

Trial Examination 2022

VCE Biology Units 1&2

Written Examination

Question and Answer Booklet

Reading time: 15 minutes

Writing time: 2 hours 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of booklet

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
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 booklet of 36 pages

Answer sheet for multiple-choice questions

Instructions

Write your **name** and your **teacher's name** in the space provided above on this page, and on the answer sheet for multiple-choice questions.

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

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 booklet.

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.

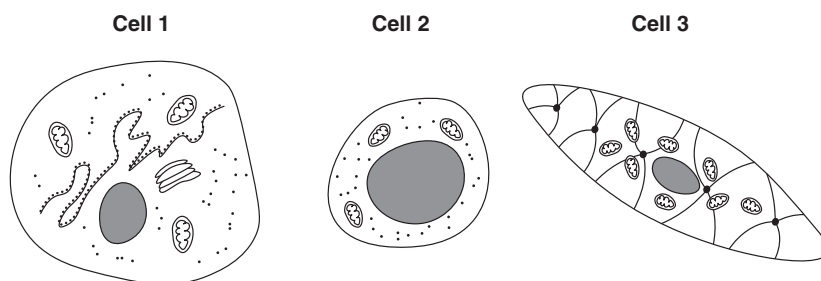
Marks will **not** be deducted for incorrect answers.

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

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

Use the following information to answer Questions 1 and 2.

The following diagram shows three different animal cells. The diagram includes some of the features that are visible when the cells are observed under an electron microscope.



Question 1

All three cells must be eukaryotic cells, not prokaryotic cells, as they have

- A. a plasma membrane.
- B. ribosomes.
- C. cytosol.
- D. mitochondria.

Question 2

Which one of the following statements about the cells is correct?

- A. Cell 1 is most likely to be found in smooth muscle tissue because it has the best shape for muscle contraction.
- B. Cell 2 is most likely to be found in smooth muscle tissue because it is spherical, which provides a greater surface area to volume ratio for exchange.
- C. Cell 3 is most likely to be found in smooth muscle tissue because it can carry out a higher rate of cellular respiration.
- D. None of the cells are likely to be found in smooth muscle tissue because they all lack a nucleus to control cell contraction.

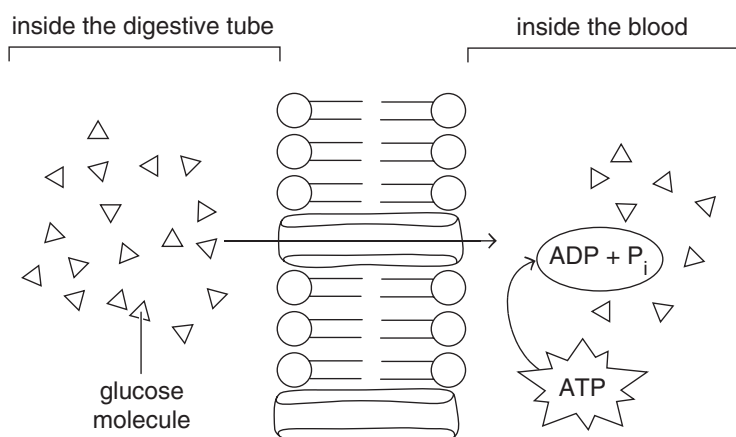
Question 3

Transport of hydrophilic substances through a cell's plasma membrane is restricted to some regions in the membrane because

- A. hydrophilic substances are large and lipid-soluble.
- B. the plasma membrane contains lipids.
- C. hydrophilic substances move along the concentration gradient.
- D. the cell must provide energy to facilitate transport of the hydrophilic substances.

Use the following information to answer Questions 4 and 5.

The following diagram shows a process by which glucose from digested food is absorbed into the blood through the plasma membrane of a cell in the digestive system.

**Question 4**

The diagram above is **not** correct because it shows

- A. energy in the form of ATP being used for the process.
- B. the phospholipid molecules of the bilayer facing the wrong way.
- C. the glucose molecules passing through protein channels using carrier proteins instead of the bilayer.
- D. the glucose molecules moving down the concentration gradient.

Question 5

The section of the membrane shown in the diagram would most likely be present in a cell in the

- A. microvilli of the stomach.
- B. lining of the oesophagus.
- C. villi of the duodenum.
- D. microvilli of the colon.

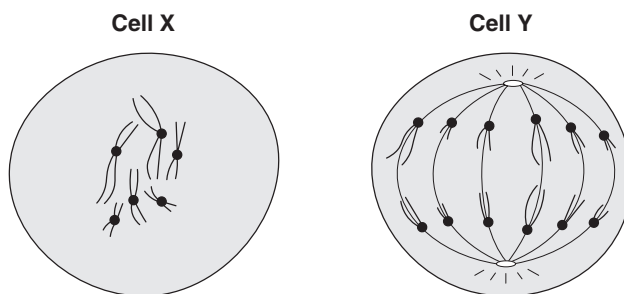
Question 6

Which one of the following processes occurs during binary fission in bacteria?

- A. the cell cycle
- B. mitosis
- C. spindle formation
- D. DNA replication

Use the following information to answer Questions 7 and 8.

The following diagram shows two animal cells undergoing different stages of the cell cycle.



Question 7

During metaphase, there would be

- A. 6 chromosomes.
- B. 6 centrioles.
- C. 6 chromatids.
- D. 12 centromeres.

Question 8

The stage occurring in cell X would occur before the stage occurring in cell Y because

- A. the chromosomes in cell X have replicated during this stage.
- B. the chromosomes in cell X have not yet lined up along the equator.
- C. cell Y is undergoing cytokinesis.
- D. the nuclear membrane in cell Y has not broken down.

Question 9

Two types of genes play a major role in regulating the cell cycle and can cause cancers if they behave abnormally.

