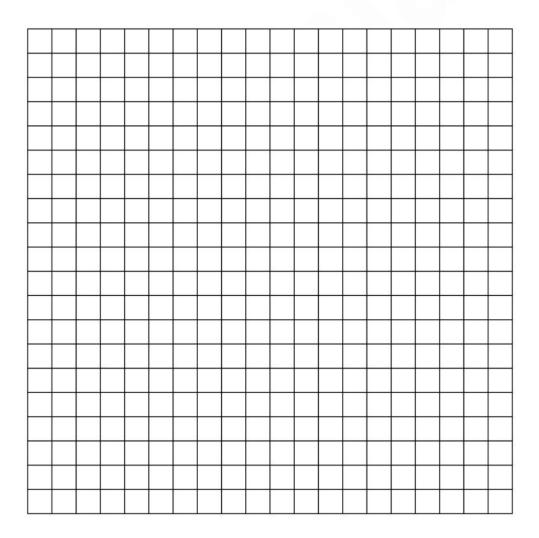
# Question 23 (8 marks)

In order to better understand population genetics in nature, scientists can use computer simulations to predict genetic variation. Below are the results of a simulation predicting the allele frequency of an animal on a specific island.

Generation	Allele Frequency (p)
0	0.80
10	0.55
20	0.40
30	0.31
40	0.29

4

(a) Use the data above to construct an appropriate graph in the grid below.



Question 23 continues on page 16

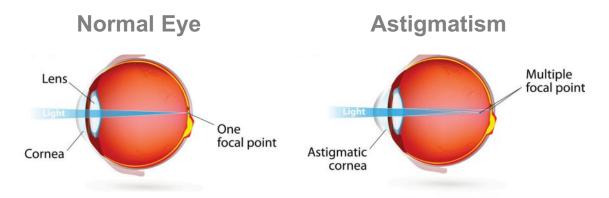
	Question	23	(continued)
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(b)	Describe the trend shown in your constructed graph.	2
		•
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(c)	The data was based on a simulation where a small population of the species migrated to an island.	2
	Justify whether this is an example of gene flow or genetic drift.	
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# Question 24 (6 marks)

A person was diagnosed with a visual disorder called astigmatism. Astigmatism distorts vision because the cornea or lens shape is different to the normal shape. The effect of this disorder is shown in the diagram below.

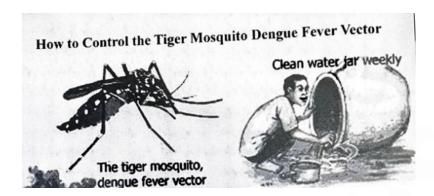
6



Explain how astigmatism would cause impaired vision and evaluate the effectiveness of ONE technology used to treat this visual disorder.


# **Question 25** (5 marks)

Below is a portion of a poster educating Cambodian children about dengue fever.



(a)	Describe why images might be used in a dengue fever poster to educate children in rural Cambodia.	2
(1	Other than using posters, explain ONE other prevention method <i>local</i> health care workers could use to prevent the spread of an infectious disease in indigenous communities.	3

Turn to page 20 for Question 26

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# **Question 26** (6 marks)

In response to the growing use of e-cigarette or 'vape' products amongst teenagers, some countries have employed public health strategies to reduce the incidence of non-infectious disease.

**Source 1** below, including the graph and additional information, was published in an online Associated Press News article. The survey quoted was conducted by the Centres for Disease Control and Prevention (CDC) and the U.S. Food and Drug Administration (FDA) on U.S. high school students.

### Source 1

# Vape debate: Are e-cigarettes wiping out teen smoking?

By MATTHEW PERRONE November 22, 2019

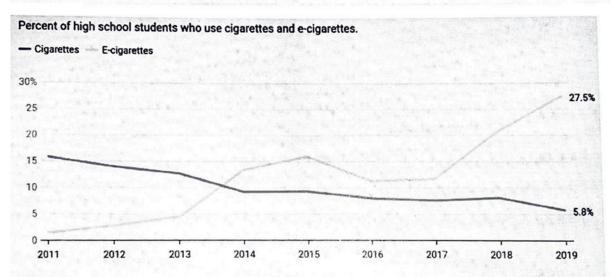


Chart: AP . Source: National Youth Tobacco Survey . Created with Datawrapper

E-cigarettes typically heat a solution that contains nicotine, the drug that makes tobacco addictive. They are generally considered less harmful than cancer-causing traditional cigarettes. But there is little long-term research on the health effects of vaping.

With one in four teenagers now using e-cigarettes, underage vaping is universally condemned, and the federal government considers it an epidemic.

