



**L-Università
ta' Malta**

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
2025 SUPPLEMENTARY SESSION**

SUBJECT: **Biology**
 PAPER NUMBER: I – Level 1-2-3
 DATE: 28th August 2025
 DURATION: 2 hours 5 minutes

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.
- The mark allocation is indicated at the end of each question. Marks allocated to parts of questions are also indicated in brackets.
- You are reminded of the necessity for orderly presentation in your answers.
- The use of electronic calculators is permitted.

For examiners' use only:

	Section A		Section B		Section C	Section D	
Question	1	2	3	4	5	6	Total
Score							
Maximum	7	8	15	15	25	30	100

Section A: This section carries 15 marks

1. a. i. By means of a word equation, show that plants can convert simple inorganic substances to organic substances using light energy.

(2)

ii. The gaseous product in a. i. is essential for the survival of most living organisms. Name the product and explain why the biological process for the survival of organisms is different from anaerobic respiration.

(2)

b. Carbon dioxide makes up **only** 0.03% of normal air and it is very often the limiting factor in photosynthesis. The effect of carbon dioxide on the rate of photosynthesis is shown in Figure 1.1.

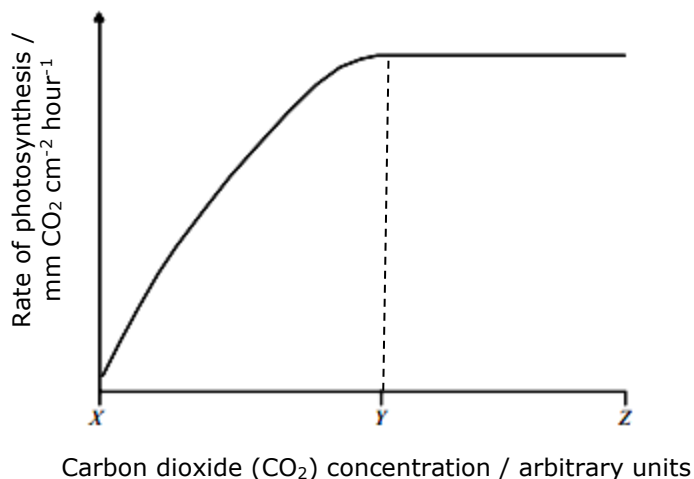


Figure 1.1: Graph showing rate of photosynthesis against CO₂ concentration
 (Source: <https://www.cityleicester.co.uk/assets/Documents/Attachments/Photosynthesis-2.pdf2.3d>)

Interpret the graph to describe the rate of photosynthesis between points X and Y, and Y and Z. Give which part shows that carbon dioxide levels are a limiting factor.

(3)

(Total: 7 marks)

2. a. Describe the structure of the human respiratory system. You may use a diagram to help in your description.

(3)

b. Describe the importance of ventilation for the respiratory system.

(1)

c. Figure 2.1 shows a small part of the gaseous exchange surface in the human respiratory system.

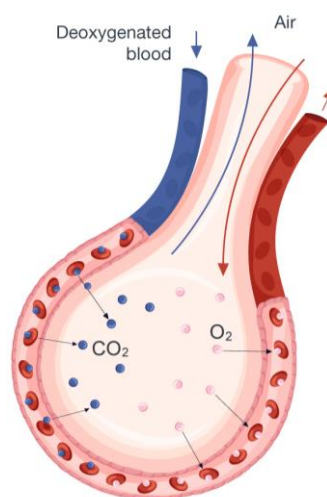


Figure 2.1: Structure of the respiratory system
(Source: <https://www.therisingmedicare.com>)

Name **TWO** characteristic features of this structure and relate how **each** feature makes gaseous exchange more efficient.

(4)

(Total: 8 marks)

Please turn the page.

Section B: This section carries 30 marks.

3. a. Honey bees do **not** hibernate. Instead on cold days and nights, they huddle to stop their body temperature from becoming too low. A group of students decided to test if huddling reduces heat loss.

The students prepared a single test tube and a group of test tubes held together with a rubber band as shown in Figure 3.1.