- The proto-oncogenes (POs) code for proteins that act as ‘accelerators’ to stimulate cell growth and division, resulting in normal growth and development of healthy organs and tissues.
- The tumour suppressor genes (TSGs) act as ‘the brakes’, slowing down or inhibiting cell division and repair and triggering cell death.

Based on your knowledge and the information above, which one of the following statements is correct for cancer cells?

- A. The TSGs in cells that result in cancerous tissue are usually mutated or silenced, which means they are non-functional.
- B. Changes in the POs of cells that result in cancerous tissue can enhance their function, which results in the controlled reduction of cell division.
- C. The activities of the POs and TSGs must be balanced so that cell division is appropriate for each region in the body.
- D. If the POs were no longer functioning in the cells, apoptosis would no longer occur.

Question 10

Which one of the following statements about cancer cells is **not** correct?

- A. Cancer cells have limitless replication potential.
- B. Cancer cells can avoid apoptosis.
- C. Cancer cells can move and invade other tissues.
- D. Cancer cells are well differentiated.

Question 11

Stem cells are sometimes referred to as 'neutral cells'.

This term is used to describe stem cells because they

- A. have the ability to divide over and over many times.
- B. are unspecialised, but have the potential to develop into specific cell types.
- C. can be induced to divide into specialised cell types for specific functions.
- D. can replace cells damaged by illness or injury.

Question 12

Which one of the following is correct for totipotent and pluripotent stem cells?

	Pluripotent stem cells	Totipotent stem cells
A.	can only form a limited number of tissue types, depending on their origin	have the potential to become any of the cells in the three different embryonic germ layers
B.	have the potential to only become blood and bone cell types	have the potential to become an entire organism
C.	can form any of the three different embryonic germ layers, but cannot give rise to an entire organism	have the potential to become an entire organism
D.	is just a different name for totipotent cells; they both have the same potential for cell differentiation	is just a different name for pluripotent cells; they both have the same potential for cell differentiation

Question 13

What is the best source of stem cells that can be harvested from an adult human?

- A. brain
- B. teeth
- C. finger and toe nails
- D. bone marrow

Question 14

The components of the excretory system vary in shape. The Bowman's capsules are spherical, the kidney tubules are cylindrical and the cells of the capsules, glomeruli and tubules are flattened.

Which one of the following statements about the shape of these components is correct?

- A. The Bowman's capsules are spherical so many of them can fit inside the small kidneys.
- B. The kidney tubules are cylindrical to provide a greater surface area to volume ratio for exchange.
- C. The cells of the capsules, glomeruli and tubules are flattened to provide a greater surface area to volume ratio for exchange.
- D. All of the different shapes provide protection from the rapid fluid movement through the structures.

Question 15

Which one of the following is **not** a process of temperature control in the human body?

- A. homeostasis
- B. negative feedback
- C. positive feedback
- D. thermoregulation

Question 16

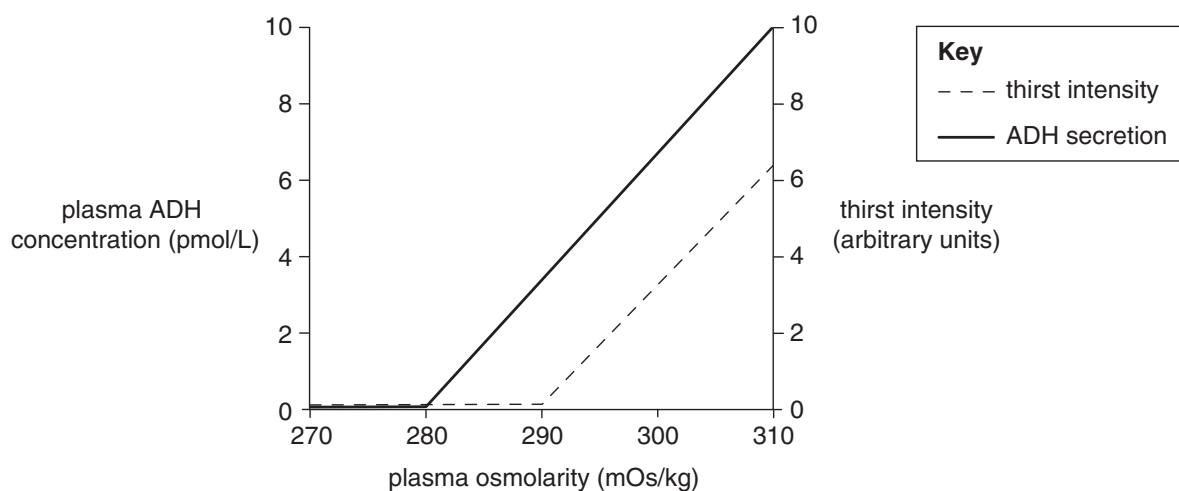
Antidiuretic hormone (ADH) is a hormone of the endocrine system involved in osmoregulation.

ADH must be

- A. made of carbohydrate.
- B. produced by a transmitter organ.
- C. secreted by a ductless gland.
- D. carried to the effector organ in the tissue fluid.

Use the following information to answer Questions 17–19.

The following graph shows two processes that change in the human body when the plasma osmolarity concentration increases. The set point is defined as the plasma osmolarity value at which hormone secretion begins to increase.



Question 17

Based on the information in the graph, the set point for ADH is

- A. 270 mOs/kg
- B. 280 mOs/kg
- C. 290 mOs/kg
- D. 320 mOs/kg

Question 18

Which organ in the body would be most active at the set point for ADH?

- A. kidney
- B. pancreas
- C. hypothalamus
- D. pituitary gland

Question 19

Nina plays tennis outside in the sun on a hot day.

Based on the information in the graph, it can be concluded that

- A. Nina will feel thirsty and drink more water before her urine concentration increases.
- B. changes in Nina's plasma osmolarity and thirst are not related to each other.
- C. water reabsorption in the kidney increases before Nina feels thirsty.
- D. thirst is not a sensation that is important for water balance in Nina's body.

Question 20

Which one of the following conditions increases the rate of transpiration?

