



VCE Biology 2013–2016

Written examination

Examination specifications

Overall conditions

The examination will be sat at a time and date to be set annually by the Victorian Curriculum and Assessment Authority.

There will be 15 minutes reading time and 2 hours 30 minutes writing time.

VCAA examination rules will apply. Details of these rules are published annually in the *VCE and VCAL Administrative Handbook*.

The examination will be marked by a panel appointed by the VCAA.

The examination will contribute 60 per cent to the Study Score.

Content

All outcomes in Unit 3 and Unit 4 will be examined. All the key knowledge that underpins the outcomes in Unit 3 and Unit 4, and the set of key skills listed on page 12 of the study design are examinable.

Questions will require students to apply Biology knowledge and skills that are related to Unit 3 and/or Unit 4.

The examination will assess a representative sample of the key knowledge and key skills that underpin the outcomes of Unit 3 and Unit 4. While students will not be required to complete practical exercises within the examination, they may be asked to draw on their practical experience when answering questions.

Each outcome will be approximately equally weighted.

Format

The examination paper will consist of two sections. Examination questions will be presented in a question and answer book.

- **Section A** will consist of 40 multiple-choice questions. Each question will be worth 1 mark. Students will be required to mark their responses on a multiple-choice answer sheet. This section will be worth 40 marks.

All questions in Section A will be compulsory.

- **Section B** will consist of short answer questions and will be worth 70 marks.

The total for the examination will be 110 marks.

Approved materials and equipment

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers and rulers.

Advice

During the 2013–2016 accreditation period for VCE Biology, examinations will be prepared according to the examination specifications above. Each examination will be an interpretation of these specifications and will test a representative sample of the key knowledge and key skills.

This sample examination is published in order to exemplify the new examination format.

Answers to multiple-choice questions are provided on page 38. Answers to other questions are not provided. Selected questions from previous examination papers from 2004–2011 are indicative of the type and scope of questions that may be expected.



Victorian Certificate of Education

Year

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Letter

Figures																			
Words																			

BIOLOGY

Written examination

Day Date

Reading time: *.* ** to *.* ** (15 minutes)

Writing time: *.* ** to *.* ** (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	x	x	70
			Total 110

- 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 white out liquid/tape.
- No calculator is allowed in this examination.

Materials supplied

- Question and answer book of 39 pages.
- Answer sheet for multiple-choice questions.

Instructions

- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- 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** for the question.

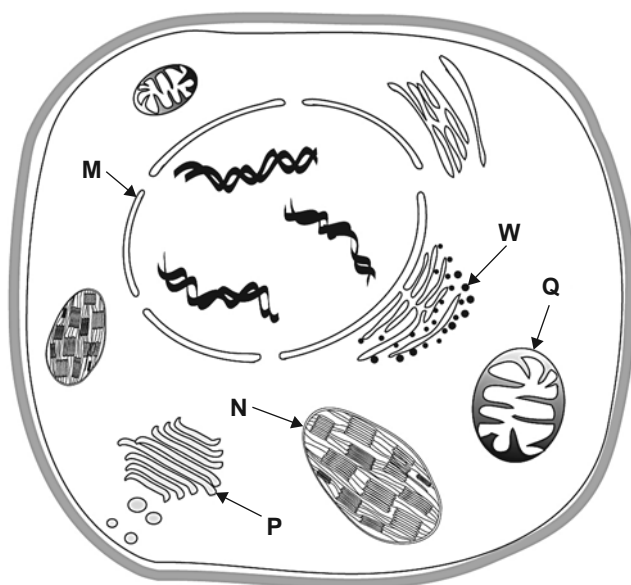
A correct answer scores 1, an incorrect answer scores 0.

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

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

Question 1

Consider the following plant cell.



A process occurring at structure **W** in this plant cell would be

- A. packaging of molecules.
- B. aerobic respiration.
- C. protein synthesis.
- D. DNA replication.

Question 2

Facilitated diffusion is a form of cell transport that

- A. moves oxygen and carbon dioxide across membranes.
- B. occurs against a concentration gradient.
- C. requires specific protein channels.
- D. uses energy supplied by ATP.

NO WRITING ALLOWED IN THIS AREA

Question 3

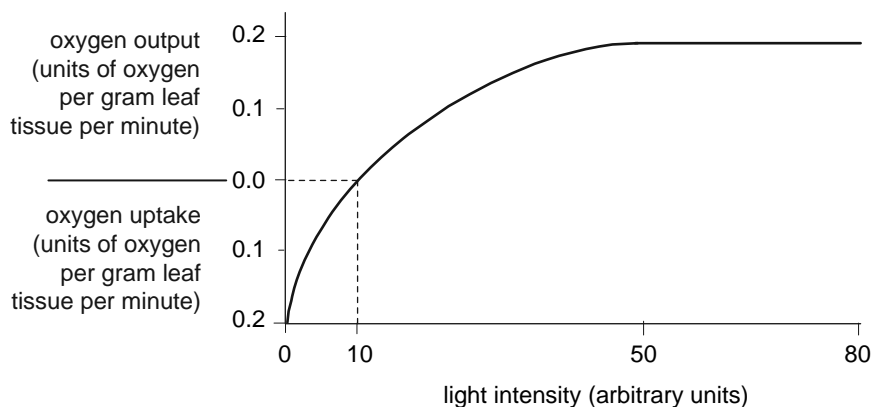
Insulin is a complex protein that is said to have a quaternary structure.

This means that insulin

- A. cannot be denatured.
- B. lacks disulfide bridges.
- C. contains all the known amino acids.
- D. has more than one polypeptide chain.

Question 4

The following graph shows the relationship between light intensity and net oxygen uptake or output by a particular green plant.

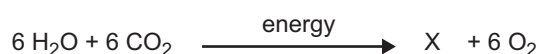


At a light intensity of 10 units

- A. the rate of photosynthesis is zero.
- B. the rate of aerobic respiration is zero.
- C. oxygen produced by photosynthesis is equal to the oxygen used by aerobic respiration.
- D. oxygen produced by photosynthesis is equal to twice the oxygen used by aerobic respiration.

Question 5

Consider the following diagram that is a summary of an important biochemical process.

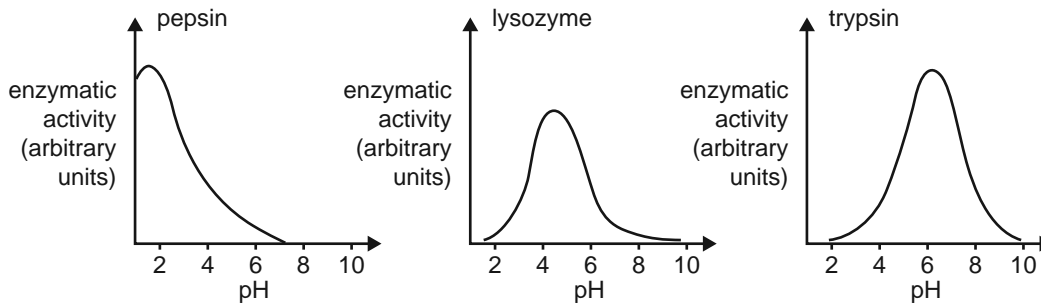


The product, X, in this biochemical process is

- A. ADP.
- B. a polymer.
- C. an amino acid.
- D. a monosaccharide.