Question 26 continues on page 21

# Question 26 (continued)

(b)	Assess the validity of <b>Source 1</b> for determining the potential effect of e-cigarettes and vape products on Australian teenagers.	2
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Question 26 continues on page 22

## Question 26 (continued)

In 2022 the NSW Government launched the Do You Know What You 're Vaping campaign, aimed at informing young people, parents, carers and schools about the misconceptions about the safety of vape products.

**Infographic 1** and **Infographic 2** from the NSW Government campaign are below.

# Infographic 1



# Infographic 2



Question 26 continues on page 23

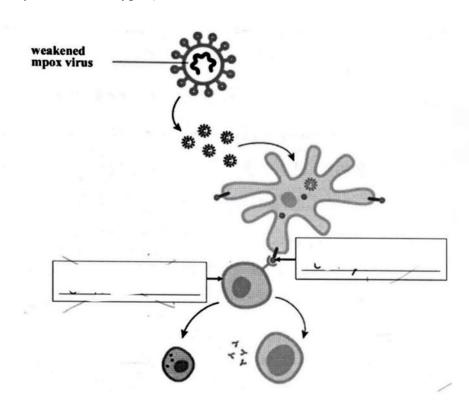
Question 26 (continued)

(b)	Using all of the information provided in Question 26, evaluate the potential effectiveness of the Do You Know What You're Vaping campaign in reducing non-infectious diseases.	4
	Refer to Source 1 and both infographics in your response.	
		•
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# **Question 27** (5 marks)

In a *live-attenuated vaccine* the pathogen remains active so it can produce a strong immune response but is weakened so it cannot cause the disease itself.

The diagram below shows the process of creating a live-attenuated vaccine for the disease mpox (previously called monkeypox).



(a)	Add I wO labels to the diagram above to identify the missing parts.	2
(b)	With reference to the diagram above, explain how a vaccine prepared in this way would produce immunity to the disease mpox.	3

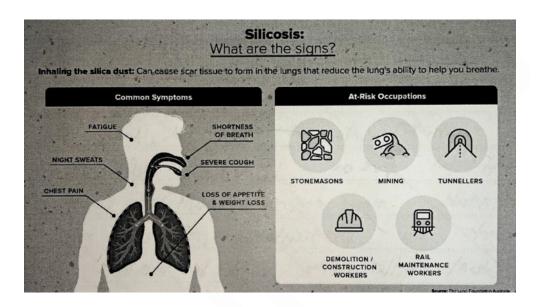
# Question 28 (6 marks)

Silicosis is a long-term, non-infectious lung disease. Silicosis is caused by prolonged exposure and inhalation of silica dust, a fine dust that is released during construction and other stone-related work.

6

The incidence of silicosis has been steadily increasing in people who are exposed to silica dust.

The common symptoms of silicosis and at-risk occupations are illustrated in the infographic below.



Design a method for an epidemiological study of the incidence of silicosis in Australian

-	that can be achiev	_	•

# **Question 29** (15 marks)

Australian scientists have recently discovered an extremely rare genetic mutation in children of western Polynesian descent. These children are at risk of developing severe and even deadly reactions to viral infections and vaccines containing live virus.

The mutation is to the IFNAR1 gene which codes for the 1FNAR1 protein, a type of interferon. Interferons enhance an individual's innate immune responses and also hinder viral replication within cells. Individuals who inherit two faulty copies of this gene are IFNAR1 deficient.

a)	Explain how inheriting two copies of this IFNARl mutation could increase the severity of a viral infection, with reference to innate and adaptive immune response.	5

Question 29 continues on page 27

# Question 29 (continued)

(b)	Explain how a mutation, such as the IFNAR1 mutation, can initially enter a population and how two individuals who do not have IFNAR1 deficiency themselves could produce a child with this condition. Include a Punnet square in your answer.	5

Question 29 continues on page 28

# Question 29 (continued)

(b)	Professor Tangye from the Garvan Institute was one of the lead scientists who discovered the IFNAR1 mutation and he highlighted the need to build genetic databases on minority indigenous populations.	5
	He stated, 'Understanding isolated populations, like Indigenous Australians, is important for better diagnosis and treatment and health care'.	
	Justify the need for greater understanding of unique genetic mutations, such as the IFNARI mutation, in preventing and treating infectious disease in at-risk indigenous populations.	
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Turn to page 30 for Question 30

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## **Question 30** (7 marks)

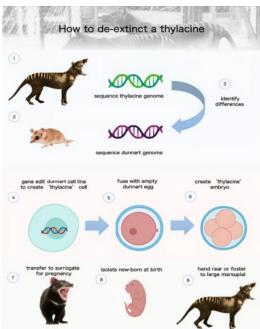
The thylacine (Tasmanian Tiger) is a carnivorous marsupial which became extinct in 1936.

7

Efforts to use somatic cell nuclear transfer (SCNT) to clone the thylacine using cells from museum specimens have failed because SCNT is only successful using DNA from living organisms.