- A. high humidity
- B. low wind velocity
- C. low temperature
- D. high light intensity

Question 21

An organism's genome consists of

- A. only the genes that code for important body features.
- B. all the genes located on the autosomes.
- C. all the DNA of the genes on all chromosomes.
- D. only the genes of the maternal chromosomes.

Question 22

Which one of the following best describes homologous chromosomes?

- A. a pair of chromosomes of the same length
- B. two chromosomes that have the same centromere position
- C. a pair of chromosomes that have identical alleles
- D. two chromosomes with the same gene loci

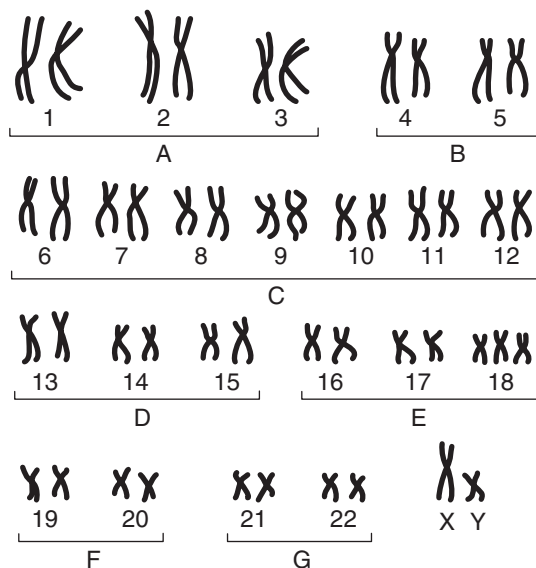
Question 23

Which row in the table shows the inputs and outputs of meiosis and the terms used to describe the chromosome numbers?

	Input	Term for chromosome number of the input into meiosis	Output	Term for chromosome number of the output from meiosis
A.	adult somatic cell	n	sex cell	n
B.	adult gonad cell	$2n$	gamete	n
C.	somatic cell	$2n$	zygote	$2n$
D.	gonad cell	n	sperm or egg	n

Use the following information to answer Questions 24–27.

The following diagram shows a karyotype for an individual with Edward's syndrome.



Question 24

Which one of the following statements is correct?

- A. All chromosomes labelled A–Y are autosomes.
- B. The chromosomes numbered 1–22 are somatic chromosomes.
- C. There are 21 pairs of homologous chromosomes shown in the diagram.
- D. The pair of chromosomes labelled X and Y are sex-linked chromosomes.

Question 25

The chromosome variation shown in the karyotype for Edward's syndrome could be summarised as

- A. $2n - 1$
- B. $2n + 1$
- C. $n + 2$
- D. $n + 3$

Question 26

The term used for a condition such as Edward's syndrome is

- A. aneuploidy.
- B. monoploidy.
- C. polyploidy.
- D. triploidy.

Question 27

Which one of the following processes occurs during meiosis to cause a condition such as Edward's syndrome?

- A. DNA replication
- B. crossing-over and recombination
- C. independent assortment
- D. non-disjunction

Question 28

There are several ways of explaining the concept of epigenetic factors.

Which one of the following does **not** fit into the accepted explanations?

- A. Epigenetic factors affect phenotypic variance.
- B. Epigenetic factors are reversible.
- C. Epigenetic factors act directly to change the DNA nucleotide sequence.
- D. Epigenetic factors include environmental factors and behaviours.

Question 29

Alcohol abuse is a major problem. Scientists have been studying genetic and environmental factors that increase a person's chances of developing an alcohol abuse disorder.

One study examined the following two genes.

- PER2 (influences the body's biological clock)
- POMC (plays a role in the stress-response system)

The study used 47 participants who were either moderate, binge or heavy drinkers.

Which one of the following results from the study would support the hypothesis that excessive alcohol consumption is an epigenetic factor?

- A. The binge and heavy drinkers had elevated levels of DNA methylation of the PER2 and POMC genes.
- B. The binge and heavy drinkers had changes in the coding of the PER2 and POMC genes.
- C. The binge and heavy drinkers had no changes in the functioning of the PER2 and POMC genes.
- D. The binge and heavy drinkers had a similar gene expression of the PER2 and POMC genes as moderate drinkers.

Use the following information to answer Questions 30–34.

Blood is divided into groups or types depending on the presence or absence of certain antigens (usually proteins) on the surface of red blood cells. The success of blood and organ transfusions and transplants depends on matching blood types. In some cases, pregnancies may be affected if the blood types of the pregnant parent and the developing baby are incompatible.

The following table shows information about four different blood grouping systems.

Name of blood grouping system	Position of gene/locus on chromosome	Symbols used for alleles of the gene	Additional information
ABO	long arm of chromosome 9	I^A, I^B, i	The $I^A I^B$ genotype results in an AB blood group with both A and B antigens present.
Rh	short arm of chromosome 1	Rh+, Rh–	Rh+ is the dominant trait.
Duffy (Fy system)	long arm of chromosome 1	Fya, Fyb	Fya is the dominant trait.
MN	long arm of chromosome 4	M, N	Both antigens M and N are present in the blood of person with genotype MN.

Question 30

Which one of the following patterns of inheritance is found in all four blood grouping systems listed in the table?

- A. codominance
- B. incomplete dominance
- C. autosomal
- D. sex-linked

Question 31

Around 40% of the Australian population has the blood type O, Rh+. Only 7% has the blood type O, Rh–. Donated O, Rh– blood is in demand as it is the only blood type that can be given to people with any of the different blood groups in transfusions.

Which one of the following parental crosses could **not** produce a child with the blood type O, Rh–?