Question 6

Examine the following graphs.



From these graphs it is reasonable to infer that at a pH of 4

- A. trypsin would be inactive.
- B. all the pepsin would be denatured.
- C. all three enzymes would lack a functional active site.
- D. lysozyme has the highest activity of the three enzymes.

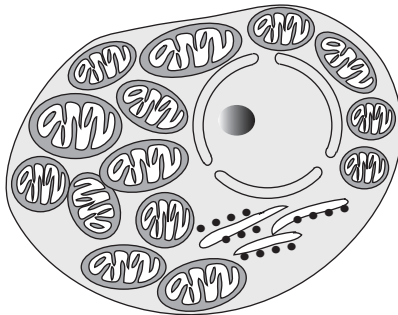
Question 7

An example of a catabolic reaction includes the formation of

- A. maltose from glucose.
- B. fatty acids and glycerol from lipids.
- C. ATP and water from ADP and inorganic phosphate.
- D. glucose and oxygen from carbon dioxide and water.

Question 8

Examine the following cell.

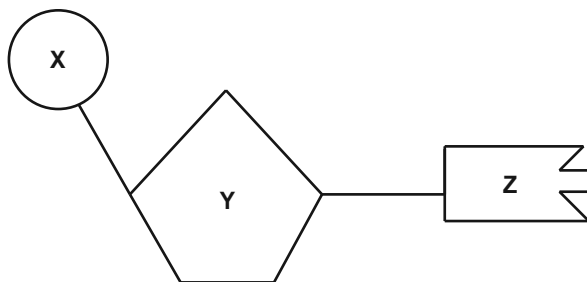


Based on the internal structure, the cell is likely to

- A. be a cheek epithelial cell.
- B. be a mature red blood cell.
- C. require high levels of oxygen.
- D. produce high levels of sugars.

Question 9

The following diagram represents a nucleotide with subunits X, Y and Z.



This nucleotide could be identified as a monomer of DNA but not RNA if

- A. X is ribose.
- B. Z is thymine.
- C. Y is phosphate.
- D. Z is paired with cytosine.

Question 10

The Golgi apparatus is responsible for the

- A. manufacture of lipids.
- B. production of energy for the cell.
- C. destruction of unwanted cellular molecules.
- D. modification and packaging of protein molecules.

Question 11

A person will gain long-term immunity after

- A. administration of the chicken pox vaccine.
- B. the inflammatory response to a bee sting.
- C. an injection of immunoglobulin if exposed to mumps.
- D. the passage of antibodies from their mother.

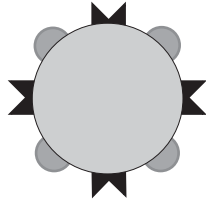
Question 12

One of the similarities between the defence mechanisms of a plant and an animal includes the





- A. production of memory cells.
- B. release of immune cells through a circulatory system.
- C. use of an epidermal layer to inhibit the invasion of pathogens.
- D. production of salicylic acid to warn cells of an invading pathogen.

Question 13

A disease-causing bacterium has the following structure.



What kind of antibodies would be most effective against this type of bacterium?

<p>A.</p> 	<p>B.</p> 
<p>C.</p> 	<p>D.</p> 

Question 14

Vibrio cholerae produces a toxin that binds to a plasma membrane receptor on intestinal cells of the host. The toxin permanently activates the G protein in target cells, causing them to lose water rapidly. When a person is infected with cholera they suffer severe dehydration.

The *V. cholerae* toxin

- A. is an example of a second messenger molecule.
- B. disrupts normal signal transduction in the cell.
- C. is a lipid-soluble molecule.
- D. acts as a neurohormone.

Question 15

Consider two cells (X and Y) in a reflex arc in the nervous system. Cell X is transmitting a signal to cell Y.

Signal transduction commences

- A. in the cytosol of cell X.
- B. along the axon of cell X.
- C. in the myelin sheath of cell X.
- D. at the synapse between cells X and Y.

Question 16

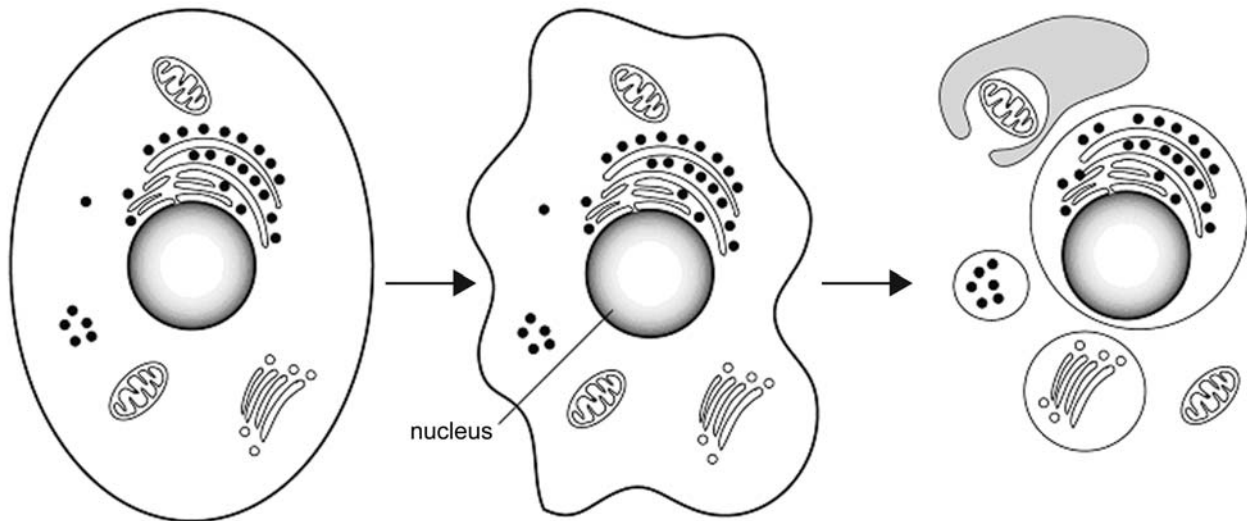
Recent research has demonstrated that members of some families are unable to feel pain. They respond normally to touch, temperature and pressure, and have no signs of nerve disease.

From this information it is reasonable to conclude that in the affected people

- A. ion channels are blocked in one group of specialised neurons.
- B. neurons in the skin are unable to respond to external stimuli.
- C. neurons are unable to produce neurotransmitters.
- D. brain cells fail to respond to electrical signals.

Question 17

The following diagram outlines a process that occurs in multicellular organisms.



This process

- A. begins with a signal binding to a specific receptor.
- B. occurs when a virus replicates within a cell.
- C. is part of mitosis.
- D. is reversible.

