Index No.:_____ AM05/I.21s

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2021 SECOND SESSION

SUBJECT:	**Biology**
PAPER NUMBER:	I
DATE:	4th October 2021
TIME:	4:00 p.m. to 7:05 p.m.

Directions to Candidates

- Write your index number in the space at the top left-hand corner of this page.
- Answer **ALL** questions. Write all your answers in the spaces provided in this booklet.
- The mark allocation is indicated at the end of each question. Marks allocated to parts of questions are also indicated.
- You are reminded of the necessity for good English and orderly presentation in your answers.
- In calculations you are advised to show all the steps in your working, giving your answer at **each** stage.
- The use of electronic calculators is permitted.

For examiners' use only:

Question	1	2	3	4	5	6	7	8	9	10	**Total**
Score											
Maximum	9	8	7	10	11	10	12	11	11	11	**100**

1. This question is related to heterotrophic nutrition.

   Secretin, Gastrin and Cholecystokinin (CCK) are hormones that are known to play an important role in the human digestive systems.

   a. Where are these hormones produced?

      Secretin: _____ (1)

      Gastrin: _____ (1)

      Cholecystokinin: _____ (1)

   b. What stimuli lead to the release of these hormones?

      Secretin: _____ (1)

      Gastrin: _____ (1)

      Cholecystokinin: _____ (1)

   c. List **ONE** function of each of these hormones.

      Secretin:_____

      _____ (1)

      Gastrin:_____

      _____ (1)

      Cholecystokinin:_____

      _____ (1)

(Total: 9 marks)

2. This question is related to the process of aerobic respiration.

Figure 1 shows an electron micrograph of the mitochondrion, the organelle in which aerobic respiration takes place.

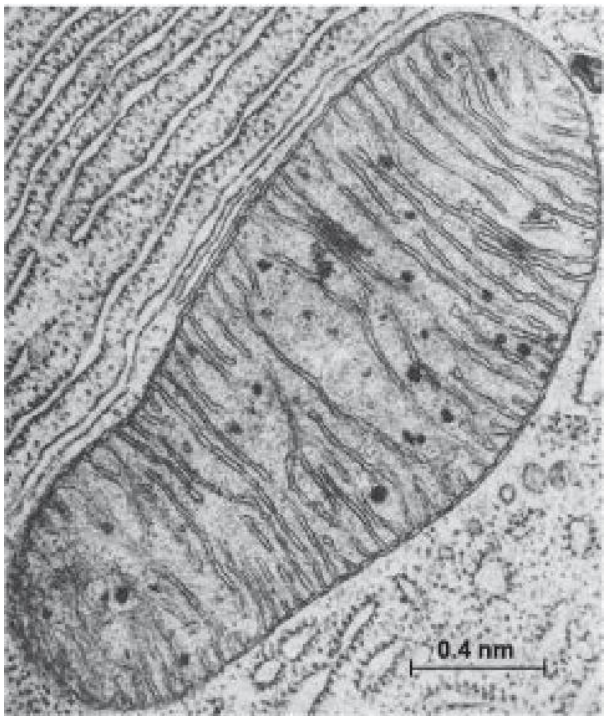


Figure 1: an electron micrograph of the mitochondrion
(Source : https://www.researchgate.net)

a. On Figure 1, clearly mark and label:
   i. using the letter A - the site of glycolysis; (1)
   ii. using the letter B - the site of Krebs' cycle; (1)
   iii. using the letter C - the site of the electron transport chain. (1)

b. How does glucose enter the cell from the surrounding tissue fluid?

_____ (1)

c. Why does glucose undergo phosphorylation upon entering the cell?

_____ (1)

d. What is the role of Nicotinamide Adenine Dinucleotide (NAD) in aerobic respiration?

_____ (1)

e. Why would a lack of oxygen interrupt the process of aerobic respiration?

_____

_____ (2)

(Total: 8 marks)

Questions continue on next page

3. This question concerns biotechnology

a. i. What is the role of restriction endonuclease enzymes?

_____ (1)

ii. Give **ONE** example of a restriction endonuclease enzyme.

_____ (1)

b. What is the function of ligase?

_____ (1)

c. PCR is commonly used in biotechnology.

i. What does PCR stand for?

_____ (1)

ii. Explain the function of PCR in biotechnology.

_____ (1)

iii. What must be present in the reaction mixture for PCR to take place?

_____

_____ (2)

(Total: 7 marks)

4. This question is to related to biomolecules.

   a. The diagram below shows part of a polynucleotide.

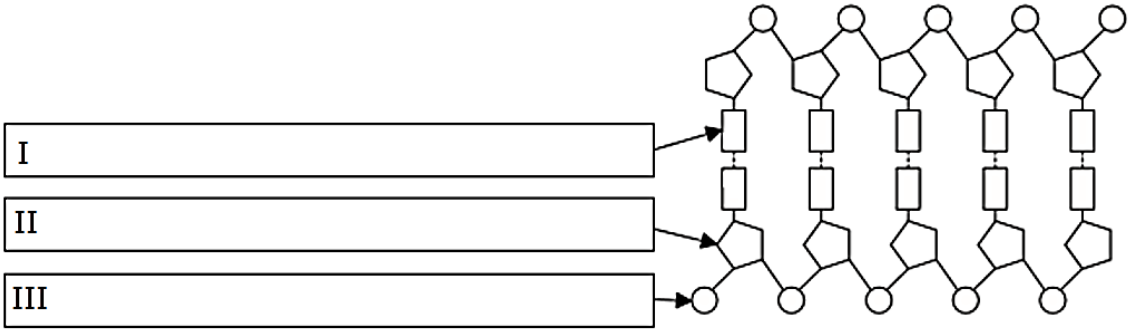


Figure 2: Part of a polynucleotide

   i. On the diagram, draw a circle round **ONE** nucleotide. (1)

   ii. In the spaces allocated, name the chemical groups labelled I, II and III. (3)

   b. Name a base which is present in RNA but absent in DNA.

   _____ (1)

   c. Complete using the correct word.

   In a DNA molecule there are four major bases, two purines and two pyrimidines. The purines are _____ and _____, while the pyrimidines are _____ and _____. The possible base pairings are _____ with _____ and _____ with _____. The sugar in DNA is _____. The bases on the two adjacent strands of the DNA molecules are held together by _____.

