TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

External Assessment 2024

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BIOLOGY

BIO315124

Section A

Pages: 12
Questions: 5
Information Sheet: 1

Preparation time for this exam: 15 minutes

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- The Biology Information Sheet can be used throughout this exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C3	/ 36

Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
Section A	5	5	36 minutes	36 marks
Section B	6	6	36 minutes	36 marks
Section C	6	6	36 minutes	36 marks
Section D	5	5	36 minutes	36 marks
Section E	6	6	36 minutes	36 marks
Totals	**28**	**28**	**180 minutes (3 hours)**	**180 marks**

Criterion

You **must** make sure your answers address:

- Criterion 3 undertake biological inquiry to generate and evaluate data.

Question 1

Marker use

A student wanted to investigate the effect of temperature on the rate of respiration in yeast. Their hypothesis was stated as follows:

Respiration rate in yeast will double for each 10°C increase in temperature.

a) From the hypothesis, identify the:

Independent variable (IV): ..... /2

Dependent variable (DV): .....

The student set up four test tubes with the following conditions:

	Test tube 1	Test tube 2	Test tube 3	Test tube 4
Amount of yeast added (g)	1.0	1.0	1.0	1.0
Amount of glucose added (g)	10	15	10	15
Water temperature (°C)	10	20	30	40

Table 1

b) Discuss **one (1)** problem with this experimental design. /1

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c) Suggest **two (2)** improvements to increase the validity and/or reliability of this experiment. /2

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Total Q1 /5

Question 2

Marker use

The following experiment (shown in Figure 1) was set up to investigate the effect of the enzyme catalase which is found in potatoes. Hydrogen peroxide of different concentrations was placed in a conical flask and the amount of oxygen given off in 20 minutes was measured.

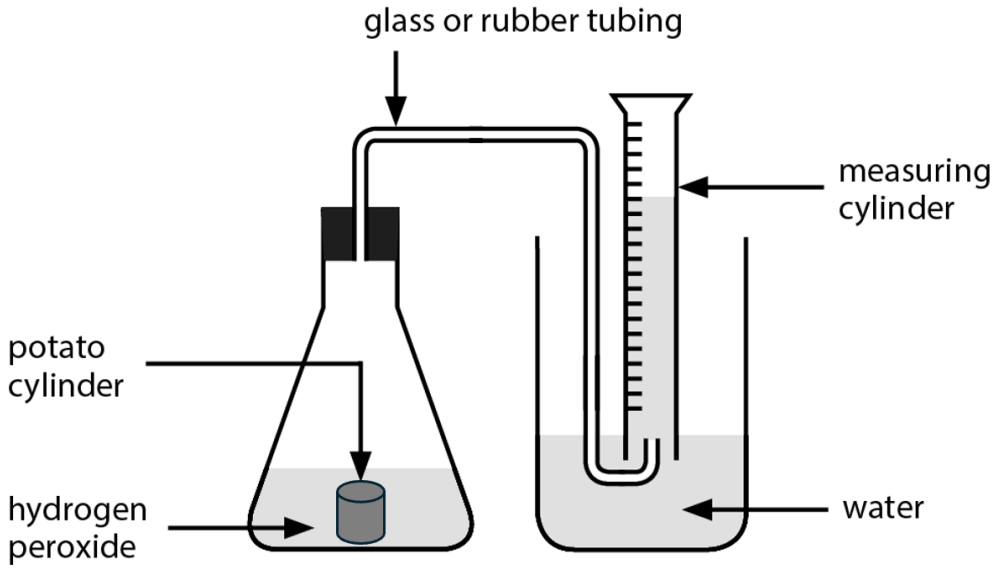

Figure 1: Diagram of an experiment investigating effects of catalase on different concentrations of hydrogen peroxide.

a) Formulate an appropriate hypothesis for this experiment. /3

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b) Describe a suitable control treatment for this experiment, including the expected results for this control. /2

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Question 2 continues

Marker use

c) Identify **two (2)** variables which would need to be kept constant in the experiment. /1

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The results from the experiment are summarised in Table 2:

	Amount of oxygen released (mL)			
Concentration of hydrogen peroxide (M)	Replicate 1	Replicate 2	Replicate 3	Mean
0.1	3.0	3.6	3.2	3.3
0.2	5.8	6.2	6.1	6.0
0.3	2.5	8.8	9.2	6.8
0.4	10.1	10.5	10.6	10.4

Table 2

d) i. Circle **one (1)** result in Table 2 that appears to be an outlier. /1

ii. Explain how you would deal with this outlier in your data analysis. /1

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e) Evaluate whether the hypothesis is supported by the results. /1

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Total Q2 /9

Question 3

Marker use

Some scientists wanted to evaluate the effect of new antibiotics on the growth of bacteria. They placed seven paper discs (A-G), each soaked in a different antibiotic, on an agar plate streaked with a common gut bacterium, *E. coli.* The results of the experiment are shown in Figure 2 – clear areas show where bacteria have not grown.

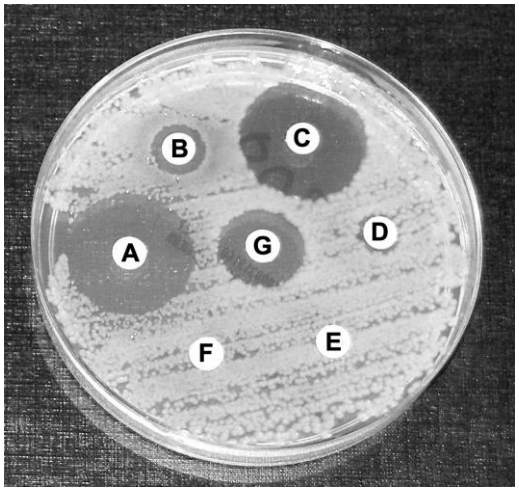

Figure 2: Photograph of experiment results showing the effect of new antibiotics on *E. coli* growth.

a) State the letters identifying **two (2)** new antibiotics most effective at stopping the growth of *E.coli*. /1

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b) Explain whether or not there is a control treatment in this experiment. /2

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c) Describe **one (1)** method of increasing the reliability of this experiment. /2

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Question 3 continues

Marker use

/3

d) Discuss the advantages and disadvantages of using a laboratory experiment rather than directly testing the new antibiotics in human subjects.

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Total Q3

/8

Question 4

Marker use

It has been suggested that green tea can help lower cholesterol levels. High levels of low-density cholesterol (LDL) are associated with increased risk of heart attacks and strokes.

A study in 2003 recruited 240 patients from urban hospitals in China with high cholesterol levels. Half of the patients were given an extract of green tea and the other half were given a placebo. Levels of cholesterol were measured before the study and twelve weeks later – results are shown in Figure 3.

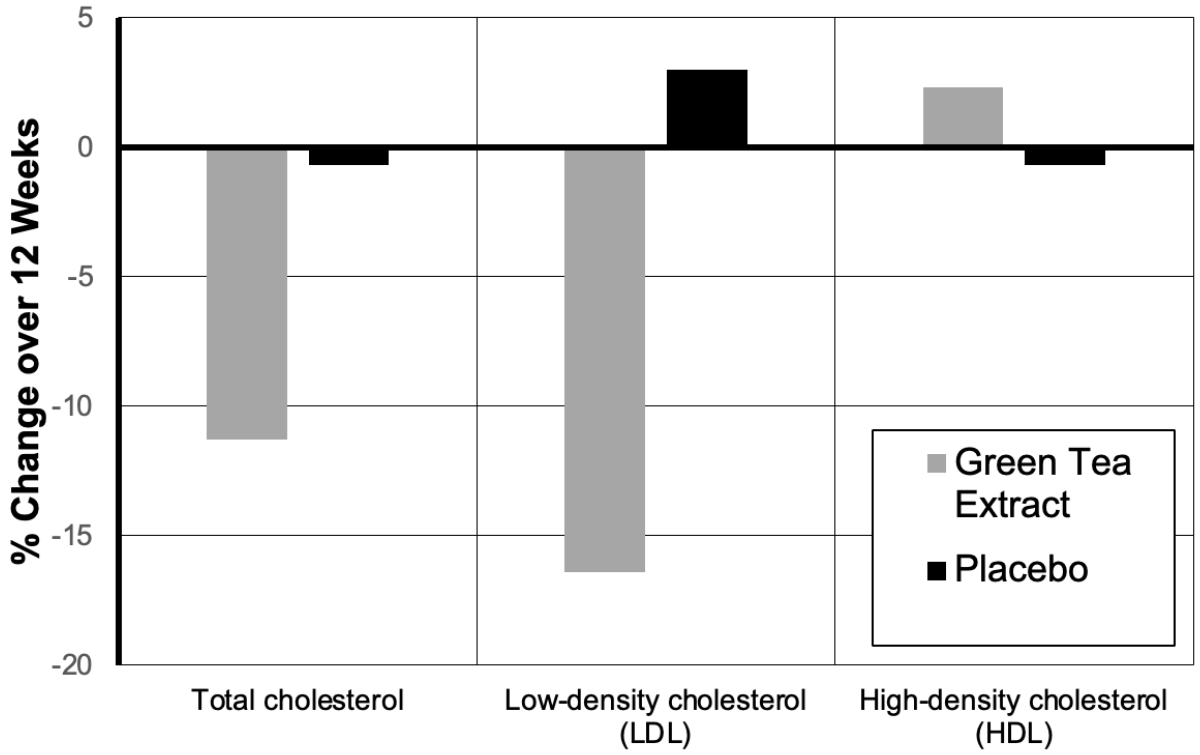

Figure 3: Diagram of experiment results showing cholestrol levels after green tea extract consumption.

Modified from Maron *et al.* (2003)

a) Summarise the results of the experiment.

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Question 4 continues

Marker use

b) i. Explain the purpose of a placebo in this experiment.

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ii. Describe how the green tea extract and placebo could be given to patients.

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c) Describe **one (1)** precaution the researchers would need to take to ensure the study was valid.

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d) Identify **two (2)** weaknesses in the study that a doctor might consider before recommending green tea to their patients.

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Total Q4

/7

Question 5

Marker use

To investigate the effect of light intensity on photosynthesis, you prepared 100 algal balls, each one containing the same amount of the alga *Chlorella* suspended in alginate. When the balls are placed in hydrogen carbonate indicator, the solution will change colour from yellow to purple as photosynthesis proceeds as shown in Figure 4.

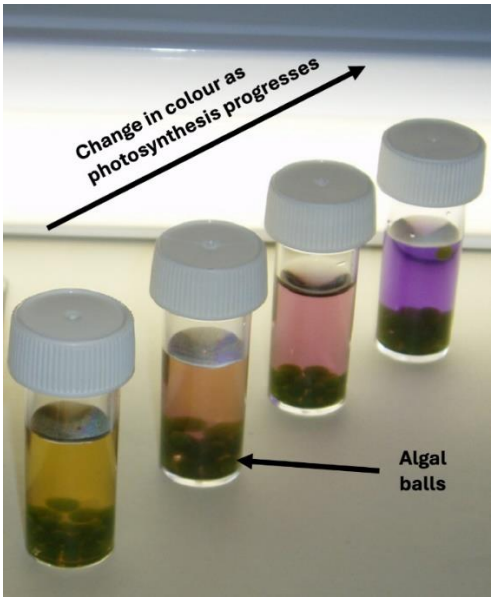

Figure 4: Photograph of vials containing algal balls showing change in colour of indicator due to photosynthesis.