- A. $ii, Rh-Rh- \times I^A i, Rh+Rh-$
- B. $I^B i, Rh+Rh- \times I^B i, Rh+Rh-$
- C. $I^A i, Rh-Rh- \times I^B i, Rh-Rh+$
- D. $I^A I^B, Rh+Rh- \times ii, Rh-Rh-$

Question 32

If one parent of a child had an $I^A I^B$ MN genotype and the other parent had an $I^A I^A$ NN genotype, the chance of the child having the blood group A N is

- A. $\frac{1}{4}$
- B. $\frac{1}{3}$
- C. $\frac{1}{2}$
- D. $\frac{3}{4}$

Question 33

A man is heterozygous for both the Duffy alleles and the Rh alleles.

The correct notation for the man's genotype is

- A. $\frac{Fya Fyb}{Rh^+ Rh^-}$
- B. $\frac{Fya Rh^-}{Fyb Rh^+}$
- C. $\frac{Fya Rh^+}{Fyb Rh^+}$
- D. $\frac{Rh^+ Rh^-}{Fya Fyb}$

Question 34

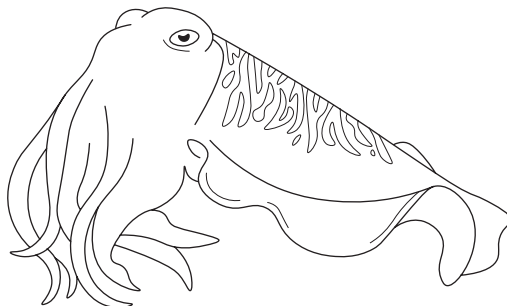
A couple has a large family of 12 children. The father is heterozygous for both the Duffy and Rh alleles. The mother is homozygous for Duffy b and Rh-.

Which one of the following is the most likely predicted ratio for the 12 offspring produced by the couple?

- A. 1 : 1 : 1 : 1
- B. 9 : 3 : 3 : 1
- C. 1 : 2 : 2 : 1
- D. 1 : few : few : 1

Use the following information to answer Questions 35 and 36.

The diagram below shows an Australian giant cuttlefish. Australian giant cuttlefish are only found in the waters of southern Australia. They inhabit reef and sea grass areas.



Australian giant cuttlefish have many adaptations, including:

- a beak to help subdue their prey and defend themselves against predators and rivals
- the ability to flatten their bodies to make themselves look bigger
- showing two dark 'eye spots' on their backs and a black ring around their mantle/covering
- a specialised hollow cuttlebone that helps them maintain buoyancy and move up and down by adjusting the levels of gas and liquid in its chamber
- highly specialised skin that varies in colour and texture by using muscle contraction to change the pigment and iridescence to match their surroundings.

Question 35

Which one of the following shows the description and type of an adaptation that would most benefit young, small cuttlefish that need to frighten predators?

	Description of adaptation	Type of adaptation
A.	skin changing colour and texture	structural
B.	ability to flatten body	behavioural
C.	beak to attack the predator	physiological
D.	hollow cuttlebone for attack	structural

Question 36

Australian giant cuttlefish are active during the day and night. They congregate in large numbers from mid-May to July for the breeding season.

The physiological adaptation that is most beneficial to a cuttlefish's survival during daylight hours is

- A. its ability to change its buoyancy to move closer to a mate.
- B. a beak to attract mates during breeding season.
- C. mass migration during the breeding season to a central area.
- D. the contraction of the muscles around coloured skin cells to change its colour for camouflage.

Use the following information to answer Questions 37–40.

In 2021, it was announced that scientists had cloned a black-footed ferret. Material for the reproductive cloning process was taken from the frozen remains of Willa, a ferret that died in 1988. The process produced a cloned female ferret named Elizabeth Ann. Elizabeth Ann is a genetic copy of Willa.

Question 37

The material that was taken from Willa's frozen remains for the reproductive cloning process was the DNA contained in the

- A. somatic cells.
- B. ovary tissue.
- C. egg cells.
- D. sperm cells.

Question 38

Using a mild electric shock, a cell containing Willa's DNA was fused with an donor egg that had its nucleus removed. The fused cell was then grown into a ball of cells in a culture medium.

The embryo was most likely placed into

- A. the original female donor.
- B. a surrogate of a different species.
- C. another female of the same species.
- D. a female egg donor of a different species.

Question 39

Which one of the following would **not** be a valid use of reproductive cloning technology in the future?

- A. bringing back extinct species that have been lost from the Earth
- B. helping to improve an endangered species' chance of survival
- C. increasing populations of threatened species by increasing genetic diversity
- D. modifying the genome of organisms to increase their genetic resistance

Question 40

The ecological role of ferrets in American ecosystems is similar to that of Northern brown bandicoots living in the bushland and rainforest ecosystems of north and eastern Australia. In recent years, the population numbers of this protected bandicoot species have declined and their distribution areas have been reduced.

This is due to

- A. being hunted for food by humans.
- B. loss of habitat due to urbanisation.
- C. poisoning and shooting by humans.
- D. the introduction of feral goats to kill bandicoots.

END OF SECTION A

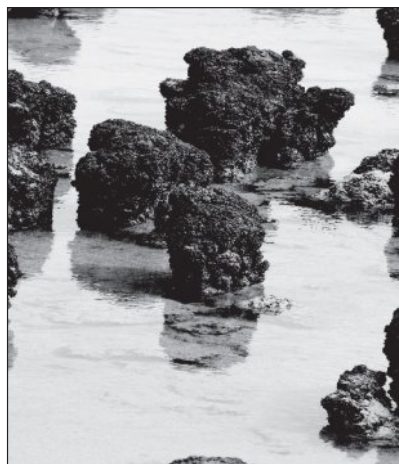
SECTION B**Instructions for Section B**

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

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

Question 1 (5 marks)

The following photographs show rock-like structures called stromatolites in the shallow water of Shark Bay in Western Australia. Shark Bay is one of only two places in the world where well-developed regions of stromatolites are still found. Stromatolites are not rocks; they are layered sedimentary formations created by photosynthetic cyanobacteria. These prokaryotic microorganisms produce mucus, which acts as an adhesive to stick sand and other rocky materials together to form 'mineral microbial mats' that build up gradually, layer upon layer.