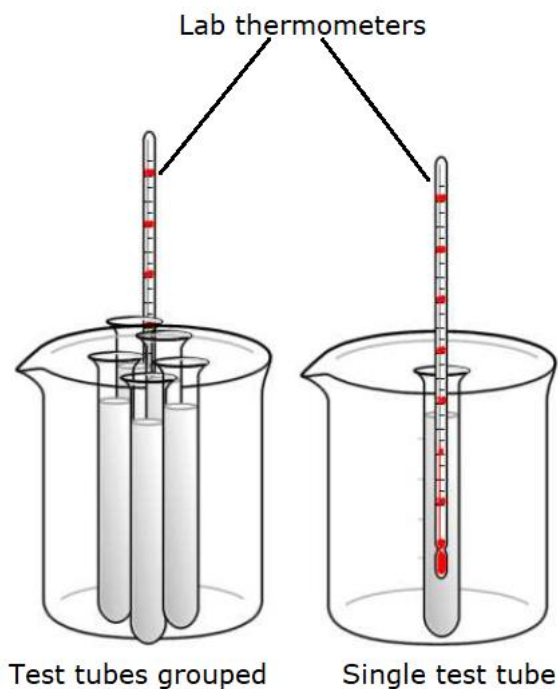


Figure 3.1: Huddling investigation

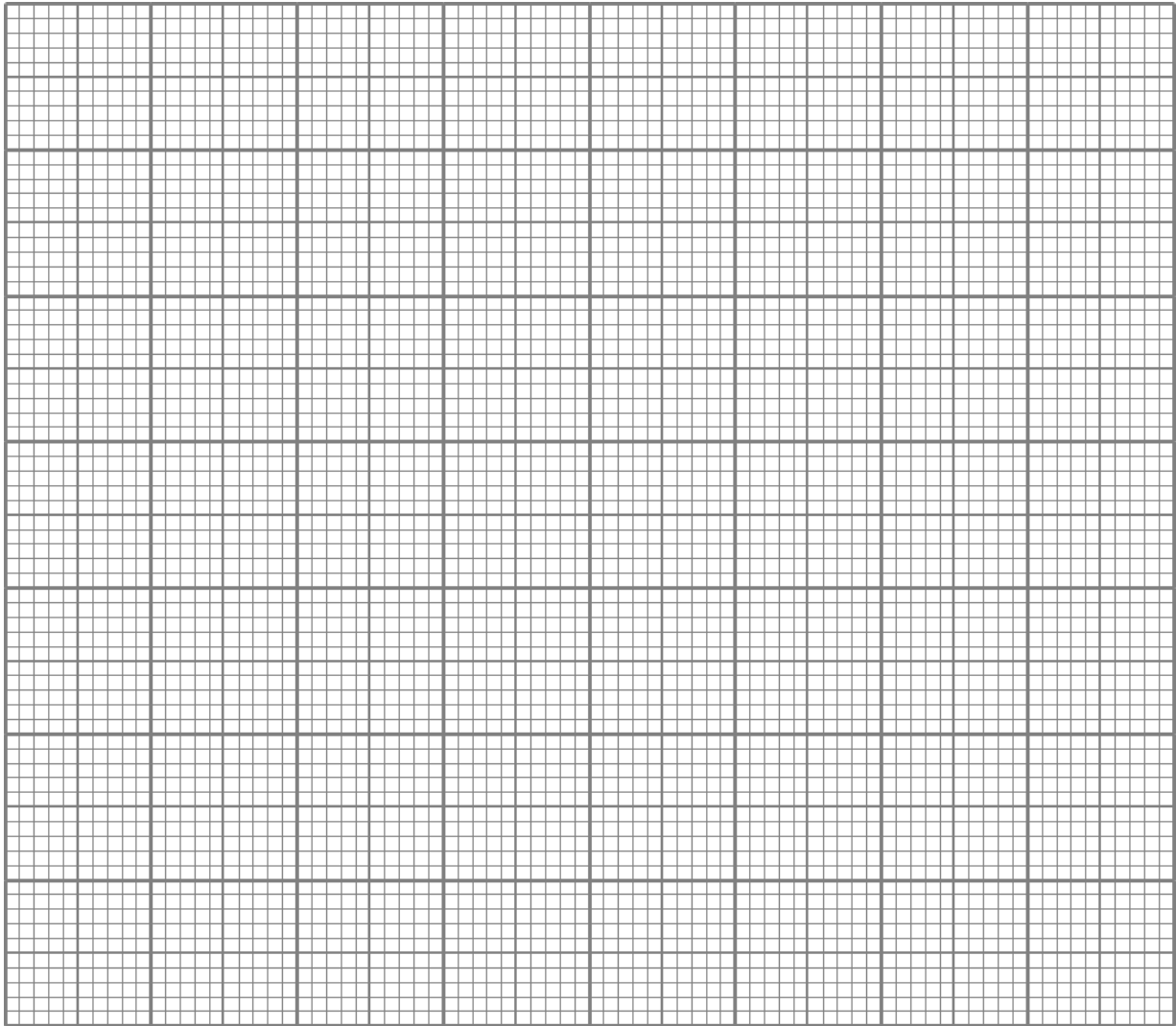
(Source: <https://studylib.net/doc/7172742/penguin-huddle-expt---teachingresourceexchange.com>)

The students poured hot water in all the test tubes and then took temperature readings every 10 minutes. Table 3.1 shows the results obtained.

Table 3.1: Results obtained from huddling investigation

Time (min)	0	10	20	30	40
Single test tube Temperature (°C)	60	40	32	25	23
Test tubes grouped Temperature (°C)	60	55	49	42	34

i. On the graph paper, on the adjacent page draw a graph to show the decrease in temperature of a single test tube. Join the points of the graph with straight lines. Plot time on the x-axis. Using the same pair of axes, plot a graph to show the decrease in temperature in the grouped test tubes. Join the points with straight lines.



(6)

ii. Interpret the **TWO** graphs obtained to determine if the students' hypothesis is correct.

(2)

iii. In investigations, some variables are controlled or kept constant. Give **ONE** controlled variable in this investigation and discuss the importance of keeping some variables controlled in this experiment.

(3)

This question continues on next page.

iv. Determine, by evaluating the experimental procedure, **ONE** modification to improve the experiment.

(2)

b. Honey bees are ectothermic animals. Define the term ectothermic.

(2)

(Total: 15 marks)

4. This question is about germination in plants.

a. Read the following passage and fill in the missing terms using the most appropriate term from the word bank below:

cotyledons, food, oxygen, photosynthesise, plant, plumule, radicle, respiration, seed coat, water.

Germination is the process by which a _____ sprouts from a seed. The seed lies inactive in the soil. For the seed to start germination it must absorb _____. This causes the seed to swell, and the _____ to break. It also activates enzymes that start the process of _____. The seed absorbs _____ from air in the soil and releases energy from the stored _____. The _____ grows downwards to anchor the plant whilst the _____ grows upwards to reach the light. The seedling emerges from the soil, and the _____ (i.e. the first leaves) begin to _____, providing energy for further growth. (5)

b. A group of students were asked to plan an experiment to show that water affects germination. They were given the following apparatus:

2 boiling tubes, cress seeds, cotton wool, 2 thermometers, water.

i. In the space below, draw a labelled diagram, showing how the apparatus is set up. (4)

ii. State **TWO** justifications why it is necessary to measure temperature in this experiment.

