



Victorian Certificate of Education
2022

Name: _____

Teacher's name: _____

STUDENT NUMBER

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Letter

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BIOLOGY

Written examination – Trial 2

2022

Reading time: 15 minutes

Writing time: 2 hours 30 minutes

QUESTION AND ANSWER BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	40	40	40
B	10	10	80
			Total 120

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, and rulers.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.
- No calculator is allowed in this examination.

Materials supplied

- Question and answer book.
- Answer sheet for multiple-choice questions.
- Additional space is available at the end of the book if you need extra space to complete an answer.

Instructions

- Write your student number in the space provided above on this page.
- Check that your name and student number on your answer sheet for multiple-choice questions are correct.
- All written responses must be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

SECTION A – Multiple-choice questions**Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1

Students set up a photosynthesis experiment by placing aquatic plants into sealed tubes, submerging them in water. They measured the rate of photosynthesis by counting the bubbles that were produced by the plant. Which of the following statements is correct?

- A. fewer bubbles would be produced by a plant that was placed in direct sunlight than a plant that was in a cool, dark room
- B. the bubbles that the students measured were made of oxygen gas
- C. the experiment needs to be repeated three times in order to be accurate
- D. the water is only used to suspend the plants; it is not an input of photosynthesis

Question 2

In the body, cells that are infected with a virus present the viral antigen on their MHC-II proteins. These antigens can then be identified by lymphocytes as part of the specific immune response.

Which of the following lymphocytes would recognise a viral antigen that is displayed by body cells and what would be the next step in the immune response pathway?

- A. a naïve B cell; a helper T cell will release cytokines to activate the naïve B cell
- B. a naïve T cell; a helper T cell will release cytokines to activate cytotoxic T cells
- C. a naïve B cell; the naïve B cell will undergo clonal selection, producing memory B cells and plasma cells
- D. a naïve T cell; the naïve T cell will undergo clonal selection, producing memory T cells and cytotoxic T cells

Question 3

A non-competitive enzyme inhibitor will

- A. bind to the active site.
- B. attach to the substrate.
- C. change the shape of the active site.
- D. not work below 37°C.

Question 4

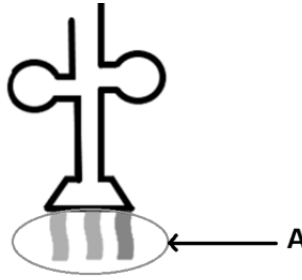
The key distinguishing feature between hominins and primates is

- A. a large cranium relative to body weight.
- B. opposable thumbs.
- C. binocular eyes.
- D. bipedalism.

DO NOT WRITE IN THIS AREA

Use the following information to answer Questions 5 and 6.

Below is a diagram of a nucleic acid involved in gene expression.



Adapted from Christinellmiller, CC BY-SA 4.0 <<https://creativecommons.org/licenses/by-sa/4.0/>>, via Wikimedia Commons

Question 5

Which option describes the role of this nucleic acid?

- A. it encodes genetic information and carries it out of the nucleus
- B. it moves genetic information into the nucleus
- C. it brings amino acids to ribosomes
- D. it is a component in ribosome structure

Question 6

In the diagram, what is indicated by 'A'?

- A. codon
- B. anticodon
- C. mRNA
- D. deoxyribose nucleotide

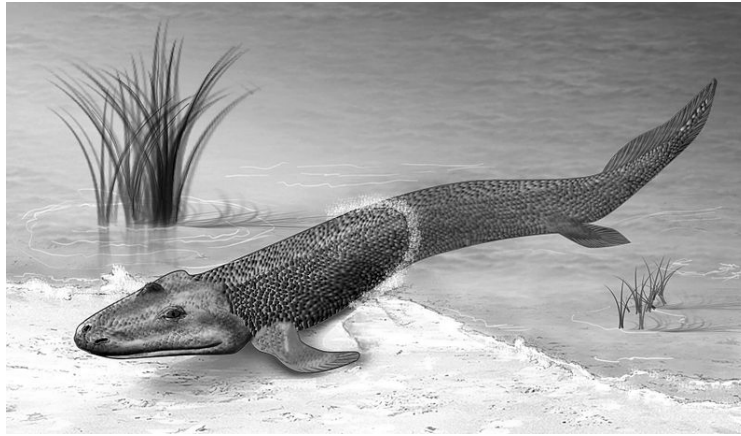
Question 7

Homo sapiens' larger brain size

- A. is caused by the cerebrum becoming more folded.
- B. has led to lesser social interaction and caregiving.
- C. has reduced the energy needs of the human body.
- D. is caused by an increase in the size of the sagittal crest.

