

External Assessment 2023

BIOLOGY

BIO315124

Section **A**

Pages: 13
Questions: 5

Preparation time for this exam: 15 minutes

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
 - Spare diagrams have been provided at the end of each 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 is provided in the instructions for each part.
- All answers must be written in **English**.
- The Biology Information Sheet can be used throughout this exam.
- You **must** make sure your answers address the listed criterion/criteria.

Marker use	
C3	/ 36

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EXEMPLAR

Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
This Section A	5	5	36 minutes	36
Section B	6	6	36 minutes	36
Section C	5	5	36 minutes	36
Section D	5	5	36 minutes	36
Section E	6	6	36 minutes	36
Totals	27	27	180 minutes (3 hours)	180 marks

Criterion/Criteria

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

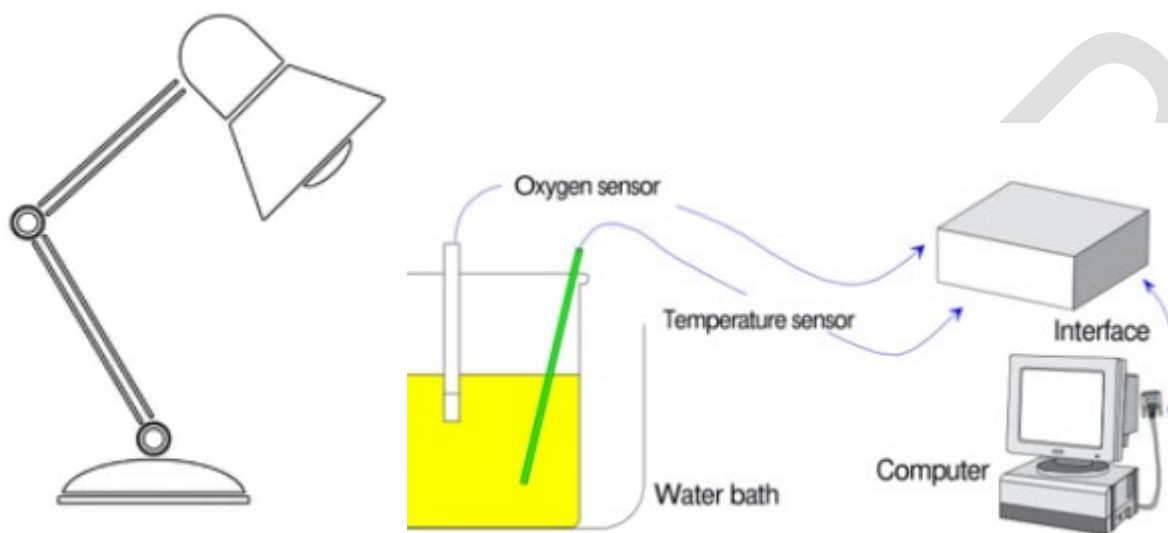
- Criterion 3 undertake biological inquiry to generate and evaluate data.

Question 1

Marker use

A scientist investigated the rate of photosynthesis in the pondweed, (*Potamogeton pusillus*). The method and equipment used by the scientist is shown below:

Equipment



Method

- Add 200cm³ of distilled water to a 300cm³ glass beaker.
- Dissolve 5g of sodium bicarbonate in the water to provide an excess of CO₂.
- Place the beaker in a water bath at 10°C and leave for 10 min to equilibrate.
- Insert an oxygen sensor into the water in the beaker and measure the baseline O₂ concentration.
- Place 100g of the pond weed into the beaker.
- Remove all other light sources from the room and place an LED light source 20cm above the top of the beaker.
- Use a light intensity meter to ensure the light intensity above the beaker is 5000 lux.
- Measure the concentration of oxygen dissolved in the water using a data logger every 10 minutes for 200 minutes. (oxygen is a product of photosynthesis).
- Repeat all the above steps in water baths at 15°C, 20°C, 25°C and 30°C.

Question 1 continues

Question 1 continued

Marker use

a) Identify the following variables from the scientist's method:

i) independent variable

/1

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ii) dependent variable

/1

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b) Identify **THREE** variables that were controlled/fixed by the scientist **and** suggest why it was important to do so.

/3

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c) Why was it important to leave the beaker of water to equilibrate for 10 minutes?

/2

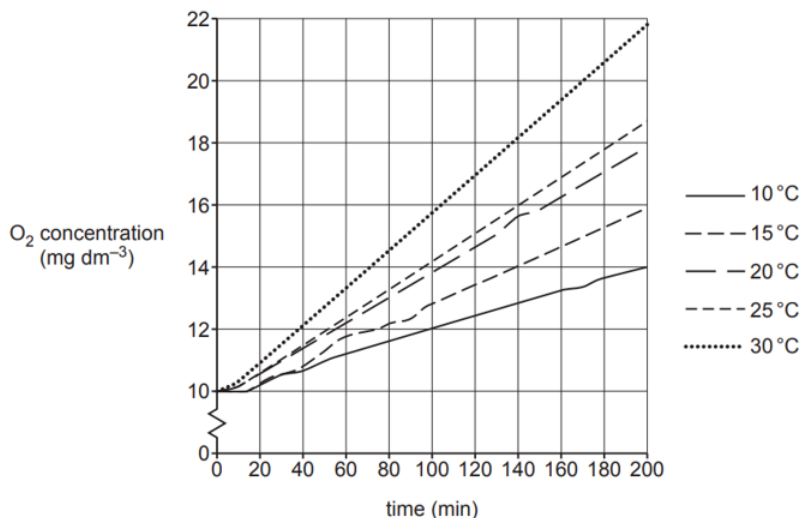
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Question 1 continues

Question 1 continued

Marker use

Results from the experiment are shown in the graph below. Graph shows the oxygen concentration in the water over 200 minutes.



d) Describe what the above results show about photosynthesis in the pond weed.

/2

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e) Suggest **ONE** way that this experiment could be modified to determine the reliability of the results. Explain how your modification would achieve this.

/2

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Total
Q1
/11

Question 2

Marker use

A group of four students grew bean seedlings in the classroom and observed that towards the end of each day the leaves of the seedlings folded and pointed downwards. Each morning the leaves unfolded and were raised again. Each student was asked to formulate a hypothesis to explain this observation. The students' actual statements are written below.

Student 1: A cooler temperature and lower light intensity cause the bean leaves to fold.

Student 2: Do the bean leaves have a daily rhythm of folding and unfolding?

Student 3: A decrease in light intensity causes bean leaves to fold.

Student 4: A change in the environment results in folding of bean leaves.

a) Which student's statement is a scientific hypothesis?

/1

b) Outline in detail why each of the other statements is not a scientific hypothesis.

/3

Total
Q2
/4

Question 3

Marker use

Four students were asked to design a first-hand investigation to determine the effect of pH on the activity of an enzyme. Their designs of the investigation are shown in the tables below.

Design A

Tube number	Contents	pH	Temp. (°C)
1	E	3	20
2	E	7	20
3	E	12	20
4	S	3	20
5	S	7	20
6	S	12	20

Design B

Tube number	Contents	pH	Temp. (°C)
1	E + S	3	20
2	E + S	7	20
3	E + S	12	20
4	S	3	20
5	S	7	20
6	S	12	20

Design C

Tube number	Contents	pH	Temp. (°C)
1	E + S	3	10
2	E + S	7	20
3	E + S	12	30
4	S	3	10
5	S	7	20
6	S	12	30

Design D

Tube number	Contents	pH	Temp. (°C)
1	E + S	7	10
2	E + S	7	20
3	E + S	7	30
4	S	7	10
5	S	7	20
6	S	7	30

Key: E = enzyme S = substrate

- a) State which of the designs A-D is the most appropriate.