Source: Reproduced with permission from Susan Ryan.

Stromatolites are the earliest fossil evidence of life on Earth and appeared along shorelines all over the world 3.5 billion years ago.

- a. i. What basic structural feature do stromatolites have that is a characteristic of all life on Earth? 1 mark

- ii. Why are stromatolites classified as prokaryotes? 1 mark

The cyanobacteria in stromatolites can carry out photosynthesis using water and carbon dioxide with sunlight to produce food and a gaseous product. Billions of years ago, the production of this gas aided in the evolution of multicellular life.

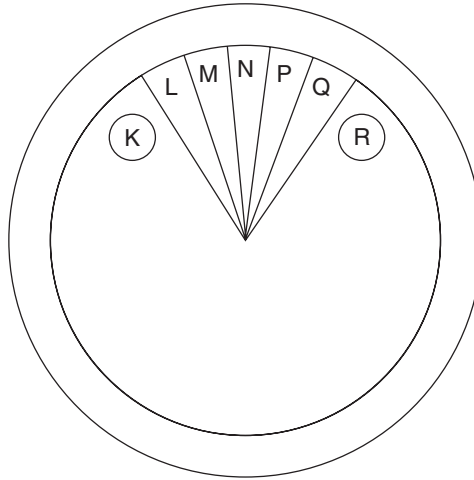
- b. i.** What must the cyanobacteria contain to be able to absorb the sunlight needed to carry out photosynthesis? 1 mark

- ii.** Identify the gas produced during photosynthesis. 1 mark

- iii.** Outline the process by which the gas identified in **part b.ii.** passes out of the organism and into the air. 1 mark

Question 2 (11 marks)

The following diagram shows the cell cycle that occurs in eukaryotic plant and animal cells. The diagram is incomplete.



- a. Complete the diagram above by drawing dividing lines to mark the regions of the missing stages and labelling them appropriately. 2 marks
- b. On the diagram above, shade in the section of the outer circle that represents interphase. 1 mark
- c. Outline **two** major structural differences between a cell at point K and a cell at point R. 2 marks

1. _____

2. _____

- d. i. Why is the process that begins at point L and ends at point P essential for organisms? 1 mark

- ii. Explain how the process occurring at point Q would be different in animal and plant cells. 2 marks

Important checks occur at different stages in the cell cycle.

- e.** Outline the check that occurs at point K. 1 mark

- f.** If an error occurs, the cell will come to a stop in the cycle and undergo one of two outcomes.
Outline the two possible outcomes for a damaged cell at point K. 2 marks

1.

2.

Question 3 (9 marks)

In the human digestive system, there are various types of cells that are specialised to synthesise and secrete different substances. The cells of the salivary glands are specialised to synthesise and secrete the enzyme amylase for chemical digestion of starch in the mouth.

a. Name and outline the function of **one** important cell organelle involved in the following processes.

i. synthesis of amylase 1 mark

ii. secretion of amylase 1 mark

The stomach lining also contains secretory cells; however, they do not produce amylase. The amylase enzyme from the mouth continues to work inside the bolus (ball of food) that passes into the stomach for a short time then ceases its action.

b. Why does amylase action cease in the stomach? 1 mark

The secretory cells of the stomach produce other essential substances needed in this region.

c. Name **two** of these substances and outline their importance in the stomach. Do **not** use the substances from your answer to **part b.** 2 marks

1.

2.

The duodenum is the first region of the small intestine. The partially digested food enters the duodenum from the stomach. Cells of the duodenum secrete some of the enzymes essential for further digestion of the complex molecules in the partially digested food. However, much of the enzyme solution enters the duodenum in an inactive form from another organ.

- d.** Draw a labelled diagram of the organ that these additional enzymes come from and indicate how they enter the duodenum.

1 mark

- e.** The bile that performs its action in the duodenum is not made by the cells lining the duodenum.

- i.** Identify the organ that contains the cells that synthesise bile.

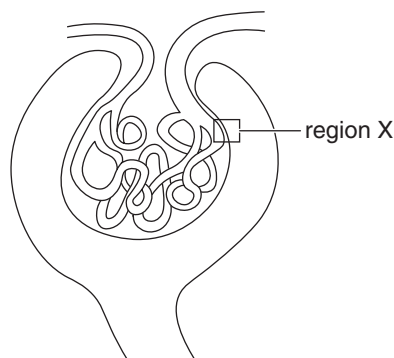
1 mark

- ii.** Explain how the action of bile is different to the action of the enzymes in the duodenum.

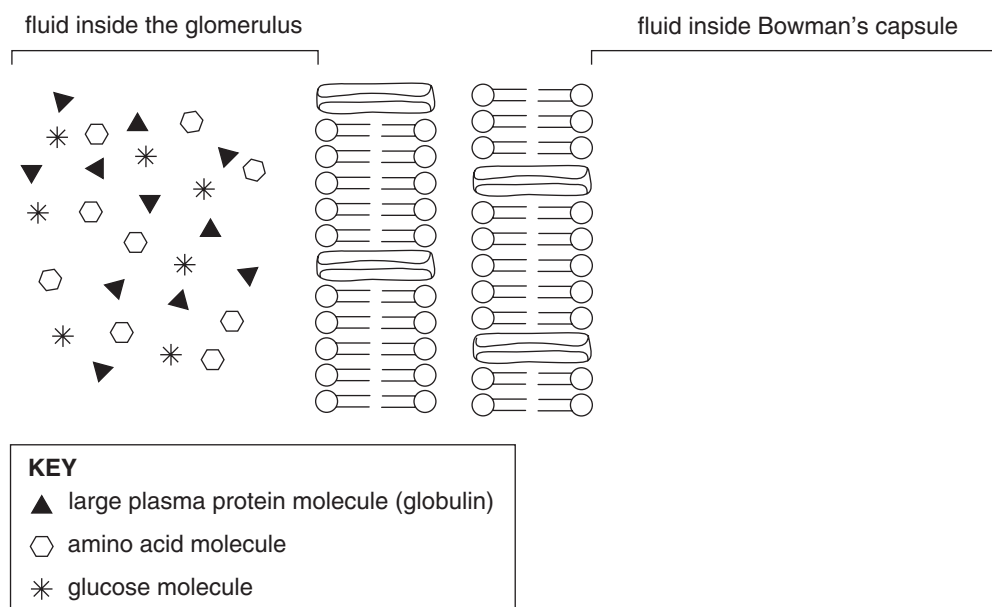
2 marks

Question 4 (6 marks)

The following diagram shows the Bowman's capsule and the glomerulus in a nephron of the excretory system. In region X, the membranes of the two structures are close together.