   (5)

(Total: 10 marks)

Questions continue on next page

5. This question is about replication of nucleic acids.

   a. What mode of replication is used in the process by which DNA replicates?

   _____ (1)

   b. Both DNA strands act as templates during replication. The scientist Reiji Okazaki discovered that one of the templates is synthesized in fragments which he termed as Okazaki fragments.

      i. Explain why one of the strands is synthesized in fragments.

      _____

      _____

      _____ (2)

      ii. On the diagram below (Figure 3) clearly show which strand would be wholly synthesized and which one would be synthesized in fragments. (2)

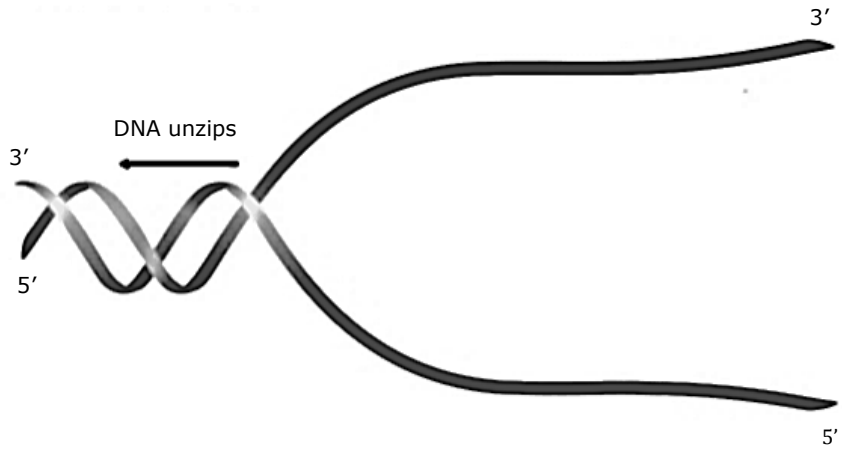


Figure 3: DNA molecule undergoing replication
(*Adapted from: https://www.yourgenome.org*)

   c. A scientist performed an experiment to determine the effects of mutations on the genetic code. By making reference to the characteristics of the genetic code give a brief explanation for the following observations:

      i. Point mutations may still lead to the expression of the same protein.

      _____

      _____

      _____ (2)

ii. Point mutations occurring at the start or the end of a gene may lead to ineffective gene translation.

_____

_____

_____ (2)

iii. Frame-shift mutations always lead to non-sense mutations.

_____

_____

_____ (2)

(Total: 11 marks)

6. This question is about human reproduction.

a. Complete the following table (Table 1) by filling in the appropriate hormone with the assigned description. Each hormone can be used more than once.

Table 1

Description	Hormone
Responsible for the thickening of the endometrium.	
Without such, menses would occur.	
Produced by the thecae and stored within the antrum (in the follicle) during follicular development and oogenesis.	
Induces ovulation.	
Maintains the endometrial thickening.	

(5)

Hormones play a vital role in gametogenesis.

b. What type of feedback mechanism is primarily exhibited during gametogenesis?

_____ (1)

Question continues on next page

c. Describe and explain **TWO** ways in which the human sperm cell is specialised for its function.

_____

_____

_____

_____

_____

_____(4)

(Total: 10 marks)

7. This question is about biogeochemical cycles.

Both energy and matter cycle through various aspects of ecosystems. Nitrogen is a good example of an element that is incorporated within various biotic and abiotic variables present within ecosystems. Figure 4 (below) is a simplified version of the nitrogen cycle.

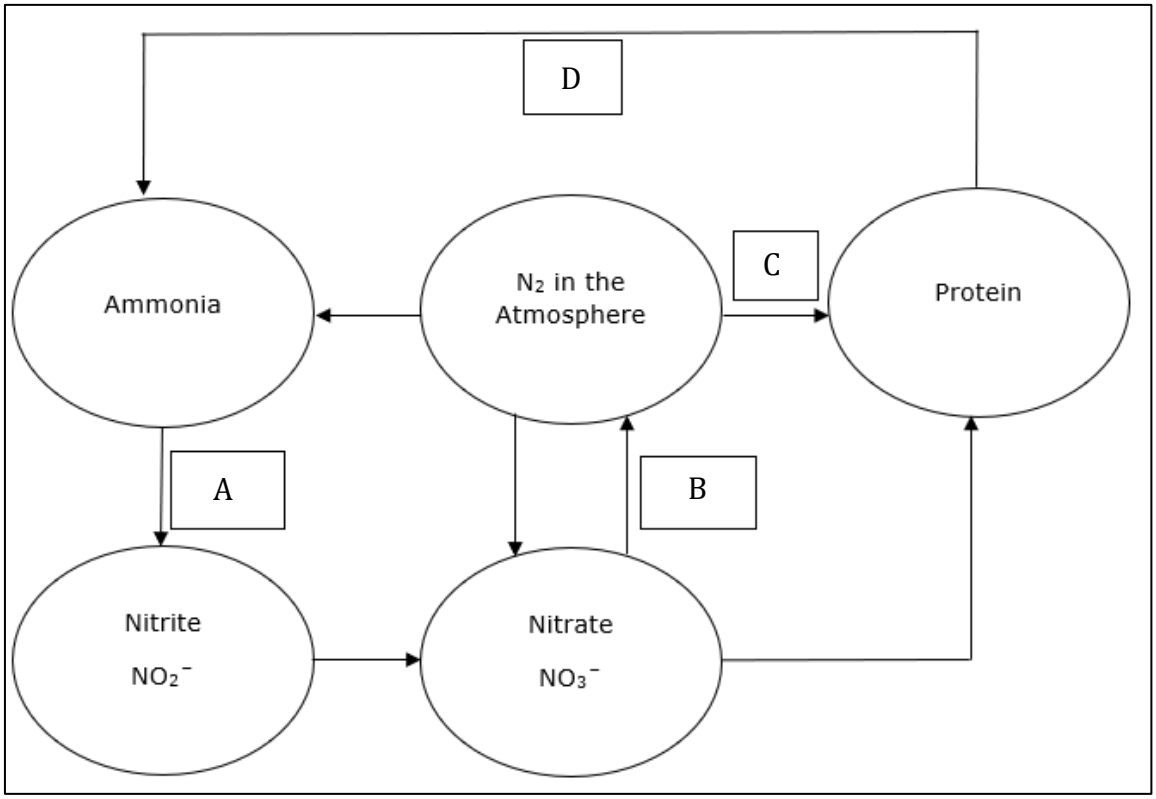


Figure 4: Simplified Nitrogen cycle
(*Adapted from: www.researchgate.net*)

a. The labelled boxes in Figure 4 represent microorganisms that play a key role in the cycle. Give the type of the microorganisms denoted by the following labels:

A. _____ (1)

B. _____ (1)

C. _____ (1)

D. _____ (1)

b. With reference to the Nitrogen cycle, explain what would happen if the following would be observed:

i. Industrial activities that utilise ammonia increase.