DO NOT WRITE IN THIS AREA

Use the following information to answer Questions 8 – 10.



https://commons.wikimedia.org/wiki/File:Tiktaalik_roseae_life_restor.jpg

A fossil, known as the Tiktaalik fossil, was discovered in 2004. It had gills and fins, but it also had weight-bearing limbs. It is thought to be an evolutionary link between water- and land-dwelling species.

Question 8

Which of the following evolutionary timelines is in the correct chronological order?

- A. prokaryotes, eukaryotes, multicellular organisms, water-dwelling animals, the Tiktaalik species, land-dwelling animals, mammals, flowering plants
- B. prokaryotes, multicellular organisms, eukaryotes, water-dwelling animals, the Tiktaalik species, land-dwelling animals, mammals, flowering plants
- C. prokaryotes, multicellular organisms, eukaryotes, mammals, water-dwelling animals, the Tiktaalik species, land-dwelling animals, flowering plants
- D. prokaryotes, eukaryotes, multicellular organisms, water-dwelling animals, the Tiktaalik species, land-dwelling animals, flowering plants, mammals

Question 9

Which fossils provide an evolutionary link between previously identified species and known species?

- A. trace fossils
- B. index fossils
- C. linking fossils
- D. transitional fossils

Question 10

Which of the following options is not a requirement for fossilisation?

- A. rapid coverage by sediment
- B. cool climate
- C. low light
- D. high oxygen availability

Question 11

Which of the following statements about the inflammatory response is correct?

- A. the steps in the inflammatory response are inflammation, vasodilation and migration
- B. in the migration step, complement proteins and phagocytes work to destroy pathogens
- C. vasodilation causes blood vessels to shrink and blood to build up, leading to swelling and redness at the affected site
- D. mast cells signal natural killer (NK) cells

DO NOT WRITE IN THIS AREA

Question 12

When a fixed number of enzymes have an unending supply of substrate, their activity will

- A. decrease because too much substrate availability will overwhelm the system.
- B. continue to rise as long as there is an unending supply of substrate.
- C. remain unchanged as only environmental factors, like temperature, can change the rate of enzyme activity.
- D. rise until it reaches a plateau when no further enzymes are available.

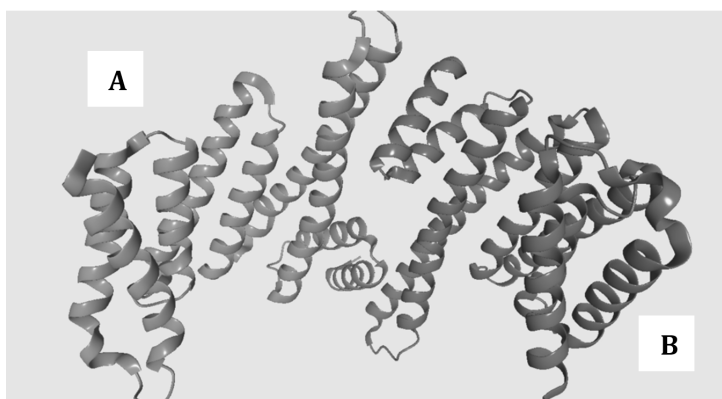
Question 13

Which of the following is not a method of disease transmission?

- A. airborne transmission
- B. antibody transmission
- C. vector transmission
- D. faecal-oral transmission

Use the following information to answer Questions 14 and 15.

Insulin, as indicated in the diagram below, is a protein that is composed of two polypeptide chains (chains A and B) linked by disulphide bonds.



Adapted From: https://upload.wikimedia.org/wikipedia/commons/0/0c/2bq0_14-3-3.png

Question 14

What is the hierarchical level of the protein structure seen in chain A?

- A. primary
- B. secondary
- C. tertiary
- D. quaternary

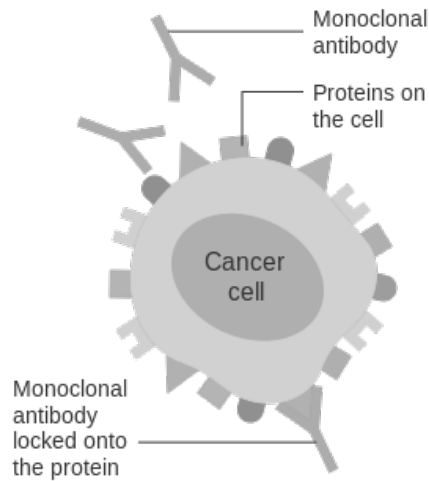
Question 15

What type of protein is insulin?