Question 18

The lymphatic system

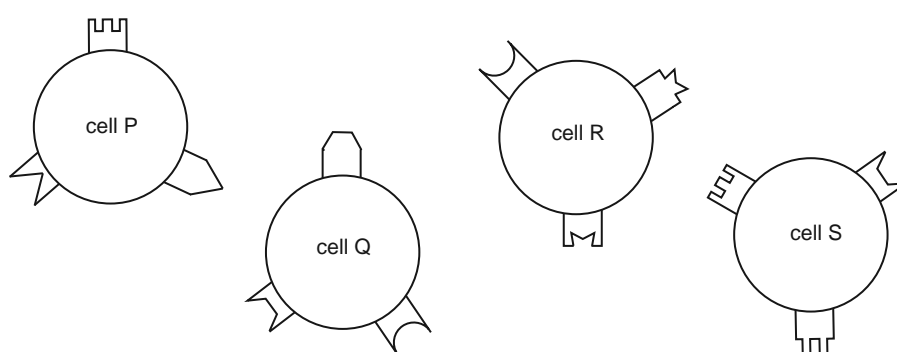
- A. controls blood clotting.
- B. contains red blood cells.
- C. contains phagocytic cells.
- D. has vessels with thick, muscular walls.

Question 19





Cells of the immune system have different kinds of structures on their surfaces. Three of the structure types that exist are

- the cell's own antigens, called self antigens
- receptors that enable a cell to identify its own antigens on any other cell
- receptors that identify foreign antigens on foreign cells.

Examine the following cells and the various structures on their surfaces.



From the information provided you are able to conclude that

- A. structure  is a self antigen for cell P.
- B. structure  is a self antigen for cell Q.
- C. structure  is a self antigen for cell R.
- D. structure  is a self antigen for cell S.

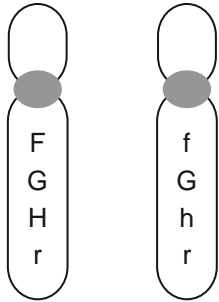
Question 20

Most water-soluble signalling molecules initiate responses within their target cells by

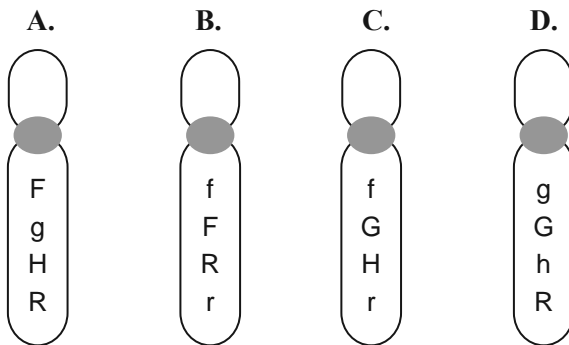
- A. forming a signalling molecule-receptor complex that binds to a site on a DNA molecule.
- B. bringing about an initial response of carbohydrate molecule production.
- C. attaching to receptors on the membranes of their target cells.
- D. activating a multistep pathway involving lipid molecules.

Question 21

A pair of homologous chromosomes involved in normal meiosis in an ovary carries the alleles shown.



Chromosomes detected in eggs produced would include

**Question 22**

In humans, a smooth chin and a straight hairline are each inherited as autosomal recessive traits. The alleles for each of the genes involved are

chin line – **S** : cleft chin

s : smooth chin

hairline – **W** : widow's peak

w : straight hairline

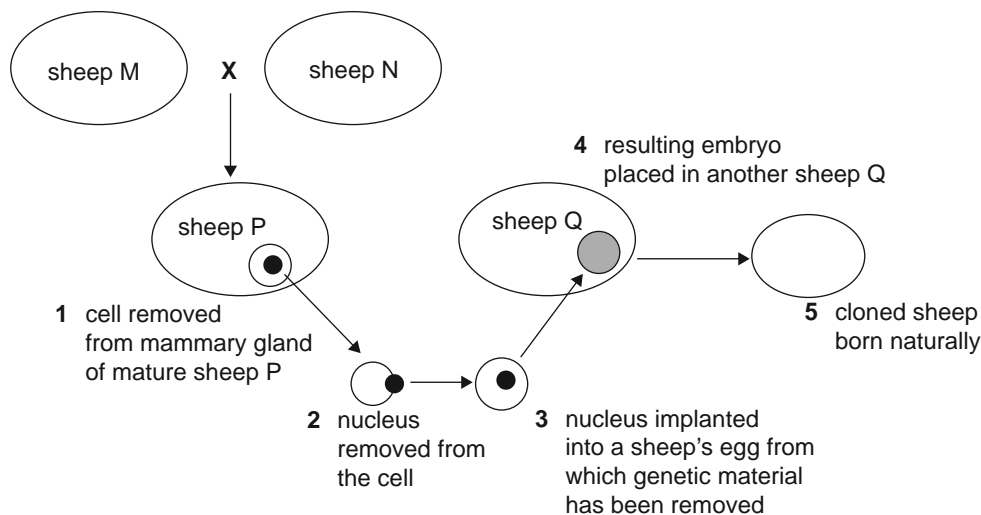
A mother and son each have a smooth chin and a straight hairline. The father of the boy has a cleft chin and a widow's peak.

The father's genotype must be

- A. *Ss Ww*.
- B. *SS WW*.
- C. *ss WW*.
- D. *ss ww*.

Question 23

The following diagram summarises the steps involved in the production of a cloned sheep.



The chromosomes in the cells of the cloned sheep will be identical with those in the cells of

- A. sheep M.
- B. sheep N.
- C. sheep P.
- D. sheep Q.

Question 24

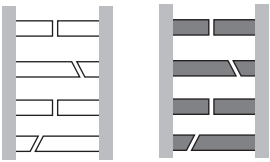
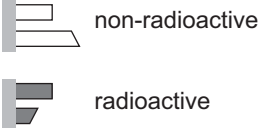
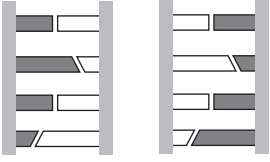
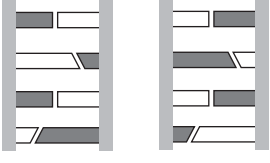
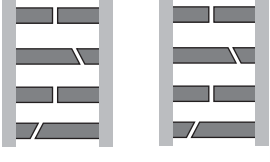
Domestic dogs vary greatly in adult size. All dog breeds have the IGF-1 gene coding for a hormone which promotes growth to adolescence. Scientists have discovered that all small dog breeds have an allele, called S, of another gene close to IGF-1.

The best hypothesis to explain the size range in dogs is that

- A. IGF-1 is the only gene controlling growth in dogs.
- B. the gene product of the S allele is a promoter of IGF-1.
- C. large breeds cannot produce a transcript of the IGF-1 gene.
- D. when S is translated its product inhibits IGF-1 gene expression.

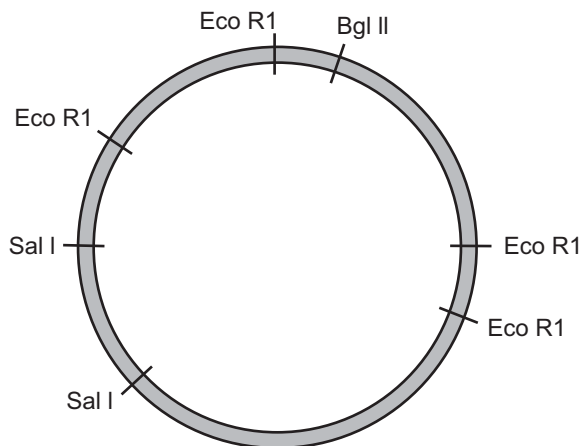
Question 25

DNA was incubated with radioactive nucleotides. After one cycle of replication the distribution of radioactive and non-radioactive nucleotides in the DNA would be

- A.**  
- B.** 
- C.** 
- D.** 

Question 26

The following diagram indicates the cutting sites of three different restriction enzymes on a particular bacterial plasmid.