_____

_____ (2)

ii. Excess nitrates accumulate within the soil.

_____

_____ (2)

iii. Leguminous plants numbers are severely reduced.

_____

_____ (2)

iv. Lack of rainfall throughout the year, thus very minimal water is present in soil.

_____

_____ (2)

(Total: 12 marks)

Questions continue on next page

8. This question is about locomotion and support.

Figure 5 is showing a longitudinal view of a myofibril, which is revealing the reason for the striated appearance of skeletal muscle.

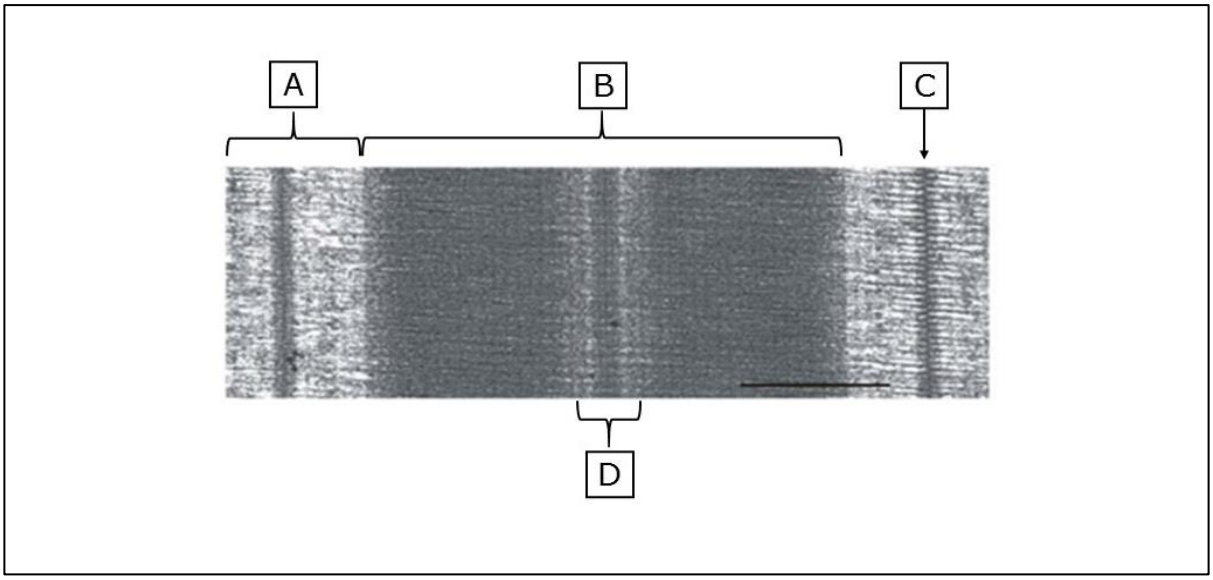


Figure 5: Fine structure of skeletal muscle.
(Adapted from: https://www.researchgate.net)

a. Identify structures A to D.

A: _____ C: _____

B: _____ D: _____

(2)

b. Clearly mark and label the M line and the Sarcomere on Figure 5. (1)

c. How are structures A, B, and D different from one another?

_____

_____

_____ (3)

d. What happens to structures A, B, and C when the sarcomere contracts?

_____

_____

_____ (3)

e. Mention **TWO** accessory proteins that play an important role during muscle contraction.

_____ (2)

(Total: 11 marks)

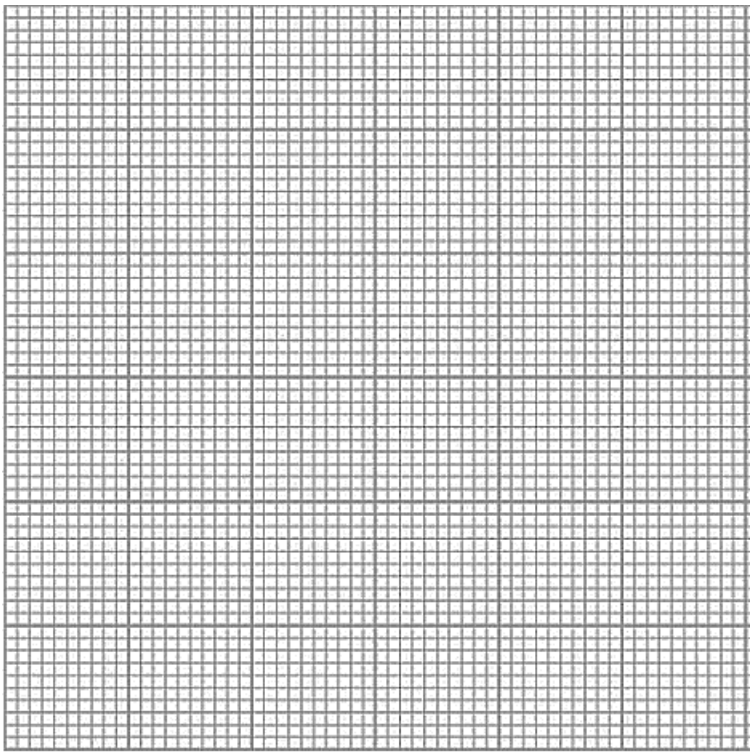
9. This question is about thermoregulation.

Table 2 shows the relationship between the external (environmental) and internal (body) temperatures in two different animals.

Table 2: The effects of the external temperature on two different animals.

Environmental temperature (°C)	**Body temperature (°C)**	
	Animal A	**Animal B**
5	5	36
10	10	37
15	15	37
20	20	37
25	25	37
30	29	37
35	36	37
40	41	37
45	44	37

a. Use the data in Table 2 to plot a graph to show how the environmental temperature is affecting the body temperature of the two animals. (3)



Question continues on next page

b. Distinguish which organism is an ectotherm and which organism is an endotherm. Use the graph to explain your answer.

