



SUBJECT: **Biology**
 PAPER NUMBER: I – Level 1-2-3
 DATE: 6th May 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 in sections A, B, C and D. 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	8	7	15	15	25	30	100

Section A: This section carries 15 marks.

1. Figure 1.1 shows an insect pollinated flower.

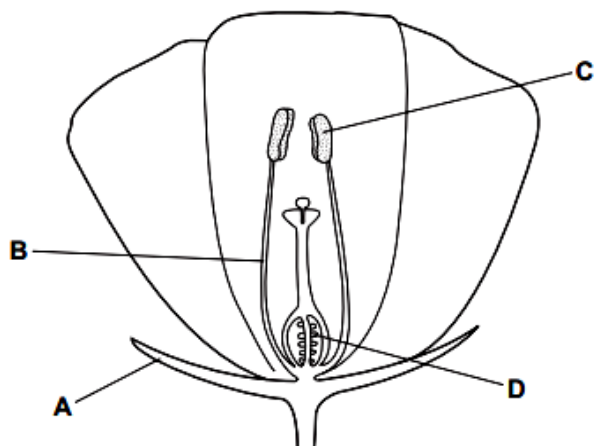


Figure 1.1: Cross-section of an insect pollinated flower

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

a. Identify structures A, B, C and D.

A _____ B _____

C _____ D _____ (2)

Flowering and non-flowering plants face distinct reproductive challenges that impact their success and survival. One of the challenges faced by flowering plants is their dependence on pollination.

b. Describe how the below mentioned challenges influence the effectiveness of reproduction in plants.

i. Lack of wind for wind pollinated flowers.

_____ (1)

ii. Fewer viable gametes.

_____ (1)

iii. Seeds falling close to the parent plant.

_____ (1)

c. A seed consists of cotyledons, an embryo and a testa. Explain the function of each of these structures.

Cotyledons: _____

Embryo: _____

Testa: _____ (3)

(Total: 8 marks)

2. Figure 2.1 shows a cross section through the human skin.

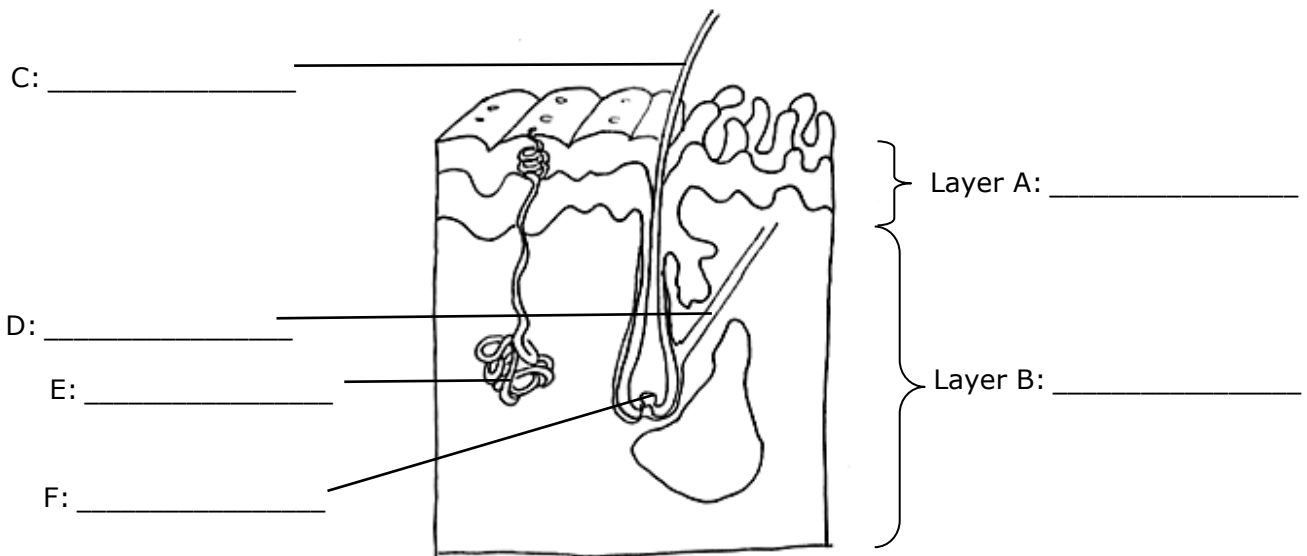


Figure 2.1: A cross section through the human skin
 (Source: <https://clipart-library.com>)

- a. Complete Figure 2.1 by labelling layers A and B and structures C, D, E and F. (3)
- b. An athlete who just completed a race is covered with sweat. Explain how the process of sweating leads to cooling.

_____ (1)

c. Figure 2.2 shows a lizard basking in the sun.

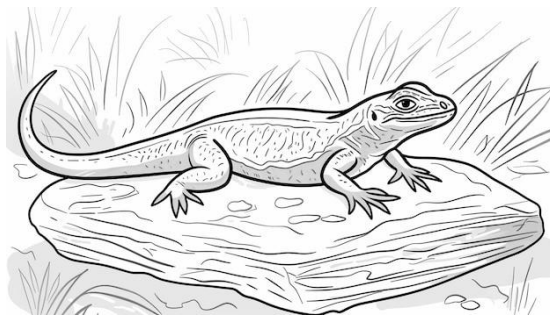


Figure 2.2 A lizard basking in the sun.
 (Source: <https://img.freepik.com>)

- i. State how basking in the sun affects the metabolic rate of the lizard. (1)
- ii. Explain why a lizard must bask in the sun in the early morning, after spending the night in a burrow.

_____ (2)

(Total: 7 marks)

Section B: This section carries 30 marks.

3. a. Define the term diffusion.

(2)

b. In a demonstration on diffusion, blocks of gelatine of different surface area to volume ratio (SA : V), containing an acid-base indicator cresol red, were put in beakers containing dilute hydrochloric acid. The indicator is red in an alkali solution but changes to yellow in acid conditions. Figure 3.1 shows one of the beakers with one size gelatine blocks and the change in colour in acid conditions.