/1

- b) For **EACH** of the other three designs, explain why they are unsuitable.

/3

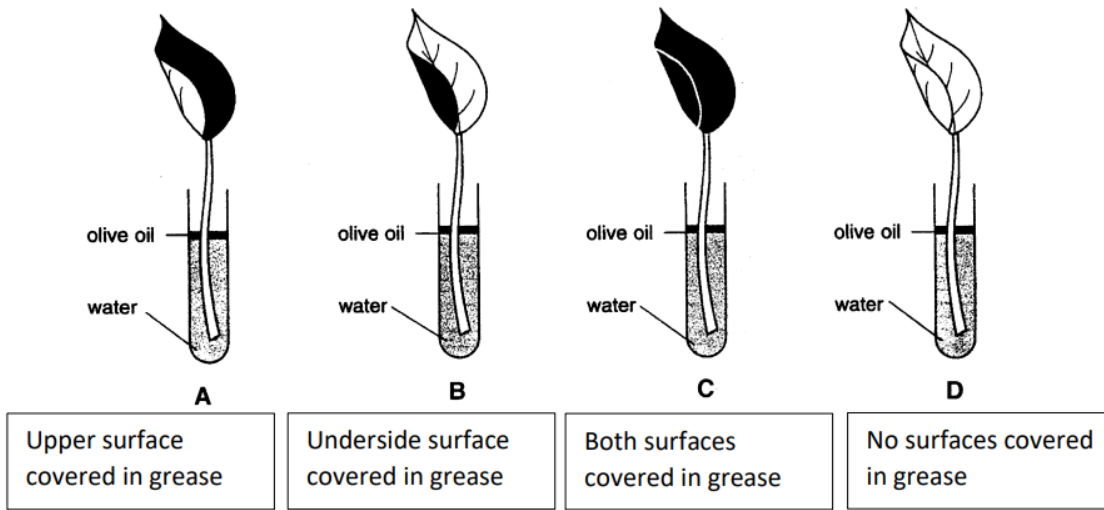
Total
Q3

/4

Question 4

Marker use

Four leaves were placed in test tubes of water. Olive oil was poured onto the surface of the water in each tube.



Grease (shown as dark shading in the diagram) can be used to prevent water loss from the leaf surface.

a) Explain why olive oil was poured onto the surface of the water in each tube.

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b) If the hypothesis being tested is: "Plants lose most water from the underside of the leaf compared to the upper side" clearly explain treatments C and D were included.

/4

Tube C

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Tube D

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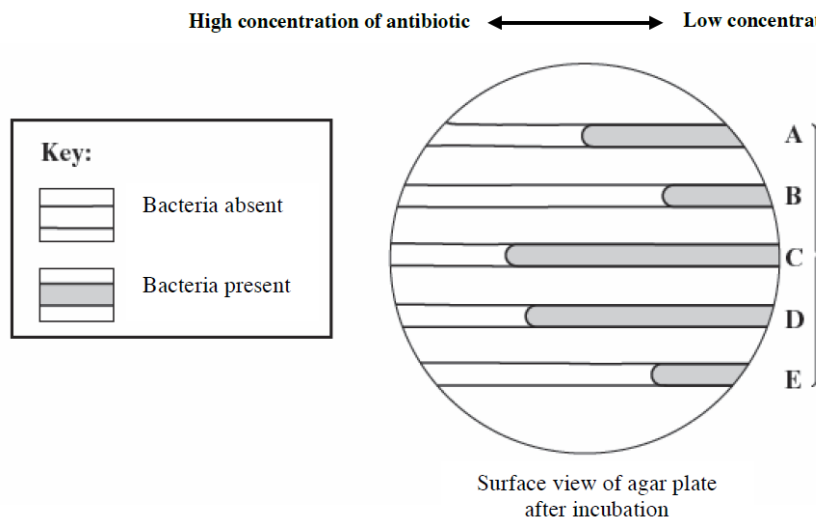
Total Q4
/6

Question 5

Marker use

The disease melioidosis is caused by the bacterium *Burkholderia pseudomallei*, and is endemic in northern Australia. The bacterium is present in soil and surface water and outbreaks of the disease follow episodes of high rainfall and flooding during the 'wet season' when people are exposed to mud and surface water.

A scientist investigated the effectiveness of an antibiotic in treating five different strains of the bacterium which causes melioidosis. She prepared an agar plate with a concentration gradient of the antibiotic. She then spread the different strains of the bacterium across the agar plate in five different lines, labelled **A** to **E** in the diagram below. The plate was incubated for 12 hours at 37°C.



a) Which strain of bacterium is the most resistant to the antibiotic? Explain your answer.

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The scientist then designed an experiment to investigate the effectiveness of the antibiotic in treating the disease melioidosis itself. She decided to use laboratory-bred mice in her experiment.

b) Give a likely hypothesis for this experiment.

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Question 5 continues

Question 5 continued

Marker use

- c) Outline **THREE** ethical considerations that would have to be examined before using laboratory bred mice.

/3

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- d) Explain why it would improve the validity of the experimental design for the scientists to use laboratory bred mice.

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EXEMPLAR

Total
Q4
/11

End of Section A
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External Assessment 2023

BIOLOGY

BIO315124

Section **B**

Pages: 18
Questions: 6

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question
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- Write your answers in the spaces provided in this exam paper.
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Marker use	
C5	/ 36

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EXEMPLAR

Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
Section A	5	5	36 minutes	36
This Section B	6	6	36 minutes	36
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Section D	5	5	36 minutes	36
Section E	6	6	36 minutes	36
Totals	27	27	180 minutes (3 hours)	180 marks