A new de-extinction effort is now underway, with scientists hoping to use the gene editing technology CRISPR to edit the genome of the fat-tailed dunnart to make it more like the thylacine genome. The fat-tailed dunnart is the closest living relative to the thylacine. Gene editing usually involves either deactivating certain genes or replacing base sequence in a gene with alternative, desired sequence.

The steps involved in the thylacine de-extinction is summarised in the diagram below.



tructure and function of DNA, reproduction and genetic technologies in developing the rocess for thylacine de-extinction.	
	••••

Using the diagram above, assess the importance of biological knowledge, including the

Question 30 continues on page 31

Question 30 (continued)

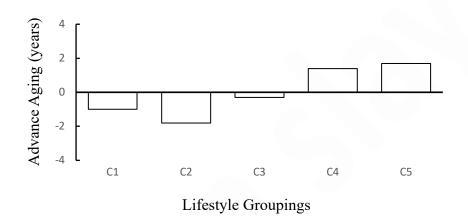
## **Question 31** (6 marks)

A study of 800 teenagers was conducted, and scientists measured chemical signs of aging in their blood-based DNA.

The teenagers filled out questionnaires about their lifestyle-related habits at 11-12 years of age, and later at ages 14 and 17.5 years. The test subjects were arranged into 5 groups based on their identified habits.

Blood samples were taken again when they were 21-25 years old to study their DNA. The results are shown below.

# Lifestyle Habits vs Biological Aging in Adolescence



# KEY: Lifestyle habit groupings

- C1 healthy
- C2 healthy + less physical activity
- C3 higher body fat
- C4 higher body fat, daily smoker
- C5 unhealthy lifestyle, daily smoker, regular alcohol use

(a)	Explain why self-reported lifestyle habits may not be a valid method of data collection.	2

Question 31 continues on page 33

# Question 31 (continued)

(b)	Analyse the results shown in the graph and support the conclusions that could be drawn from the data.	4

# **Question 32** (8 marks)

During the Middle Ages, many Europeans carried genetic mutations that protected them from the bubonic plague. Today, many Europeans still carry the genetic mutations. The bubonic plague is caused by the bacterium *Yersinia pestis*.

8

Researchers found that carrying a variant of the ERAP2 gene made people 40% likelier to survive the plague. This is because the ERAP2 gene makes a protein that snips off pieces of the bacterial pathogen. When an immune cell engulfs a pathogen, those foreign pieces are presented on its surface triggering an immune response.

However, this variant of the ERAP2 gene also increases the risk of Crohn's disease, a disorder in which the immune cells attack friendly bacteria in the gut, causing damaging inflammation and pain.

Using knowledge and understanding of protein synthesis and the immune response, discuss how the ERAP2 gene functions in bubonic plague and Crohn's disease.							

Question 32 continues on page 32

Question 32 (continued)

# **End of Examination**

# Section I—MULTIPLE CHOICE (20 marks)

# Attempt Questions 1–20 in Section I Use the multiple-choice answer sheet

# Multiple-choice questions: answer sheet

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.								
s	amp	<b>ble</b> : $2 + 4 = (A)$	2 (B	) 6 (C) 8 (D) 9				
	Α		В		c $\bigcirc$	D	$\circ$	
If	you	think you have ma	de a n	nistake, put a cross	through the incorrect answ	ver and	d fill in the new answer.	
	Α		В		c $\bigcirc$	D	$\circ$	
If	you	have changed your	mind	and have crossed o	ut what you consider to be	e the c	correct answer, then	
ir	dica	ite this by writing th	ne wor	d <i>correct</i> and drawii	ng an arrow as follows:			
	A		В		c $\bigcirc$	D	0	
				correct				
1.	Α	0	В	0	СО	D	0	
2.	Α	0	В	0	c O	D	0	
3.	Α	0	В	0	c O	D		
4.	Α	0	В	0	CO	D	$\circ$	
5.	Α	0	В	0	CO	D (	$\circ$	
6.	Α	0	В	0	c 🔾	D	0	
7.	Α	0	В	0	CO	D	$\circ$	
8.	Α	$\circ$	В	$\circ$	c O	D	$\circ$	
9.	Α	0	В	$\circ$	c O	D	$\circ$	
10.	Α	0	В	$\circ$	CO	D	$\circ$	
11.	Α	0	В	0	CO	D	$\circ$	
12.	Α	0	В	0	c O	D	$\circ$	
13.	Α	0	В	0	c 🔾	D	0	
14.	Α	$\circ$	В	$\circ$	c O	D	$\circ$	
15.	Α	0	В	$\circ$	c O	D	$\circ$	
16.	Α	0	В	0	CO	D	0	
17.	Α	0	В	$\circ$	c O	D	0	
18.	Α	0	В	0	c O	D	$\circ$	
19.	Α	0	В	0	CO	D	$\circ$	
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