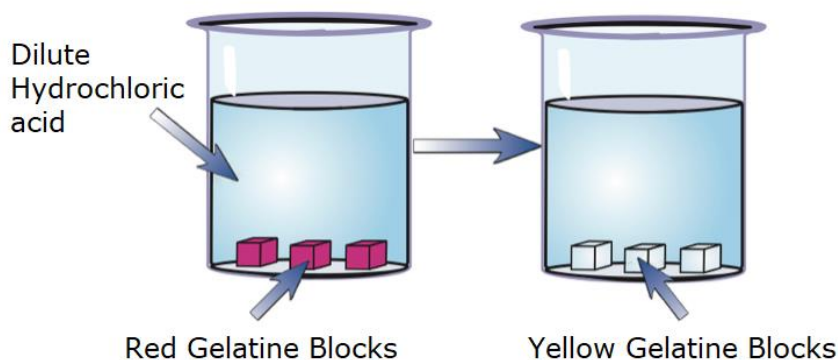


Figure 3.1: Change of cresol red indicator to yellow in acid conditions
(Source: <https://studymind.co.uk/notes/investigating-transport-across-membranes/>)

The students recorded the time taken for the red colour in the different gelatine blocks to change to yellow completely.

i. Explain, in terms of diffusion and SA : V ratio, what is happening during the investigation.

(3)

ii. When the gelatine blocks were put in the relevant beakers, hydrochloric acid was poured to cover the blocks (as shown in Figure 3.1). Justify why it is important to cover the blocks.

(2)

c. Figure 3.2 shows the graph plotted from the results of the diffusion experiment.

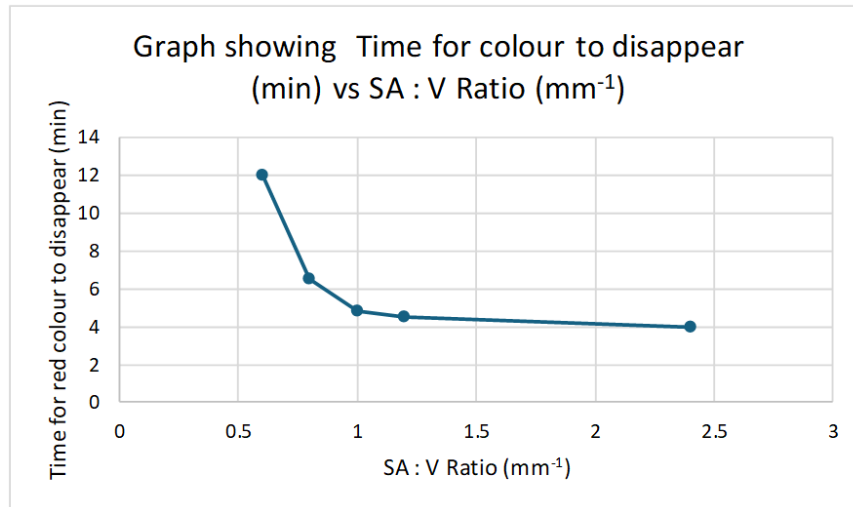


Figure 3.2: Graph plotted from the results of the diffusion experiment
(Source: *Advanced Biology principles and applications* pg. 136)

i. Describe the trend shown in the graphical representation.

(2)

Life forms on Earth evolved into multicellular organisms.

ii. Explain how multicellular organisms developed from undifferentiated cells.

(3)

iii. Use the trend stated above to predict how surface area to volume ratio influences the efficiency of gas exchange in different organisms and the impact this has on large animals.

(3)

(Total: 15 marks)

Please turn the page.

4. Several students were investigating experiments on transpiration.

a. In one experiment a student took a plant in a pot and covered the soil with plastic as shown in Figure 4.1. The plant was weighed at the beginning of the experiment and reweighed after 24 hours.



Figure 4.1: Plant with covered pot

(Source: [researchgate.net/figure/](https://www.researchgate.net/figure/))

i. Covering the pot with plastic is considered as a precaution. Justify the importance of this precaution.

_____ (2)

ii. The plant was put inside a large transparent container to create a controlled environment. Identify **ONE** variable that needs to be kept constant.

Variable _____ (1)

iii. State **ONE** variable that changes and affects the rate of transpiration when the plant is in the large transparent container.

Variable _____ (1)

iv. Explain how the variable listed in part a iii. affects transpiration from a plant.

_____ (3)

b. In a second experiment, a shoot of a plant was attached to a capillary tubing as shown in Figure 4.2. The water uptake is measured by recording the time taken for a bubble in the tube to move a set distance. Three different variables (X, Y and Z) were tested, and the rate of transpiration was measured for each variable. A control was also tested. The control creates a baseline for this experiment where variables X, Y and Z are controlled. The rate of transpiration was tested by measuring the distance moved by the bubble in 30 minutes under each variable. Results are shown in Table 4.1.

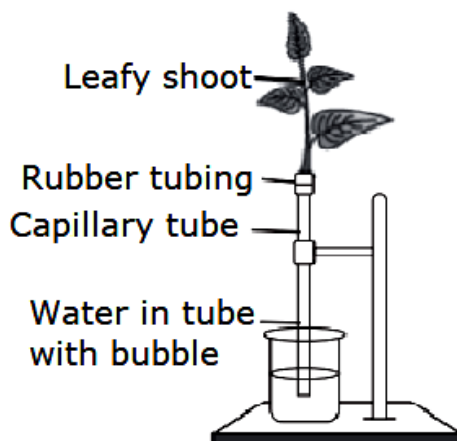


Figure 4.2: Transpiration experiment using capillary tubing
 (Source: <https://askfilo.com/biology-question-answer>)