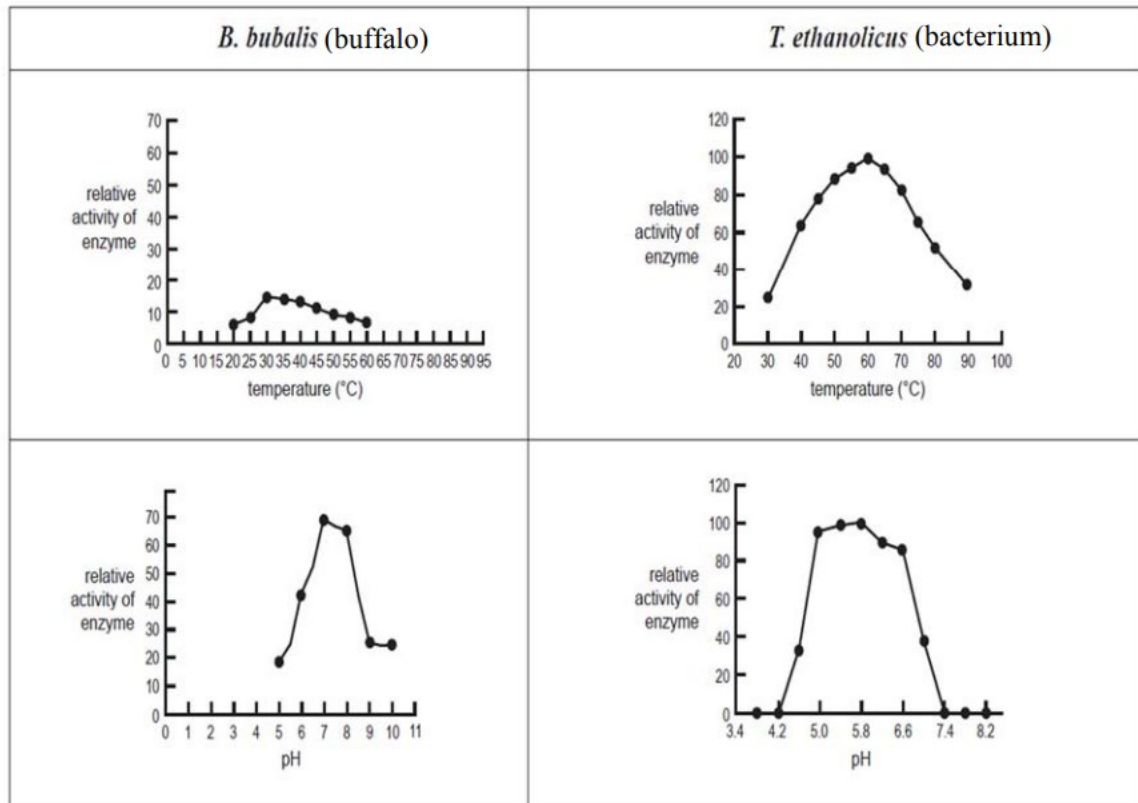
Criterion/Criteria

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

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

Question 6

The enzyme lactate dehydrogenase is found in a wide variety of organisms. It catalyses the conversion of both pyruvate to lactate and lactate to pyruvate. The River Buffalo (*Bubalus bubalis*) is a domestic animal common in Pakistan. The bacterium (*Thermoanaerobacter ethanolicus*) lives in geothermal (hot) springs. Scientists studying the enzyme lactate dehydrogenase from these two organisms in varying temperatures and pH, produced the following graphs.



a) (i) From the graphs above, suggest the optimum temperature for this enzyme in the River Buffalo and the bacterium.

River Buffalo:

Bacterium:

/1

Question 6 continues

Question 6 continued

Marker use

(ii) Identify **ONE** key difference in the relative activity of the enzymes with varying pH conditions for the two species. Explain why this is to be expected.

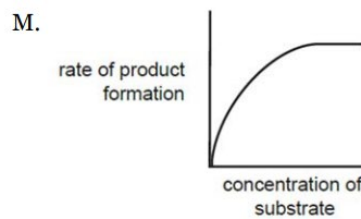
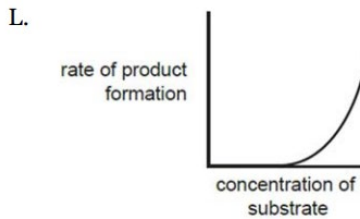
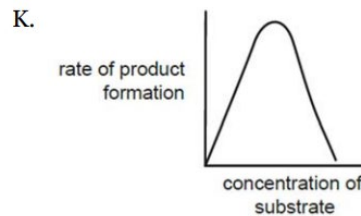
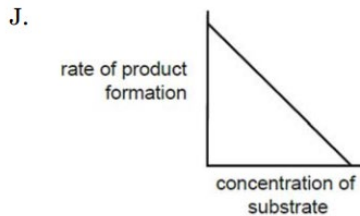
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/2

Consider an enzyme-facilitated reaction in which the concentration of the enzyme is constant.

b) State which of the following graphs shows the effect of increasing substrate concentration on the rate of product formation.

/2



Correct graph:

Explanation:

.....

Question 6 continues

Question 6 continued

Marker use

Many cancer cells obtain their energy needs by taking up glucose and converting it to lactate using lactate dehydrogenase. FX11 is a competitive inhibitor of lactate dehydrogenase.

c) Explain how FX11 could be used as a potential treatment for cancer.

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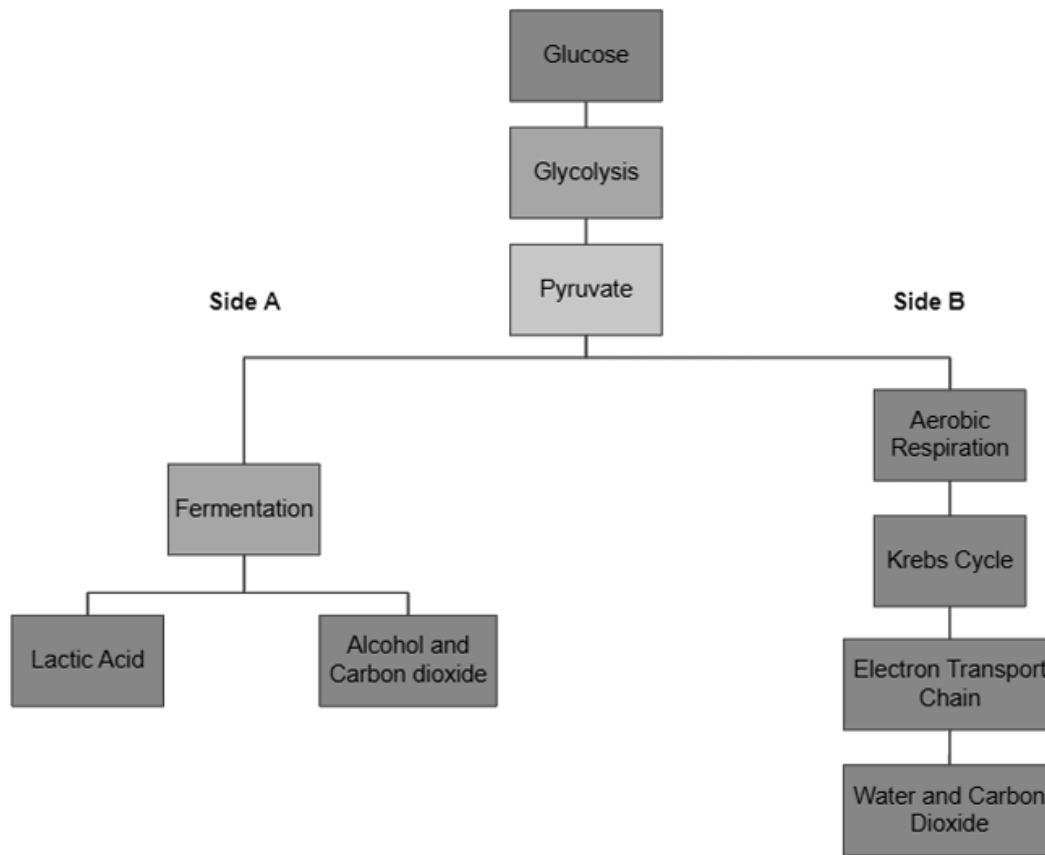
EXEMPLAR

Total
Q6
/7

Question 7

Marker use

Cellular respiration can be either aerobic or anaerobic. Consider the diagram below of cellular respiration in animal cells.



a)

Side A	Side B
i	i
ii	ii
iii	iii
iv	iv

/2

Question 7 continued

- i) where in the cell the processes take place
- ii) Whether oxygen is available or not
- iii) How many ATP molecules are produced by the processes indicated
- iv) Final products of metabolic pathway.

/2

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b) Describe how energy is transferred from one form into another in Side B and explain why this is important for cellular metabolism.

/3

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Total
Q7
/5

Question 8

Marker use

Two students noticed bubbles forming on the submerged leaves of an Elodea plant growing in an aquarium, under bright LED light (temperature from light did not increase water temperature). The bubbles seen on the leaves were the result of a gas formed within the cells of the leaves. The photograph below shows the appearance of these bubbles.



- a) Describe what occurs in the cells of these leaves to result in the formation of these bubbles.