_____

_____

_____

_____

_____

_____ (4)

c. The mammalian skin is the organ of the body in contact with the environment and therefore monitors the changing temperatures. Identify and briefly explain **TWO** characteristics that the skin depicts to lose excess heat.

_____

_____

_____

_____

_____

_____ (4)

(Total: 11 marks)

10. This question is about the liver.

a. Complete Table 3 below by distinguishing between glycogenolysis and glycogenesis.

Table 3: Comparison between glycogenolysis and glycogenesis.

	Glycogenolysis	**Glycogenesis**
Role		
Stimulated by		
Inhibited by		

(6)

b. Explain how the following components are associated with bile formation and function.

i. Duodenum.

_____ (1)

ii. Liver.

_____ (1)

iii. Gall bladder.

_____ (1)

c. The body is unable to store excess amino acids taken in the diet. Amino acids which are not used must be removed. This takes place in the liver in two main stages: deamination and detoxification. Briefly explain how deamination is different from detoxification?

_____

_____

_____

_____ (2)

(Total: 11 marks)

Blank Page

Blank Page

Blank Page

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2021 SECOND SESSION

SUBJECT:	**Biology**
PAPER NUMBER:	II
DATE:	5th October 2021
TIME:	4:00 p.m. to 7:05 p.m.

Directions to Candidates

- Answer the question in Section A, any **TWO** questions from Section B and **ONE** question from Section C. Write all your answers in the separate booklet provided.
- If more than two questions from Section B are attempted, only the first two answers shall be taken into consideration.
- If more than one question from Section C is attempted, only the first answer shall be taken into consideration.
- The mark allocation is indicated at the end of each question. Marks allocated to parts of questions are also indicated.
- You are reminded of the necessity for good English and orderly presentation in your answers.
- In calculations you are advised to show all the steps in your working, giving your answer at each stage.
- The use of electronic calculators is permitted.

SECTION A

1. Read carefully the following extract. Then using the information provided and your knowledge of Biology, answer the questions that follow. The numerals in the left-hand margin are the line numbers.

Climate change may push Zika virus into southern and eastern Europe

Rising temperatures due to climate change may lead to the spread of the mosquito-borne Zika virus to currently cooler regions. Under the most drastic model of global warming, the risk of Zika transmission will increase over southern and eastern Europe, the northern US, northern China and southern Japan by 2080.

Marcus Blagrove at the University of Liverpool in the UK and his colleagues looked at two opportunistic species of mosquitoes which are ectoparasites capable of spreading Zika virus. These two species, *Aedes albopictus* and *Ochlerotatus detritus,* are common in temperate biomes.

Groups of these mosquitoes were given Zika virus exposed to temperatures between 17 and 31°C. The researchers then studied their lifespans and Zika virus infectivity at different temperatures. They found that Zika virus was present in the insects' salivary glands – and that therefore they were infectious – at temperatures of 19°C and above.

Mosquitoes are unable to regulate their own heat, so the temperature of their bodies is the same as the surrounding environment, says Blagrove. "The warmer the environment is, the warmer the mosquito, which allows the virus to replicate faster," he says. "That tends to be why mosquito-borne viruses have major outbreaks in hot countries, particularly at hot times of year."

Outbreaks of Zika virus have previously occurred in South and Central America, south-east Asia and parts of Africa. In lower temperatures in the real world, the virus may take so long to replicate that the mosquito dies before it becomes infectious.

Based on lifespan and infectivity, the researchers created risk maps of the rate of Zika virus spread over different regions globally. At present, only a few areas in Europe, such as along the Mediterranean coast, are warm enough for Zika virus to be potentially transmitted.

The team used existing forecasting models of climate change to model the Zika virus transmission risk between 2050 to 2080. Even under an optimistic scenario, in which carbon emissions start declining in 2020 and reduce to zero by 2100, the risk zone for Zika virus spread would extend up into the southern US states, as well as further into China and Europe.

For particularly warm years in future, policymakers may have to consider measures such as reducing mosquito populations, says Blagrove.

Adapted from New Scientist July 2020.

a. What is the role of mosquitoes in the Zika virus transmission? (1)

b. What are the genus names of the two mosquito species mentioned in the passage? (2)

c. Mosquitoes are ectoparasites (line 6). Define the term ectoparasite. (2)

d. Mosquitoes are classified in the class Insecta.

   i. Give the name of the phylum, the class Insecta is in. (1)

   ii. List **TWO** other classes found in this phylum. (2)

   iii. List **TWO** diagnostic features found in mosquitoes that indicate that they form part of the class Insecta rather than the other two classes mentioned as an answer to part (ii). (2)

   iv. During its lifespan, a mosquito can undergo complete metamorphosis. Define the term complete metamorphosis. (2)

e. List the **TWO** basic components that make up a virus. (2)

f. The two mosquito species mentioned in the passage "are common in temperate biomes" (line 7). Define the term biome. (1)

g. "Mosquitoes are unable to regulate their own heat, so the temperature of their bodies is the same as the surrounding environment" (lines 12-13). Give the biological term used to describe this statement. (1)

h. Mosquitoes are described as opportunistic species (line 6). Explain. (3)

i. "For particularly warm years in future, policymakers may have to consider measures such as reducing mosquito populations, says Blagrove" (lines 26-27). List **TWO** measures that may be used during the warm years to reduce mosquito populations. (2)

j. Explain global warming (line 2) in terms of the greenhouse effect. (2)

k. Mention **TWO** effects of climate change, other than those mentioned in the passage. (2)

(Total: 25 marks)

SECTION B

Answer any TWO questions from this section; your answers should take the form of essays. Each question carries twenty five marks.

1. Give a detailed account of the life-cycles of mosses and ferns.

2. The endocrine system works together with the nervous system to regulate many aspects of the human body. Compare and contrast these two body systems.

3. Give an account of the transport of water and solutes in plants.

4. Nuclear division in somatic cells differ from that of germ-line cells. Give a detailed account on the phases of both.

(Total: 50 marks)

Please turn the page.

SECTION C
Answer ONE question from this section.