If the plasmid was incubated with the restriction enzyme Eco R1, the number of pieces of DNA obtained would be

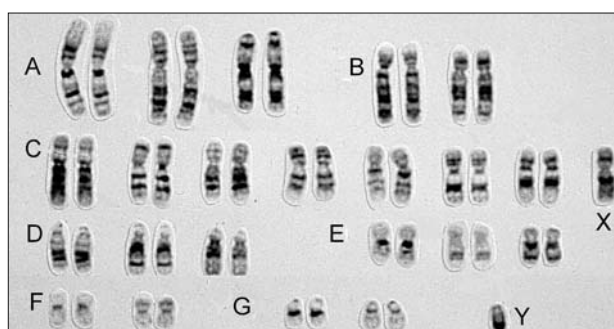
- A.** two.
B. three.
C. four.
D. seven.

Use the following information to answer Questions 27 and 28.

The following ultrasound image shows a fetus at the week 12 stage of development.



The area J surrounding the fetus contains amniotic fluid which includes skin cells from the fetus. A small sample of amniotic fluid can be extracted and the skin cells cultured. The following image is of a karyotype prepared from cultured skin cells of the fetus in the photograph.



Question 27

The number of autosomes in this karyotype is

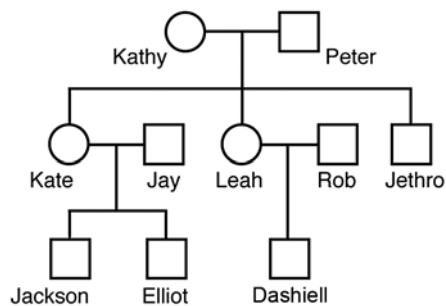
- A. 22
- B. 23
- C. 44
- D. 46

Question 28

Examination of the karyotype reveals that the fetus

- A. is a male.
- B. has a defective allele.
- C. has an extra X chromosome.
- D. has three number 13 chromosomes.

Use the following information to answer Questions 29 and 30.



Question 29

From an analysis of this pedigree, individuals with the same mitochondrial DNA (mDNA) include

- A. Kathy and Peter.
- B. Peter and Jethro.
- C. Jay, Rob and Jethro.
- D. Jackson, Elliot and Dashiell.

Question 30

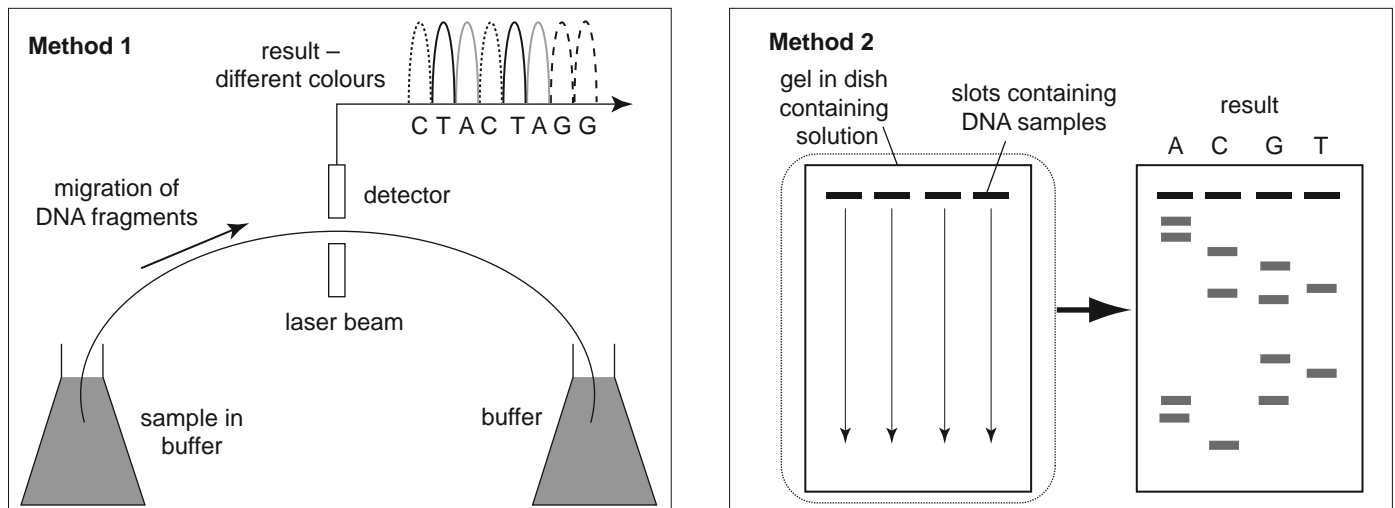
Jackson is known to have the X^H allele.

It is reasonable to claim that the allele must also be present in

- A. Kate.
- B. Peter.
- C. Elliot.
- D. Jethro.

Question 31

The following figures show two different methods used to sequence DNA.



It would be correct to conclude that

- A. method 1 requires 4 slots for the loading of the DNA.
- B. method 2 uses a laser beam to separate the individual nucleotides.
- C. method 1 uses fluorescent dyes to distinguish between the different nucleotides.
- D. method 2 requires the DNA to be loaded at the positive end on the sequencing gel.

Question 32

The founder effect and bottleneck are examples of

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

Question 33

There is evidence that *Homo sapiens* and *Homo neanderthalensis* coexisted in Europe more than 30 000 years ago. Both of these species left signs of cultural evolution from this period.

An example of evidence which would show that cultural evolution was occurring in these groups at this time is

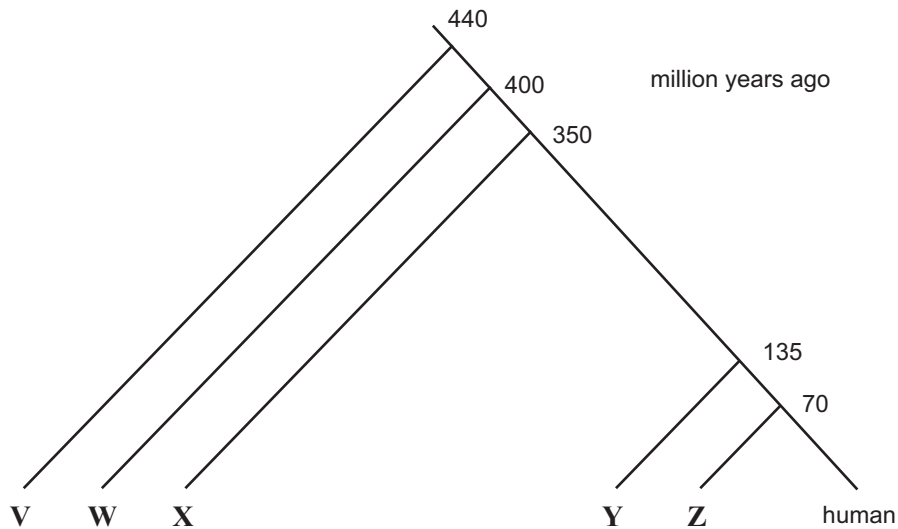
- A. drawings and carvings on rocks.
- B. animal remains close to a *Homo* skeleton.
- C. male and female skeletons in the same area.
- D. *Homo sapiens* and *Homo neanderthalensis* skeletons in the same area.