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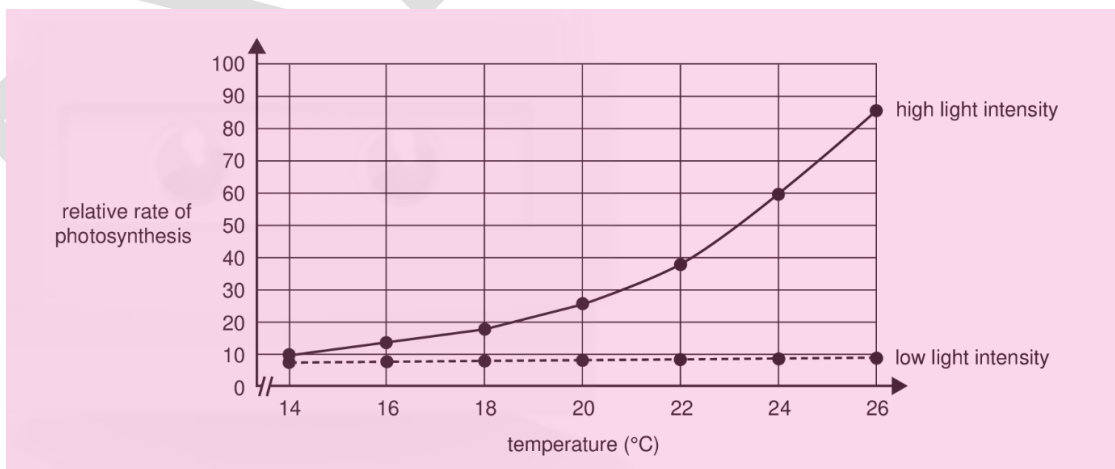
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/2

- b) The students investigated the rate of photosynthesis in the leaves of the Elodea plant. The graph of these results is shown below.



/3

Question 8 continues

Question 8 continued

Marker use

(i) Name the two stages of photosynthesis.

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/1

(ii) Consider the relative rates of photosynthesis at a temperature of 20°C. Explain the difference observed of the relative rates of photosynthesis when the *Elodea* plant was exposed to low light intensity compared to when it was exposed to higher light intensity. Refer to both stages of photosynthesis in your answer.

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/2

EXEMPLAR

Total
Q8
/5

Question 9

a) The table below shows the function of the four main enzymes involved with DNA replication.

/2

(i) Complete the table below by adding the correct enzymes so that it matches its function.

Spare diagram used (X)

Enzyme	Function
	Joins together fragments of newly synthesized DNA to form a seamless strand.
	Synthesizes short RNA sequences called primers
	Unwinds the double helix by breaking hydrogen bonds
	Adds daughter nucleotides on the parent strands

(ii) DNA is a double stranded molecule which holds the genetic information of the cell and is kept protected in the nucleus. Within the nucleus DNA is replicated semi-conservatively in order to produce new cells.

/1

State **ONE** structural feature of DNA and explain how this feature is important in the process of semi-conservative replication of a cell's DNA.

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Question 9 continues

Question 9 continued

Marker use

b) A scientist identified a single-stranded molecule with the structure shown below.

exon	intron	exon	intron	exon	intron
50 bases	150 bases	70 bases	80 bases	120 bases	40 bases

/2

(i) In which part of a cell would this molecule be found?

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(ii) What would be the expected base length of the molecule that is to be translated into a protein?

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(iii) Describe the function of mature mRNA.

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Total
Q9
/7

Question 10

Marker use

Tryptophan (trp) is the least abundant amino acid in eukaryotic cells. Consider the genetic code below.

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

a) Using the genetic code:

(i) The DNA sequence below is missing three nucleotides. What DNA bases would be needed to code for trp? Complete the missing nucleotides below.

DNA strand T A C T T C G G C T C A G T A _ _ _

(ii) Provide the corresponding mRNA strand.

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/1

/1

Question 10 continues

Question 10 continued

Marker use

b) If a deletion mutation occurred to the fourth nucleotide of the DNA sequence above (highlighted), what might be the effect on the polypeptide chain and the function of the final protein produced if the sequence coded for an enzyme?

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EXEMPLAR

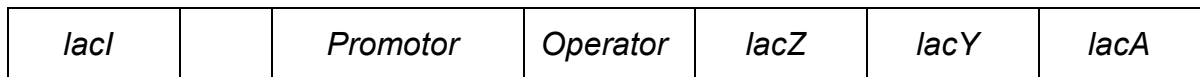
Total
Q10
/6

Question 11

Marker use

The *lac* operon is a section of DNA present in the genome of *Escherichia coli* (*E.coli*). The structural genes of the *lac* operon are only fully expressed when the bacteria are exposed to high lactose concentrations.

Below is a diagram showing the *lac* operon and a nearby region of the *E.coli* genome.



a) Name the enzyme that is required to bind to the promotor for transcription to take place.

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b) Identify the product of the *lacI* gene and describe the effect of that product on the functioning of the *lac* operon

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c) If *E.coli* is put into a nutrient medium containing lactose, *lacZ* is transcribed and a protein is synthesised.

/2

(i) Identify the protein produced when *lacZ* is transcribed and explain why it is essential for the survival of *E.coli*.

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.....

Total
Q11
/6

Spare Diagrams

Marker use

Question 7

Side A	Side B
i	i
ii	ii
iii	iii
iv	iv

Question 9

Enzyme	Function
	Joins together fragments of newly synthesized DNA to form a seamless strand.
	Synthesizes short RNA sequences called primers
	Unwinds the double helix by breaking hydrogen bonds
	Adds daughter nucleotides on the parent strands

End of Section B
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12

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External Assessment 2023

BIOLOGY

BIO315124

Section C

Pages: 14
Questions: 5

Suggested working time: 36 minutes

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Marker use	
C6	/ 36

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EXEMPLAR

Guide to Exam Structure

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Section A	5	5	36 minutes	36
Section B	6	6	36 minutes	36
This Section C	5	5	36 minutes	36
Section D	5	5	36 minutes	36
Section E	6	6	36 minutes	36
Totals	27	27	180 minutes (3 hours)	180 marks

Criterion/Criteria

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

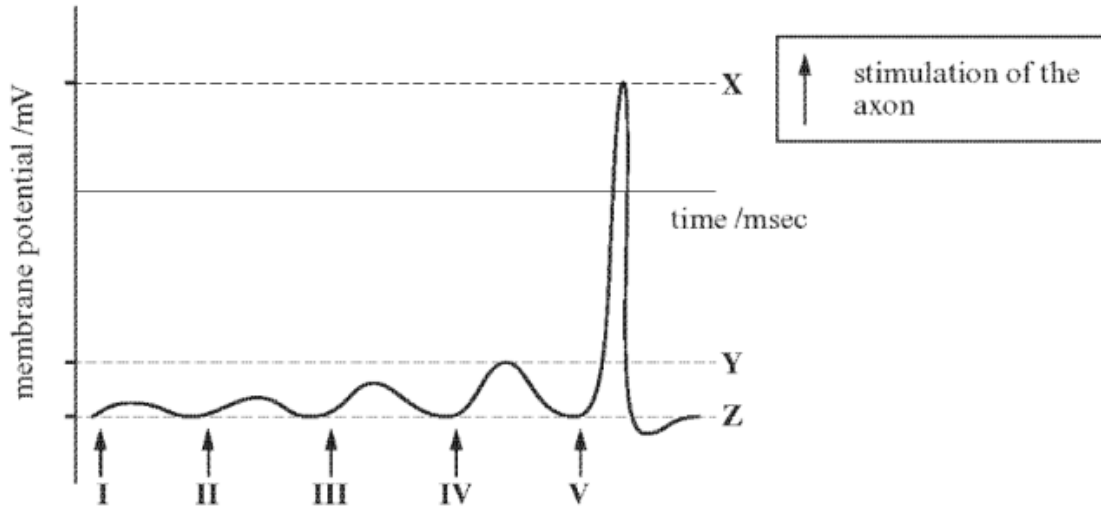
- Criterion 6 analyse homeostatic concepts, processes and interrelationships

Question 12

Marker use

The axon of a motor neuron was stimulated using an intracellular electrode. The strength of each stimulus was increased by the same amount each time and the potential difference across the cell membrane was monitored using an oscilloscope.