Justification 1: _____
 _____ (1)

Justification 2: _____
 _____ (1)

c. The students then investigated the effect of watering cress seeds with polluted water. Table 4.1 shows the results obtained:

Table 4.1: The effect of polluted water on germination of cress seeds

Concentration of polluted water /%	Number of germinated seeds	% germination
0 (distilled water)	50	100
10	42	84
20	40	80
30	30	60
50	20	50
100	0	0

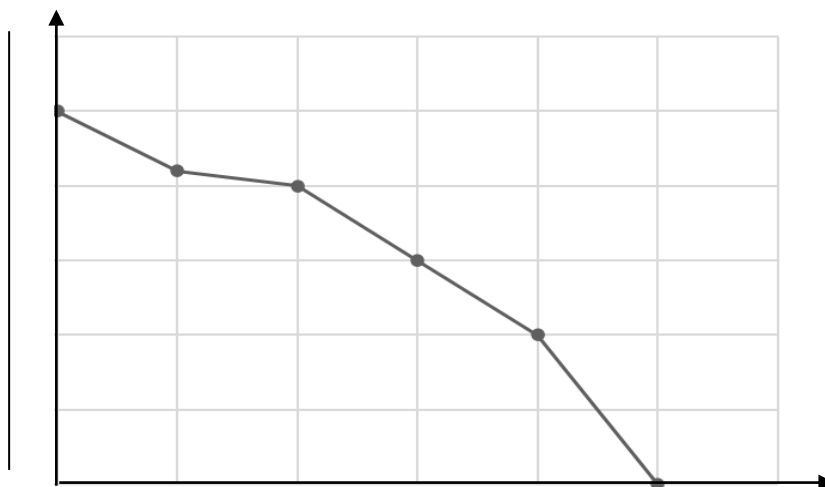
(Adapted from <https://www.biologydiscussion.com>)

i. Describe the effect of increasing the concentration of polluted water on the percentage germination of cress seeds.

 _____ (1)

This question continues on next page.

ii. The graph below shows a sketch of the effect of the % concentration of polluted water on % germination. By identifying the dependent and independent variables, label the y and x axes. (1)



iii. Describe **TWO** ways how this experiment can be modified to get more reliable results.

(2)

(Total: 15 marks)

Section C: This section carries 25 marks

5. a. The following diagram shows a line transect.

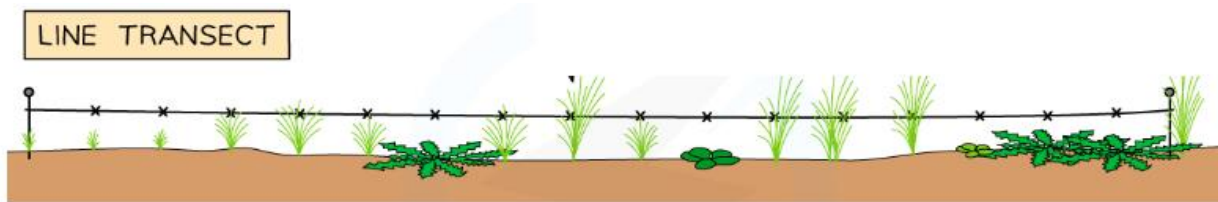


Figure 5.1: A line transect

(Source: <https://www.savemyexams.com/>)

i. Describe what a line transect is and how it is set up.

(2)

ii. Determine the primary purpose of using a line transect.

(2)

iii. Name **TWO** abiotic factors which can affect plant diversity and explain how this limits population size distribution.

(4)

iv. Within the line transect, several species of plants were identified. All these plants identified contained xylem tissue. Describe how the structure of the xylem allows for the transport of water.

(4)

This question continues on next page.

b. Sea Turtles are ectothermic, seawater-adapted reptiles. They have lungs like those of mammals and therefore need to surface for air. They do **not** have teeth, but a beak-like jaw to match its diet of fish, jellyfish, and crustaceans.

(Taken from: <https://naturetrustmalta.org/environmental-education/biodiversity/fauna/priority-endangered-species/>)



Figure 5.3: A loggerhead turtle

(Source: <https://cyprusnorth.wordpress.com/2013/06/25/the-caretta-caretta-turtle/>)

i. Unfortunately, sea turtles also eat plastic bags, unable to distinguish these from food. Assess how the fact that the sea turtles eat plastic impacts food chains.

(3)

ii. Identify an adaptation, found in the text above, that enabled animals to successfully live on land.

(1)

iii. Give **TWO** reptilian features that made them successful land animals.

(2)

c. The Yelkouan Shearwater is one of the resident Mediterranean seabirds. Malta is an important place for the species as it holds 10% of the global population.

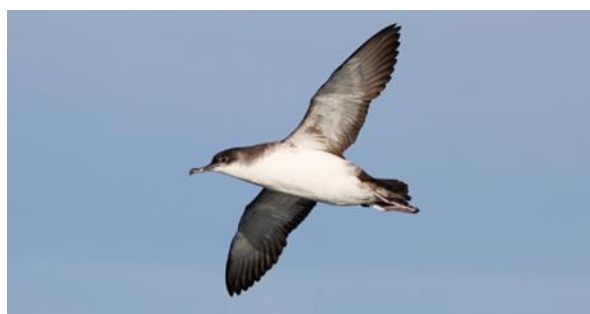


Figure 5.4: Yelkouan Shearwater

(Source: Photograph taken by Victor Parnis)

Tracking seabirds, like the Yelkouan Shearwaters, is important to understand and collect information regarding their behaviour, where they are going, where they are feeding and how long they are staying at sea. Such information is useful in the conservation efforts to the areas where shearwaters most frequently forage. These areas might also be the areas where the species is most at risk of accidental by-catch.