Modified from Science and Plants in Schools CC-SA 4.0

a) Describe your experimental setup in detail including your treatments (with a suitable control), replication, controlled variables and your measurement methods.

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Question 5 continues

Marker use

b) Describe the expected data from your experiment that would support your hypothesis.

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End of Section A

Total Q5

/7

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BIOLOGY

BIO315124

Section B

Pages: 16
Questions: 6
Information Sheet: 1

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
    - Spare diagrams have been provided at the end of this section. Indicate in the boxes provided if you have used the spare diagrams.
- Write your answers in the spaces provided in this exam paper.
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Marker use	
C5	/ 36

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Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
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Section C	6	6	36 minutes	36 marks
Section D	5	5	36 minutes	36 marks
Section E	6	6	36 minutes	36 marks
Totals	**28**	**28**	**180 minutes (3 hours)**	**180 marks**

Criterion

You **must** make sure your answers address:

- Criterion 5 analyse the processes and mechanisms by which biological systems are regulated.

Question 6

Marker use

Figure 5 show three stages in a model of an enzyme-catalysed reaction.

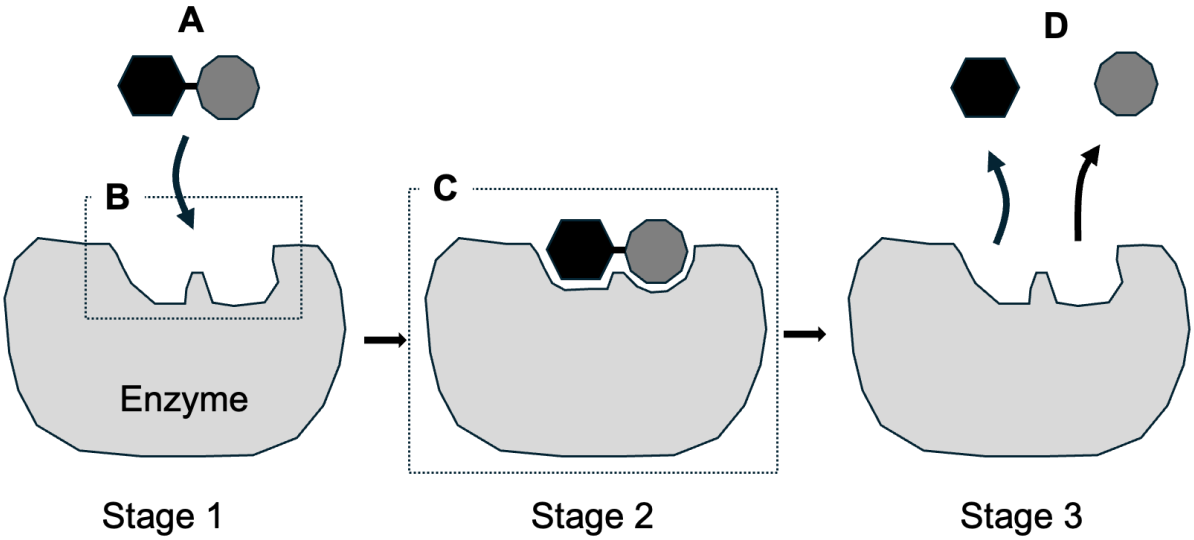

Figure 5: Diagram of three stages of an enzyme-catalysed reaction.

a) Identify the components of the reaction labelled A–D in Table 3 below.

/2

Letter	Component
A	
B	
C	
D	

Table 3

b) Referring to Figure 5, describe how enzymes catalyse biological reactions.

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Question 6 continues

Marker use

Figure 6 shows inhibition of the same enzyme reaction.

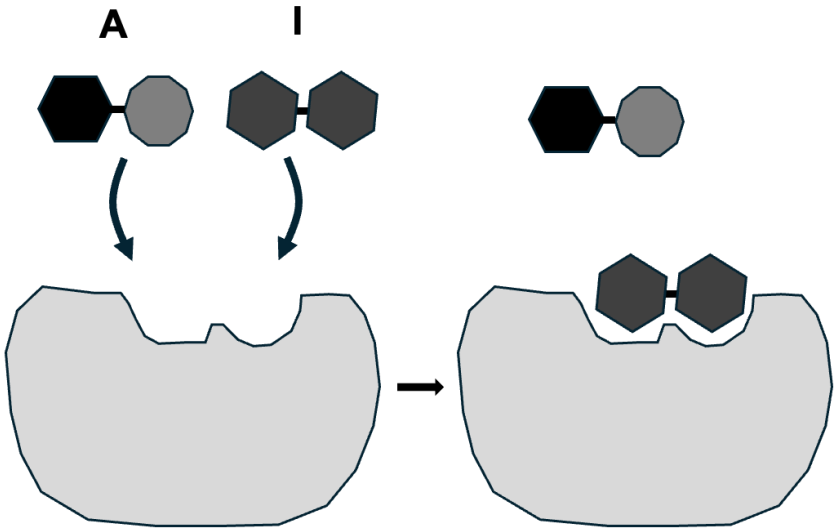

Figure 6: Diagram of the inhibition of the same enzyme reaction.

c) State the type of inhibition shown.

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d) Describe another type of enzyme inhibition.

/2

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Total Q6

/8

Question 7

Marker use

a) State **one (1)** environmental factor that can cause mutations in DNA.

/1

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b) Circle or shade the codon mutations in the mRNA sequences shown in Figure 7 compared with the original mRNA sequence.

/1

AUG	AAG	CCU	CAC	AUU	GUC	AUA	AAA	AAU	Original mRNA sequence
AUG	AAG	CCU	CAC	AUU	GUC	ACA	AAA	AAU	Mutation 1
AUG	AAG	CCU	CAC	AAU	GUC	AUA	AAA	AAU	Mutation 2

Figure 7: Diagram of three mRNA sequences.

Spare diagram used (X) ☐

Question 7 continues

Marker use

c) Using Figure 8, explain the difference between mutation 1 and mutation 2.

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Codon Chart

First Base	Second Base: U	Second Base: C	Second Base: A	Second Base: G	Third Base
U	UUU, UUC – Phenylalanine (Phe/F) UUA, UUG – Leucine (Leu/L)	CUU, CCU, CAU, CGU – Serine (Ser/S)	AUU, ACU – Tyrosine (Tyr/Y) **AAU** – STOP **AGU** – STOP	GUU, GCU – Cysteine (Cys/C) **GAU** – STOP GGU – Tryptophan (Trp/W)	U, C, A, G
C	CUU, CUC, CUA, CUG – Leucine (Leu/L)	CUC, CCC, CAC, CGC – Proline (Pro/P)	AUC, ACC – Histidine (His/H) AAC, AGC – Glutamine (Gln/Q)	GUC, GCC, GAC, GGC – Arginine (Arg/R)	U, C, A, G
A	AUU, AUC, AUA – Isoleucine (Ile/I) **AUG** – Methionine (Met/M)	CUA, CCA, CAA, CGA – Threonine (Thr/T)	AUA, ACA – Asparagine (Asn/N) AAA, AGA – Lysine (Lys/K)	GUA, GCA – Serine (Ser/S) GAA, GGA – Arginine (Arg/R)	U, C, A, G
G	GUU, GUC, GUA, GUG – Valine (Val/V)	CUG, CCG, CAG, CGG – Alanine (Ala/A)	AUG, ACG – Aspartic acid (Asp/D) AAG, AGG – Glutamic acid (Glu/E)	GUG, GCG, GAG, GGG – Glycine (Gly/G)	U, C, A, G

Figure 8: Codon Chart.

Total Q7

/5

Question 8

Marker use

Figure 9 shows a diagram of a chloroplast, the organelle used for photosynthesis.

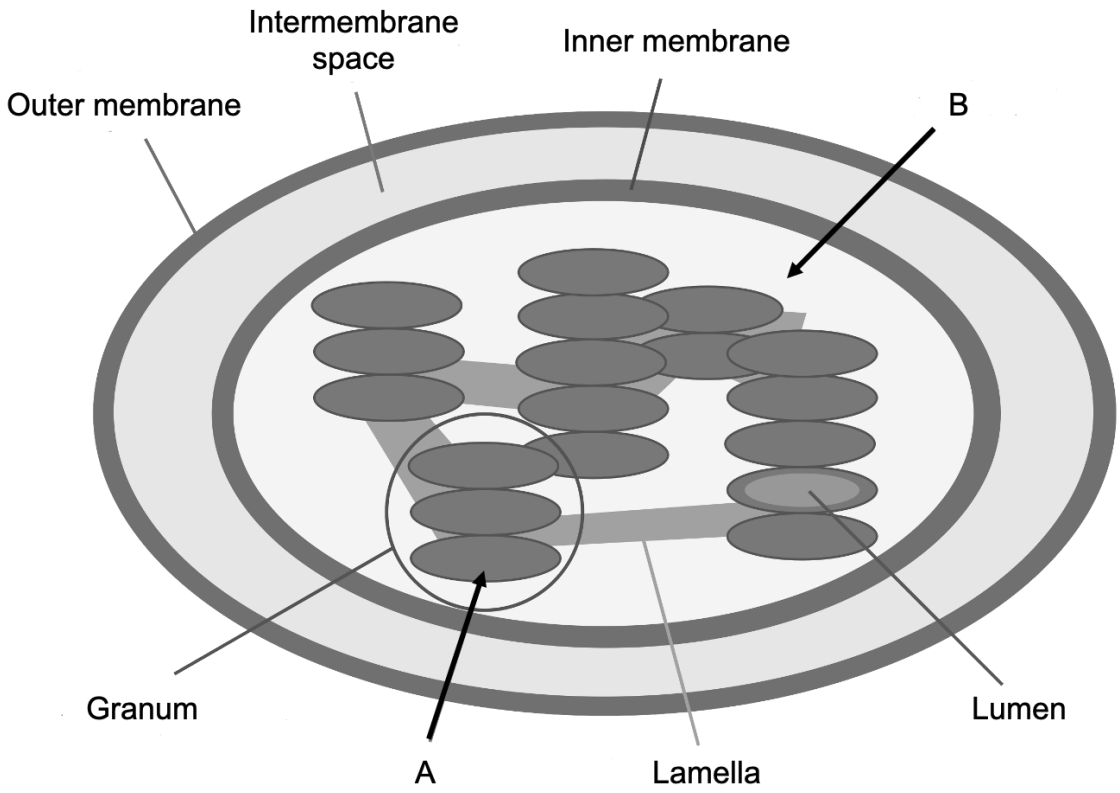

Figure 9: Diagram of a chloroplast.

Wikimedia Foundation CC 4.0

a) Identify the structures labelled A and B.

A: ..... /1

B: .....

b) State where the light-dependent reaction for photosynthesis occurs in the chloroplast. /1

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Question 8 continues

Marker use

c) Figure 10 shows the results of an experiment measuring the rate of photosynthesis in a plant in a greenhouse at 20°C with 0.03% carbon dioxide. On the graph sketch the curve if the experiment was conducted at 20°C with 0.05% carbon dioxide.