- A. a biochemical enzyme
- B. a peptide hormone
- C. a regulatory protein
- D. a structural protein

DO NOT WRITE IN THIS AREA

Use the following information to answer Questions 16 – 18.



Source: https://commons.wikimedia.org/wiki/File:Diagram_showing_a_monoclonal_antibody_attached_to_a_cancer_cell_CRUK_070.svg (Cancer Research UK)

Monoclonal antibodies, as seen in the diagram, can be used to treat cancer as well as other autoimmune diseases through a variety of approaches.

Question 16

The proteins on the cancerous cell to which monoclonal antibodies attach are known as

- A. MHC-I proteins.
- B. MHC-II proteins.
- C. pathogens.
- D. non-self antigens.

Question 17

Which of the following options is not an approach that monoclonal antibodies use to combat cancer?

- A. binding to cancerous cells and marking them as foreign so that they are targeted by natural killer (NK) cells
- B. binding to cancerous cells and interacting with complement proteins to form membrane attack complexes
- C. binding to cancerous cells and interacting with helper T cells to induce the external apoptosis pathway
- D. carrying radioactive isotopes or drugs to cancerous cells by conjugated monoclonal antibodies

Question 18

A patient receiving treatment with monoclonal antibodies receives what type of immunity?

- A. natural passive immunity
- B. artificial passive immunity
- C. natural active immunity
- D. artificial active immunity

DO NOT WRITE IN THIS AREA

Use the following information to answer Questions 19 – 21.

Barnacles are attached to rocks and cannot travel to avoid natural disasters or to mate with other barnacle populations.

A heatwave in a small coastal town led to the dark barnacles along the shoreline dying off. The lighter-grey barnacles were more likely to survive and now, the population is mostly comprised of light-grey barnacles.

Question 19

What occurred in this population?

- A. natural selection
- B. gene flow
- C. bottleneck effect
- D. viral drift

Question 20

What is unable to occur in the barnacle population due to its fixed position?

- A. gene flow
- B. natural selection
- C. genetic drift
- D. speciation

Question 21

How would the mass deaths of the dark barnacles and the barnacles' fixed positions likely affect the genetic diversity of the barnacle population?

- A. it would increase the frequency and number of unique alleles, leading to greater genetic diversity
- B. it would reduce the frequency and number of unique alleles, leading to greater genetic diversity
- C. it would increase the frequency and number of unique alleles, leading to lower genetic diversity
- D. it would reduce the frequency and number of unique alleles, leading to lower genetic diversity

Question 22

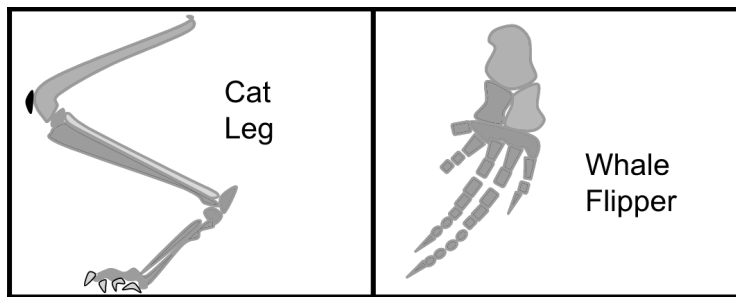
What is the function of having an antibiotic resistance gene in a plasmid for bacterial transformations?

- A. to activate the GFP gene in plasmids
- B. to select for bacteria that have taken up the plasmid
- C. to ensure that the gene of interest has been inserted into the plasmid
- D. to kill off any recombinant plasmids

DO NOT WRITE IN THIS AREA

Question 23

Cat limbs and whale fins both developed from the same structures in shared ancestors, as indicated in the diagram below.



Adapted From: <https://upload.wikimedia.org/wikipedia/commons/9/08/Structures.svg>

What is this an example of?

- A. vestigial structures
- B. homologous structures
- C. analogous structures
- D. trace structures

Question 24

Present day Europeans and Asians have around 1-3% neanderthal DNA. This suggests that

- A. modern *Homo sapiens* are descended from neanderthals.
- B. neanderthals and *Homo sapiens* experienced genetic drift between populations.
- C. neanderthals and some humans lived at the same physical location at the same time.
- D. neanderthals do not have mtDNA.