Yelkouans share the parenthood fairly between male and female, one is going at sea when the other is incubating the egg or taking care of the chicks for the first few weeks. They always come back to their nest location throughout the breeding season. Information collected also explains when they are flying or rafting or diving, and at what depth they can dive. During the breeding season they need more food, mainly fish or molluscs, to feed their chicks until they are raised.

The population keeps decreasing due to climate change, overfishing, bycatch and light pollution at sea but also chick and egg predation by invasive species and noise disturbance on land.

(Source: <https://birdlifemalta.org/2022/05/a-journey-with-the-yelkouan-shearwater/>)

- i. Yelkouan shearwater is among the most threatened seabird species globally. From the text, identify **TWO** threats to Yelkouan Shearwaters.

(2)

- ii. Define the Greenhouse Effect that is associated with global warming.

(3)

- iii. State **TWO** specific actions to fight climate change.

(2)

(Total: 25 marks)

Section D: This section carries 30 marks.

- 6. a. Amylase is an enzyme that acts on starch, forming maltose.

- i. In the statement above identify the protein.

(1)

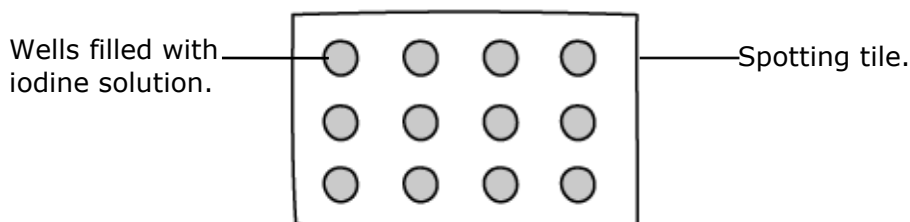
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ii. Define the term enzyme.

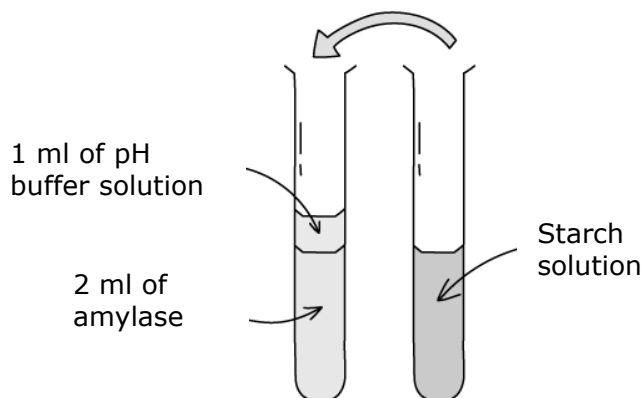
(2)

b. Students were asked to investigate the effect of pH on the action of amylase. This is the report of their procedure:

1. All the wells of a spotting tile were filled with iodine solution.

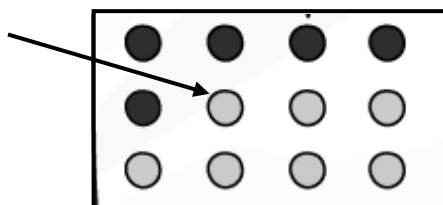


2. 2 ml of amylase were put in a test tube. 1 ml of pH buffer solution that keeps the pH constant at pH 7 was added.
3. The mixture was allowed to stand for 2 minutes.
4. 2 ml of starch were then added to the amylase and pH buffer mixture.



5. The stopwatch was started and every 10 seconds, a droplet of solution was transferred into a well with iodine solution, prepared in step 1.
6. The procedure was repeated until no more colour changes were observed in the iodine solution.
7. The time taken for the reaction to be completed was recorded.

Time until the colour of iodine solution did not change = 60 s.



8. Steps 1-7 were repeated for pH values ranging from pH 3 to pH 7.

(Figures adapted from <https://www.savemyexams.com>)

i. State the colour of iodine solution when starch is present and when starch is absent:

Starch present: _____ (1)

Starch absent: _____ (1)

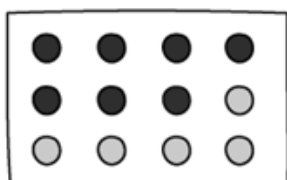
ii. Explain why at pH 7, after 60 s the iodine solution did **not** change colour at all.

_____ (1)

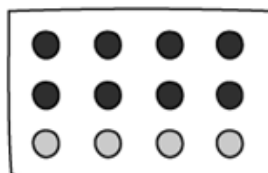
iii. Explain why the mixture of the amylase and the pH buffer were allowed to stand for 2 minutes before starch was added.

_____ (2)

c. The diagrams below show the results obtained when the experiment was performed at pH 5 and pH 9. Use the diagrams and the information in part b., to record the time when the reaction was over in the table below.



pH 5

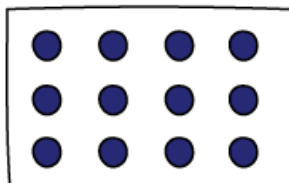


pH 9

pH value	pH 5	pH 9
Time until the colour of iodine solution did not change (s)		

(2)

d. When the experiment was repeated at pH 14, the following result was obtained.



A student wrote that 'No reaction occurred at pH 14.
State whether the statement is correct and give a reason for your answer.