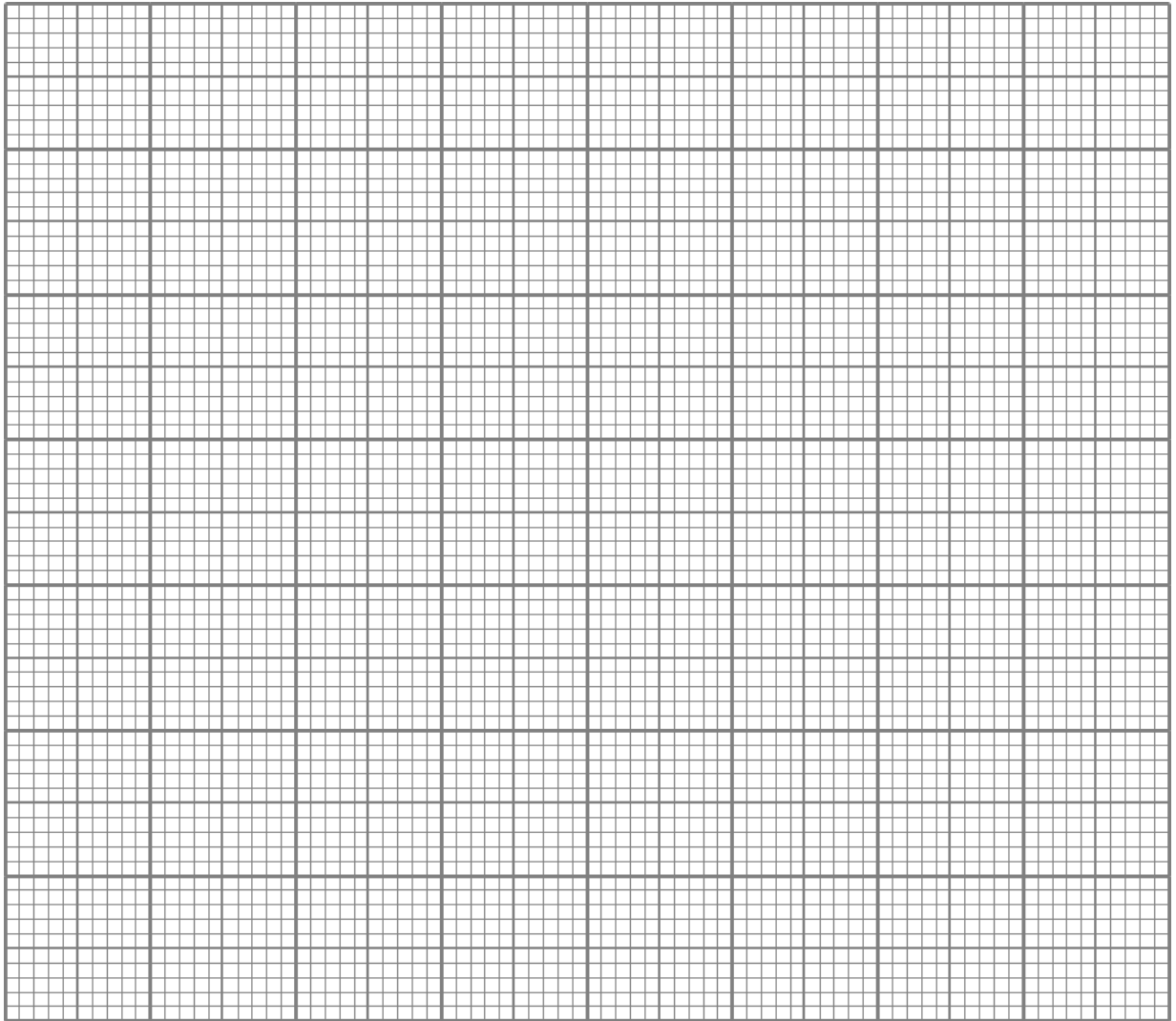
Table 4.1: Results of transpiration experiment

Variable	Control	Variable X	Variable Y	Variable Z
Rate of transpiration (mm)	50	180	90	320

(Adapted from: <https://www.bbc.co.uk/bitesize/guides/zyk8msg/revision/9>)

On the graph paper on the next page, plot a bar chart of rate of transpiration against the variable.

Please turn the page.



(4)

- c. The xylem tissue permits the passage of water through the plant to the leaf. Give **TWO** adaptations of the structure of the xylem and describe how **each** adaptation allows the passage of water.

(4)

(Total: 15 marks)

Section C: This section carries 25 marks.

5. During a fieldwork trip a number of students set up a pitfall trap to catch small woodland animals which move around on the surface of soil.

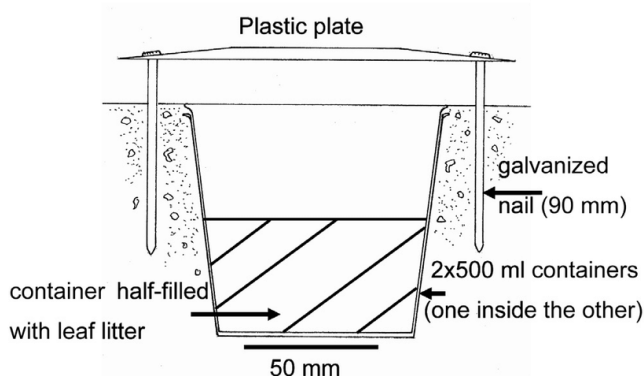


Figure 5.1: Pitfall trap

(Source: <https://www.researchgate.net/figure/>)

Table 5.1 below shows the numbers of animals caught at different times.

Table 5.1: Number of animals caught at day or at night

Animal	Numbers of animals caught	
	During the day 8.00 am – 8.00 pm	During the night 8.00 pm – 8.00 am
Beetles	1	20
Earthworms	0	3
Slugs	1	2
Snails	1	4
Spiders	1	2
Woodlice	10	36

a. i. Draw **TWO** conclusions from the results of the investigation.

(2)

ii. Pitfall trapping is a sampling technique. Quadrat sampling is another sampling technique. State **TWO** reasons why quadrats might **not** be appropriate to sample small animals.

(2)

iii. State a reason for the difference in the number of animals caught during the day and during the night.

(2)

iv. Give **ONE** other type of sampling technique.

(1)

b. The microscopic green plant *Pleurococcus** lives on tree trunks. A group of students carried out an investigation on a tree to determine the relationship between the density of *Pleurococcus* and the direction faced by the plants. *Pleurococcus* typically grows on the north side of tree trunks, where it receives less direct sunlight compared to the south side.

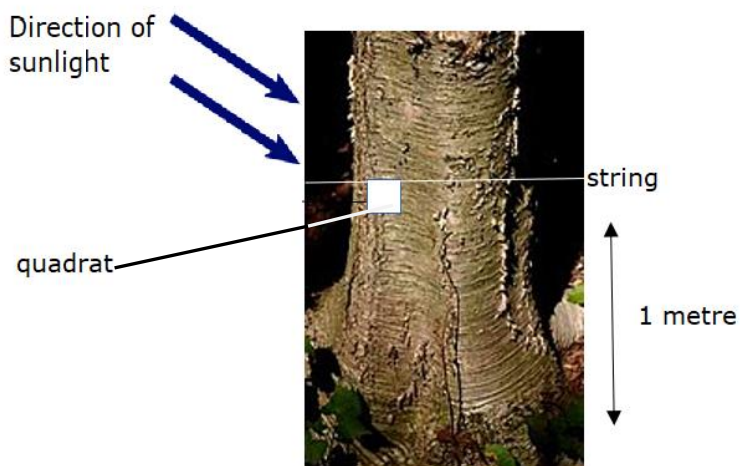


Figure 5.2: Tree trunk with *Pleurococcus*
(Photograph taken in Buskett, Malta)

A tree which has an uneven growth of *Pleurococcus* at the lower part of the tree trunk was chosen. A string was tied around the tree trunk one metre from the ground. A compass was used to determine the direction in which the plant colonies faced. Four 10 cm x 10 cm quadrats were placed on the lower part of the string, equally spaced from each other. The density of *Pleurococcus* in each sampling square was given a density score between 1 (the least) and 4 (the most).