Question 34

Comparisons of the amino acid sequences of the α -globin polypeptide have been made between humans and a number of other vertebrates. The number of differences is shown in the table below.

Organism	shark	kangaroo	carp	cow	newt
Amino acid differences in α -globin compared to human	79	27	68	17	62

An evolutionary relationship between these vertebrates was determined and illustrated in the figure below.

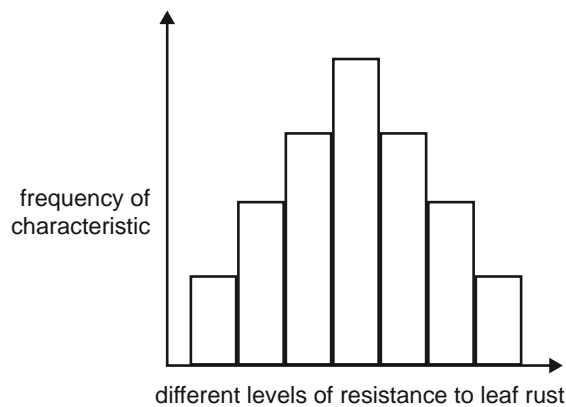


Based on the information provided, the correct placement of each animal on the figure to show the evolutionary relationship is

- V = cow, W = kangaroo, X = newt, Y = carp, Z = shark.
- V = shark, W = carp, X = newt, Y = kangaroo, Z = cow.
- V = carp, W = shark, X = kangaroo, Y = newt, Z = cow.
- V = kangaroo, W = cow, X = newt, Y = shark, Z = carp.

Question 35

Members of a barley plant species show varying levels of partial resistance to the leaf rust, *Puccinia hordei*. The graph below shows the distribution of a population of barley plants with regard to this characteristic.



With respect to rust resistance, these plants show

- A. high mutation rates.
- B. polygenic inheritance.
- C. discontinuous variation.
- D. inheritance due to a single pair of alleles.

Question 36

Scientific opinion was once evenly divided regarding the geographical origin of the modern human. Two hypotheses were put forward – the ‘Out-of-Africa’ hypothesis and the ‘Multi-Regional’ hypothesis.

In general, researchers now accept that the ‘Out-of-Africa’ hypothesis is better supported by current information.

Findings from worldwide human fossil sites that would best support the ‘Out-of-Africa’ hypothesis include

- A. dating of fossils by radioactive uranium.
- B. the degree of decomposition of remains.
- C. the present-day climate of the region.
- D. variations in mitochondrial DNA.

Question 37

Selective breeding over many generations has produced gradual changes in farm animals.

It is reasonable to state that such gradual changes in a herd of cattle

- A. result from random mating in the herd in each generation.
- B. are due to the occurrence of gene mutations in each generation.
- C. result from the restriction of breeding to chosen animals in the herd.
- D. will improve traits that enhance the survival of the animals in the wild.

Question 38

The following statements are about ideas, discoveries and techniques.

Idea 1. The molecular structure of DNA was revealed to be a double helix.

Idea 2. Individuals best suited to the environment have the best chance of surviving and reproducing.

Idea 3. Comparing the similarities of nucleotide sequences in different organisms helps determine how closely related the organisms are to each other.

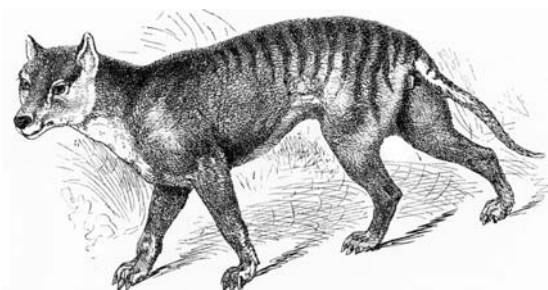
Idea 4. Organisms can alter their structure to suit their environment and then they are able to pass this favourable alteration on to their offspring.

What would be the correct sequence of timing from oldest to youngest?

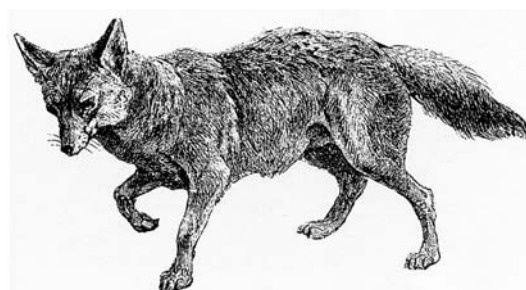
- A. 1 3 2 4
- B. 4 2 1 3
- C. 3 1 4 2
- D. 2 4 3 1

Question 39

Examine the following drawings.



Tasmanian tiger



American grey wolf

The Tasmanian tiger (now extinct) and the American grey wolf evolved independently of each other, but show similar physical structures and hunting behaviours.

The similarities between the two organisms are most likely a result of

- A. homology.
- B. genetic drift.
- C. allopatric speciation.
- D. convergent evolution.

Question 40

In 2006, two separate palaeontology laboratories were set up in the Sahara desert.

Laboratory 1 – uncovered a burial site that contained human remains. More than 200 human remains were found and they were dated from 10 000 to 4500 years ago.

Laboratory 2 – discovered a 110-million-year-old plant-eating dinosaur, *Nigersaurus*, in a nearby area in a different sedimentary layer.

To date the fossils accurately, the two groups of palaeontologists would most likely have used

- A. carbon-14 dating for both the human and dinosaur remains.
- B. uranium-235 dating for both the human and dinosaur remains.
- C. uranium-235 dating for the human remains and carbon-14 dating for the dinosaur remains.
- D. carbon-14 dating for the human remains and uranium-235 dating for the dinosaur remains.

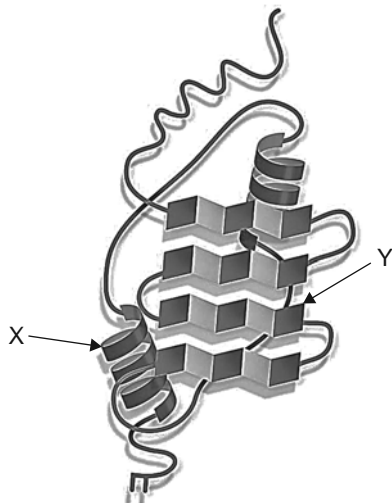
**END OF SECTION A
TURN OVER**

THIS PAGE IS BLANK

NO WRITING ALLOWED IN THIS AREA

Question 2 (8 marks)

The diagram below shows the structure of a particular protein molecule.



- a.** The protein contains two distinctive types of polypeptide chains labelled X and Y.
What are the names of these two types?