Conclusion is CORRECT / INCORRECT. (1)

Reason: _____ (1)

This question continues on next page.

e. i. A student added the enzyme maltase instead of amylase in the experiment. Describe why the experiment did **not** work.

_____ (2)

ii. A student repeated the experiment with 1 ml of water instead 1 ml of amylase. State what happens to the time taken for the experiment to work. Give a reason for your answer.

Time taken will _____ (1)

Reason: _____ (1)

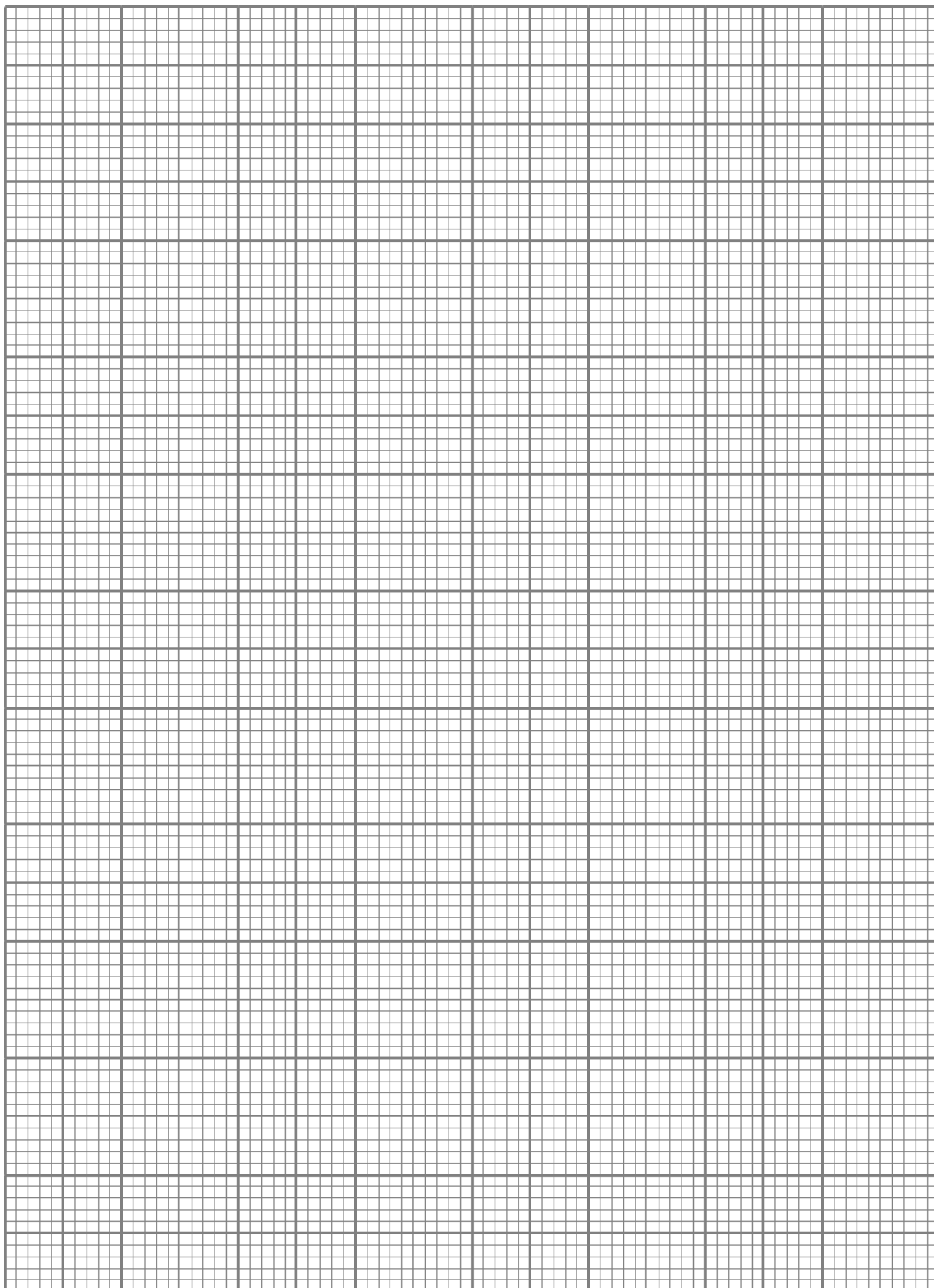
f. The students carried out a similar experiment, where they investigated the effect of temperature on the breakdown of starch by amylase. They calculated the rate of reaction at **each** temperature. Table 6.1 summarizes the results obtained:

Table 6.1 The effect of temperature on the rate of breakdown of starch by amylase

Temperature /°C	Rate of reaction / min ⁻¹
25	0.25
35	0.40
45	0.75
55	0.55
65	0.30
75	0.15

Draw a graph of rate of reaction against temperature. Use a ruler to connect the plots. (5)

DO NOT WRITE ABOVE THIS LINE



This question continues on next page.

g. From the graph determine the optimum temperature for amylase. _____ (1)

h. From the graph, explain the rate of reaction per minute:

i. between 25°C and 35°C;

(2)

ii. at 45°C;

(2)

iii. between 55°C and 75°C.

(2)

j. In industry amylase is used in the food processing industry. When bakers prepare dough to produce bread, they can add amylase to the mixture of flour, water and yeast. Explain why the addition of amylase will help the dough to rise faster.

(2)

(Total: 30 marks)



SUBJECT:	Biology
PAPER NUMBER:	II – Level 2-3
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Question	1	2	3	4	5	6	7	Total
Score								
Maximum	9	11	10	10	20	20	20	100

Section A: This section carries 40 marks.

1. a. Figure 1.1 shows two types of cells, X and Y.