The results of the experiment are shown in the graph below.



a) Suggest values for the membrane potential at:

X.....mV Z.....mV

/1

b) Generation of an action potential involves ion channels.

Explain how opening and closing of ion channels results in the repolarisation and repolarisation of the axon membrane shown at point V on the graph

Depolarisation

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/3

Question 12 continues

Question 12 continued

Marker use

Repolarisation

/2

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c) Explain why an action potential was not generated by stimuli I to IV

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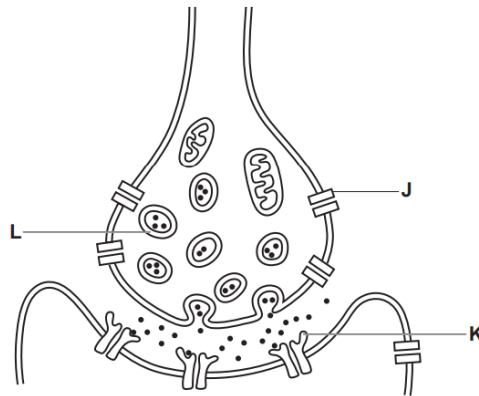
EXEMPLAR

Total
Q12
/6

Question 13

Marker use

The diagram below represents a synapse.



Which one of the following statements, A, B, C or D, describes structures or events occurring at a synapse?

a) Enter the correct letter in the box

- A Acetylcholine is broken down by enzymes so that it can bind to structure K.
- B An action potential causes structure J to close.
- C Structure J is a voltage gated Ca^{2+} channel.
- D Structure L contains calcium.

b) Explain why the other three letters are incorrect.

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/3

Total
Q13
/4

Question 14

Marker use

a) (i) What is the function of thermoreceptors?

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(ii) Identify **TWO** places you would find thermoreceptors in the human body?

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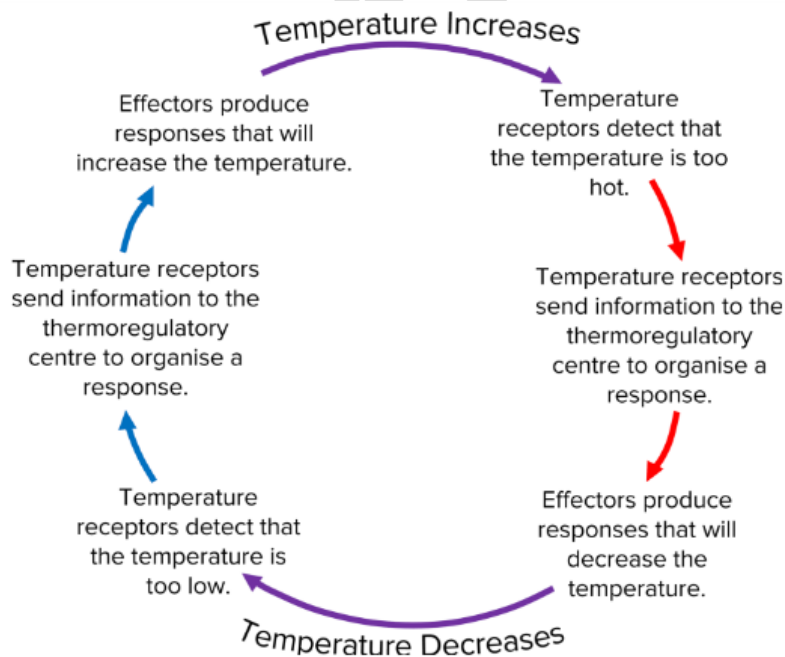
(iii) Why does the human body need to maintain a constant internal body temperature of 37.5°C?

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b) Demonstrate your understanding of thermoregulation and negative feedback by referring to the diagram below and answering questions (i) to (iv).

/1



Question 14 continues

Question 14 continued

Marker use

(i) Identify **TWO** effector organs for thermoregulation and how they would respond to an increase in core body temperature

/2

Effector 1:

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Effector 2:

.....

(ii) Explain how the effectors identified above help to maintain a constant internal body temperature in humans (37.5°C?), even when the outside temperature is well above body temperature?

/3

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EXEMPLAR

Total
Q14

/8

Question 15

Marker use

a) List **TWO** differences between the nervous system and the endocrine system.

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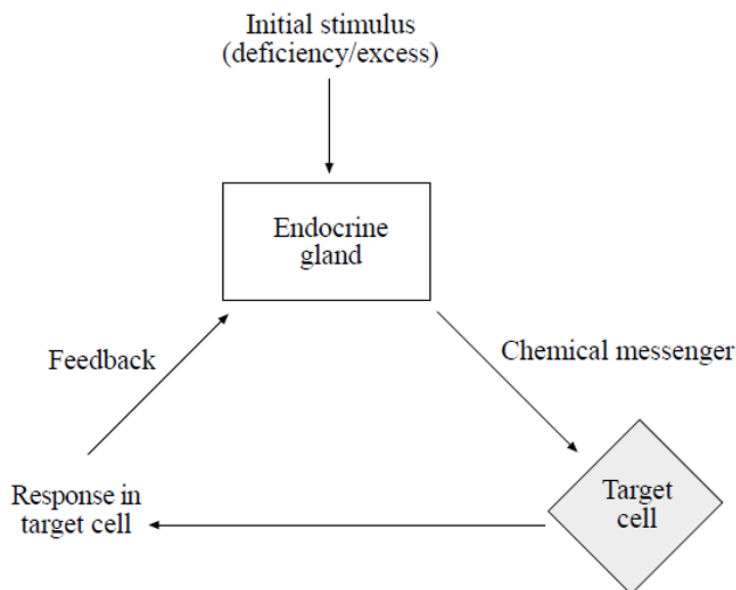
b) Hormones are transported throughout the body but the hormone affects only certain cells. Explain why only certain cells are affected.

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The diagram below represents an interaction between parts of an organism.



c) What does the term *chemical messenger* in this diagram represent?

/1

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Question 15 continues

Question 15 continued

Marker use

d) In humans, glucose is regulated in a similar way to the type of feedback displayed in the diagram. For this system involved, name the:

/3

(i) Endocrine gland(s)

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(ii) Target cell(s) involved

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(iii) Chemical messenger(s) released

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e) Describe the response in the target cell and the effect of the feedback on the endocrine gland when glucose levels are low.

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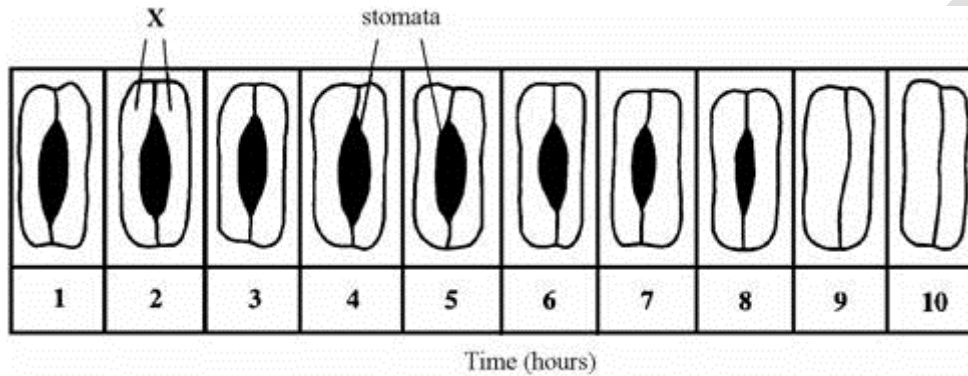
Total
Q15
/10

Question 16

Marker use

Both plants and animals require structural features and physiological responses to maintain water balance. The following questions relate to water balance in both plants and then animals.