Question 25

Antibiotic-resistant bacteria pose a significant public health issue. Which of the following does not contribute to this issue?

- A. natural selection acting on bacteria
- B. overprescribing or inappropriately prescribing antibiotics
- C. antigenic drift changing surface antigens
- D. a patient stopping a course of antibiotics as soon as symptoms clear

Question 26

What is not a role of complement proteins?

- A. attracting phagocytes to pathogens
- B. releasing interferons to neighbouring cells
- C. forming membrane attack complexes (MACs)
- D. sticking to the outside of pathogens to aid recognition

Question 27

The light-independent reaction of photosynthesis

- A. always occurs in mesophyll cells.
- B. can only occur at low temperatures.
- C. is also known as the Calvin cycle.
- D. uses sunlight to split H₂O.

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Use the following information to answer Questions 28 and 29.

Second Base									
First Base	U		C		A		G		Third Base
U	UUU	phe	UCU	ser	UAU	tyr	UGU	cys	U
	UUC		UCC		UAC		UGC		C
	UUA	leu	UCA		UAA	STOP CODON	UGA	STOP CODON	A
	UUG		UCG		UAG		UGG		G
C	CUU	leu	CCU	pro	CAU	his	CGU	arg	U
	CUC		CCC		CAC		CGC		C
	CUA		CCA		CAA	gln	CGA		A
	CUG		CCG		CAG		CGG		G
A	AUU	ile	ACU	thr	AAU	asn	AGU	ser	U
	AUC		ACC		AAC		AGC		C
	AUA		ACA		AAA	lys	AGA	arg	A
	AUG	met (START CODON)	ACG		AAG		AGG		G
G	GUU	val	GCU	ala	GAU	asp	GGU	gly	U
	GUC		GCC		GAC		GGC		C
	GUA		GCA		GAA	glu	GGA		A
	GUG		GCG		GAG		GGG		G

Source: https://commons.wikimedia.org/wiki/File:Amino_Acid_Codon_Table.svg

mRNA	CGAUGAAAACUACCUCGUAAGGAG
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Question 28

What is the correct amino acid sequence that would be produced if the mRNA sequence above was translated?

- A. arg
- B. met – lys – thr – thr – ser
- C. arg – cys – lys – leu – pro – lys – glu
- D. met – lys – thr – thr – ser – tyr

Question 29

Which of the following correctly lists the movement of proteins after translation by ribosomes on the rough endoplasmic reticulum?

- A. secretory vesicle, Golgi apparatus, transport vesicle, plasma membrane
- B. Golgi apparatus, transport vesicle, plasma membrane, secretory vesicle
- C. transport vesicle, Golgi apparatus, secretory vesicle, plasma membrane
- D. plasma membrane, secretory vesicle, Golgi apparatus, excretory vesicle

Question 30

Which of the following is not a chemical barrier in animals?

- A. acidic sweat
- B. lysozyme enzymes in tears
- C. stomach acid
- D. cilia in the airways

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Question 31

A study wanted to assess the effectiveness of a new antiviral drug on the severity of symptoms of adults infected with SARS Cov-19. Two groups of infected patients of equal size were created. One group received an antiviral drug and one group received just a sugar pill, alongside general monitoring of their health. The group that received the antiviral drug was the

- A. control group.
- B. experimental group.
- C. independent group.
- D. variable group.

Use the following information to answer Questions 32 – 34.

Scientists are attempting to create future-ready wheat by introducing drought-tolerance genes into the genome of common wheat (*Triticum aestivum*).

Scientists screened genes from common wheat crops that were grown in areas of low rainfall as well as Wild Emmer wheat (*Triticum dicoccoides*), which is known for its drought tolerance.

Source: <https://www.hindawi.com/journals/bm/2013/548246/>

Question 32

Which of the following experiments conducted with common wheat will create a transgenic organism?

	Species From Which the Gene is Sourced	Method of Gene Introduction
A.	Common Wheat (<i>T. aestivum</i>)	Crossbreeding Plants
B.	Common Wheat (<i>T. aestivum</i>)	CRISPR-cas9
C.	Wild Emmer Wheat (<i>T. dicoccoides</i>)	Crossbreeding Plants
D.	Wild Emmer Wheat (<i>T. dicoccoides</i>)	CRISPR-cas9

Question 33

The modified crops were then grown in threes in drought conditions at two temperature points. Wheat yields were measured at the end of the season.

Which of the following measurements are the most precise?