1. Use your knowledge of Biology to distinguish between the following pairs:

   a. directional selection and disruptive selection; (5)

   b. balanced polymorphism and transient polymorphism; (5)

   c. radial and bilateral symmetry; (5)

   d. primary and secondary active transport; (5)

   e. lysosomes and peroxisomes. (5)

OR

2. Use your knowledge of Biology to explain the following statements:

   a. A courtship ritual ensures that the blue-footed booby bird (*Sula nebouxii*) only mates with males of the same species even though it shares its habitat with several other species of the same genus which share various similarities. (5)

   b. In reality, the Hardy-Weinberg principle is not a reliable way that can be used to determine whether the genetic structure of a population is changing. (5)

   c. A climax community is the result of changes in species composition and abundance through time. (5)

   d. Active immunity always results in long-term effects unlike passive immunity which is always short-term. (5)

   e. Inbreeding increases the chance of the expression of recessive diseases. (5)

(Total: 25 marks)

Index No.:_____ AM 05/III.21s

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2021 SECOND SESSION

SUBJECT:	**Biology**
PAPER NUMBER:	III
DATE:	6th October 2021
TIME:	4:00 p.m. to 7:05 p.m.

Directions to Candidates

- Write your index number in the space at the top left-hand corner of this page.
- Answer **ALL** questions. Write all your answers in the spaces provided in this booklet.
- The mark allocation is indicated at the end of each question. Marks allocated to parts of questions are also indicated.
- You are reminded of the necessity for good English and orderly presentation in your answers.
- In calculations you are advised to show all the steps in your working, giving your answer at each stage.
- The use of electronic calculators is permitted.

For examiners' use only:

Question	1	2	3	1	**Total**
Score					
Maximum	17	16	17	40	**90**

Section A: Answer all questions.

1. This question is about biodiversity and classification of organisms.

   a. The organisms shown in Figures 1 and 2 belong to the Phylum Annelida.
      i. Identify the Class for **each** of these two species. (2)

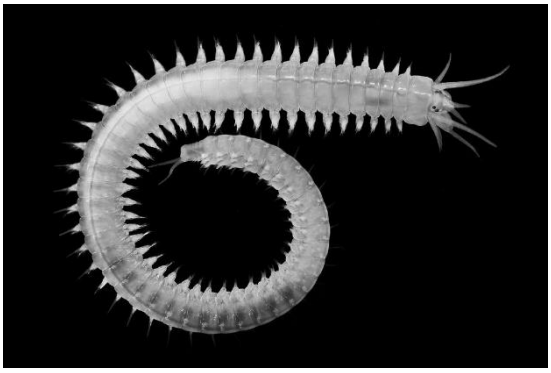


Figure 1
Source: https://o.quizlet.com

Class: _____

Figure 2
Source : https://o.quizlet.com

Class:_____

ii. Name the type of segmentation found in both organisms.

_____ (1)

iii. Define the type of segmentation mentioned as an answer to part (ii) above.

_____ (1)

iv. Identify **ONE** visible characteristic feature, other than segmentation, for **each** of these two annelids, and describe the function of these features. (4)

Figure 1	visible characteristic feature:
	function:
Figure 2	visible characteristic feature:
	function:

b. Figure 3 shows an animal which is frequently found in the countryside.

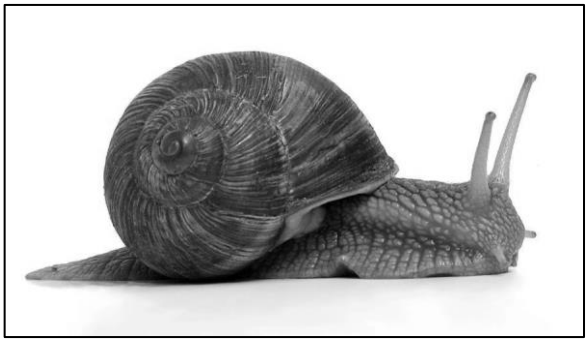


Figure 3
(Source: https://upload.wikimedia.org/wikipedia)

i. Identify the Phylum and Class.

Phylum: _____ (1)

Class: _____ (1)

ii. Carefully observe Figure 3 and complete the following paragraph:

This organism is characterised by the presence of a calcareous _____ which is coiled in a _____ pattern. The organism has two pairs of _____, the upper pair bears _____ at the tip. A muscular _____ lies beneath the shell. Unlike the organisms shown in Figures 1 and 2, this organism does not show any visible _____. (3)

c. The organisms in Figures 4 and 5 belong to the same Phylum.

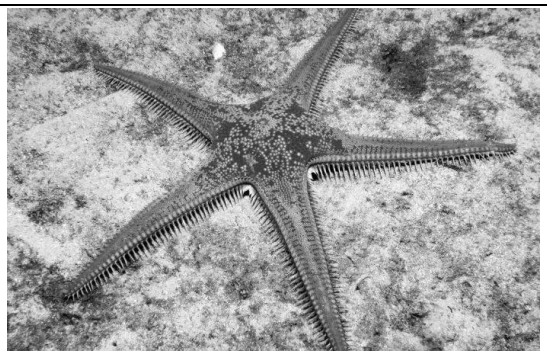


Figure 4
Source: https://www.atlantisgozo.com

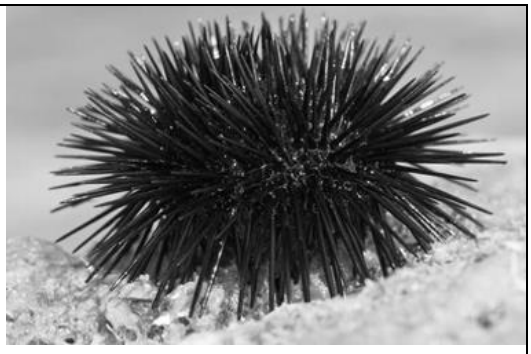


Figure 5
Source: https://image.shutterstock.com/

i. Name the Phylum to which the organisms shown in Figures 4 and 5 belong.

_____(1)

Question continues on next page

ii. Identify the Class for **each** of these two species.

Figure 4: _____(1)

Figure 5: _____(1)

iii. What kind of symmetry is exhibited by both organisms (Figures 4 and 5)?