/2

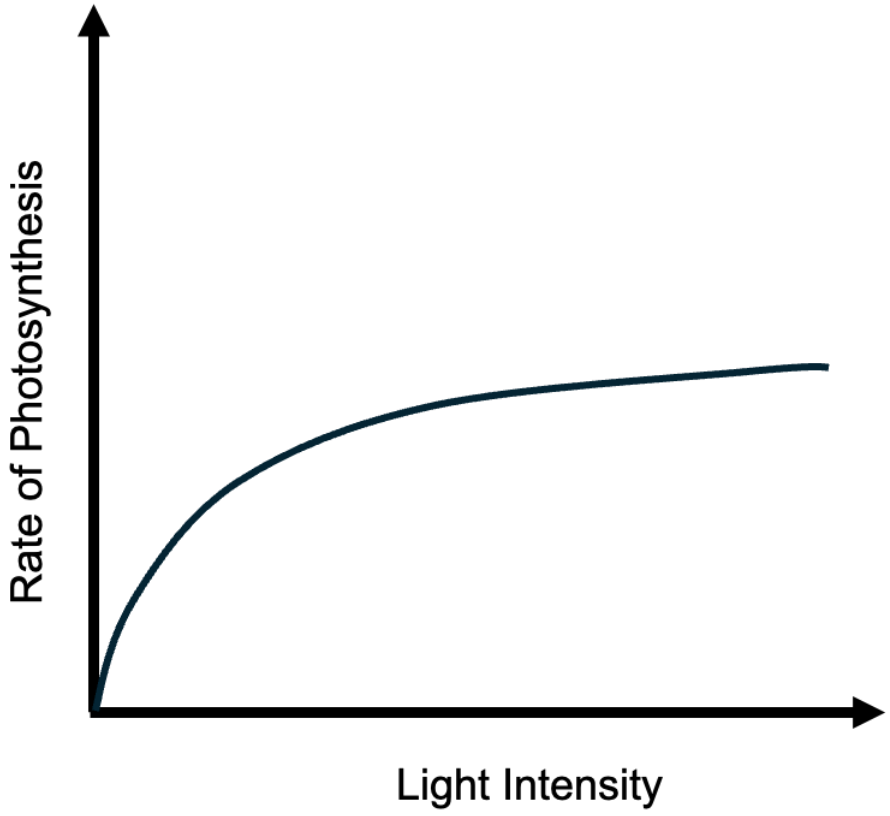

Figure 10: Graph measuring the rate of photosynthesis.

Spare diagram used (X) ☐

d) Explain the concept of limiting factors in photosynthesis.

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Total Q8

/7

Question 9

Marker use

Figure 11 shows a summary of protein synthesis in a eukaryotic cell.

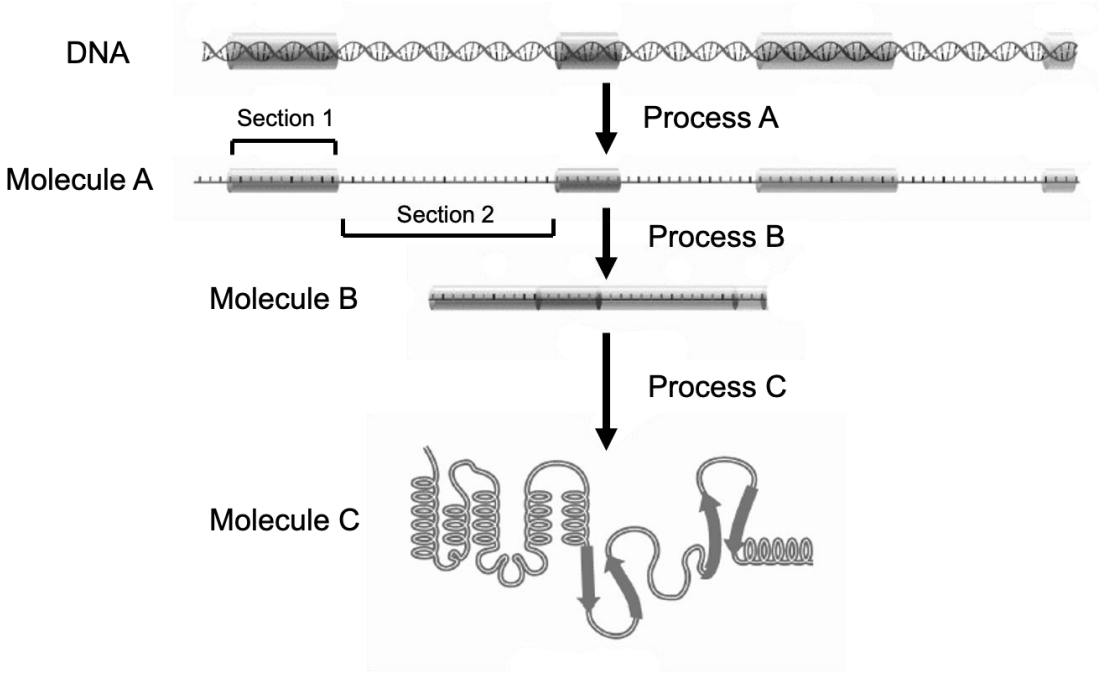

Figure 11: Image of protein synthesis in a eukaryotic cell.

Modified from Wikimedia Commons CC 4.0

a) Identify each of the following components in Figure 11.

/2

Process A: .....

Section 1:.....

Section 2:.....

Molecule C:.....

b) Describe fully how molecule C is produced in process C.

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Total Q9

/5

Question 10

Marker use

Figure 12 shows DNA replication including some of the enzymes involved.

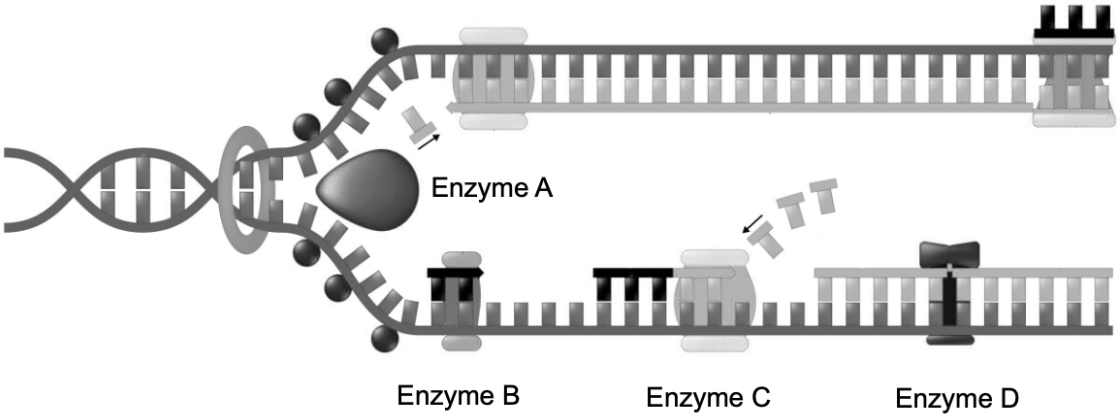

Figure 12: An image of DNA replication with labelled enzymes.

Wikimedia Commons CC 4.0

a) State the term for this replication where each new pair of DNA strands contains one of the two parental strands. /1

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b) In Table 4 below, state the letter corresponding to each named enzyme. /2

Letter	Name of Enzyme
	DNA Polymerase
	Helicase
	Ligase
	RNA Primase

Table 4

c) Explain the importance of DNA replication to multicellular organisms. /2

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Total Q10 /5

Question 11

Marker use

The *lac operon* in the bacterium *E. coli* is a group of linked genes that encodes for three enzymes involved in the metabolism of the sugar lactose. The structure of the *lac operon* is shown below:

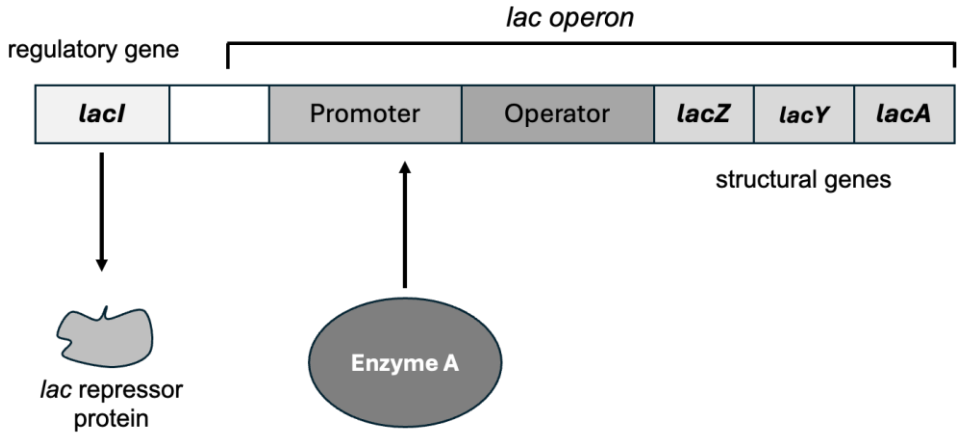

Figure 13: Diagram of the structure of the lac operon.

a) State the identity of Enzyme A. /1

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b) Explain how the *lacI* gene functions to regulate the *lac operon* when lactose is present and glucose is absent. /3

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c) The bacterium *E. coli* lives in the digestive system of many different animals. Explain the importance of the *lac operon* to the survival of *E. coli* in these different habitats. /2

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Total Q11 /6

Spare Diagrams

Question 7 b)

AUG	AAG	CCU	CAC	AUU	GUC	AUA	AAA	AAU

Original mRNA sequence

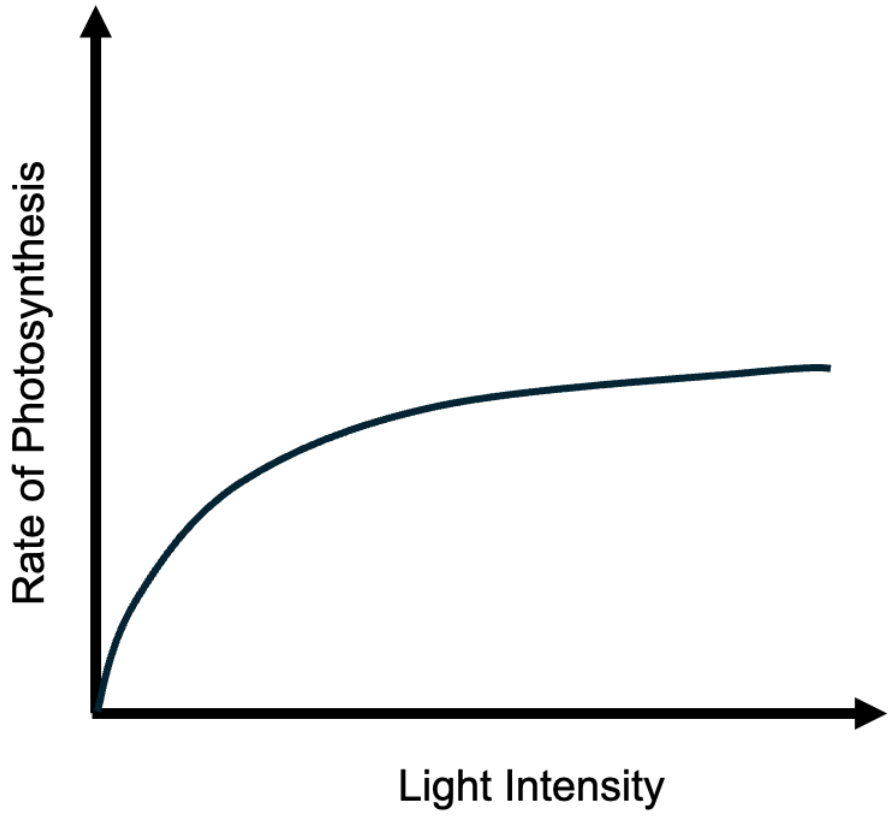
AUG	AAG	CCU	CAC	AUU	GUC	ACA	AAA	AAU

Mutation 1

AUG	AAG	CCU	CAC	AAU	GUC	AUA	AAA	AAU

Mutation 2

Question 8 c)



End of Section B

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BIOLOGY

BIO315124

Section C

Pages: 12
Questions: 6
Information Sheet: 1

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
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Marker use	
C6	/ 36

Guide to Exam Structure

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Section D	5	5	36 minutes	36 marks
Section E	6	6	36 minutes	36 marks
Totals	**28**	**28**	**180 minutes (3 hours)**	**180 marks**

Criterion

You **must** make sure your answers address:

- Criterion 6 analyse homeostatic concepts, processes and interrelationships.