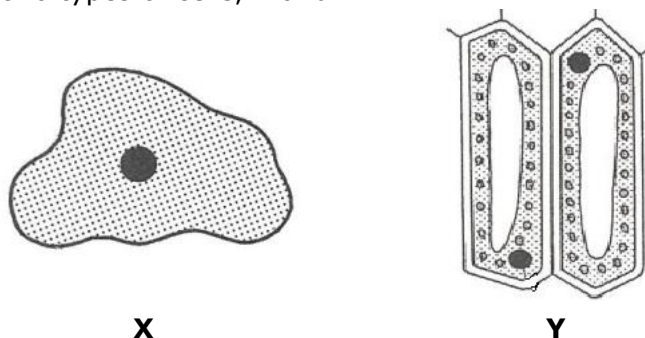


Figure 1.1: Two different types of cells

(Source: Standard Grade Biology)

i. Identify cell X and cell Y.

Cell X _____ Cell Y _____ (1)

ii. Name **TWO** structures found in cell Y but **not** in cell X and give the function of each structure.

Structure _____ Function _____
 _____ (2)

Structure _____ Function _____
 _____ (2)

b. Living organisms are either multicellular or unicellular. Most cells contain several organelles that have specific functions. The following table shows the levels of organisation in multicellular organisms. Fill in the missing descriptions in Table 1.1. (3)

Table 1.1: Cellular organisation of complex organisms

Structure	Description
Organelle	Structure that performs specific functions within a cell.
Cell	
Tissue	A group of cells having the same structure and function.
Organ	
Organ system	
Organism	An organism is a living system that performs vital functions.

Figure 1.2 shows a specialised plant cell.

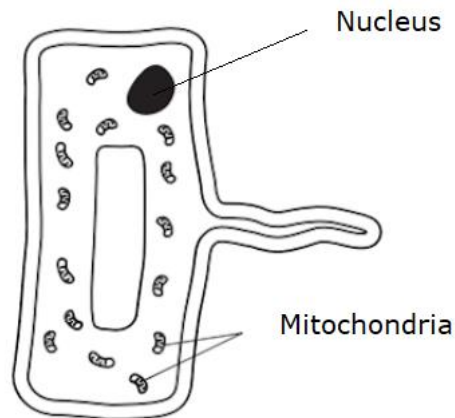


Figure 1.2: A specialised plant cell

(Source: <https://studyx.ai/homework/105406909-7>)

c. Explain how this cell is specialised.

(1)

(Total: 9 marks)

2. Figure 2.1 shows the female reproductive system.

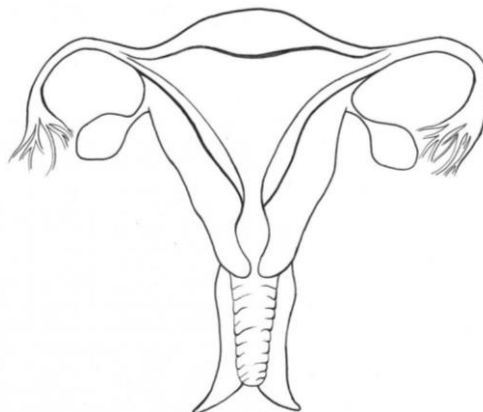


Figure 2.1 The female reproductive system

(Source: <https://o.quizlet.com>)

a. On Figure 2.1 label:

- i. an ovary; (1)
- ii. the uterus. (1)

b. On Figure 2.1 label the site where fertilization occurs with the letter **F**. (1)

This question continues on next page.

c. Table 2.1 lists some of the reproductive hormones in the human female and their functions. Complete the table by filling in the missing information.

Table 2.1: Female reproductive hormones and functions

Hormone	Function
Follicle stimulating hormone (FSH)	
	Brings about ovulation.
Oestrogen	
	Prevents menstruation.

(4)

d. Name the hormone that brings about the secondary sexual characteristics in males and describe **ONE** of these characteristics.

Hormone: _____

Characteristic: _____

(2)

e. Upon fertilisation, the zygote divides into a ball of cells until it is implanted. The placenta then forms. Describe **TWO** functions of the placenta.

(2)

(Total: 11 marks)

3. a. Figure 3.1 shows the blood glucose levels feedback loop.

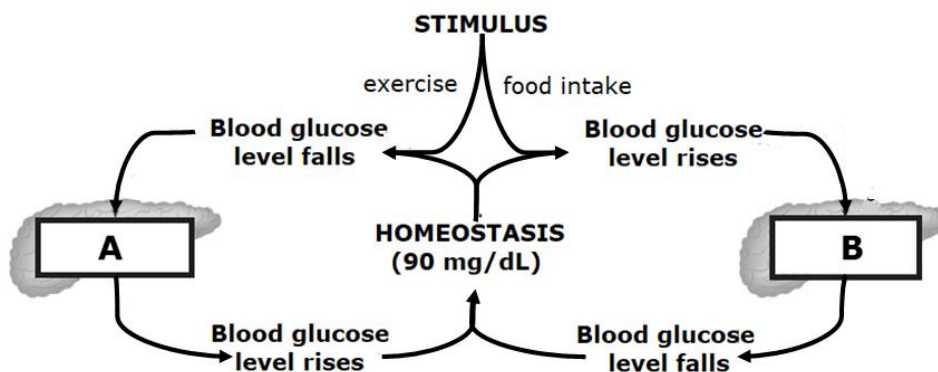


Figure 3.1: Blood glucose level feedback loop

(Source: https://www.researchgate.net/figure/Blood-glucose-level-negative-feedback-loop_fig1_342547469)

i. In diagram 3.1 changes in the blood glucose level are detected by the pancreas. Explain, how a change is brought about when hormones are produced.