_____ (1)

(Total: 17 marks)

2. This question is about enzymes.

Amylase is a hydrolytic enzyme, produced in the saliva, which catalyzes the hydrolysis of starch into maltose.

$$\text{starch} + H_2O \xrightarrow[\text{(amylase)}]{\text{salivary enzyme}} \text{maltose}$$

An experiment was carried out to investigate the effect of using different concentrations of amylase solution on the rate of the reaction.

a. Using a suitable indicator, the disappearance of starch as catalysed by the enzyme, was used to determine the progress and rate of the reaction.

i. Which indicator was used in this experiment?

_____ (1)

ii. What colour changes did the scientist expect to observe?

_____ (1)

b. Several test-tubes were filled with 5 cm^3 of water each and 6 drops of the indicator identified in your answer to part a (i) were added to each tube and mixed thoroughly. To the first test-tube labelled X, a drop of 1% starch solution was added, whilst a drop of amylase solution was added to another test-tube labelled Y. The remaining tubes were set aside to be used later during the experiment to test for the presence of starch.

i. What are test-tubes X and Y called and what is their function for the purpose of this experiment?

_____

_____

_____

_____

_____

_____ (2)

Five test-tubes labelled A to E were used to prepare the different enzyme concentrations shown in Table 1. Five other test-tubes were labelled *a to *e, and 5 cm^3 of 1% starch solution were pipetted into each tube. Test-tubes A to E and *a to *e were put in a 35°C water bath for five (5) minutes.

The contents of test-tube *a were then added and mixed to the contents of test-tube A. On mixing, the timer was started to time the reaction.

At regular intervals, 1 cm^3 of the enzyme/substrate mixture was withdrawn from the reaction test-tube A and added to a test-tube containing the indicator. The time taken until no observable colour change occurred upon the addition of the enzyme/substrate mixture to the indicator was recorded as the time required for the complete digestion of starch present.

These steps were repeated for the other four test-tube combinations, that is, B with *b, C with *c, D with *d and E with *e.

The results of this experiment were tabulated in Table 1 (next page).

Question continues on next page

Table 1: Results – rate of reaction at different enzyme concentrations

Test Tube	**Salivary Amylase Concentration (%)**	**Time for digestion of starch (s)**	**Rate of Hydrolysis Reaction (s^{-1})**
A	1	660	0.0015
B	2	300	0.0033
C	5	135	0.0074
D	10	55	0.0182
E	20	50	0.0200

c. Why did the scientist put test-tubes A-E and *a-*e in a 35°C water bath?

_____

_____

_____

_____ (2)

d. What would have happened to the hydrolysis reaction had the scientist put the test-tubes in a water bath set at 80°C instead? Explain.

_____

_____

_____

_____ (2)

e. Using the results obtained in this experiment (Table 1), describe the relationship between enzyme concentration and the rate of the hydrolysis reaction. Explain these results in terms of enzyme-substrate complex formation.

_____

_____

_____

_____

_____

_____ (3)

f. Using the results tabulated in Table 1, how would the rate of the reaction change if the scientist keeps increasing the enzyme concentration up to 55% Salivary Amylase solution? Explain your answer.

_____

_____

_____

_____

_____

_____ (3)

g. If the scientist were to put a pH 2 tablet into each of the test tubes *a-*e, turning the pH of these tubes very acidic, how would the results obtained in Table 1 change? Explain your answer.

_____

_____

_____

_____

_____ (2)

(Total: 16 marks)

Questions continue on next page

3. This question is about photosynthesis.

A biology student wanted to study the effects of varying the light intensity on the rate of photosynthesis. She set up the apparatus shown in Figure 6.

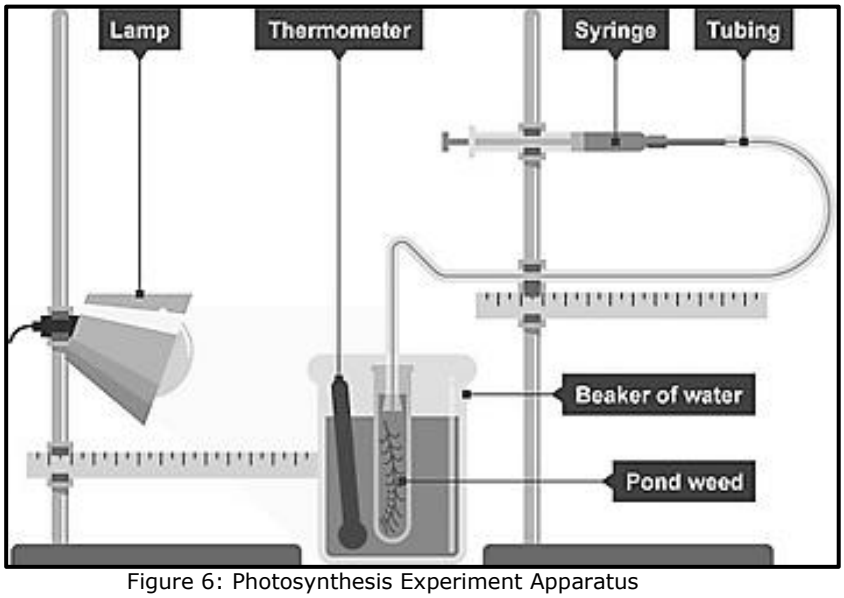


Figure 6: Photosynthesis Experiment Apparatus
Source: http://brilliantbiologystudent.weebly.com

The student used a freshly cut piece of a healthy *Elodea* plant and put it stem end up, in the test tube containing 1% aerated sodium hydrogencarbonate solution. The tube was placed in a beaker filled with water and the temperature was noted. She made sure that the capillary tubing and syringe were filled with the sodium hydrogencarbonate solution and that no air bubbles were trapped anywhere in the system.

The student switched off all the lights in the laboratory. She placed a lamp, as the only light source, 15 cm away from the beaker and allowed the plant to acclimatise for 3 minutes until a steady evolution of bubbles could be observed. Then, she started the timer and collected the volume of gas generated over a time interval of 5 minutes. Using the syringe, she drew the gas bubbles into the tubing and measured the length of the gas column produced.

This experiment was repeated three more times, each time increasing the distance between the lamp and the plant. The temperature of the water in the beaker was checked regularly and the water was replaced with a fresh supply as required.

The results of the experiment were noted and tabulated as shown in Table 2 below.

Table 2: The Effect of Light Intensity on the Rate of Photosynthesis – Experiment Results

Distance from light source (d) (units: cm)	Length of gas bubble (l) (units: mm)
15	30
25	20
35	15
45	11

a. Explain the use of the sodium hydrogencarbonate solution in this experiment.