Question 12

Marker use

Some scientists investigated the rate of transpiration of a plant in a small greenhouse. They measured the rate of transpiration as the temperature increased. All other conditions remained the same and the plant's roots had access to excess water. Figure 14 shows their results.

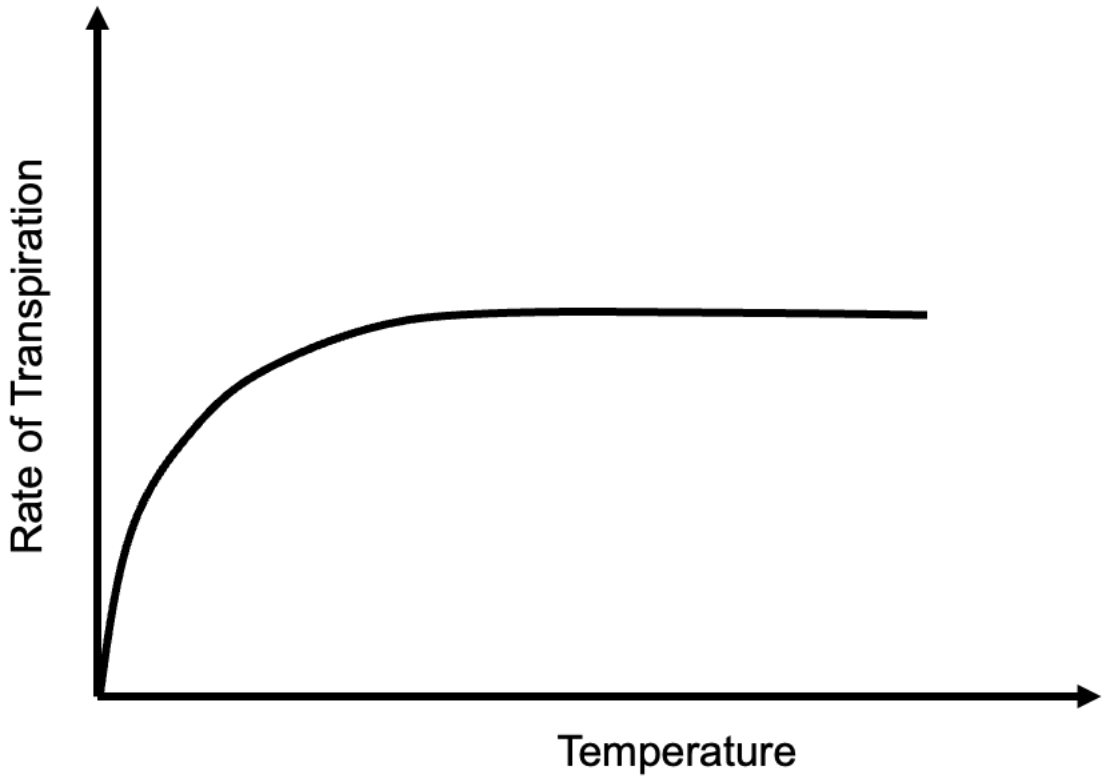

Figure 14: Graph showing the rate of transpiration in a small greenhouse.

a) Explain the shape of the graph.

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/2

b) Explain any changes you would expect to see in the plant's response if there was only a small amount of water available to its roots.

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Total Q12

/4

Question 13

Marker use

Figure 15 shows the normal range of glucose and insulin levels in the plasma (bloodstream) of non-diabetic individuals over a 24-hour period.

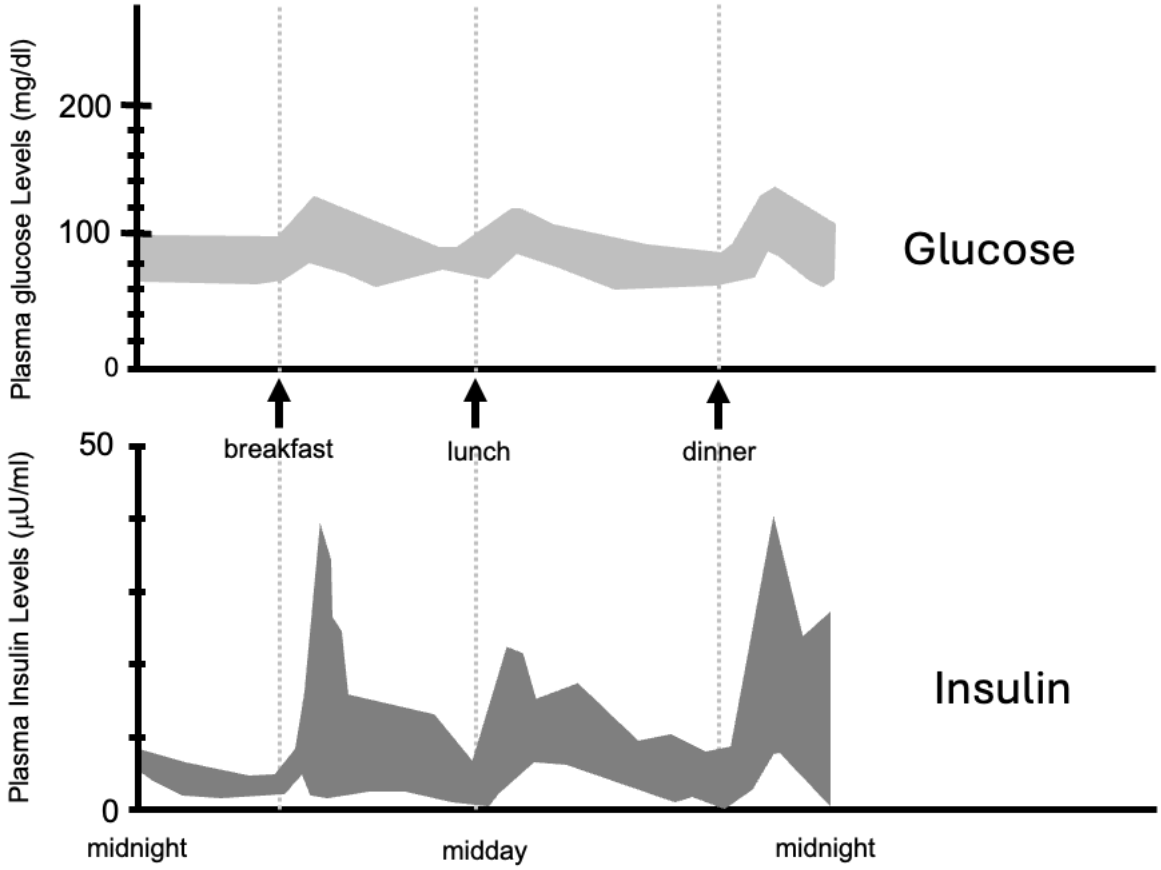

Figure 15: Graphs showing glucose and insulin levels in the plasma of non-diabetic individuals.

Source: Modified from Jacobs 1997 CC-SA 4.0

a) Using Figure 15 estimate the normal upper and lower levels of blood glucose.

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b) Meals were consumed at the times indicated by arrows on the x-axis of the top graph. Using information from the graphs, suggest what might have been different between breakfast and lunch.

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Question 13 continues

Marker use

Figure 16 shows homeostatic control of blood glucose.

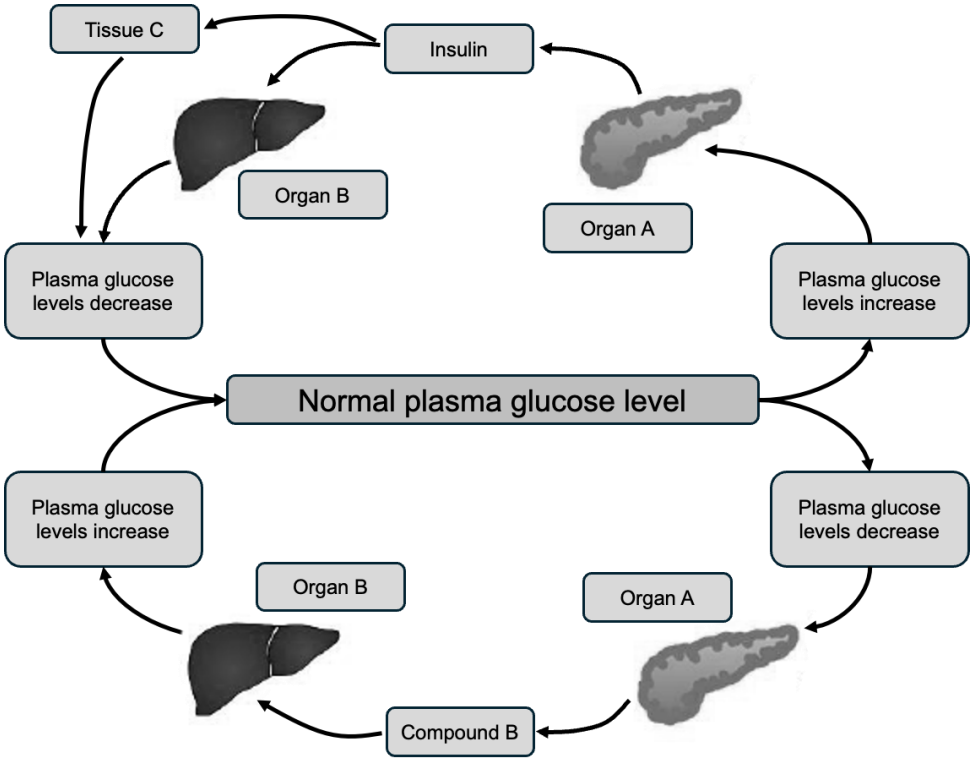

Figure 16: Diagram showing homeostatic control of blood glucose.

Adapted from Wikimedia Commons CC-SA 4.0

c) State the identity of these components shown in Figure 16:

/2

Organ A: .....

Organ B: .....

Tissue C: .....

Compound B:.....

d) Using the diagram, explain how control of plasma glucose is an example of negative feedback.