Region X is expanded in the diagram below. The diagram is incomplete.



a. The diagram above contains the following image.



i. What does this image represent?

1 mark

ii. Why are there four rows of these images, with two rows facing in the opposite direction to the other two?

1 mark

- b.** Using the symbols shown in the key, complete the diagram on the previous page by filling in the column for the fluid inside the Bowman's capsule for protein and amino acids. Justify your response. 2 marks

In a Biology class, Jacob said that amino acids could cross the membranes from the blood in the glomerulus into the cavity of the Bowman's capsule because amino acids are hydrophilic.

- c.** Was Jacob correct to use the term 'hydrophilic' to describe the amino acids that move into the glomerular filtrate in the Bowman's capsule? Justify your response. 1 mark

- d.** Glucose is filtered into the Bowman's capsule, yet it does not appear in the urine of a healthy, non-diabetic person.
Why is glucose absent from the urine of a healthy, non-diabetic person? 1 mark

Question 5 (9 marks)

Alloxan is a toxic chemical that has been used in laboratories to induce diabetes in rats. The chemical destroys important hormone-secreting cells in the pancreas, which induces diabetes. Absence of this hormone affects skeletal muscle tissue, urine production and energy levels in the treated rats.

- a.** Identify the important hormone that would **not** be produced and secreted by the pancreatic cells of the rats treated with alloxan. 1 mark

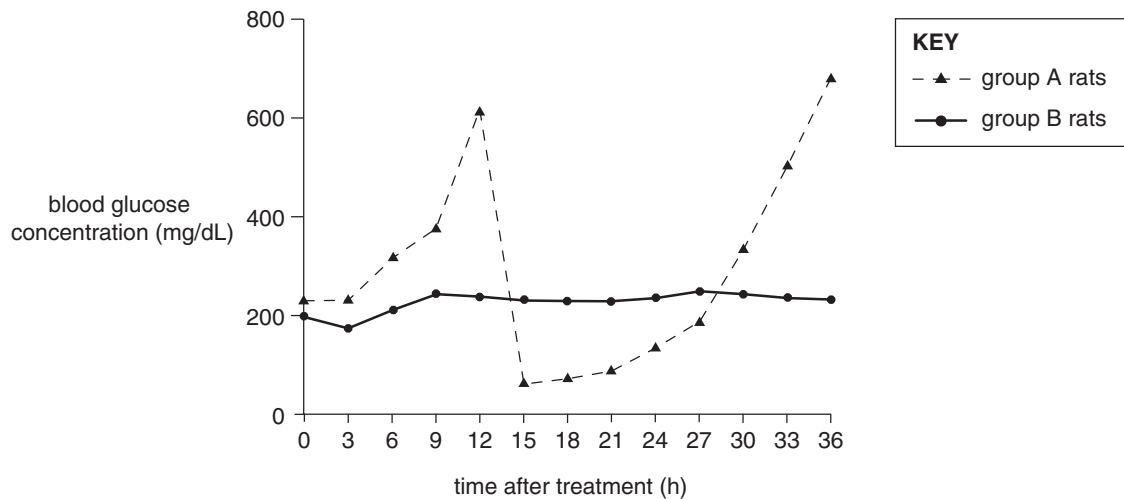
An experiment was set up in a laboratory with two groups of 20 male rats of the same species, size, age and health. Group A was given a volume of alloxan solution and group B was given the same volume of distilled water. Both groups were kept in similar environmental conditions and the rats' blood-glucose concentration was measured over the next 36 hours.

- b. i.** Suggest a hypothesis for this experiment. 1 mark

- ii.** Is this a controlled experiment? Justify your response. 1 mark

- iii.** Why were rats used in this experiment and not chickens? 1 mark

The following graph shows the results obtained from the experiment.



- c. i. Which group of rats was treated with alloxan? Use the information from the graph to justify your choice. 1 mark

- ii. The graph for group A unexpectedly and for no explainable reason decreased rapidly at 12 minutes, resulting in a low blood glucose concentration at 15 minutes. It remained low for about 5 hours.

What is the name of the condition suffered by the group A rats during this time period?

1 mark

- iii. Are the results valid? Justify your response. 1 mark

- iv. Are the results precise? Justify your response. 1 mark

- d.** Alloxan can be found in the flour used to make some popular Indian foods. Global health literature suggests that ingesting this flour may put consumers at risk.

Outline why there is concern about this type of flour being used for cooking.

1 mark

Question 6 (8 marks)

DNA is found in the chromosomes of cells. Depending on the species and the location within the cell, these chromosomes may be linear or circular. Some cells also contain small circular DNA molecules known as plasmids. The following table contains information about the DNA of nine different species, including their genome size and the number and location of their chromosomes. If they contain any plasmids, this is also recorded.