_____

_____ (1)

b. Explain how the beaker of water was used to increase the accuracy of the results.

_____

_____ (1)

c. Mention **ONE** other precaution the student took to reduce inaccuracies in her experiment results.

_____ (1)

The intensity of light (I) falling on a given object, is inversely proportional to the square of the distance of the plant from the source (d). Using this relationship, the student calculated the varying light intensity as $1000/d^2$. She tabulated the results of her calculations in Table 3.

Questions continue on next page.

d. Using the results provided in Table 2 (can also be accessed from Table 3) and the two equations explained below, calculate the rate of oxygen production by photosynthesis for the varying light intensities used in this experiment. Input your results in Table 3 below.

Equations:

$$V=\pi r^2 l$$

where:
V = volume of gas collected (mm^3)
r = radius of the tubing = 0.5mm and
l = length of gas bubble collected as tabulated in Table 2
π = 3.14

and

$$\text{Rate of Oxygen Production } (mm^3/min) = V/t$$

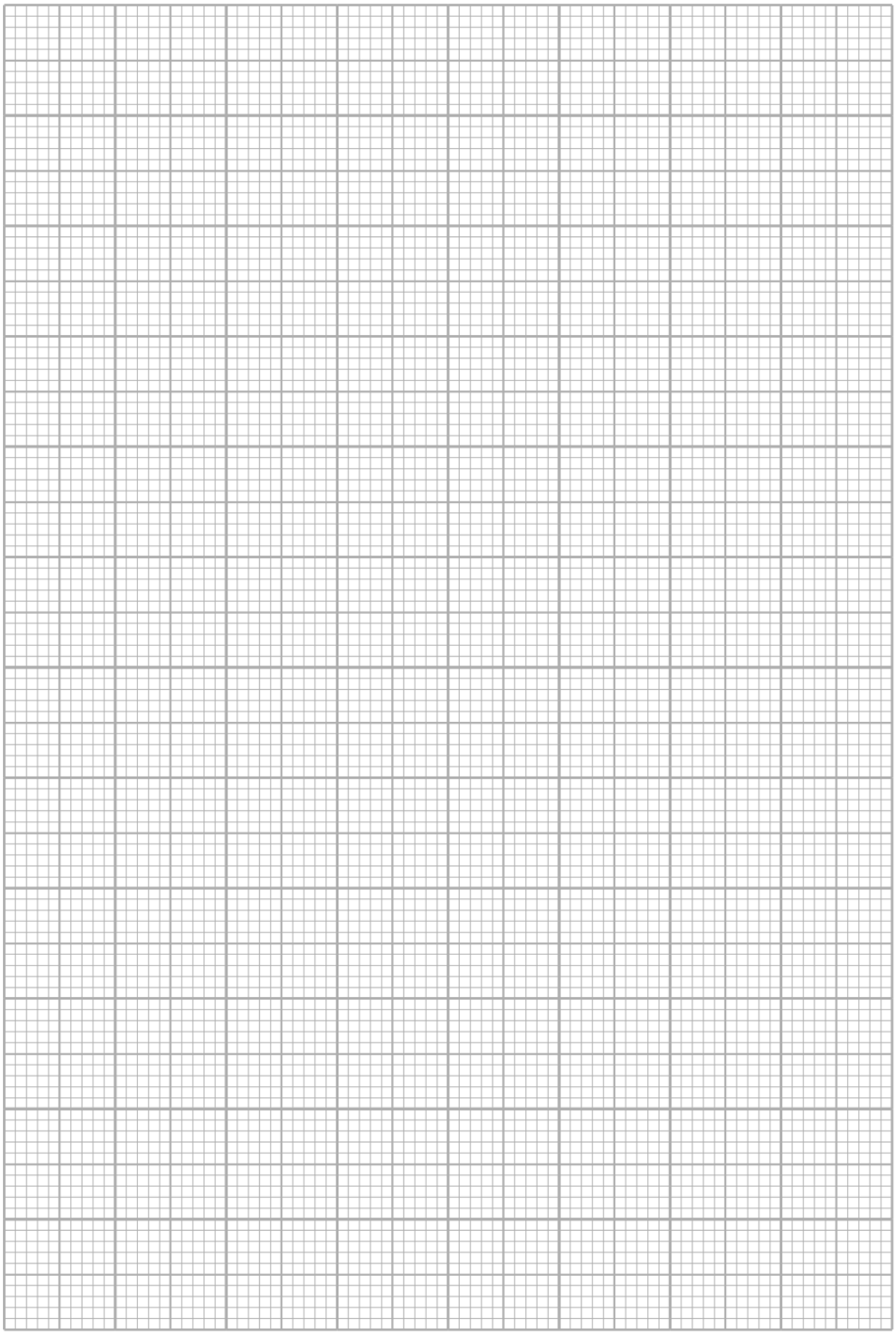
where:
V = volume of gas collected (mm^3)
t = time interval used to collect the bubbles, that is, 5 minutes

Table 3: Calculations

Distance from light source (d)	Light Intensity (I)	Length of gas bubble (l)	Volume of Gas Collected (V)	Rate of Oxygen Production
(cm)	($1000/d^2$)	(mm)	(mm^3)	(mm^3/min)
15	4.44	30		
25	1.60	20		
35	0.82	15		
45	0.49	11		

(8)

e. On the graph paper, plot a graph of the rate of oxygen production (mm^3/min) against varying light intensity ($1000/d^2$). (4)



Questions continue on next page.

f. Explain the relationship between light intensity and the rate of oxygen production (hence the rate of photosynthesis), as demonstrated by your graph.

_____

_____

_____

_____

_____

_____ (2)

(Total: 17 marks)

Section B: Answer all parts to this question.

1. Water potential is a measure of the tendency of water molecules to move from one area to another. When tissue samples are left in a range of solutions of different concentrations for a certain period of time, the solution that does not induce an increase or decrease in the mass or volume of the tissue has the same water potential as the tissue.

   You are required to devise an experiment to determine the water potential of potato tissue.

   You are provided with the following materials:

   - potato;
   - sucrose solutions with the following concentrations: 0.2 M, 0.4 M, 0.6 M, 0.8 M and 1.0 M;
   - petri dishes;
   - weighing balance;
   - ruler;
   - distilled water;
   - other laboratory apparatus as required.

   a. State the aim of your biological investigation.