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Total Q13

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Question 14

Marker use

a) State the approximate temperature range within which the core temperature of the human body is controlled. /1

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b) Identify the structure in the brain responsible for temperature regulation. /1

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c) Describe how **two (2)** specific responses will increase body temperature if receptors detect that the body temperature is too low. /2

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d) Explain why temperature regulation within narrow limits is vital for the survival of endothermic (warm-blooded) organisms. /2

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Total Q14 /6

Question 15

Marker use

Antidiuretic hormone (ADH) is produced by the pituitary gland in response to changes in the osmotic potential of blood and other intracellular fluids. ADH travels in the bloodstream to its effector organ. The half life of ADH (time taken for half of the ADH to be used or removed) is about 20 minutes.

a) State the effector organ upon which ADH operates.

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b) A gardener has been working hard outside on a hot day for two hours without drinking. Explain the changes in ADH production and its subsequent effects on the gardener's body.

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Total Q15

/4

Question 16

Marker use

Figure 17 shows the idealised action potential of a single neuron.

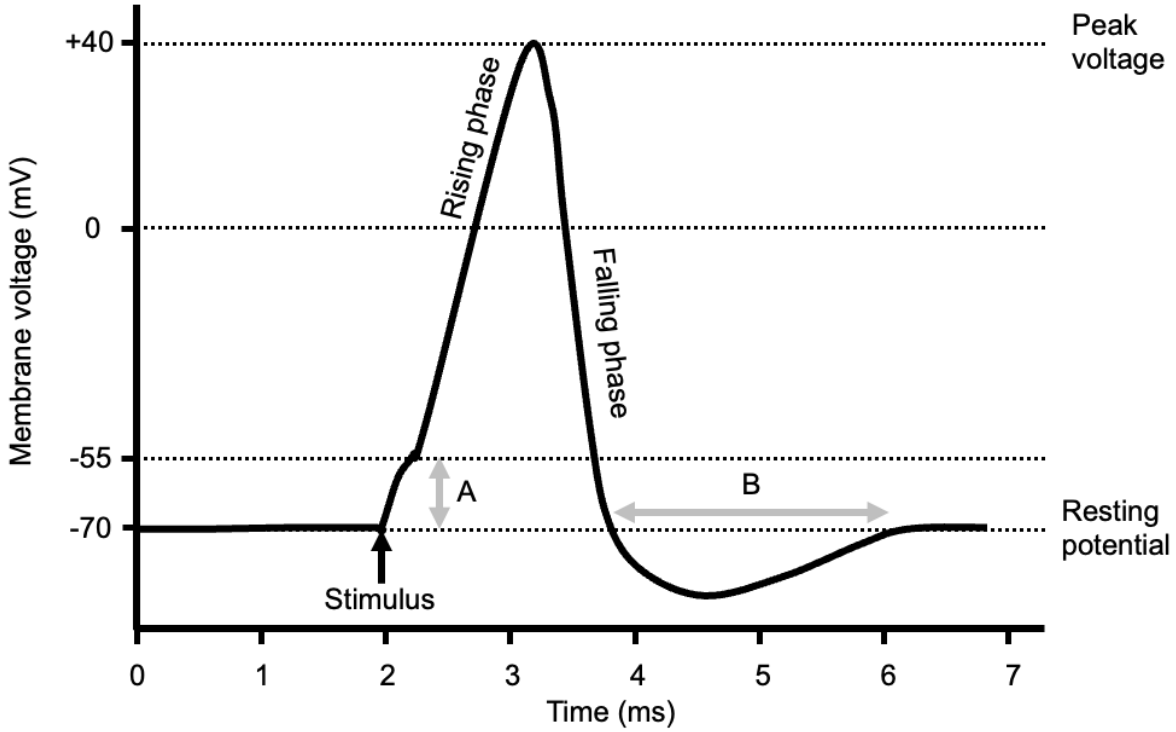

Figure 17: Graph showing idealised action potential of a single neuron.

a) i. State the name given to the voltage difference marked A on the diagram in Figure 17. /1

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ii. Describe the importance of this voltage difference to the progression of the action potential. /1

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b) Describe what is happening during the period marked B in Figure 17. /2

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Question 16 continues

Marker use

c) Estimate the approximate duration of the whole action potential shown.

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The following diagram (Figure 18) shows a cross section through the membrane of the axon of a neuron at the resting potential of -70mV. The transmembrane ion channels are also shown.

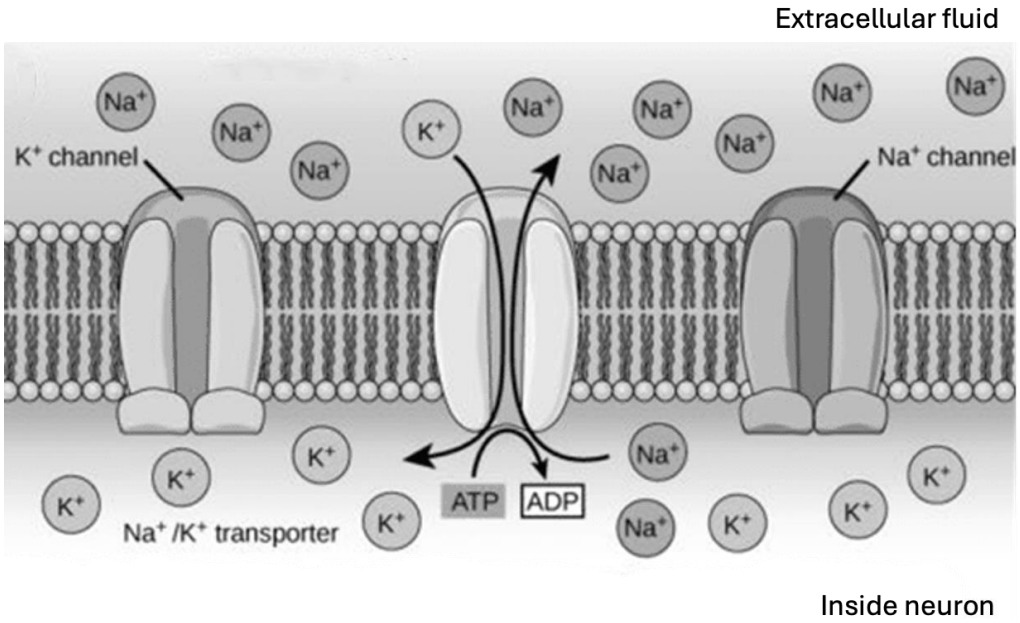

Figure 18: Diagram showing a cross section through the membrane of the axon of a neuron.

Adapted from Wikimedia Commons CC-SA 4.0

d) Describe the changes that occur on both sides of the membrane in the course of the depolarisation and repolarisation of the axon during the action potential.

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Total Q16

/9

Question 17

Marker use

Figure 19 shows a signal travelling from neuron A to neuron B across a synapse. Some of the structures associated with the synapse are numbered.

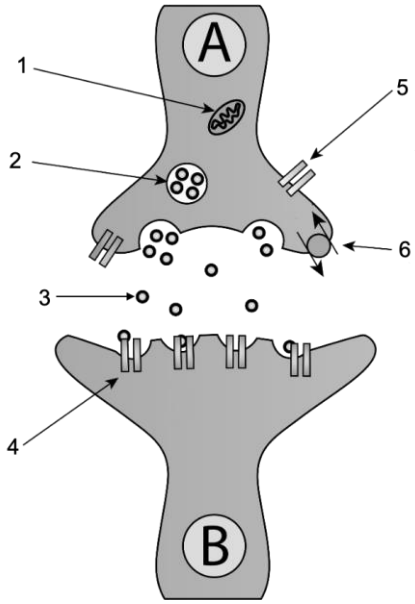

Figure 19: Diagram of a signal travelling from neuron A to neuron B across a synapse.

Modified from Wikimedia Commons CC-SA 3.0

a) State the name of one neurotransmitter.

/1

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b) In Table 5 complete the missing names and functions of parts of the synapse shown in Figure 19.

/4

Number	Name	Function
1	Mitochondrion	
2		
3	Neurotransmitter	
4		
5	Voltage-gated calcium channel	
6	Neurotransmitter reuptake pump	

Table 5

Total Q17

/5

End of Section C

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BIOLOGY

BIO315124

Section D

Pages: 16
Questions: 5
Information Sheet: 1

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- The Biology Information Sheet can be used throughout this exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C7	/ 36

Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
Section A	5	5	36 minutes	36 marks
Section B	6	6	36 minutes	36 marks
Section C	6	6	36 minutes	36 marks
Section D	5	5	36 minutes	36 marks
Section E	6	6	36 minutes	36 marks
Totals	**28**	**28**	**180 minutes (3 hours)**	**180 marks**

Criterion

You **must** make sure your answers address:

- Criterion 7 analyse concepts, processes and interrelationships as organisms respond to pathogens.

Question 18

Marker use

Figure 20 shows the process of infection of a human lung cell with the influenza (flu) virus.

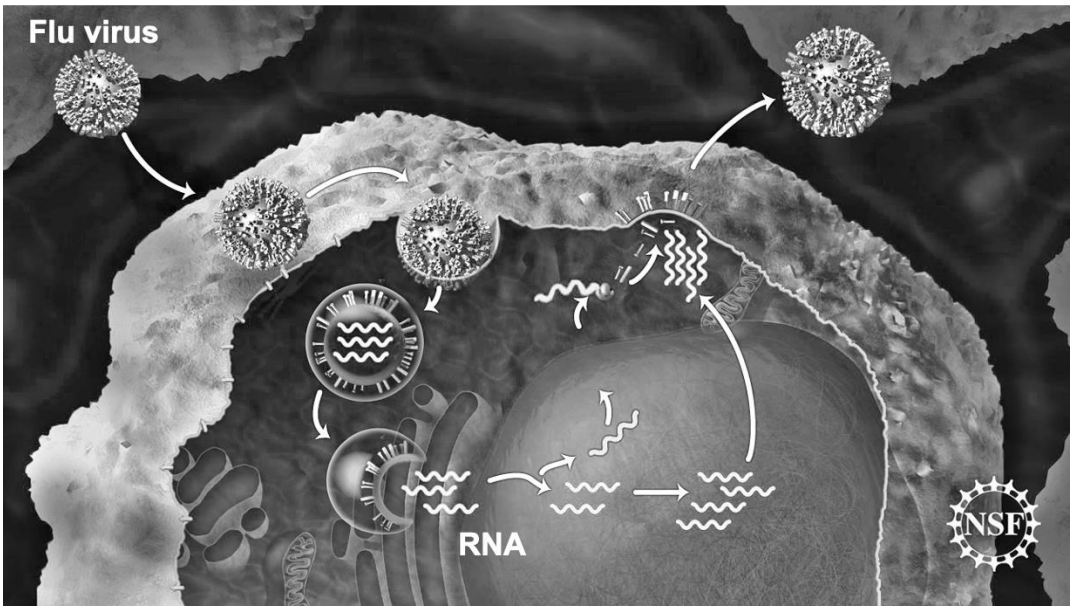

Figure 20: Diagram showing the process of infection of a human lung cell with the influenza virus.

Public Domain image – National Science Foundation

a) Describe **one (1)** similarity and **one (1)** difference between a prion and a virus.

.....

.....

.....

.....

/2

b) Using Figure 20, explain how flu viruses can infect new individuals. Include information on transmission from person to person.

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/3

Total Q18

/5

Question 19

Marker use

a) For each of the categories of the immune system's first line of defence provide **one (1)** example and describe how that example prevents infection by pathogens. /3

Type of defence	Example	Mode of Action
Physical		
Chemical		
Microbiological		

Table 6

b) State **one (1)** way that pathogens can overcome or bypass the first line of defence. /1

.....