2 marks

chain X _____

chain Y _____

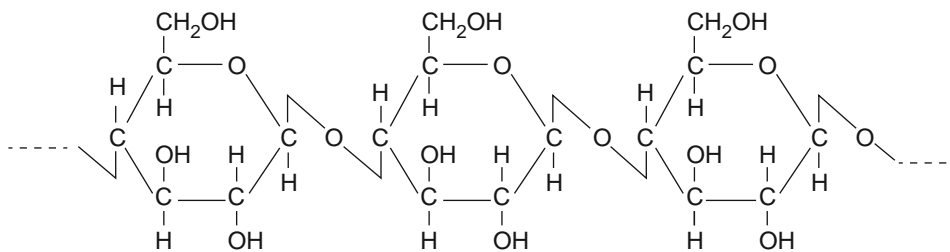
- b.** Proteins can be found in the membrane of a cell.
Draw a labelled diagram to show the arrangement of both proteins and other major components in the plasma membrane.

2 marks

Consider the molecules you have labelled in your diagram in **part b**.

- c. Apart from the protein molecules, describe the roles played by the molecules in the plasma membrane. 2 marks

The following diagram shows a portion of an unknown macromolecule found in cells. The remaining portion of the macromolecule contains the same repeating unit.



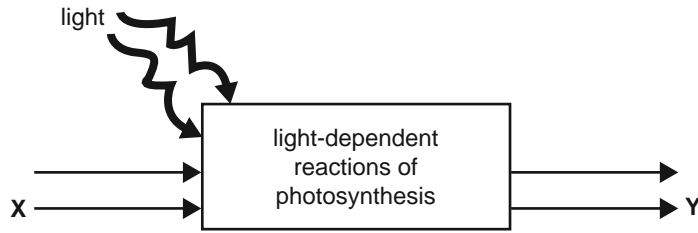
Two students discuss this diagram. Sally suggests it represents cellulose. Toby disagrees. He suggests that the diagram represents the enzyme cellulase.

- d. Name the student who is correct and explain why.

2 marks

Question 3 (6 marks)

The following diagram shows a simplified representation of the first stage of photosynthesis.

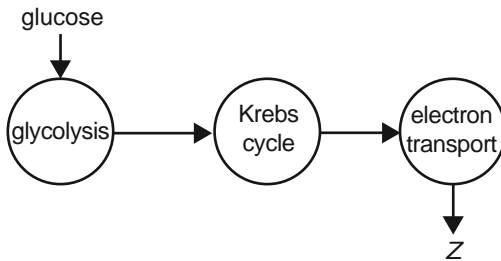


a. Where in the plant cell would the first stage of photosynthesis occur? 1 mark

b. i. Name one input item that X could represent. 1 mark

ii. Name one output item that Y could represent. 1 mark

The breakdown of glucose in aerobic respiration can be represented as occurring in three stages, as shown below.



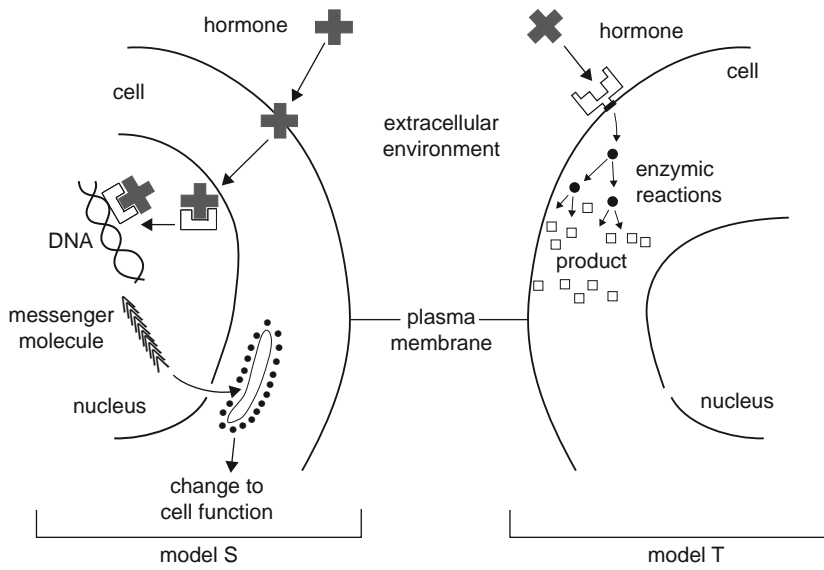
c. i. Within a cell, where does the electron transport stage of aerobic respiration occur? 1 mark

ii. Describe what happens during the electron transport stage.
In your answer include the name of product Z. 2 marks

NO WRITING ALLOWED IN THIS AREA

Question 4 (5 marks)

Hormone X is a lipid-soluble hormone produced by one of the human endocrine glands. Consider each of the following general models for signal reception and transduction.



a. Which model, model S or model T, best corresponds to the mechanism of hormone X? Explain your choice.

2 marks

Some tissues in the human body would not respond to hormone X.

b. What is the most likely explanation for this condition?

1 mark

NO WRITING ALLOWED IN THIS AREA

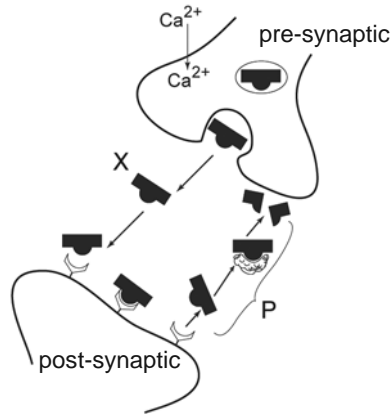
- c. A tissue that has been responsive to hormone X may, over time, lose its response to hormone X, even though the concentration of hormone X remains unchanged. Based on your understanding of how a hormone controls the functioning of cells, suggest reasons for this decrease in responsiveness.

2 marks

NO WRITING ALLOWED IN THIS AREA

Question 5 (4 marks)

The following diagram shows a synapse between the end of one neurone and the dendrite of another.



a. What is the general name for molecule X?

1 mark

b. Describe what occurs at stage P.

1 mark

c. Explain, with the use of a diagram, how the message is transmitted along the axon of the post-synaptic neuron.

2 marks

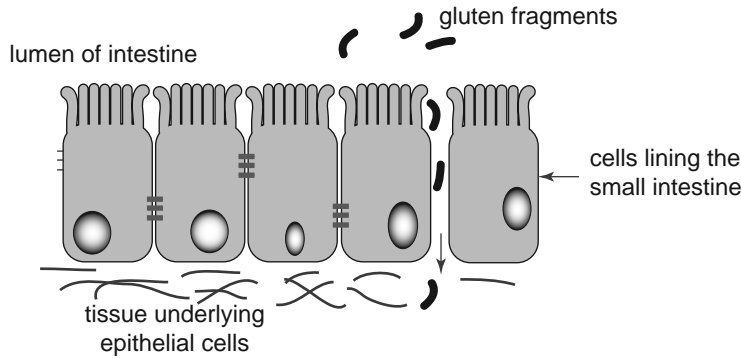
Question 6 (5 marks)

Coeliac disease in humans is caused when cells of the immune system attack the epithelial cells that line the small intestine.

a. What is the general name given to this type of disorder?

1 mark

Coeliac sufferers are unable to break down the gluten found in grains such as wheat. One of the features of coeliac disease is ‘leaky gut syndrome’. A small gap appears between the epithelial cells that line the small intestine. Gluten fragments enter the gap and accumulate under the epithelial cells. Macrophages are stimulated to remove the fragments.