   _____

   _____

   _____ (2)

   b. List and justify **TWO** precautions that should be taken.

   _____

   _____

   _____

   _____

   _____

   _____ (4)

   c. Using the material provided, devise and describe an experimental procedure that may be used in order to find the water potential of potato tissue.

   NB: There are different methods that can be used to find the water potential. You need to give only **ONE** method.

Questions continue on next page.

(12)

The graph shown in Figure 7 shows results obtained in an experiment to determine the water potential of potato tissue.

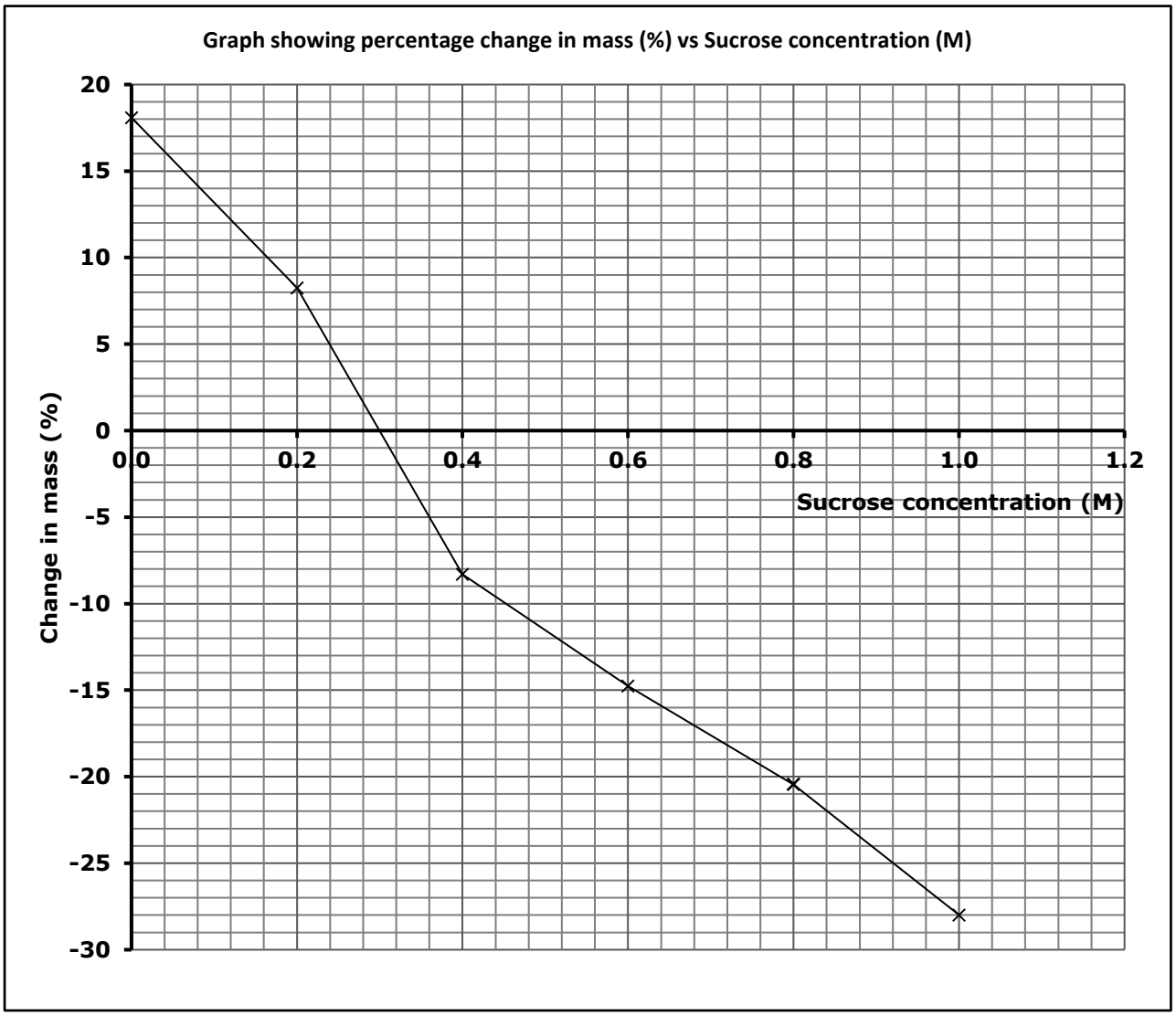


Figure 7: Graph showing percentage change in mass versus sucrose concentration.

d. Briefly describe any trend that emerges from the graph.

_____

_____

_____

_____

_____

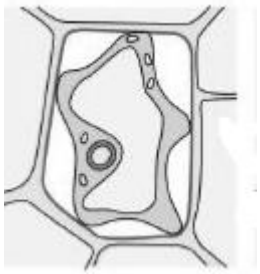
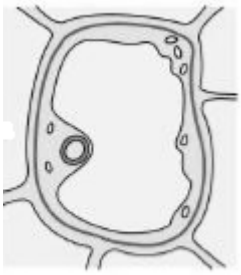
_____ (3)

Questions continue on next page.

e. Use your biological knowledge to give a detailed explanation of the results.

(6)

f. A section of potato tissue from two different solutions was taken and each was mounted on a slide. Figures 8 and 9, below, show a simplified diagrammatic representation of the observations. Identify possible concentrations from where the cells were taken and explain why.

i.	 Figure 8 *(Source: http://friedbiochem.weebly.com/)*	(3)
ii.	 Figure 9 *(Source: http://friedbiochem.weebly.com/)*	(3)

g. Use the graph and Table 4 below to determine the water potential of the potato tissue and explain how you arrived at your answer.

Table 4: Table to convert molarity to solute potential (kPa)

Sucrose concentration (M)	**Solute potential (kPa)**
0.0	0
0.1	-247
0.2	-494
0.3	-740
0.4	-987
0.5	-1234
0.6	-1481
0.7	-1728
0.8	-1974
0.9	-2221
1.0	-2468

_____

_____

_____

_____

_____

_____

_____

_____ (5)

h. List **TWO** sources of error in your investigation.

_____

_____ (2)

(Total: 40 marks)

BLANK PAGE

BLANK PAGE

BLANK PAGE