The results of the investigation are shown in Table 5.2 below.

Table 5.2: Density of *Pleurococcus* per quadrat

Quadrat	Density score
A	1
B	2
C	4
D	3

* The word *Pleurococcus* is a scientific term and therefore written in italics.

i. Which of the quadrats was facing North? Explain your answer.

(1, 1)

ii. Apart from light, name **TWO** other conditions needed by *Pleurococcus* to live.

(2)

iii. Various abiotic variables affect the growth of *Pleurococcus* on the bark of a tree. Explain how the wind can limit its population size.

(1)

c. i. Name the following habitats found in the Maltese Islands.

Habitat A



Habitat B



Figure 5.3: Habitats of the Maltese Islands
(Source: a - <https://x2.timesofmalta.com/20231013/> and b - <https://maltainsideout.com>)

Habitat A _____ Habitat B _____ (1, 1)

ii. Describe **TWO** main characteristics of habitat A and habitat B.

Habitat A _____
_____ (2)

Habitat B _____
_____ (2)

iii. Plants adapted to life on land as they evolved from water to land. List **TWO** advantages for plant life on land.

(2)

This question continues on next page.

d. Some 4,500 crayfish were removed from Chadwick Lakes in the past two years and efforts are continuing to control the population of this species. Environmentalist Prof. Deidun warned that the crayfish was spreading uncontrollably. He explained that as a result of the intentional release of the species, which is popular with aquarium enthusiasts, the species, along with a number of other closely related species, was present throughout the island. Crayfish grow quickly, even in only seasonally present water and wreak havoc on freshwater species such as the painted frog and freshwater crab. But it was not all bad news since the red crayfish was popular for consumption purposes.

(4,500 crayfish removed from Chadwick Lakes in two years 15 October 2024 | Times of Malta)



Figure 5.4: a - Chadwick Lakes; b – Crayfish found in Chadwick Lakes

(Sources: a - <https://ensure.com.mt/chadwick-lakes-wied-il-qlejgha/>

b - <https://chadwicklakes.mt/biodiversity/red-swamp-crayfish-procambarus-clarkii-ic-ckala-l-hamra-tal-ilma-helu/>)

i. The crayfish is a very problematic invasive species. State **TWO** negative impacts of an invasive species.

_____ (2)

ii. Explain, by giving **THREE** reasons, why the crayfish was successful in its new environment.

_____ (3)

(Total: 25 marks)

Section D: This section carries 30 marks.

6. A group of students investigated the process of aerobic and anaerobic respiration in yeast cells.
- a. The students prepared 4 glasses, labelled A, B, C and D. In each glass they put 10 ml of water, 5 g of glucose and 2 g of yeast. The yeast cells were put in different conditions as shown in table 6.1:

Table 6.1: Different conditions for yeast

Glass	A	B	C	D
Condition	Cold water (8 °C)	Hot boiling water	Warm water (25 °C) The glass was not covered with plastic.	Warm water (25 °C) The glass was covered with plastic.

The students allowed the experimental set up to stand for 10 minutes. Then they estimated the rate of respiration by measuring the height of foam produced. Table 6.2 shows the results obtained.

Table 6.2: Results of height of foam at different conditions for yeast

Glass	A	B	C	D
Height of foam produced in 10 minutes / cm	2	0	6	5

(Adapted from <https://www.open.edu/openlearn>)

Identify the variable that is changing in:

Glass A and glass B: _____ (1)

Glass C and glass D: _____ (1)

- b. Explain why the mixtures of water, glucose and yeast were stirred well at the start of the investigation.

 _____ (2)

- c. Describe a chemical test that the students performed to show that the gas producing the foam is carbon dioxide.

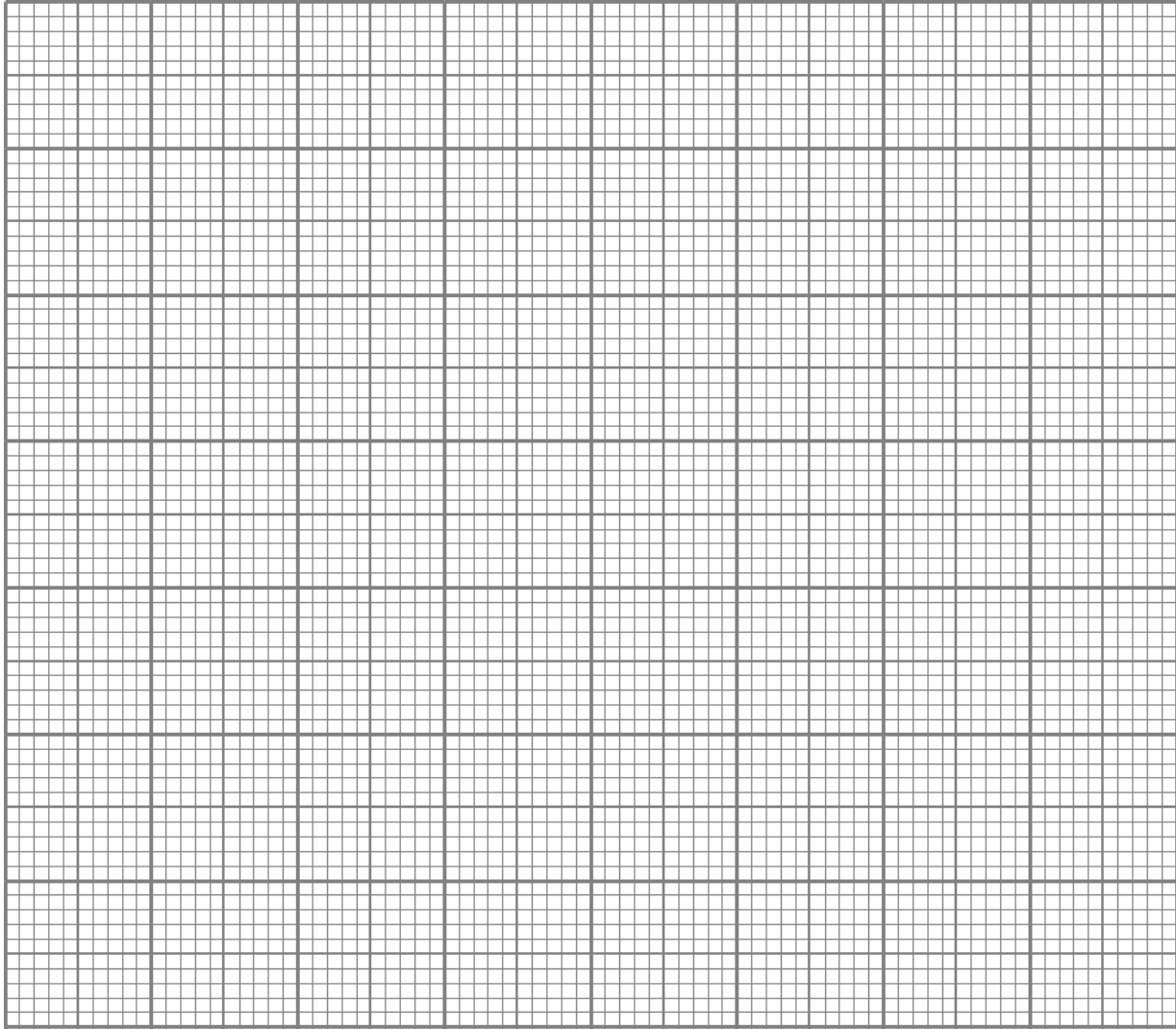
 _____ (2)