.....

c) The first and second lines of defence in the immune system are also known as innate responses. Describe **two (2)** differences between innate and adaptive responses. /2

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Question 19 continues

Marker use

In the second line of defence, a bacterial pathogen may encounter one of the cells of the immune system and undergo phagocytosis as shown in Figure 21. Three sequential stages in the process are numbered 1, 2 and 3 on the diagram.

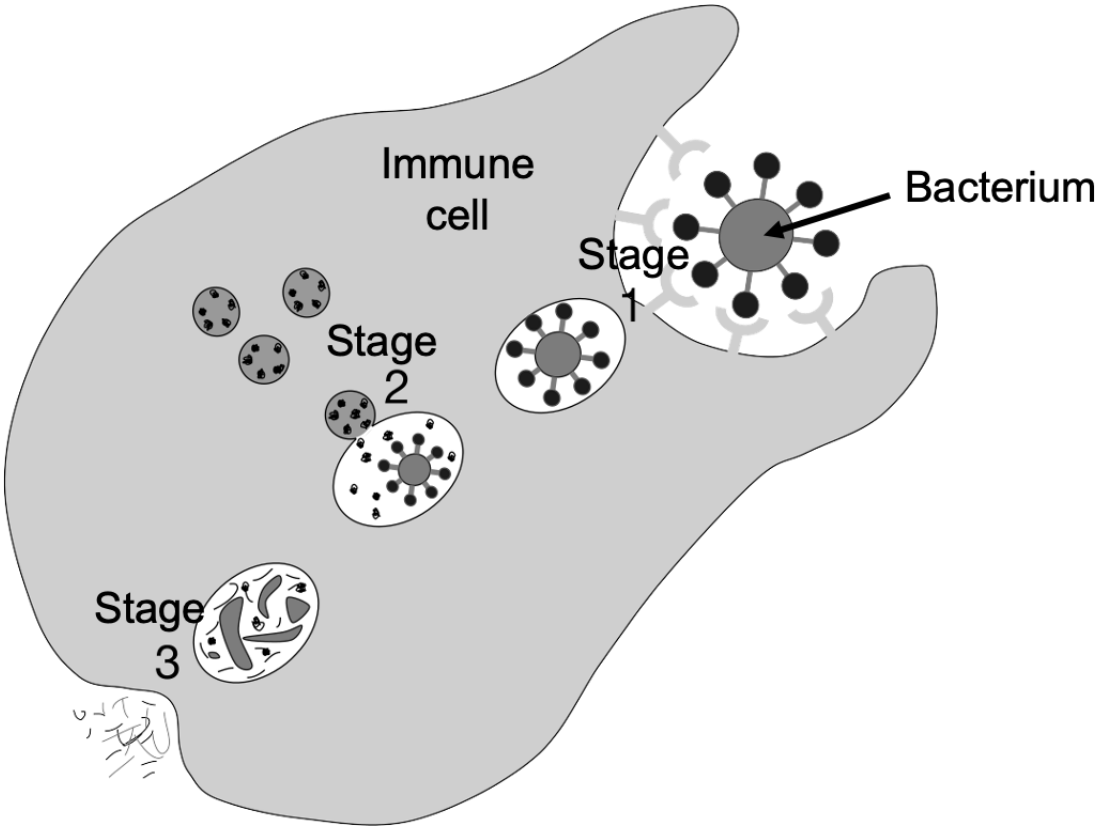

Figure 21: Diagram showing phagocytosis

Modified from Mango Slices on Wikimedia Commons CC BY-SA 4.0

d) State **one (1)** immune cell that might perform phagocytosis.

.....

.....

/1

e) Describe the **three (3)** stages of phagocytosis shown in Figure 21.

Stage 1: .....

.....

Stage 2: .....

.....

Stage 3: .....

.....

/3

Total Q19

/10

Question 20

Marker use

Figure 22 shows the life cycle of the multicellular parasite *Schistosoma mansoni*. This parasite causes schistosomiasis (bilharzia) which has negative effects including abdominal pain, diarrhoea and long-term kidney damage. The parasite is passed through faeces and infects snails living in freshwater before passing into humans when they enter the water.

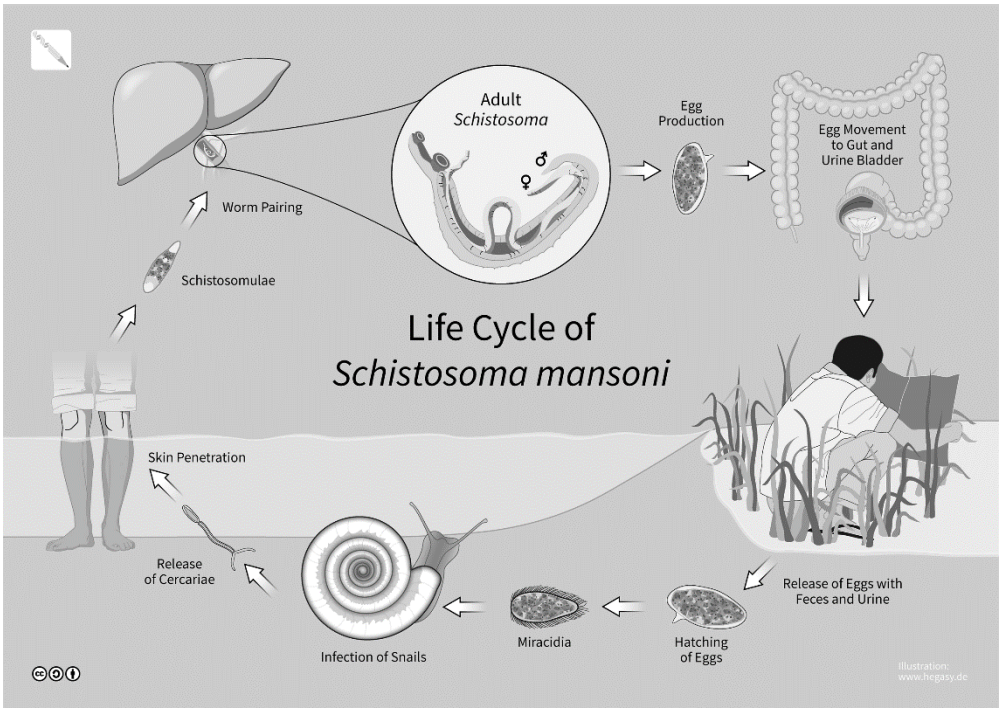

Figure 22: Diagram of the life cycle of the multicellular parasite.

Modified from http://www.hegasy.de CC BY-SA 4.0

a) Adult *S. mansoni* are not found in snails. State the general term for an organism such as the snail which is infected by non-reproductive stages of a pathogen. /1

.....

.....

b) Describe, in detail, **two (2)** methods which could reduce the impacts of *S. mansoni* on human populations in countries where it is endemic (established). /2

.....

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.....

.....

Question 20 continues

Marker use

/2

c) Schistosomiasis is not currently found in Australia. Explain how the parasite could become established.

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Total Q20

/5

Question 21

Marker use

Figure 23 shows the response of the adaptive immune system to infection by a pathogen.

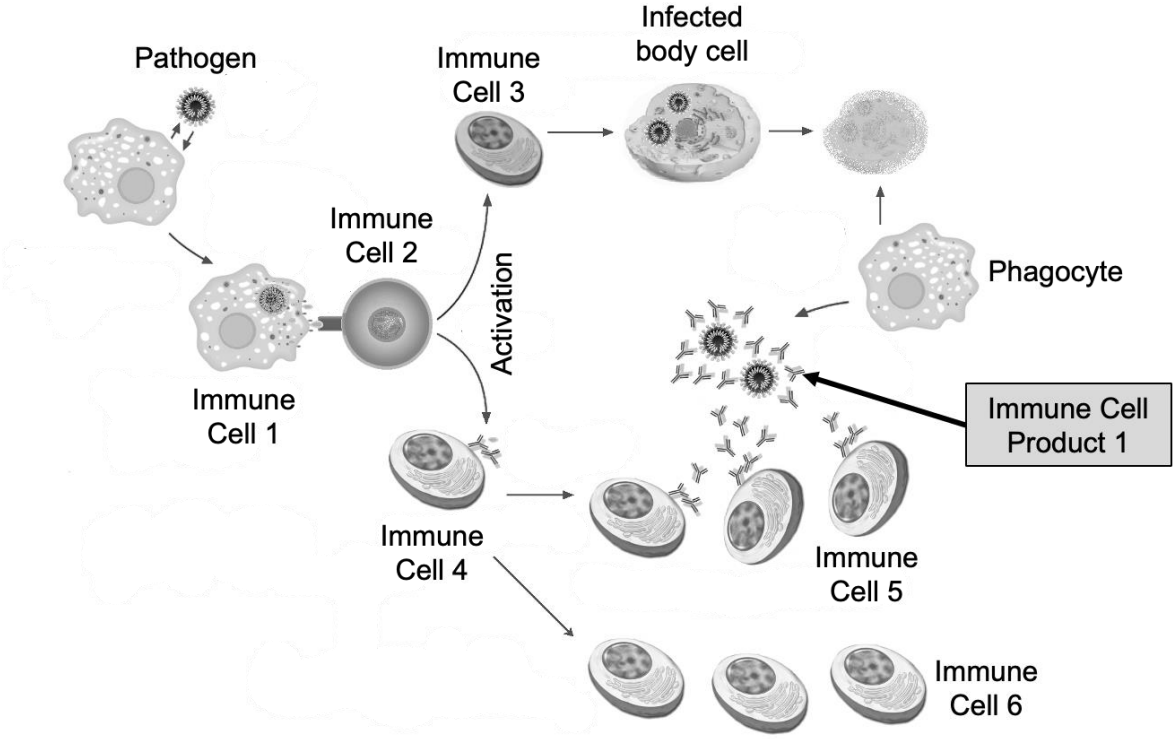

Figure 23: Diagram showing the response of the adaptive immune system to an infection by a pathogen.

Modified from Sciencia58 on Wikimedia Commons CC BY-SA 4.0

a) In Table 7 use the terms from the following list to identify the immune cells shown in Figure 23:

/3

Antigen-presenting cell	**B-lymphocyte**	**Cytotoxic (killer) T-cell**
Memory B-cell	**Plasma cell**	**T-lymphocyte**

Immune Cell 1:	Immune Cell 4:.....
Immune Cell 2:	Immune Cell 5:.....
Immune Cell 3:	Immune Cell 6:.....

Table 7

Question 21 continues

Marker use

b) Explain **two (2)** ways in which Immune Cell Product 1 contributes to the adaptive immune response. /2

.....

.....

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.....

c) Describe the changes in the levels of circulating immune cells after the body has recovered from the pathogen. /2

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.....

d) Explain how the adaptive immune response is different when the body is exposed to a pathogen which it has encountered previously. /3

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Total Q21 /10

Question 22

Marker use

Governments often encourage immunisation programs in response to infectious diseases. Figure 24 shows three scenarios with different levels of immunisation.