	Crop and Temperature	Crop Yield (tonnes per hectare)
A.	Common Wheat at 37°C	1.674, 1.766, 1.507
B.	Common Wheat at 41°C	1.354, 1.357, 1.349
C.	Wild Emmer Wheat at 37°C	2.011, 1.988, 2.107
D.	Wild Emmer Wheat at 41°C	1.832, 1.932, 1.745

Question 34

Crossbreeding plants is an example of

- A. selective breeding.
- B. genetically modified organisms.
- C. ethical maleficence.
- D. natural selection.

Question 35

The genetic code is described as degenerate, meaning that

- A. more than one codon codes for an amino acid.
- B. it is the same in every organism.
- C. it requires an mRNA copy of DNA to be made before translation can occur.
- D. the genetic code is only made up of four bases.

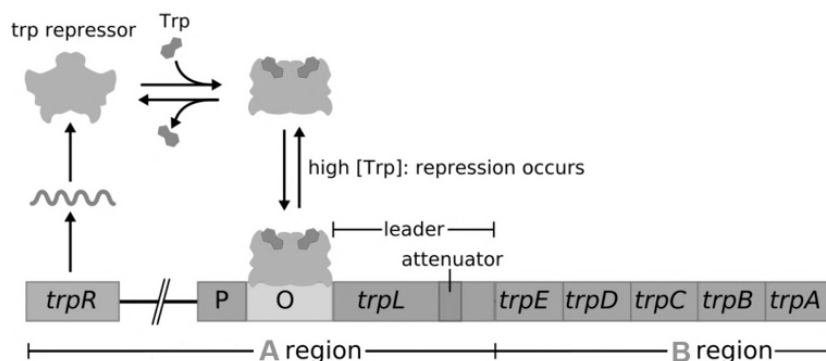
Question 36

Which is the correct definition and example of the type of speciation provided?

- A. Galapagos finches are an example of sympatric speciation; they developed into a new species without a geographic barrier
- B. Galapagos finches are an example of allopatric speciation; they developed into a new species without a geographic barrier
- C. Howea palms are an example of sympatric speciation; they developed into a new species without a geographic barrier
- D. Howea palms are an example of allopatric speciation; they developed into a new species without a geographic barrier

Use the following information to answer Questions 37 and 38.

The below image shows a diagrammatic representation of the *trp* operon.



Adapted From: <https://commons.wikimedia.org/wiki/File:Trpoperon.svg>

Question 37

Regulatory genes

- A. are shown in the B region of the diagram.
- B. create proteins that assist in cell structure or proteins that perform roles around the body.
- C. can code for proteins that stop gene expression.
- D. only control the expression of a single structural gene.

Question 38

Which statement about the *trp* operon is correct?

- A. structural genes will only be expressed when there is high cellular tryptophan levels
- B. tryptophan molecules bind to RNA polymerase to change its shape and prevent transcription
- C. when there are high cellular levels of tryptophan, an antiterminator hairpin will form in mRNA
- D. a longer mRNA molecule will be produced when low levels of tryptophan are in the cell

Use the following information to answer Questions 39 and 40.

The table below and phylogenetic tree provided in Question 40 show the results of sequencing a 9-base pair region of the genomes of four species of fruit bat and comparing it to an ancestral sequence.

Origin	Sequence
Ancestral sequence	GCGATCTGC
Species A	GCCATCTGC
Species B	GCAATGTCC
Species C	GCTATGTCC
Species D	TCGATCTAC

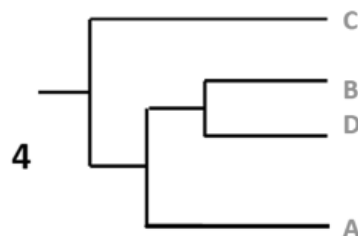
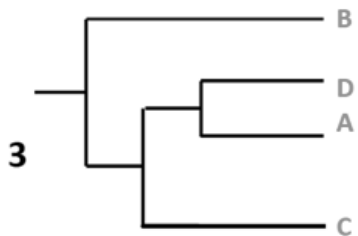
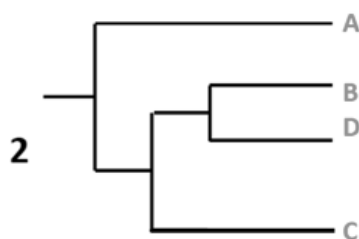
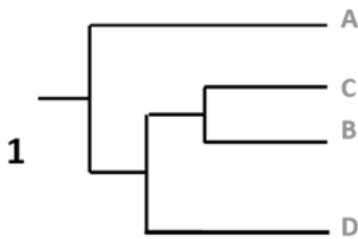
Question 39

What type of mutations occurred between the ancestral sequence and the sequence in Species C?