- d. Table 6.3 shows the change in the height of foam with time as measured in glass C. On the graph paper on the next page, plot a graph of the height of foam against the time taken. (4)

Table 6.3: Height of foam in 10 minutes

Time / min	0	2	4	6	8	10
Height of foam / cm	0	1.1	1.9	3.3	4.8	6.0

This question continues on next page.



e. Give **ONE** reason for **each** of the following observations:

i. No foam is produced in glass B, where hot boiling water was added to the yeast.

_____ (2)

ii. In glass A **only** 2 cm of foam were produced but 6 cm of foam were produced in glass C.

_____ (2)

f. In another experiment, the students investigated the effect of glucose, sucrose and lactose on the rate of anaerobic respiration in yeast cells. Figure 6.1 shows the apparatus set-up used:

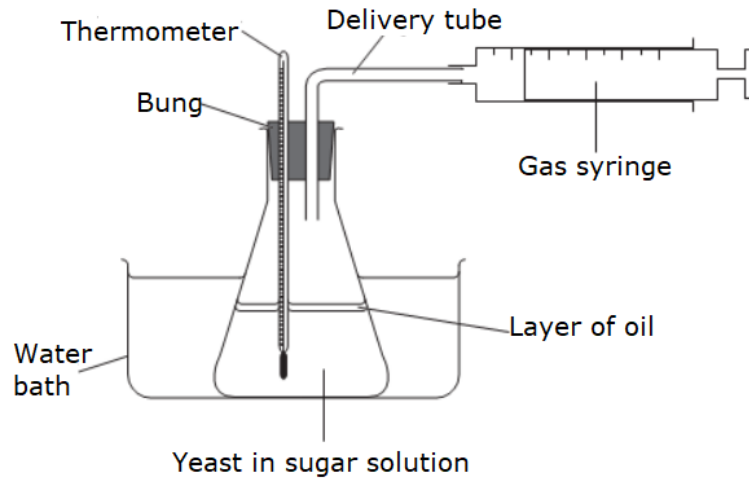


Figure 6.1: Experimental set up to investigate the effect of different sugars in yeast cells.

(Source: <https://pmt.physicsandmathstutor.com>)

Explain how this experimental set-up:

- i. Ensures that yeast cells **only** perform anaerobic respiration.

_____ (2)

- ii. Ensures that the variable affecting the rate of anaerobic respiration is the type of sugar and **not** temperature.

_____ (2)

- iii. Allows the students to calculate the rate of anaerobic respiration more accurately.

_____ (2)

The students measured the volume of carbon dioxide produced after 10 minutes. The bar chart in Figure 6.2 shows the results obtained:

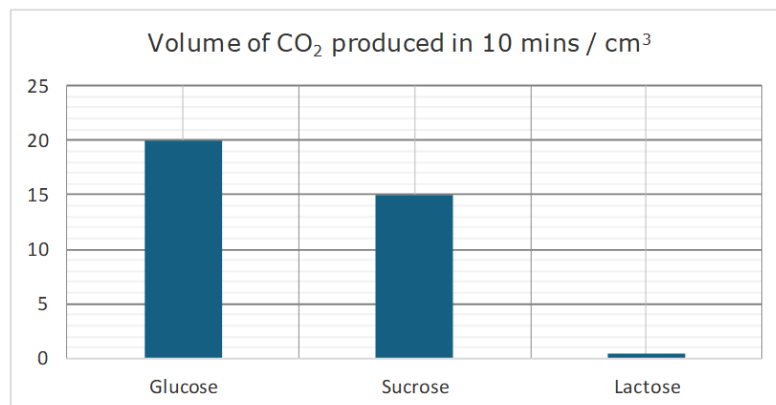


Figure 6.2: Volume of carbon dioxide produced in 10 minutes/ cm³ by yeast cells

g. From the bar chart determine the volume of carbon dioxide produced after 10 minutes when yeasts fermented:

i. glucose: _____ cm³.

ii. sucrose: _____ cm³. (1)

h. i. The water for the yeast in sugar solution was boiled before the solution was made. Justify this precaution.

_____ (1)

ii. The same yeast concentration was used for each sugar investigation. Explain why.

_____ (1)

i. A student concluded that, "Yeast cells do not have enzymes to use the sugar lactose in anaerobic respiration". State if this conclusion is true or false and give a reason for your answer.

Conclusion is _____ (1)

Reason: _____

_____ (2)

j. The products of anaerobic respiration in yeast cells and in bacteria are used in the production of different foods. In the table below state the product of anaerobic respiration that is important in the production of the type of food listed. (3)

Type of food	Product of anaerobic respiration
Bread	
Wine	
Yoghurt	

k. Nerve cells in the brain **only** carry out aerobic respiration. They cannot switch to anaerobic respiration if oxygen is lacking. Give **ONE** reason why nerve cells die when they cannot perform any type of respiration.

 _____ (1)

(Total: 30 marks)



SUBJECT: **Biology**
 PAPER NUMBER: II – Level 1-2
 DATE: 6th May 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 of sections A, B, C and D. Write all your answers in the spaces provided.
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For examiners' use only:

	Section A				Section B	Section C	Section D	
Question	1	2	3	4	5	6	7	Total
Score								
Maximum	7	12	13	8	20	20	20	100

Section A: This section carries 40 marks.

1. a. Complex carbohydrates called polysaccharides are composed of smaller units called monosaccharides.

i. Continue the following statement:

Protein molecules are composed of smaller units called _____ and

lipids are composed of _____ and _____. (1, 1)

ii. Name the **THREE** elements common to both lipids and proteins.

_____ (1)

b. Ethanol and water are used to test for one of the complex molecules mentioned in part a ii. Name this molecule and describe the changes one would observe in case of a positive result.