Name of species	Genome size (number of base pairs)	Chromosome number and their location
<i>Salmonella</i> bacteria	4.94 million	1 chromosome 2 plasmids
yeast	12.6 million	32 in nucleus 1 mitochondrial
mushroom	33.49 million	26 in nucleus 1 mitochondrial
salamander (amphibian)	116.6 billion	20 in nucleus 1 mitochondrial
zebra fish	1.68 billion	50 in nucleus 1 mitochondrial
human	3.27 billion	46 in nucleus 1 mitochondrial 1 chloroplast
chilli plant	3.22 billion	24 in nucleus 1 mitochondrial 1 chloroplast
corn/maize	2.14 billion	20 in nucleus 1 mitochondrial 1 chloroplast
wheat	12 billion	44 in nucleus 1 mitochondrial 1 chloroplast

- a. i. Based on the information in the table, outline the relationship between genome size and chromosome number for these species. 1 mark

- ii. Why is the genome size much larger than the chromosome number for all the species shown in the table? 1 mark

The salamander (amphibian) has the greatest genome size of all the species shown. In a Biology class, Wendy stated that this is because the salamander is more complex than the zebra fish, which has a genome size of 1.68 billion. David disagreed with her.

- b.** Who is correct? Justify your answer. 1 mark

- c.** Corn/maize and the salamander (amphibian) both have the same nuclear chromosome number, yet they are completely different types of organisms. 1 mark
- Why is this the case?

- d. i.** There is no information for chromosome location in *Salmonella* bacteria shown in the table. 1 mark
- Suggest a possible reason for this.

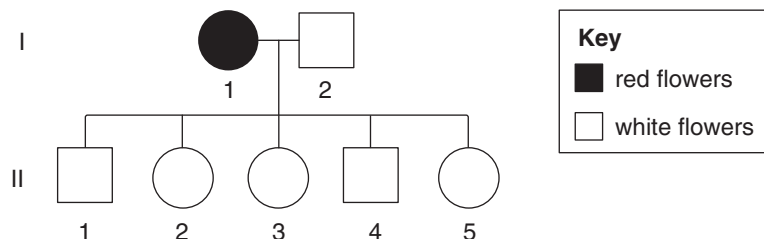
- ii.** The table shows three chromosome locations for wheat, but only two chromosome locations for zebra fish. 1 mark
- Suggest a possible reason for this.

- e. i.** Based on the information given in the table, write the diploid number for a mushroom. Use the correct notation. 1 mark

- ii.** Based on the information given in the table, write the haploid number for a zebra fish sperm. Use the correct notation. 1 mark

Question 7 (6 marks)

The incomplete pedigree below shows a cross between two plants, one with red flowers and one with white flowers, and the five offspring they produced. The colour of the flowers of the offspring has **not** been shown.



- a. i.** What phenotype(s) would the offspring have if the pattern of inheritance of flower colour is incomplete dominance? 1 mark
- _____
- _____
- ii.** Give a reason for your answer to **part a.i.** 1 mark
- _____
- _____
- b. i.** What phenotype(s) would the offspring have if the pattern of inheritance of flower colour is codominant inheritance? 1 mark
- _____
- _____
- ii.** Allocate allele symbols for the two flower colours if flower colour is inherited as a codominant trait and use those symbols to write the genotypes for the phenotype(s) given in **part b.i.** 1 mark
- _____
- _____
- c.** In another type of plant, the pattern of inheritance of red flower colour is completely dominant to white. However, a plant that produces red flowers could have one of several genotypes for red colour.
- i.** Name a cross that could be used to determine the genotype of the plant that produces red flowers. 1 mark
- _____
- ii.** How would the cross named in **part c.i.** determine the genotype? 1 mark
- _____
- _____
- _____

Question 8 (8 marks)

Glucose-6-phosphate dehydrogenase (G6PD) deficiency is a condition inherited as an X-linked recessive disorder, usually affecting males of African and Mediterranean descent. G6PD deficiency results in a form of haemolytic anaemia in which red blood cells break down. Although the protein coded for by the G6PD gene is produced, the condition is not shown unless it is triggered by certain medications, stress, infections and/or foods; the disease is commonly called 'favism' as it is triggered by chemicals that are found naturally occurring in fava beans. Over 400 million people globally have the condition. All mutations that cause G6PD deficiency are on the long arm of the X chromosome, Xq28.

- a. Based on the information above, allocate appropriate allele symbols for G6PD deficiency and unaffected conditions. Use the correct notation. 1 mark

- b. Outline whether a male could be a carrier of the G6PD gene. 1 mark

- c. If a female carrier had a child with an unaffected male, what is the chance of them having a male child that may show symptoms of G6PD deficiency? Show all working in the spaces provided. 3 marks

Parental cross _____

Gametes

Chance of male child with G6PD deficiency _____

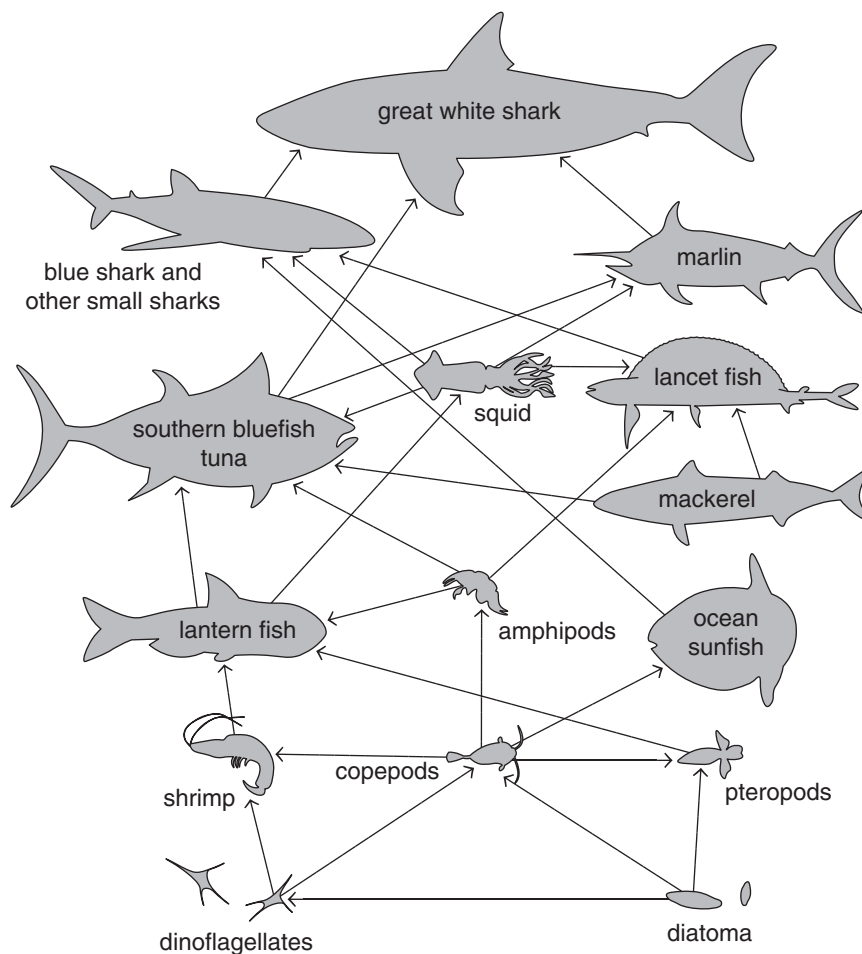
- d. Identify the genotype and conditions that could result in a female symptomatic for G6PD deficiency. 2 marks