- a) A potted plant was left in a hot, brightly lit room for ten hours. The plant was not watered during this period. The drawings show how the mean width of stomata changed over the ten-hour period.



- (i) Name the cells labelled X on the drawing.

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- (ii) The width of the stomata changed over the ten-hour period. Explain the advantage to the plant of this change in relation to homeostasis.

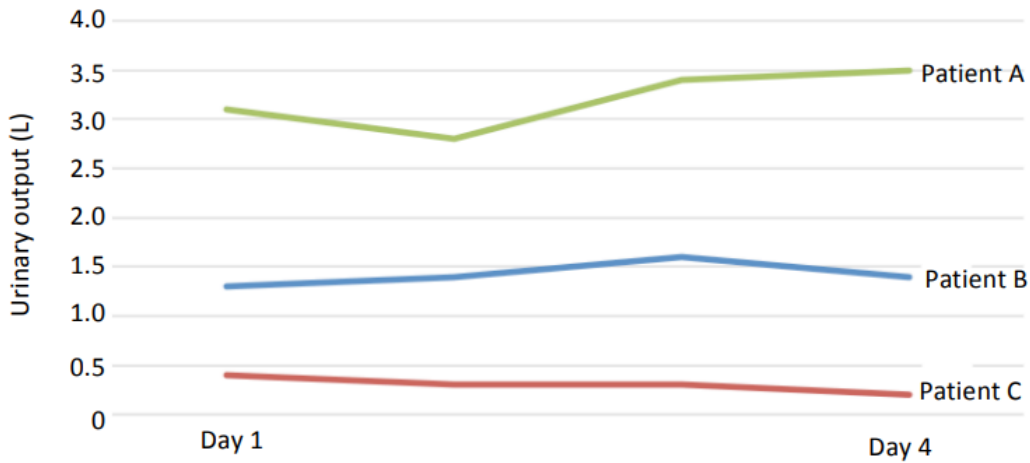
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/1

/3

Question 16 continues

b)
Different drugs can affect the production of ADH. Alcohol can cause a decrease in the amount of ADH being produced, while Ecstasy can cause an increase in the amount of ADH being produced. Three patients (A, B and C) involved in an outpatient clinic had a urine test conducted. All of their urine was collected and measured daily. The results are indicated in the graph below.



Patient B had normal results.

Which of these patients was likely to be a long-term alcoholic, and which patient was likely to be taking the drug Ecstasy? Explain your answer.

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Total
Q16
/8

End of Section C
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12

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BIOLOGY

BIO315124

Section **D**

Pages: 12

Questions: 5

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
 - Spare diagrams have been provided at the end of each 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 is provided in the instructions for each part.
- All answers must be written in **English**.
- The Biology Information Sheet can be used throughout this exam.
- You **must** make sure your answers address the listed criterion/criteria.

Marker use	
C7	/ 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
Section B	6	6	36 minutes	36
Section C	5	5	36 minutes	36
This Section D	5	5	36 minutes	36
Section E	6	6	36 minutes	36
Totals	27	27	180 minutes (3 hours)	180 marks

Criterion/Criteria

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

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

Question 17

Marker use

Humans have sophisticated immune responses to invading pathogens.

- a) Describe how **one structural and one biological barrier** prevents pathogens from entering the internal environment of the human body.

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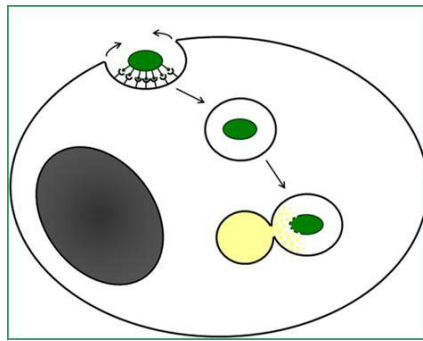
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- b) Outline how phagocytic cells protect the human body once a pathogen has gained entry to the internal environment by describing 1, 2 & 3 from the diagram

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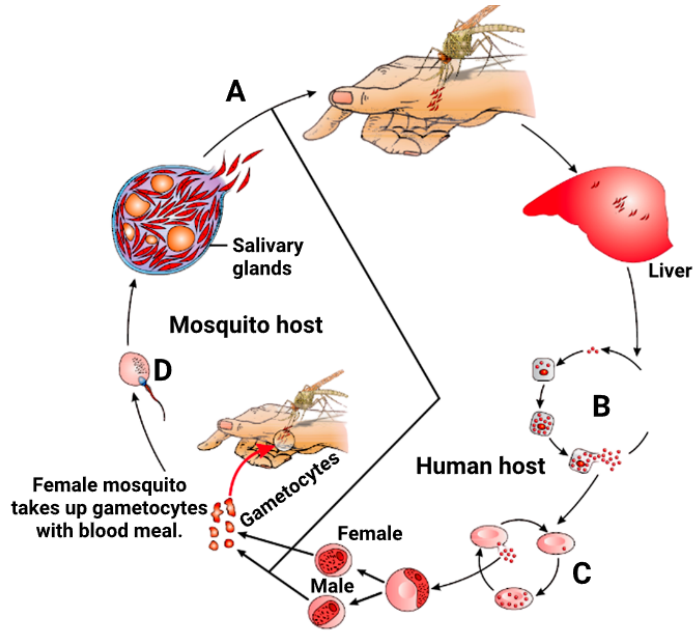
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Total
Q17
/5

Question 18

Marker use

The life cycle below represents how the malaria protist (plasmodium) is transmitted.



a) (i) What type of transmission is used by the malaria protist?

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(ii) Name the primary and secondary host in the life cycle above

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(iii) Describe **TWO** ways that could be used to reduce transmission of the disease malaria.

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Question 18 continues

Question 18 continued

Marker use

b) The malaria protists burrow into the liver cells where they divide to produce more copies of themselves. Most currently used vaccines work by getting the body to produce antibodies against the disease. Antibodies are unable to attack the malaria parasite once it has invaded liver cells and thus the approach of the Jenner Institute's Malaria Vaccines Programme has been to design vaccines that will induce potent T-cell responses against the liver stage of malaria infection.

(i) Explain how vaccines usually work by referring to the following statement from above: '*most currently used vaccines work by getting the body to produce antibodies against the disease*'.

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(ii) Explain how a T-cell response would be a more effective vaccine for malaria.

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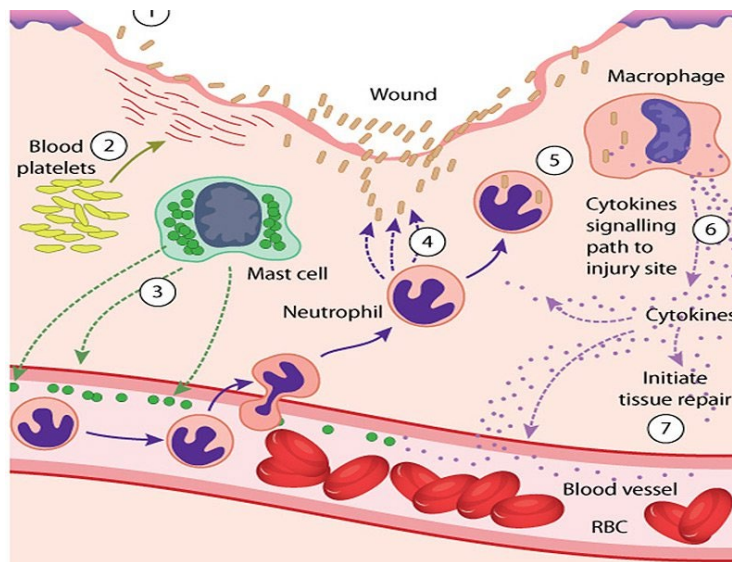
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/ 3

Total
Q18
/ 10

Question 19

Marker use



a) Name the immune response shown above.