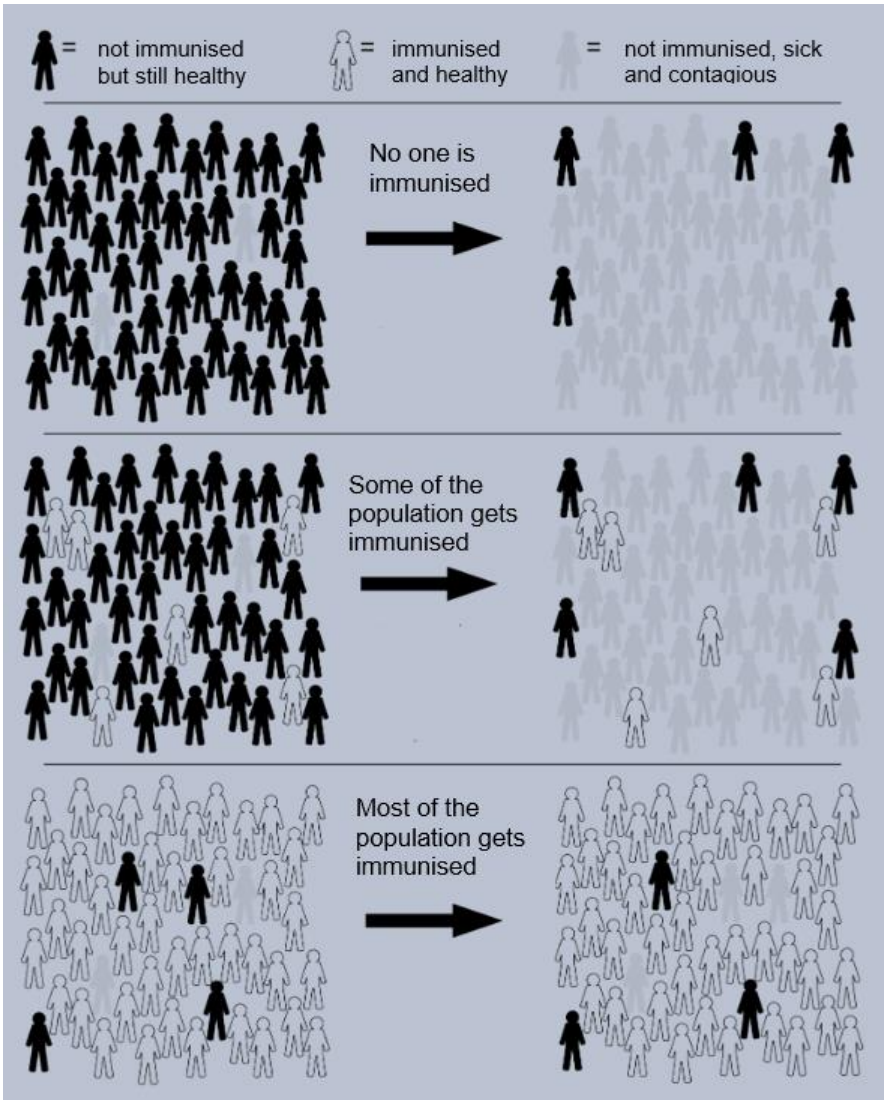

Figure 24: Diagram showing three scenarios with different levels of immunisation.

a) Circle **two (2)** terms from the following list that describe the type of immunity produced by vaccination:

/1

Active Acquired Natural Passive

b) Explain how babies can have immunity to some pathogens without vaccination.

/2

.....

.....

.....

.....

Question 22 continues

Marker use

c) Using information in Figure 24, explain the concept of herd immunity.

/3

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Total Q22

/6

End of Section D

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BIOLOGY

BIO315124

Section E

Pages: 16
Questions: 6
Information Sheet: 1

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
    - Spare diagrams have been provided at the end of this section. Indicate in the boxes provided if you have used the spare diagrams.
- Write your answers in the spaces provided in this exam paper.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- The Biology Information Sheet can be used throughout this exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C8	/ 36

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Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
Section A	5	5	36 minutes	36 marks
Section B	6	6	36 minutes	36 marks
Section C	6	6	36 minutes	36 marks
Section D	5	5	36 minutes	36 marks
Section E	6	6	36 minutes	36 marks
Totals	**28**	**28**	**180 minutes (3 hours)**	**180 marks**

Criterion

You **must** make sure your answers address:

- Criterion 8 analyse cell division, genetics and evolution to explain biological persistence and diversity.

Question 23

Marker use

Figure 25 shows a simplified version of the cell cycle in animal cells. Five different stages of the cell cycle are represented in the inner ring.

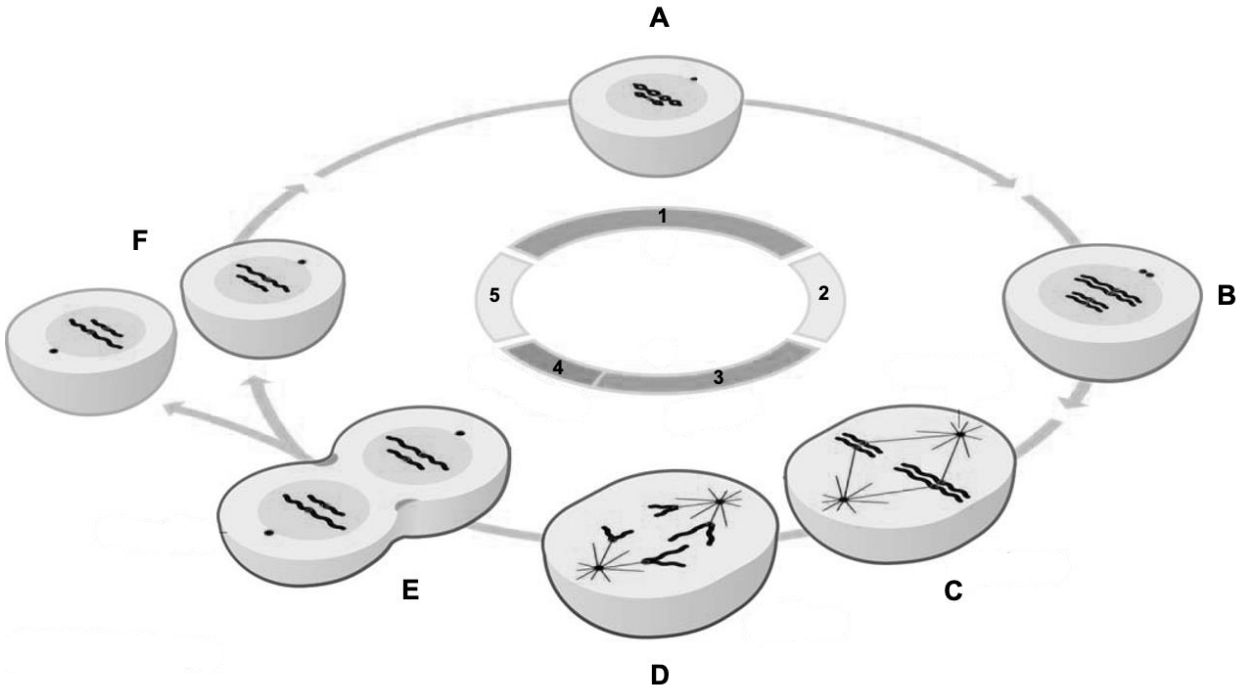

Figure 25: Diagram of a simplified version of the cell cycle in animal cells.

David O Morgan CC-SA 4.0

a) State which number or letter represents the following stages of the cell cycle.

/3

Anaphase: .....

Cytokinesis: .....

Interphase:.....

Metaphase:.....

Prophase: .....

Telophase:.....

b) Explain the importance of metaphase to the process of cell division.

/1

.....

.....

Question 23 continues

Marker use

A different type of cell division, meiosis, occurs during sexual reproduction. A simplified version of meiosis is shown in Figure 26.

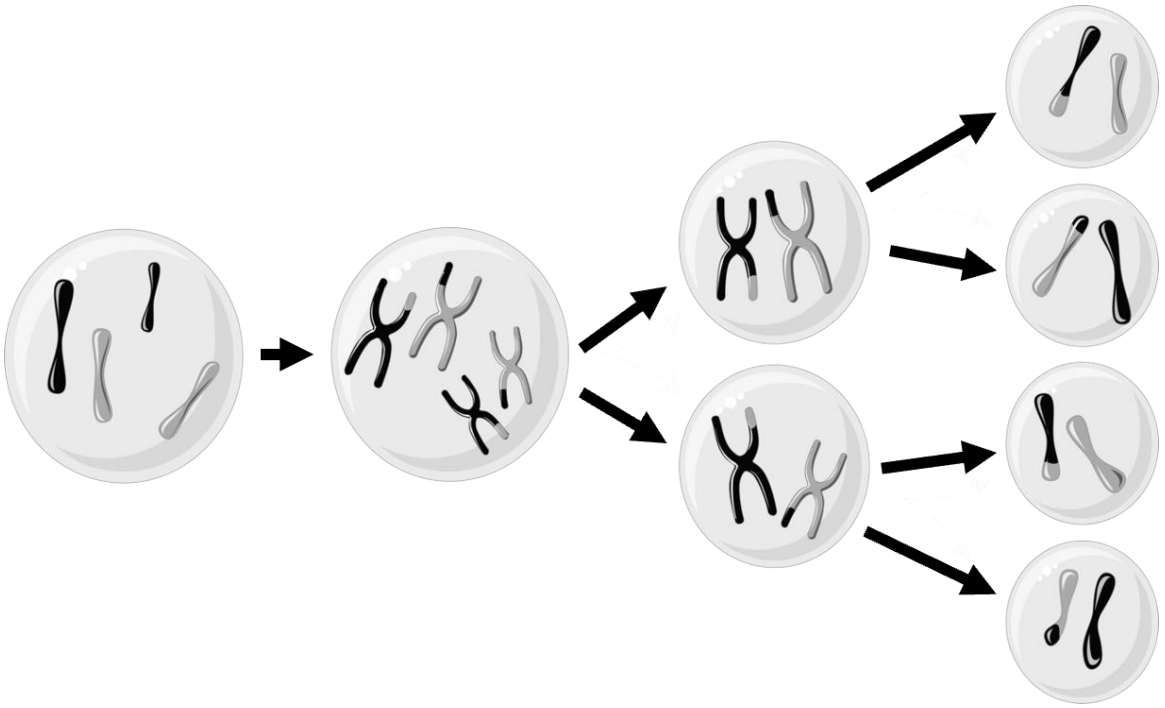

Figure 26: Diagram of a simplified version of meiosis.

Laboratoires Servier CC-SA 3

c) Describe the processes that occur during interphase.

/2

.....

.....

.....

.....

d) Explain how **two (2)** differences between mitosis and meiosis create variation in the final cells produced.

/2

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.....

.....

.....

Total Q23

/8

Question 24

Marker use

Peas show a wide variety of traits that exhibit simple patterns of inheritance. Two of these characteristics are the shape of the seed (round or wrinkled) and the colour of the seed (yellow or green). If true-breeding peas with round, yellow seeds are crossed with true-breeding peas with wrinkled, green seeds all of the offspring (F_1 generation) have round and yellow seeds.

a) Identify the recessive alleles for shape and colour.

.....

.....

/1

b) If two of the F_1 generation are crossed, list the expected ratio of phenotypes of the resulting offspring.

/2

.....

.....

.....

.....

c) Explain how you would determine the genotype of an unknown individual with a dominant phenotype.

/2

.....