_____ (1)

ii. Explain the importance of this combination of responses in blood glucose regulation.

_____ (2)

iii. Hormones A and B have an antagonistic role. With the help of Figure 3.1, describe why the roles of hormones A and B are considered as antagonistic.

_____ (2)

iv. Explain how these hormones arrive at the target organ or target cells.

_____ (1)

v. This type of feedback is known as negative feedback. Explain the importance of this type of feedback.

_____ (2)

b. In most cases, the nervous and endocrine system both work together for the coordination of body functions. Explain using an example.

_____ (2)

(Total: 10 marks)

4. a. i. State **TWO** ways how humans may affect the Carbon Cycle.

_____ (2)

ii. Sustainable Development Goal (SDG) 7 states 'Ensure access to affordable, reliable, sustainable and modern energy for all.'

Describe **ONE** initiative that reduces the human impact on the Carbon Cycle.

_____ (1)

This question continues on next page.

b. Carbon dioxide is a greenhouse gas. Describe the stages of the greenhouse effect, including the role of greenhouse gases.

(3)

c. Pyramids of numbers can vary significantly in shape depending on the ecosystem being studied and the sizes of the organisms involved.

Figure 4.1 shows an inverted pyramid of numbers.



Figure 4.1: An inverted pyramid of numbers
(Source: <http://www.bbc.co.uk/bitesize/zy6rng8/revision/3>)

Explain when a pyramid of numbers is inverted and give **ONE** example of such an inverted pyramid.

(2)

d. In relationships between producers and consumers, energy is lost as it is transferred from one trophic level to another. Give **ONE** explanation how energy is lost.

(2)

(Total: 10 marks)

Section B: This section carries 20 marks

5. Can the heart heal itself? New study says it can

A research team co-led by a physician-scientist, Dr Sadek, at the University of Arizona College of Medicine found that a subset of artificial heart patients can regenerate heart muscle, which may open the door to new ways to treat and perhaps someday cure heart failure.

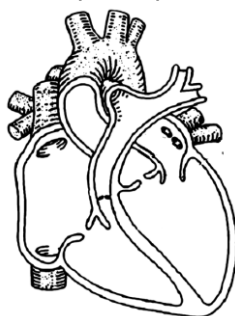


Figure 5.1: Cross-section of the heart
(Source: https://www.researchgate.net/figure/Basic-anatomy-of-the-heart_fig1_240294013)

There is no cure for heart failure, though medications can slow its progression. The only treatment for advanced heart failure, other than a transplant, is a pump replacement through an artificial heart, called a left ventricular assist device, which can help the heart pump blood.

The investigators found that patients with artificial hearts regenerated muscle cells at more than six times the rate of healthy hearts. "This is the strongest evidence we have, so far, that human heart muscle cells can actually regenerate, because it solidifies the notion that there is an intrinsic capacity of the human heart to regenerate," Sadek said. "It also strongly supports the hypothesis that the inability of the heart muscle to 'rest' is a major driver of the heart's lost ability to regenerate shortly after birth. The pump pushes blood into the aorta, bypassing the heart," he said. "The heart is essentially resting."

Next, Sadek wants to figure out why only about 25% of patients are "responders" to artificial hearts, meaning that their cardiac muscle regenerates. "It's not clear why some patients respond and some don't, but it's very clear that the ones who respond have the ability to regenerate heart muscle," he said. "The exciting part now is to determine how we can make everyone a responder, because if you can, you can essentially cure heart failure."

(Source: <https://www.sciencedaily.com/releases/2024/12/241220191007.htm>)

a. On Figure 5.1, mark with the letter **X**, the left ventricle. (1)

b. From the text, identify the major artery of the body.

_____ (1)

c. Explain, by recognising the function of the left ventricle, why the pump is attached to this chamber.

_____ (2)

d. The heart has a number of valves. Describe the function of these valves and name **ONE** of these valves.

_____ (2, 1)

e. Using your biological knowledge on genetics, explain why some patients can regenerate heart muscle and other cannot.

_____ (2)

This question continues on next page.

Section C: This section carries 20 marks.

6. a. A teacher asked students to design an experiment to investigate the effect of varying ethanol concentrations on the rate of anaerobic respiration in yeast cells.

The students were provided with the following materials: yeast suspension, glucose, 5 different ethanol concentrations (50%, 40%, 30%, 20%, 10%) and distilled water, vegetable oil, lime water.

Lime water turns milky in the presence of carbon dioxide. The time taken for the lime water to turn milky was measured.

Figure 6.1 shows the set-up of this investigation.

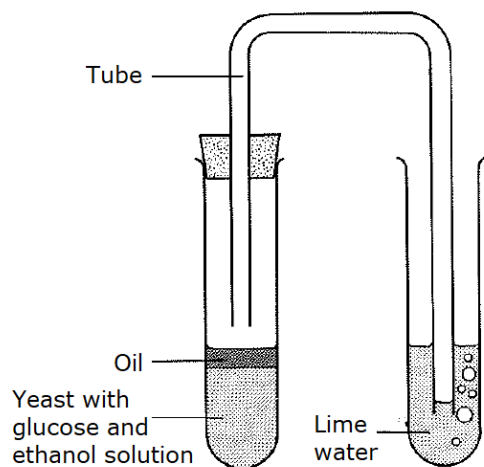


Figure 6.1: Set -up of investigation

(Source: GCSE Biology Quick Check)

- i. A student suggested that the test tube containing the yeast solution should be put in a water bath. Explain the importance of the water bath.

_____ (2)

- ii. Identify the dependent variable and state what apparatus is used for this variable.