- e. Outline whether the factors that trigger the symptoms of the G6PD condition could be considered epigenetic factors.

1 mark

Question 9 (12 marks)

The following diagram shows a food web of some of the major species that reside in the waters of the Great Australian Bight.



Many of the species found in the waters of the Great Australian Bight have unique adaptations.

a. Using your knowledge and the information above, complete the table below.

4 marks

Organism/ Species	Adaptation and adaptive advantage	Type of adaptation
great white shark		structural
blue shark	They migrate in a long, looping pattern to the tropical Indian Ocean then return to the Great Australian Bight to forage for food each year.	
southern bluefin tuna and mackerel	They are 'warm-blooded' and can regulate their body temperature by endothermy, retaining the body heat they generate when swimming.	
shrimp		structural

- b.** Sharks have lived for about 450 million years on Earth. They have survived five major extinctions, which wiped out 75–96% of life on the Earth. However, in the last 100 years, they have been facing the threat of extinction.

- i.** The great white shark eats many species but is not eaten alive by any other species shown on the food web.

Given their position in the food web, what term can be applied to the great white shark?

1 mark

- ii.** Healthy oceans need sharks as a ‘keystone species’.

Explain what this term means and what may happen to the ecosystem of the Great Australian Bight if the number of sharks is drastically reduced.

2 marks

Great white sharks are ovoviviparous, which means the baby shark grows in an egg that hatches inside the mother and, soon after, the young shark is born.

- c. i.** Do great white sharks reproduce sexually or asexually? Justify your response.

1 mark

- ii.** The great white shark is a threatened species.

Explain which method of reproduction (sexual or asexual) would be more advantageous to the survival of the species.

2 marks

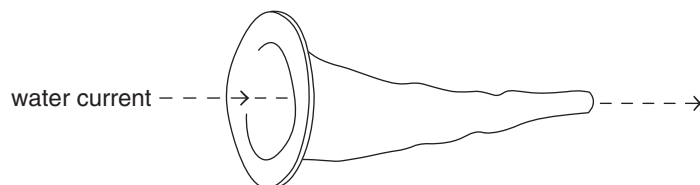
- d.** Scientists have found that female scalloped hammerhead sharks (*Sphyrna lewini*) have given birth without mating with a male.

i. What is the name for this form of asexual reproduction? 1 mark

- ii.** Assume the haploid number for a scalloped hammerhead shark is $n = 36$.
How many chromosomes would be found in the somatic cells of a scalloped hammerhead shark offspring produced by the type of reproduction named in **part d.i.**? 1 mark

Question 10 (6 marks)

The Wadawurrung People of south-western Victoria traditionally caught eels as a food source. When the flowering of several species occurred, including stringybark eucalypts and coastal banksias, the Wadawurrung People would know to set traps for the short-fin eels that started their migration down the rivers to the sea. Eel traps are long cone-shaped devices, woven from river reeds and spear grass, that feature a large opening and a small hole in one end, as shown in the diagram below. Smaller eels can pass through the small hole.



- a. i. Outline the relationship between the flowering of stringy barks and the availability of the eels as a food resource. 1 mark

- ii. What is the importance of the shape of the eel trap in terms of the long-term survival of the short-fin eel species? 1 mark

- iii. Students discussed the eel traps in a Biology class. Piv stated that the practice would be considered an interdependent relationship between the flowering stringybarks and the eels. Roza disagreed and stated that it is an interdependent relationship between the eels and the local people.

Who is correct? Justify your response. 1 mark

- b.** The traditional land management practices of Australia's First Nations peoples have sustained the environment for tens of thousands of years. One of these practices involves the use of fire to burn a selected area, which encourages rapid regeneration and abundant new growth.

- i.** Outline a structural adaptation of a plant species that would help them to survive the fire and rapidly regenerate as a result. 1 mark

- ii.** Explain how the abundant new growth would be beneficial for Australia's First Nations peoples when hunting animals as a food resource. 2 marks

END OF QUESTION AND ANSWER BOOKLET

VCE Biology Units 1&2

Written Examination

Multiple-choice Answer Sheet

Student's Name: _____

Teacher's Name: _____

Instructions

Use a **pencil** for **all** entries. If you make a mistake, **erase** the incorrect answer – **do not** cross it out. Marks will **not** be deducted for incorrect answers.

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

All answers must be completed like this example:

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

Use pencil only

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
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26	A	B	C	D
27	A	B	C	D
28	A	B	C	D

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33	A	B	C	D
34	A	B	C	D
35	A	B	C	D
36	A	B	C	D
37	A	B	C	D
38	A	B	C	D
39	A	B	C	D
40	A	B	C	D