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.....

d) Using the ABO classification of blood types, explain **one (1)** form of multiple allele inheritance.

/2

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.....

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.....

Total Q24

/7

Question 25

Marker use

Thomas Hunt Morgan was the first scientist to demonstrate the existence of sex-linked traits, where the allele is found only on the X chromosome. In fruit flies, eye colour is one such trait, with red eye colour dominant to white.

a) State the genotype of the following fruit flies.

/1

White-eyed female:.....

White-eyed male:.....

b) Complete the following Punnett Square in Figure 27.

/4

Red-eyed male

White-eyed female

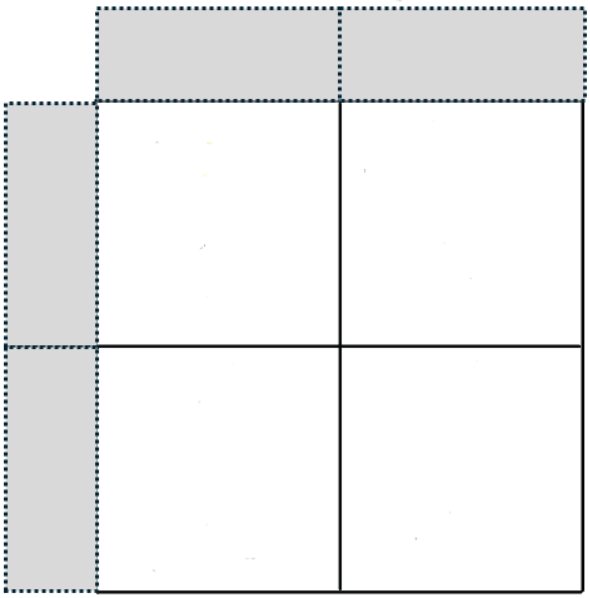

Figure 27: Punnett Square for answering Question 25 b)

Spare diagram used (X) ☐

Phenotype ratio:.....

Genotype ratio: .....

Total Q25

/5

Question 26

Marker use

People with Marfan syndrome are usually tall and thin, with unusually long arms, legs, fingers and toes. One example of a pedigree for a family with Marfan syndrome is shown in Figure 28.

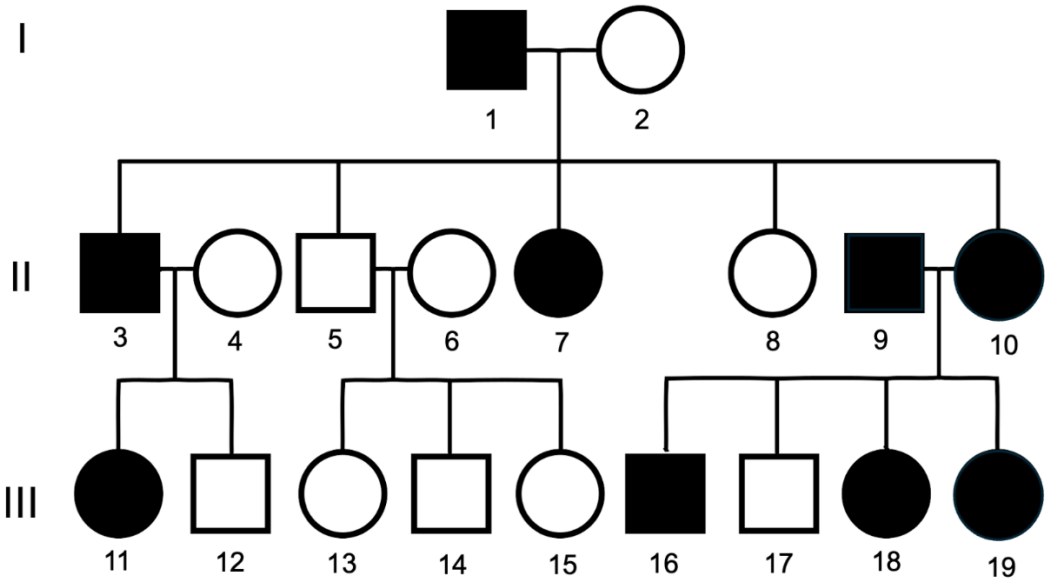

Figure 28: Diagram of a pedigree for a family with Marfan syndrome.

a) From the pedigree, provide **one (1)** example of:

/1

Affected male:.....

Non-affected female .....

b) Using evidence from the pedigree, explain the pattern of inheritance of Marfan syndrome.

/3

.....

.....

.....

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.....

.....

Question 26 continues

Marker use

/2

c) Explain why you would use a pedigree in some circumstances and a Punnett Square in other cases.

.....

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.....

Total Q26

/6

Question 27

Marker use

Figure 29 shows the evolution of antibiotic resistance in a population of bacteria.

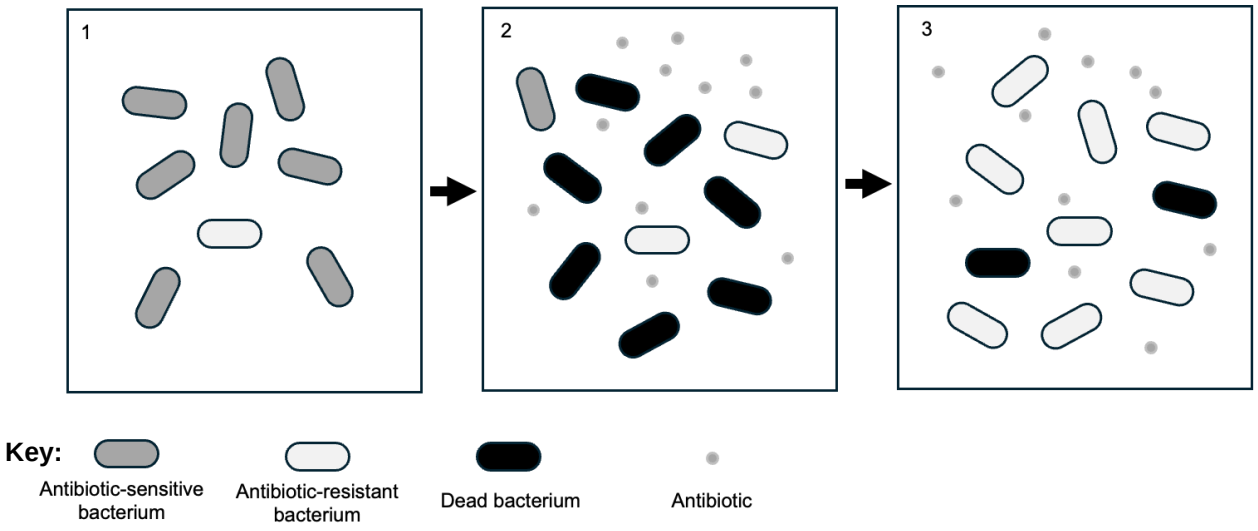

Figure 29: Diagram of the evolution of antibiotic resistance in a population of bacteria.

a) State **one (1)** way a mutation might arise in a bacterium.

.....

.....

/1

b) Explain why mutations are necessary for evolution to occur.

.....

.....

.....

.....

/2

c) Using the diagram in Figure 29, explain how the frequency of antibiotic resistance in the population increases over time.

.....

.....

.....

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.....

.....

/3

Total Q27

/6

Question 28

Marker use

Figure 30 shows the change in a population of beetles due to habitat loss and fragmentation.

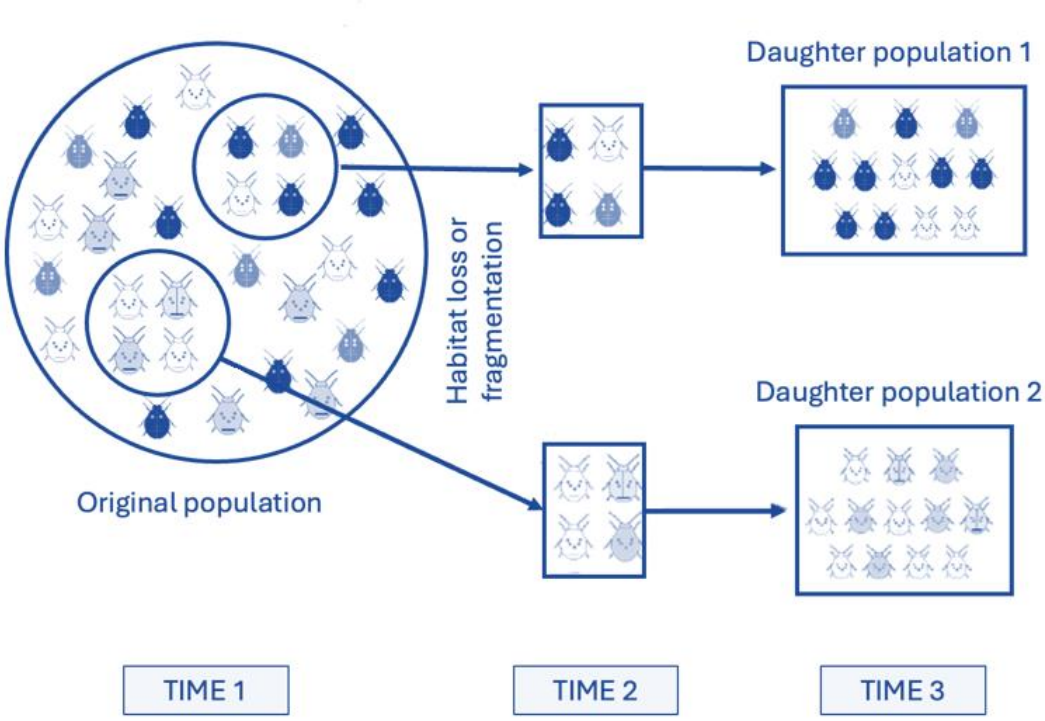

Figure 30: Diagram showing the change in population of beetles due to habitat loss and fragmentation.

Wikimedia Commons Gohar7 CC-SA 4.0

a) State the term used to describe this form of evolution.

.....

.....

/1

b) Explain the consequences of these changes for the **two (2)** daughter populations over time.

/3

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.....

Total Q28

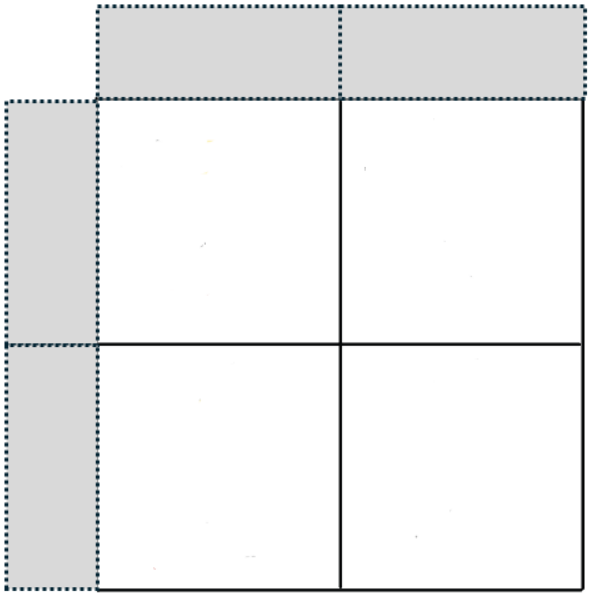
/4

Spare Diagrams

Question 25 b)

Red-eyed male

White-eyed female



End of Section E

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