_____ (1)

c. Describe the link between the molecular size of carbohydrates and their solubility.

_____ (3)

(Total: 7 marks)

2. This question is about genetic material and inheritance. The DNA molecule carries genetic information.

a. i. Name the organelle in the cell where DNA is found.

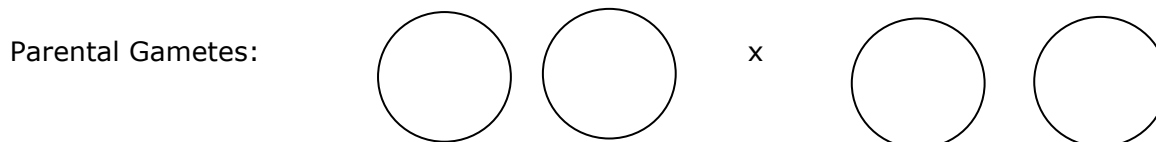
_____ (1)

ii. Distinguish between a DNA molecule and a chromosome.

_____ (2)

b. A male rabbit is crossed with a female rabbit. The owner of the rabbits predicts that 50% of the offspring will be males and 50% of the offspring will be females. Complete the genetic diagram below to show that the prediction of the owner of the rabbits was correct.

Parental Genotypes: Male: _____ x Female: _____



Female		
Male		

(4)

c. When snapdragons that produce flowers with red petals only, are crossed with snapdragons that produced flowers with white petals only, all the offspring produce flowers with both red and white petals. Name the type of inheritance observed in snapdragons. Give a reason for your answer.

Type of inheritance: _____ (1)

Reason: _____

_____ (1)

d. Snapdragons have been used to create purple tomatoes. The scientists extracted DNA from snapdragon plants and inserted it into the DNA of tomatoes. This caused the tomatoes to obtain a rich purple colour and to produce very high amounts of antioxidants. Antioxidants are chemicals that protect organisms from disease. In 2023, the purple tomato was the first GMO to be sold to home gardeners.

(Adapted from Woodruff S., (2024) A new purple tomato is available to gardeners. Its color comes from snapdragon DNA)

(Source: <https://www.opb.org/article/2024/02/06/>)

Please turn the page.

i. State what the term GMO stands for.

_____ (1)

ii. Using information in the text, list the properties of the purple tomato that are **not** found in the natural red tomato.

_____ (2)

(Total: 12 marks)

3. a. Microorganisms are everywhere. Many of them are useful but some cause serious diseases.

In the following table:

- i. name the **THREE** types of pathogens/agents that can cause disease;
- ii. identify **ONE** example of a disease caused by **each** pathogen/agent.

Name of pathogen/agent	Disease caused by pathogen/agent

(3, 3)

b. i. Doctors prescribe antibiotics to treat some infectious diseases. Name the pathogens that are destroyed by antibiotics.

_____ (1)

ii. It is easy for microbes to invade the human body which must quickly activate its immunity to react and destroy them. Define the term immunity.

_____ (2)

c. i. Describe the structure of a virus.

_____ (2)

ii. Since viruses do **not** have organelles, nuclei, or even ribosomes they are **not** able to replicate on their own. They must use host cells to create more viruses.

Complete the following table by filling in steps 2 and 3.

Step 1	Virus enters the body, attaching itself to a host cell releasing its genetic material into host cell
Step 2	
Step 3	
Step 4	New viruses infect new cells

(2)

(Total: 13 marks)

4. A young person starts monitoring the breathing rate at the start of an exercise routine consisting of a two-minute walk, followed by a step-up exercise for six minutes. Afterwards the person stops exercising and stays at rest.

The graph in Figure 4.1 shows how the breathing rate varies whilst the young person is exercising.

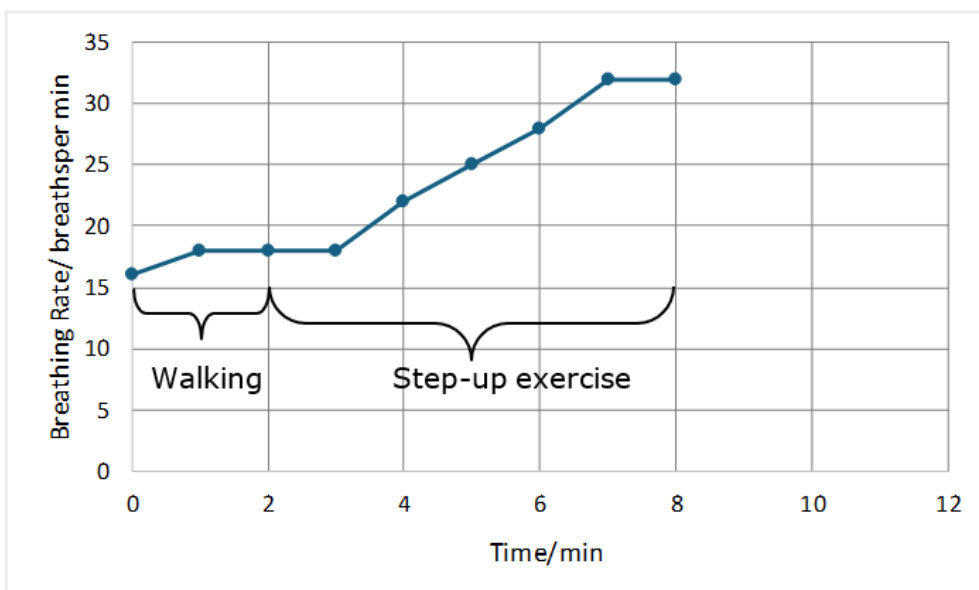


Figure 4.1 Graph showing variation of breathing rate during exercise.

a. i. Predict the expected breathing rate, after 8 minutes, when the young person stops the exercise routine.

(2)

This question continues on next page.

ii. Give a reason for your answer.

(2)

b. During which part of the exercise is the young person most likely to produce lactic acid in the muscles. Give a reason for your answer.

(2)

c. Describe the purpose of ventilation in ensuring an efficient gas exchange in the alveoli.

(2)

(Total: 8 marks)

Section B: This section carries 20 marks.

5. Show me your beak and I'll tell you what you eat.

The following illustration shows four different types of finches collected and studied by Charles Darwin during the second voyage of HMS Beagle to the Galápagos Islands in 1835.