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b) Which line of defence is this process associated with?

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c) How does histamine function within this response to promote healing?

(i) Circle on the diagram the cell that produces histamine.

(ii) How does histamine function within this response to promote healing?

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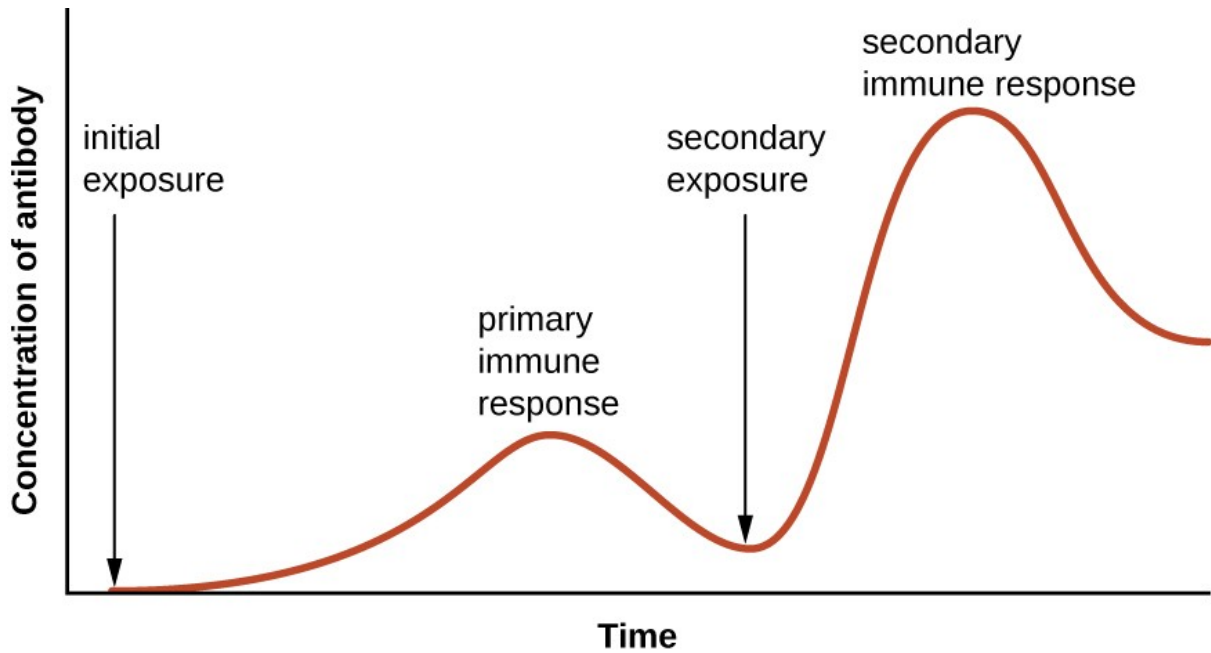
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Total
Q19
/6

Question 20

Marker use

A daily blood sample was obtained from an individual who received a single vaccination against a particular strain of influenza A virus. The individual had no prior exposure to this strain of influenza. The graph below shows the concentration of antibodies present in the individual's blood for this strain of influenza A over a period of 28 days.



a) On what day was the vaccination administered? Explain.

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/2

Question 20 continues

Question 20 continued

Marker use

b) What has occurred on day 22 to cause a dramatic rise in concentration of antibodies? Explain.

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c) Influenza A viruses are able to mutate, resulting in a change to the proteins on the surface of the influenza viruses' coat.

/3

Would the influenza A vaccine, provided in the above example, provide life-long immunity for the individual? Explain.

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d) State **ONE** way in which a high rate of immunisation in a population can restrict the spread of a disease.

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(i) Explain the significance of fever in response to influenza A infection.

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**Total
Q20**

/10

Question 21

Marker use

A park ranger was injected with an anti-venom serum to treat a snakebite. The treating doctor explained that the injection would not protect the ranger against future snakebites.

a) Name the type of immunity provided by the anti-venom.

/1

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b) Explain why anti-venom will not protect against future snake bites.

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c) Snake venom contains antigens which should stimulate an immune response in humans. Why, then, is anti-venom necessary?

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**Total
Q21
/5**

End of Section D
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BIOLOGY

BIO315124

Section **E**

Pages: 13

Questions: 6

Suggested working time: 36 minutes

Instructions:

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Marker use	
C8	/ 36

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Guide to Exam Structure

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This Section A	5	5	36 minutes	36
Section B	6	6	36 minutes	36
Section C	5	5	36 minutes	36
Section D	5	5	36 minutes	36
This Section E	6	6	36 minutes	36
Totals	27	27	180 minutes (3 hours)	180 marks

Criterion/Criteria

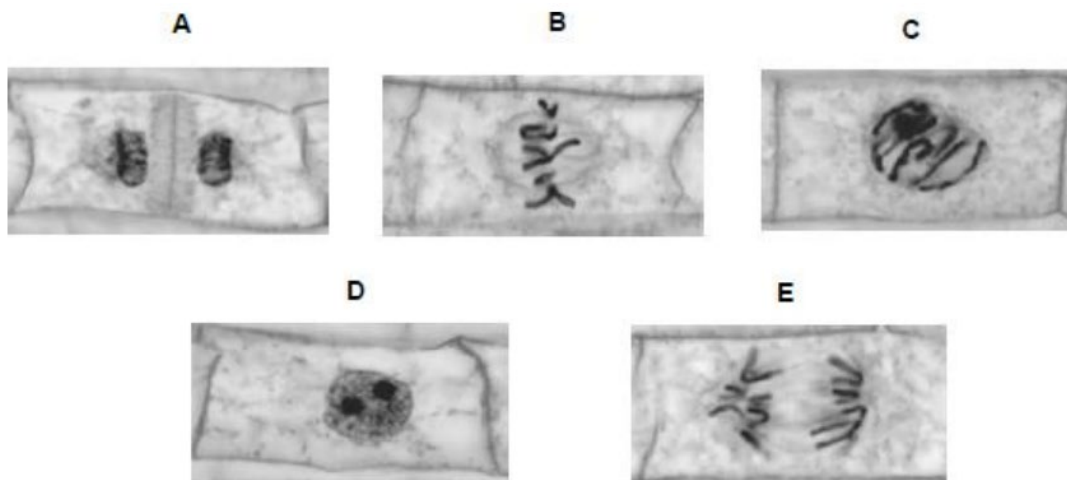
You **must** make sure your answers address:

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

Question 22

Marker use

The figure below shows some cells from an onion root tip at different stages of the cell cycle.



© Ed Reschke/Oxford Scientific/Getty Images

a) Place stages **A** to **E** in the correct order starting with **D**.

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/1

b) The student concluded that the cell in the image **E** above was in the anaphase stage of mitosis. Was she correct? Give two reasons for your answer.

/3

1:.....

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2:.....