- A. frameshift mutation
- B. point mutation
- C. block mutation
- D. somatic mutation

Question 40

Which phylogenetic tree correctly represents the data from the table?



- A. tree 1
- B. tree 2
- C. tree 3
- D. tree 4

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SECTION B**Instructions for Section B**

Answer **all** questions in the spaces provided.

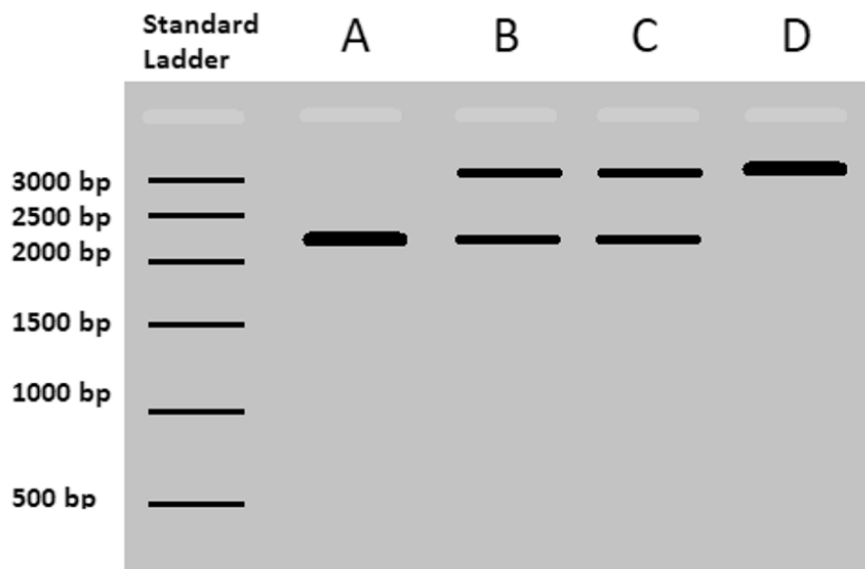
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (12 marks)

Scientists in Melbourne have been experimenting using CRISPR in mice to inactivate a mutated version of the GG1 gene that they believe may be disease-causing in humans and mammals. In mice, the GG1 gene is 2380 base pairs (bp) long. The mutated variation known as GG1-B is 2930 bp long.

Scientists screened baby mice for the GG1-B variant using polymerase chain reaction (PCR) to target and amplify the gene.

The results for four different mice (A, B, C, D) were run on gel electrophoresis alongside a standard ladder – these results are included in the image below.



- a. Which of the four mice is homozygous for the GG1-B variant? Justify your answer. 3 marks

b. Outline the steps of a single cycle of polymerase chain reaction (PCR).

3 marks

c. Name the component that acts as the endonuclease during CRISPR-Cas9 and explain why it does not work like a typical restriction enzyme.

2 marks

d. Scientists are exploring the potential of using CRISPR-Cas9 for gene editing in humans. Describe two potential ethical issues with using CRISPR-Cas9 to eliminate genetic diseases.

2 marks

e. Using CRISPR to correct the genetic basis of inherited genetic diseases is mainly suggested for embryos. Explain why this process would be most effective in embryos as compared to adults.

2 marks

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Question 2 (5 marks)

- a. State the total ATP yield produced by one molecule of glucose in aerobic cellular respiration. 1 mark

- b. Name the regions 'A' and 'B' that are indicated in the below diagram and name the cellular respiration process that occurs at each part. 2 marks



Adapted From: <https://commons.wikimedia.org/wiki/File:10x>

- c. Name the molecule that glucose is broken down into during glycolysis, and name the further derived molecule that is an input of the Krebs cycle. 2 marks

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Question 3 (11 marks)

Vaccination for COVID-19 is one of the main forms of combatting the disease and controlling spread. COVID-19 vaccines either introduce or have the body create a fragment of the disease to which the immune system responds, building immunity for future infections.

- a.** How does the lymphatic system streamline the recognition of the viral antigen? 1 mark

- b.** Outline the steps that occur in the cell-mediated immune response that leads the body to produce cytotoxic T cells when it encounters a viral antigen. 4 marks

- c.** Describe why having a majority of people being vaccinated and gaining herd immunity is important in combatting and controlling disease. 1 mark

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- d.** List three measures, other than vaccination and herd immunity, that may be used to control and/or screen disease transmission. 3 marks

- e.** Describe antigenic drift and outline how it can impact the effectiveness of a vaccine. 2 marks

Question 4 (8 marks)

The basis of the 'Out of Africa' model is that *Homo sapiens* evolved first in Africa and then spread around the world between 100,000 and 200,000 years ago, superseding all other hominin species.