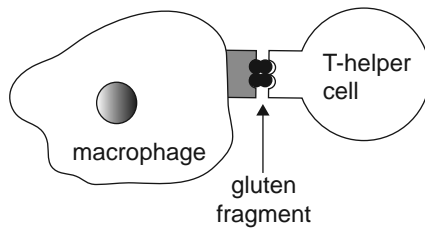
b. Explain how a macrophage is able to remove and destroy a gluten fragment. You may use a written answer or labelled diagrams or both.

2 marks

NO WRITING ALLOWED IN THIS AREA

Once a macrophage has destroyed a gluten fragment, it displays a piece of the fragment on its membrane using a special major histocompatibility complex (MHC) marker. A T-helper cell then attaches to the MHC marker-antigen complex.

The macrophage T-helper cell complex is shown below.



The macrophage T-helper cell complex stimulates other cells and chemicals to target and damage epithelial cells that line the intestine.

- c. Name one cell or chemical that would be stimulated by the macrophage T-helper cell complex and state its function.

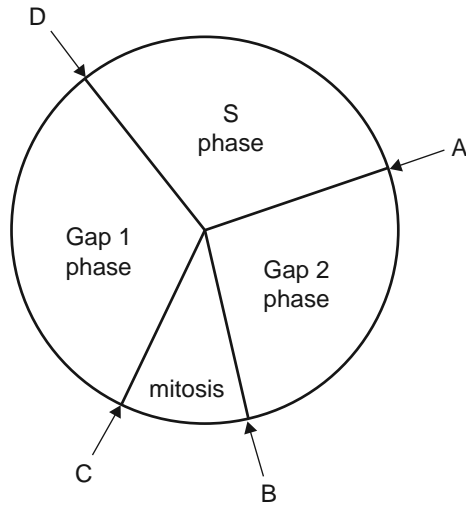
2 marks

name _____

function _____

Question 7 (9 marks)

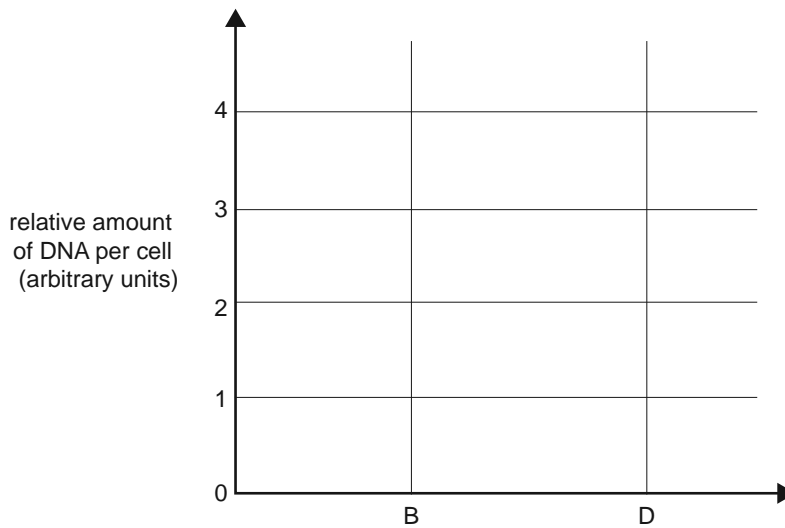
When a cell replicates it goes through a series of events that can be summarised by the following diagram. The cycle moves in a clockwise direction and includes mitosis. Note four points, labelled A, B, C and D.



Given that two cells are formed as a result of replication, a cell must replicate its DNA during the cycle.

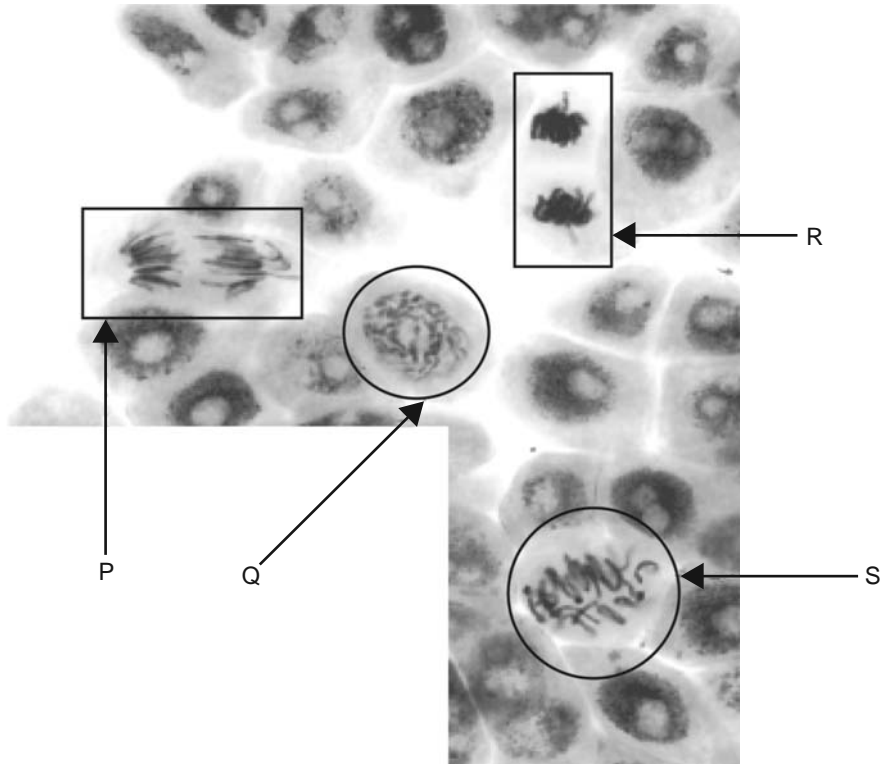
- a. Using crosses, mark on the graph below the relative amount of DNA present at each of the points B and D in the cycle.

1 mark



NO WRITING ALLOWED IN THIS AREA

The following photograph shows a group of cells, some of which are replicating by mitosis. The letters P, Q, R and S indicate cells that are at different points in the cell cycle.



b. Starting with the cell closest to the beginning of mitosis, arrange the letters P, Q, R and S in the order in which they would occur during the cell cycle.

1 mark

If a serious error occurs during mitosis, the daughter cells may not survive to complete the cell cycle and apoptosis can occur.

c. What is apoptosis?

1 mark

d. Suggest how apoptosis can be explained as an example of signal transduction.

2 marks

NO WRITING ALLOWED IN THIS AREA

- e. In relation to the immune system, name one type of cell that could be destroyed by apoptosis and explain the benefit of this response.

2 marks

Some types of cancers are caused by viruses whose genetic material is integrated with the host cell's DNA and, as a result, the cell is unable to undergo apoptosis.

- f. What is a virus?

1 mark

- g. Suggest a mechanism to explain how a tumour virus (a virus associated with cancer) may interfere with a host cell's ability to undergo apoptosis.

1 mark

NO WRITING ALLOWED IN THIS AREA

CONTINUES OVER PAGE

**SECTION B – continued
TURN OVER**

In the process at Y, the molecule shown below has a specific function.



- b. Describe the structure of this molecule and then relate its structure to the specific function that the molecule has in the process occurring at Y.