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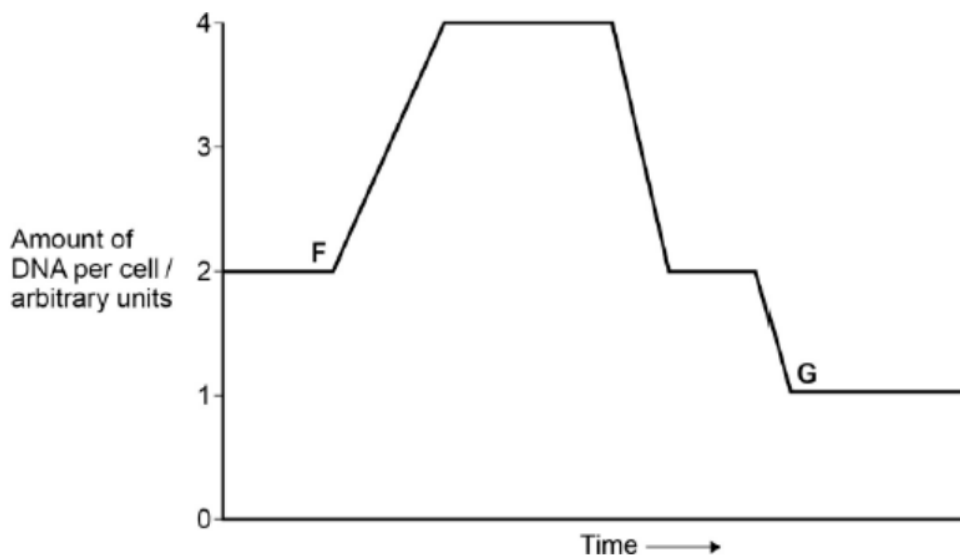
Total
Q22

/4

Question 23

Marker use

The figure below shows how the amount of DNA per cell changed during interphase and meiosis in an animal.



- a) Explain how the behaviour of chromosomes causes these changes in the amount of DNA per cell between **F** and **G**.

/ 4

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Question 23 continues

Question 23 continued

Marker use

b) What would happen to the amount of DNA per cell at fertilisation of cell G?

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c) During Prophase 1 in meiosis, a significant even occurs. Identify what this even is and explain why this event is important for the long-term survival of a species.

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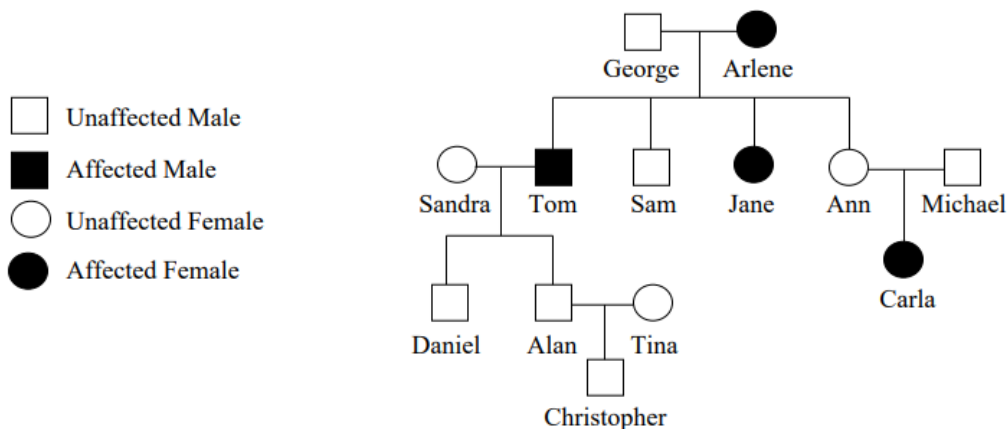
/ 3

**Total
Q23
/ 8**

Question 24

Marker use

- a) Alkaptonuria is a disease which causes body tissues and urine to be stained dark. The shaded areas in the diagram below represent an affected individual.



- (i) Explain whether alkaptonuria is caused by a dominant or recessive allele.

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- (ii) Explain using **TWO** pieces of evidence from the pedigree, why alkaptonuria is not an X linked disease.

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Question 24 continues

Question 24 continued

Marker use

(iii) Write the genotypes for the individuals listed below.

George:.....

Arlene:.....

Sam:.....

Sandra:.....

/2

(iv) If Ann and Michael were to have more children is there any chance the child will not have alkaptonuria? Show your working.

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/2

**Total
Q24
/9**

Question 25

Marker use

In the fruit fly *Drosophila melanogaster*, one gene determines hairiness and another determines body colour. When a pure-breeding (for both characteristics) hairy fly with black body is mated to a pure breeding (for both characteristics) hairless fly with grey body, all the flies produced in the next generation have hairy grey bodies.

a) Which characteristic, black body or grey body, is recessive? Explain your answer.

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/2

b) An individual from the F1 generation is crossed with a hairless parent. What proportion of hairy flies (regardless of body colour) would you expect? Show all working.

/2

c) If the F1 are allowed to mate among themselves, what proportion of their offspring will have the same phenotype as the F1? Show all working.

/3

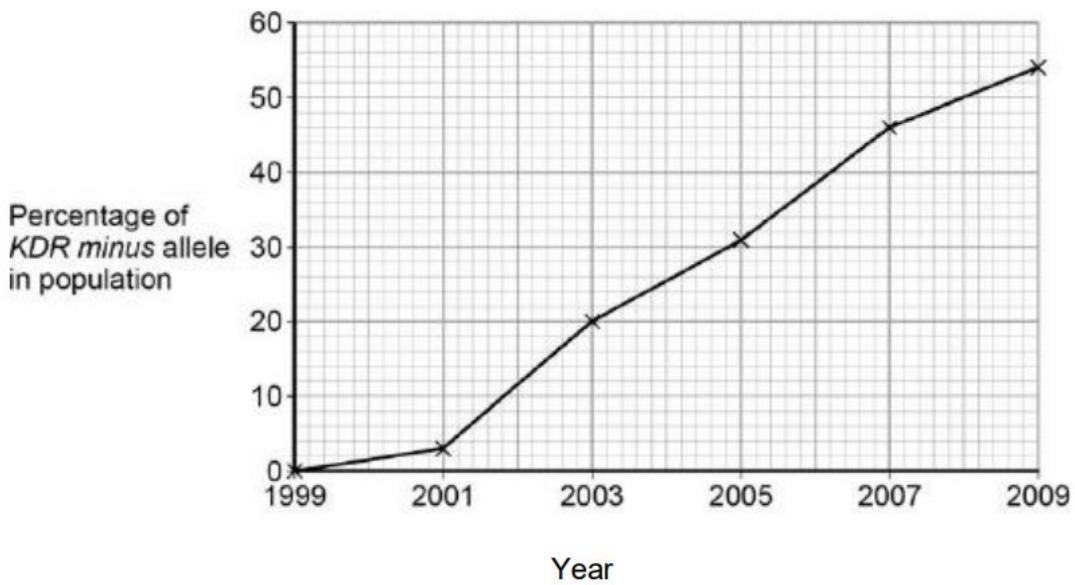
**Total
Q25
/7**

Question 26

Marker use

Malaria is a disease that is spread by insects called mosquitoes. In Africa, DDT is a pesticide used to kill mosquitoes, to try to control the spread of malaria. Mosquitoes have a gene called *KDR*. Today, some mosquitoes have an allele of this gene, *KDR minus*, that gives them resistance to DDT. The other allele, *KDR plus*, does not give resistance.

Scientists investigated the frequency of the *KDR minus* allele in a population of mosquitoes in an African country over a period of 10 years. The figure below shows the scientists' results.



a) Suggest an explanation for the results in the figure above.

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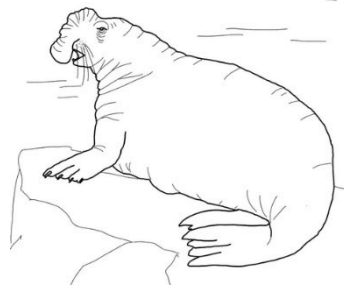
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Total
Q26
/5

Question 27

Marker use



Northern Elephant Seals, *Mirounga angustirostris*, were hunted by humans to the point of extinction. By the end of the 1890's there were only 20 Elephant Seals remaining on an isolated island. Their population today is approximately 100 000. Scientists have studied 24 alleles to find there to be no genetic variation.

Identify the mechanism(s) of evolution which may have reduced the genetic diversity found in today's Elephant Seals and explain what the consequences are of such a mechanism(s).

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Total
Q27
/3

End of Exam

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