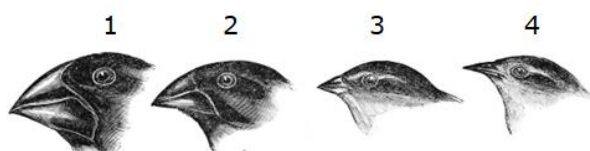


Figure 5.1: Darwin's Finches

(Source: https://en.wikipedia.org/wiki/Darwin%27s_finches)

The Galápagos finches are a classic example of the adaptation of organisms to new ecological contexts. There are currently 14 recognized species of Darwin's finches that are unique to the islands. They share common features of nest architecture, egg pattern, and courtship displays. They differ little except in the shapes of their beaks, feeding behaviour, song, structure, and feathers.

Darwin observed that small variations in beak shape enabled the different species to specialise in eating different types of food such as seeds, insects, cactus flowers and fruits. The variations in beak shape reduced competition between the finches for food.

Species change gradually through time in response to changes in the environment. Evidence indicates that the Galápagos islands have undergone many changes in sea level, elevation and climate.

(Adapted from <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/darwins-finches>)

a. i. From the text, identify **ONE** observation Darwin make about the Galápagos finches.

(1)

ii. Identify **ONE** similarity and **ONE** difference other than the one mentioned in the answer to part a i. between the finches of the Galápagos Islands.

Similarity _____ (1)

Difference _____ (1)

iii. Changes in the environment force species to adapt to new conditions. State what would have happened to Darwin’s finches had they failed to adapt to the new conditions.

 _____ (2)

iv. ‘The variations in beak shape reduced competition between the finches for food’. Name this type of competition.

_____ (1)

v. Different finches have evolved unique beak shapes that correspond to their specific diet. Use Figure 5.1, to give the number of the finch which corresponds to the diet.

Number	Diet
	Suited for cracking hard seeds and nuts
	Suited for catching insects and probing flowers

(2)

vi. State the basic mechanism which gave rise to small variations in beak shape to enable the different species of finches to specialise in different types of food.

_____ (1)

vii. A finch and a bat belong to different groups of animals. They share a common skeletal structure in their forelimbs. Despite the differences in appearance, the underlying bone structure is similar.

Use your biological knowledge to explain why both groups have a common underlying bone structure in their forelimbs.

 _____ (2)

viii. Define the term evolution.

_____ (1)

This question continues on next page.

b. i. Moving from water to land was no easy feat for plants. On land, plants had advantages but faced new challenges. State **ONE** advantage for plant life on land.

(1)

ii. The success of ferns as land plants is attributed to their adaptation to various environmental conditions on land. Describe **TWO** basic features of ferns which helped them adapt to life on land.

(4)

c. The evidence for evolution is provided by fossils. Use the list below to choose the correct word or phrase to complete the following sentences:

single-celled, long time scales, preserved, hard, extinct

Fossils are the _____ remains of previously living organisms.

Bones and shells are commonly fossilised as they are _____ and durable by nature.

Fossils provide evidence of evolution over _____.

(3)

(Total: 20 marks)

Section C: This section carries 20 marks.

6. This question is about photosynthesis.

a. Figure 6.1 shows a cross section through a dicot leaf. Label structures A to E. (5)

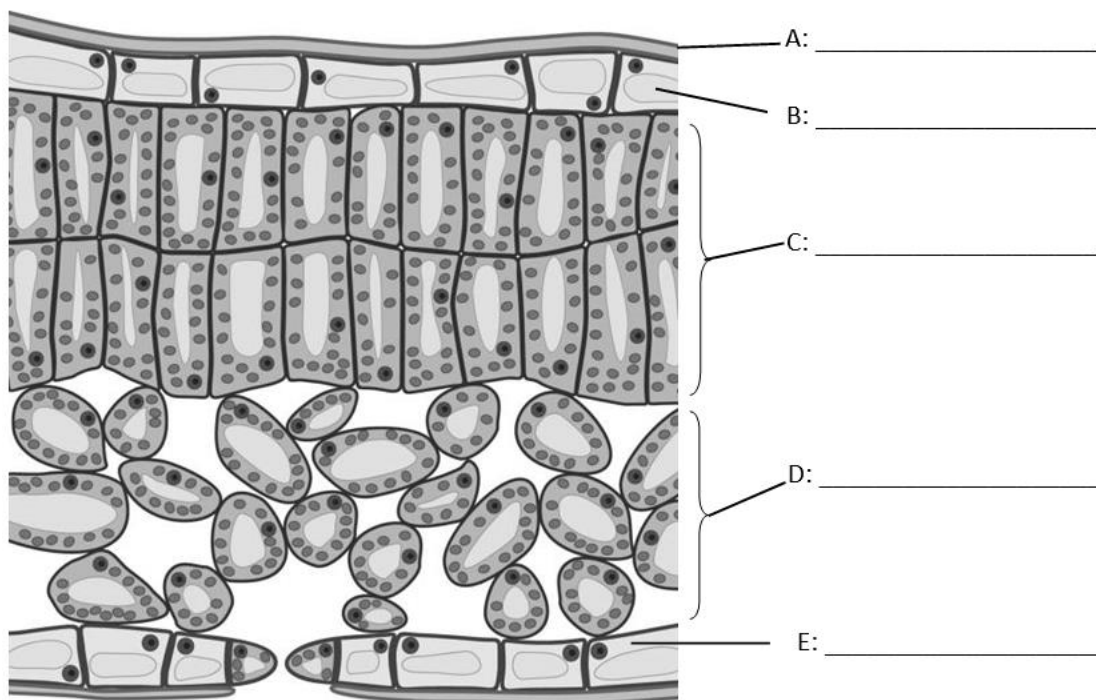


Figure 6.1 Cross-section through a dicot leaf (Source: <https://media.istockphoto.com/id/1367985507>)

b. A group of students were asked to perform an experiment to investigate the effect of light intensity on the rate of photosynthesis. The apparatus was set up as shown in Figure 6.2.