Dependent variable: _____ Apparatus _____ (2)

- iii. Explain why the addition of glucose is important in this investigation.

_____ (3)

This question continues on next page.

iv. This type of anaerobic respiration is called alcoholic fermentation. Name another type of fermentation process and distinguish between the products of these two types of fermentation.

Name _____ (1)

Difference _____

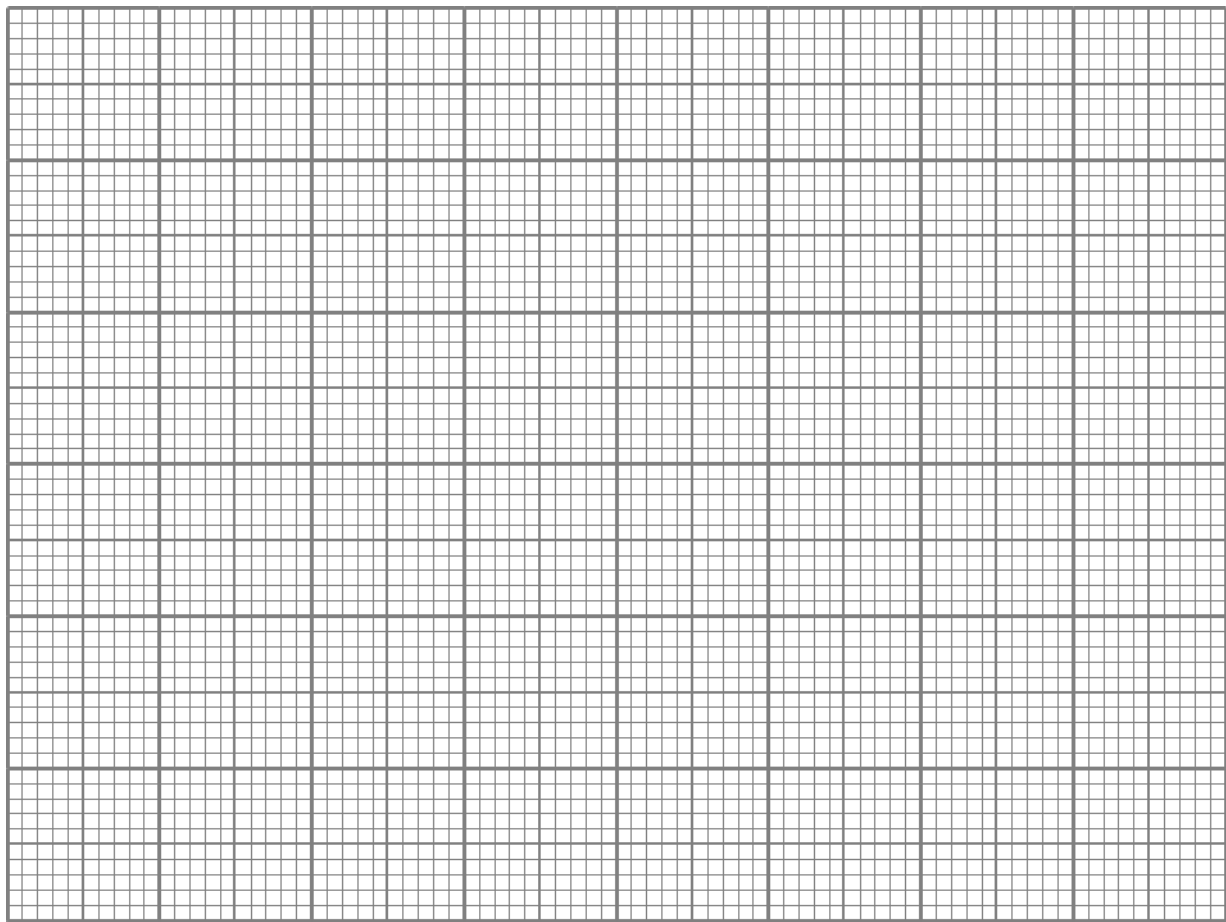
_____ (2)

b. Table 6.2 shows the results obtained from the experiment.

Table 6.2 Table of results obtained

Ethanol concentration	Rate of respiration / min ⁻¹
0	5.0
10	4.2
20	3.5
30	2.8
40	1.5
50	Does not turn milky after 5 min

i. On the graph paper below, draw a graph to show the effect of increasing ethanol concentration on the rate of respiration in yeast. Join the points of the graph with straight lines. Plot ethanol concentration on the x-axis. (4)



ii. Describe the effect of increasing ethanol concentration on the rate of respiration in yeast and state how the results support this conclusion.

Effect: _____ (1)

Evidence: _____ (1)

iii. Below are two precautions students must take when performing this investigation. For **each** precaution explain why it should be followed.

Precaution: Use equal volumes of yeast suspension and glucose in each test tube.

_____ (1)

Precaution: The yeast – ethanol – glucose suspension is covered with oil.

_____ (1)

iv. Some yeast cells in the original solution may be dead. Explain why this is a limitation in this experiment.

_____ (2)

(Total: 20 marks)

Section D: This section carries 20 marks.

7. Life on Earth is deeply connected with the development of its atmosphere, the evolution of plant and animal organisms, and the complex interactions between organisms and their environments. From the oxygen-producing cyanobacteria that transformed the early atmosphere, to the rise of diverse plant forms and mobile animals, and the complex relationships between insects and flowering plants — each stage marks a significant leap in biological complexity.

a. Explain how photosynthetic bacteria, such as cyanobacteria, changed the Earth’s atmosphere billions of years ago and how this had an impact on the evolution of living things.

_____ (4)

This question continues on next page.