Modern humans had reached Asia approximately 70,000 years ago before moving down through South-east Asia and into Australia approximately 50,000 years ago. *Homo sapiens*, however, were not the first hominins to inhabit this region; *Homo erectus* had already been in Asia for at least 1.5 million years.

The remains of an Indigenous man, dubbed 'Mungo Man,' was discovered in a lake from the World Heritage-listed Willandra Lakes region in far-western New South Wales. The remains have been dated to be over 40,000 years old.

Source: <https://australian.museum/learn/science/human-evolution/the-spread-of-people-to-australia/>

- ai.** Radiocarbon dating can be used for organic samples up to 60,000 years old. 1 mark

What is the half-life of carbon-14?

- aii.** Radiocarbon dating determines numerical age for fossils and other materials. Can this be considered absolute or relative dating? 1 mark

- b.** Researchers attempted to extract mitochondrial DNA (mtDNA) from Mungo Man and sequence it; however, further research has discovered that the sample had been contaminated with modern human DNA, likely from people handling the bones. 2 marks

What kind of scientific error is this? Justify your answer.

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- c.** Why is mitochondrial DNA (mtDNA) especially useful for determining evolutionary relationships? 2 marks

- d.** Does the discovery and dating of the Lake Mungo remains directly impact or contradict the 'Out of Africa' hypothesis? Justify your answer. 2 marks

Question 5 (13 marks)

Biochemical processes such as photosynthesis require enzymes and coenzymes to facilitate and speed up reactions.

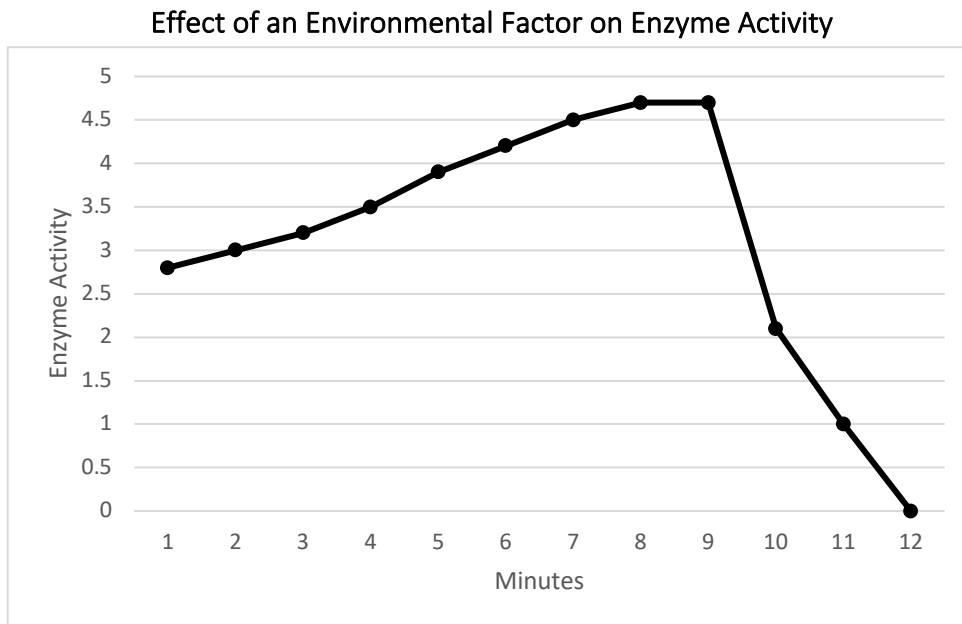
- a.** Write the unloaded form of ATP and describe its role in the light-dependent and light-independent stages of photosynthesis. 3 marks

- b.** Rubisco is an enzyme in photosynthesis that fixates carbon. If it binds to the wrong substrate, Rubisco undergoes a process called photorespiration. 2 marks

Name the alternate substrate that Rubisco may bind to and outline the effect that this has on photosynthesis.

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- c. The two key factors that determine whether Rubisco undergoes carbon fixation or photorespiration are temperature and substrate concentration. A team was studying the impact of these different environmental factors on Rubisco enzyme activity. The results from one of their experiments is shown below. 3 marks



Referring to the graph, what change was made at nine minutes? Justify your answer, referencing the data.