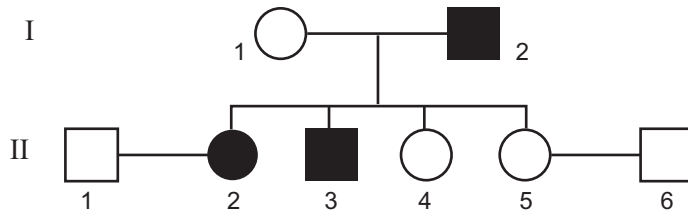
3 marks

SECTION B – continued
TURN OVER

NO WRITING ALLOWED IN THIS AREA

Question 9 (5 marks)

Haemophilia is an X-linked recessive condition. The following pedigree shows a portion of a family in which some members have haemophilia. Those on the pedigree with haemophilia are shaded.



- a. Use appropriate allele symbols from X^H , X^h and Y to indicate the genotype of each of the following individuals.

1 mark

I1 _____ and I2 _____

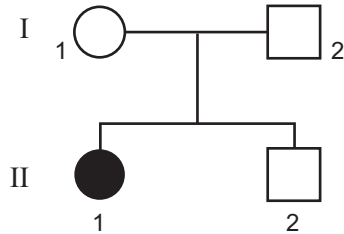
- b. The couple II1 and II2 have a son.
What is the probability that the child has haemophilia?

1 mark

- c. The couple II5 and II6 have a son.
What is the probability that the child has haemophilia?

1 mark

The following pedigree is of a family in which one member (shaded) has an autosomal recessive condition. The alleles of the gene locus involved are G and g .



- d. Give a possible genotype for each of the four members of the family.

2 marks

I1 _____

I2 _____

II1 _____

II2 _____

NO WRITING ALLOWED IN THIS AREA

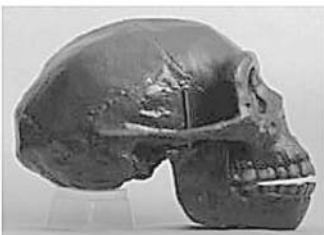
Question 10 (6 marks)

The pictures below show views of skulls from *Homo erectus* and *Homo sapiens*.

skull set 1



skull set 2



- a. With reference to two structural features of the skull, which skull set represents *Homo erectus*? Justify your choice.

2 marks

skull set _____

justification _____

According to one interpretation of the hominid fossil record, *Homo habilis* is thought to have existed about 2 million years ago.

- b. What kind of discoveries have been made at *Homo habilis* sites that have increased our understanding of the technological evolution of hominids?

1 mark

NO WRITING ALLOWED IN THIS AREA

The rate of technological evolution has been increased by cultural evolution of *Homo sapiens*.

- c. i.** Describe one example of the effect that cultural evolution has had on the rate of technological evolution.

1 mark

Cultural evolution depended on the development of physical capabilities of the *Homo* genus.

- ii.** What physical feature has played the most important role in this advancement? How has this feature developed over evolutionary time?

1 mark

feature _____

development _____

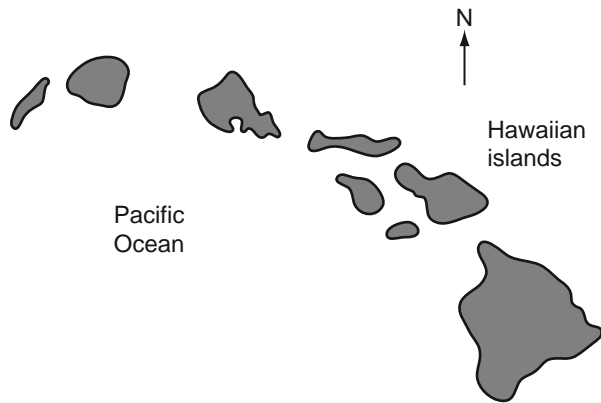
Arguably, modern *Homo sapiens* have taken the manipulation and control of the environment to its highest level in history.

- iii.** Does this mean that our species will no longer physically evolve by the mechanism of natural selection? Justify your answer.

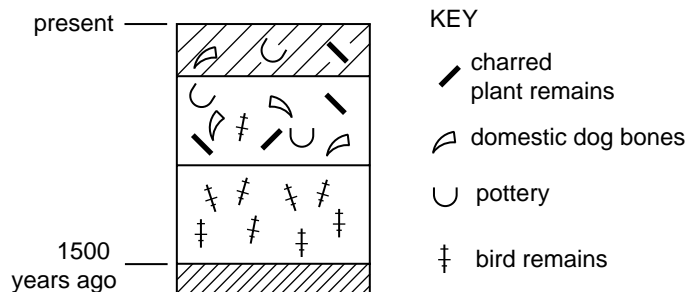
1 mark

Question 11 (7 marks)

The islands of Hawaii in the Pacific Ocean were formed as a result of volcanic action in which small landmasses were thrown up by submarine volcanoes. The youngest of the islands lies to the east of the oldest.



A similar pattern of deposition has been found across all islands, shown by the profile below.

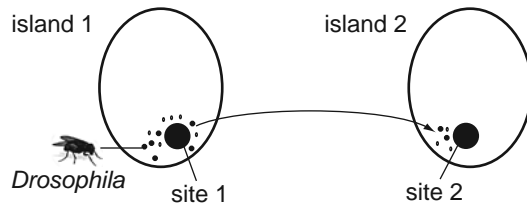


- a. What assumption is made about the formation of strata when interpreting profiles such as this? 1 mark

- b. i. State a hypothesis to account for the disappearance of many of the bird species from the groups of islands. 1 mark

- ii. Provide evidence to support your hypothesis. 1 mark

Biologists studied many species of the fruit fly, *Drosophila*, living on the Hawaiian islands. The species varies widely in appearance, behaviour and habitat. The diversity of *Drosophila* can be explained by the successive colonisation of newly formed islands by a small number of individuals ‘island-hopping’ from the neighbouring westerly island. This is represented in the diagram below.



- c. i. What name is given to this small group of colonising individuals? 1 mark

- ii. Explain how the new and old colonies became separate species. 3 marks

NO WRITING ALLOWED IN THIS AREA

Question 12 (5 marks)

Long before the development of agricultural crops, hunter-gatherers in southern Africa would pick the tastiest nutty fruits of the marula tree and scatter them around their camps. These would germinate and grow into fruit-bearing trees. The best seeds would be chosen from these trees and the process would be repeated.

- a.** Explain how this practice is an example of selective breeding. In your answer include the selective agent and the phenotypic characteristic being acted on.

2 marks

Current domestication processes include marcotting. This involves peeling away bark from a branch, stimulating the branch to produce roots. The branch is then cut and planted in soil.

- b. i.** What can you infer about the genotype of trees propagated through marcotting?

1 mark

- ii.** Outline one disadvantage of a plantation of marula trees grown through marcotting compared to a natural population of marula trees.

1 mark

- c.** Should the fruit from marcotted marula trees be labelled as genetically modified (GM)? Explain why.

1 mark

Answers to multiple-choice questions

Question	Answer
1	C
2	C
3	D
4	C
5	D
6	D
7	B
8	C
9	B
10	D
11	A
12	C
13	B
14	B
15	D
16	A
17	A
18	C
19	C
20	C

Question	Answer
21	C
22	A
23	C
24	D
25	B
26	C
27	C
28	A
29	D
30	A
31	C
32	C
33	A
34	B
35	B
36	D
37	C
38	B
39	D
40	D