- d. When designing their experiments on factors that affect enzyme activity, the team were careful to only test one factor at a time. 2 marks

Given this approach, if the substrate concentration was being changed between groups in the experiment, explain what should happen to the temperature and why.

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- e. Changing weather conditions, including rising temperatures and water unavailability, can increase photorespiration in plants. While 85-90% of plants undergo regular photosynthesis, some plants have adaptations to decrease photorespiration and maximise photosynthesis.

3 marks

Sources: Khan Academy (<https://www.khanacademy.org/science/biology/photosynthesis-in-plants/photorespiration-c3-c4-cam-plants/a/c3-c4-and-cam-plants-agriculture>); Science Direct (<https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/c3-photosynthesis>) (taken from A.S. Raghavendra, in Encyclopedia of Applied Plant Sciences, 2003))

Describe the adaptations of C₄ and CAM plants to maximise photosynthesis.

Question 6 (10 marks)

Galapagos finches developed into different species after they dispersed across different islands, creating geographic isolation between the Finch populations.

- a. What type of speciation is this? Describe the process.

4 marks

- b. Small groups of finches from an island group would be able to cross large distances with the right wind.

1 mark

Identify the term for when a population is seeded by a small group of individuals with different allele frequencies to the main population.

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- c.** Outline the steps of natural selection for the Galapagos finches.

3 marks

- d.** Over a long period of time, with little change in selection pressures, how is natural selection likely to affect genetic diversity? Why is this the case?

2 marks

Question 7 (4 marks)

The first European settlers in Australia brought with them infectious diseases that severely impacted the Aboriginal and Torres Strait Islander populations, resulting in mass infections and death.

“Smallpox spread across the country with the advance of European settlement, bringing with it shocking death rates. The disease affected entire generations of the First Nations populations and survivors were in many cases left without family or community leaders.” (National Museum of Australia)

Source: <https://www.nma.gov.au/defining-moments/resources/smallpox-epidemic>

- a.** Give three reasons why smallpox and other European diseases would have had such a severe impact on the First Nations populations. 3 marks

- b.** One of the main symptoms of smallpox is a fever. What is the purpose of a fever in the body? 1 mark

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Question 8 (8 marks)

Biofuels that are made from biomass are considered to be a potentially greener alternative to fossil fuels.

Source: <https://www.intechopen.com/chapters/65086>

- a.** Give two reasons why biofuels are considered more environmentally friendly than fossil fuels. 2 marks

- b.** What are two of the required environmental factors to induce anaerobic respiration? 2 marks

- c.** List the biofuel that can be made by anaerobic fermentation and one application of this fuel. 2 marks

- d.** List the outputs of anaerobic respiration for plants/yeast as opposed to animals. 2 marks

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Question 9 (5 marks)

a. Outline the steps in the process of transcription.

3 marks

b. Describe how a single gene can produce multiple different mRNA strands.

2 marks

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Question 10 (4 marks)

Humans have two sets of chromosomes (i.e., humans are diploid). It is common for plants to have more than two sets of chromosomes; this can be advantageous, especially to crop plants, due to increased heterozygosity and as this can protect against the effects of deleterious mutations. It also, however, often results in reduced fertility due to meiotic errors, allowing for the production of seedless varieties.

Source: https://www.researchgate.net/profile/Wellington-Clarindo/publication/288831058_The_and_its_key_role_in_plant_breeding/links/568f43308ae86ec752430a/The-and-its-key-role-in-plant-breeding.pdf

- a.** Common in plants, what is the term for having multiple sets of chromosomes? 1 mark

- b.** What term is used to describe having one or more chromosomes missing from a set of chromosomes, or having one or more additional chromosomes? 1 mark

- c.** Plants with high yields or desirable traits, such as seedless fruit, have been developed using genetic modification (GMO), but some consumers and farmers have rejected GMO products and crops. 2 marks

Outline one concern and one benefit regarding GMO crops.

END OF QUESTION AND ANSWER BOOK

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Clearly number all responses in this space.

[illegible]

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**Student
name:**

Use a **PENCIL** for **ALL** entries. For each question, shade the box which indicates your answer.

Marks will **NOT** be deducted for incorrect answers.

NO MARK will be given if more than **ONE** answer is completed for any question.

If you make a mistake, **ERASE** the incorrect answer – **DO NOT** cross it out.

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
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38	A	B	C	D
39	A	B	C	D
40	A	B	C	D