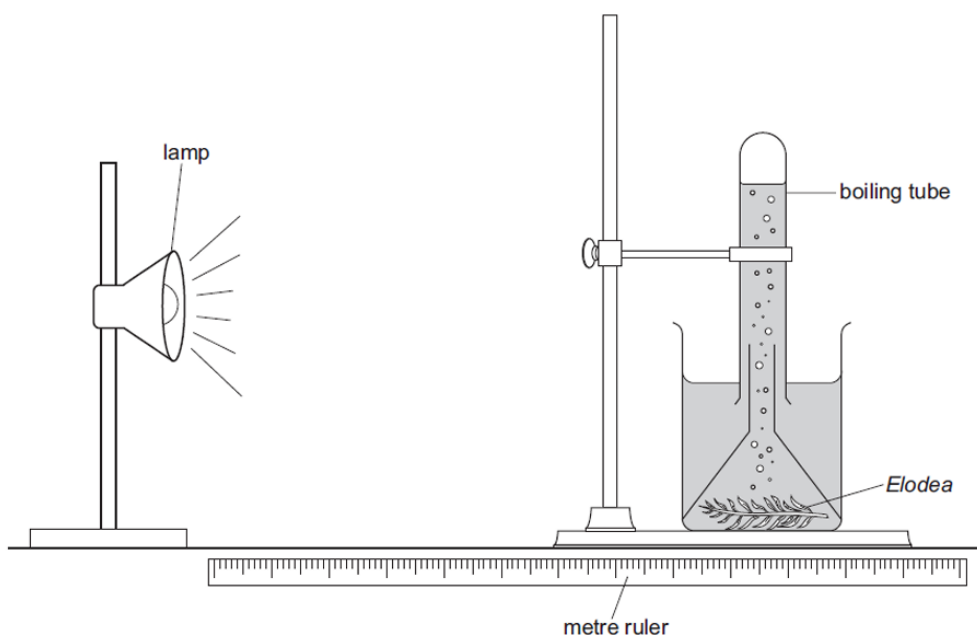


Figure 6.2 Apparatus set-up to investigate the effect of light intensity on the rate of photosynthesis. (Source: www.eduqas.co.uk)

The students were also given another beaker of water. On Figure 6.1 mark with an X, the place where the beaker should be placed to prevent heat from the lamp from affecting the rate of photosynthesis. (1)

c. The students varied the distance of the lamp from the *Elodea**. They determined the rate of photosynthesis by counting the number of bubbles produced per minute. Table 6.1 shows the results obtained.

Table 6.1 Table of results obtained

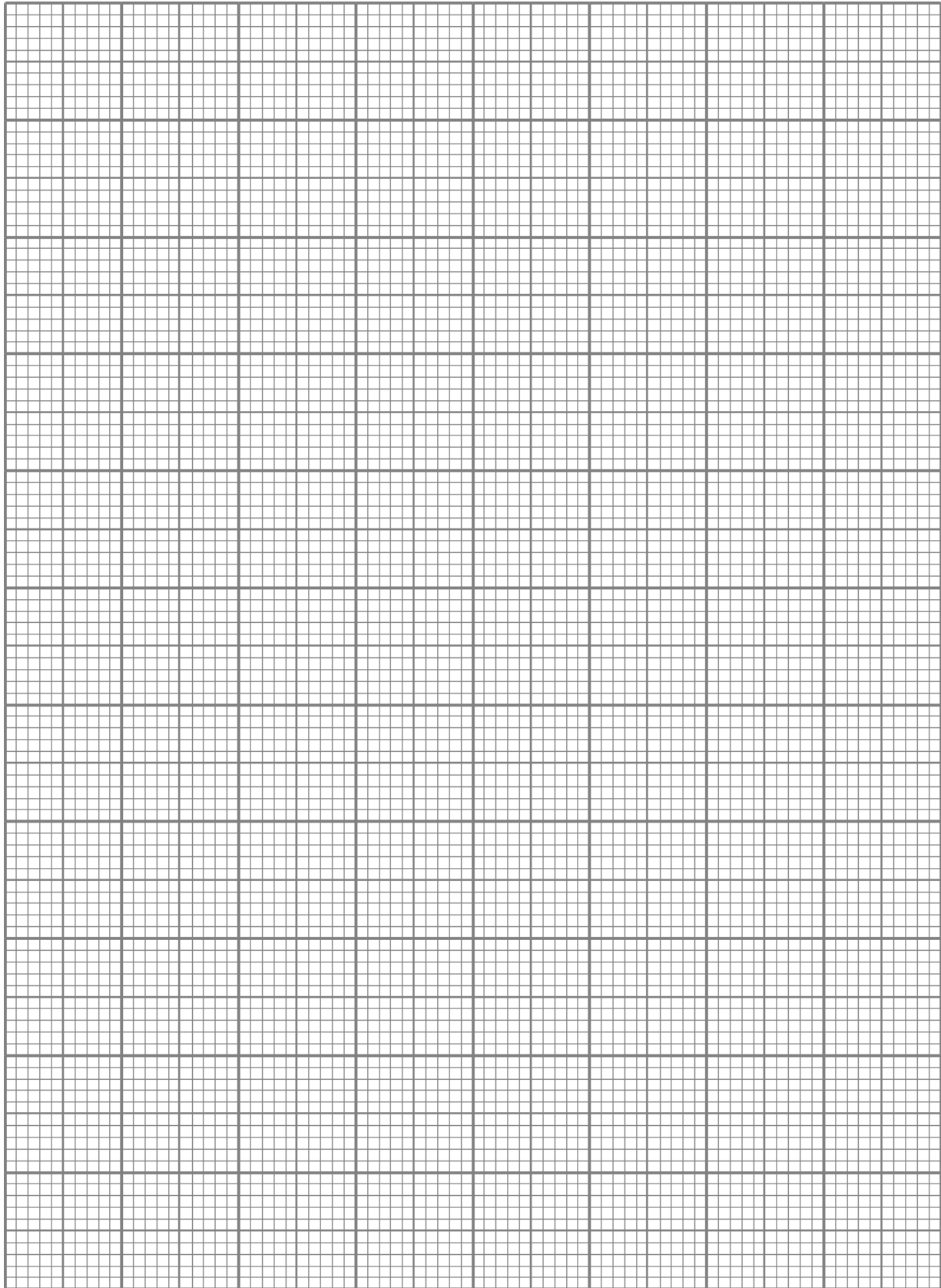
Distance from Lamp (cm)	Average number of bubbles /min ⁻¹
10	24.0
20	24.0
30	23.5
40	21.0
50	15.5
60	10.5
70	5.0

Plot a graph of the average number of bubbles per minute against the distance from the lamp. Use a ruler to join the plots. (5)

* The word *Elodea* is a scientific name and therefore in italics.

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d. With reference to the graph describe how the rate of photosynthesis varies with increasing distance between the lamp and the plant.

(4)

e. Name **TWO** other environmental factors that may limit the rate of photosynthesis.

Factor 1: _____

Factor 2: _____ (2)

f. Fill-in the missing terms in the following:

Photosynthesis is a form of _____ nutrition. This process converts simple _____ substances to _____ substances. (3)

(Total: 20 marks)

Section D: This section carries 20 marks.

7. The Selmunett lizard is very likely extinct. There have been no sightings of this sub-species of lizard since 2007. The primary cause of its decline is attributed to over-predation by introduced rats, which significantly impacted the lizard population on Selmunett island.

a. i. Define the term extinction.

(2)

ii. Explain how the presence of rats on Selmunett island affects the ecosystem, and the population of rats, Selmunett lizards and any lizards' prey.

(4)

This question continues on next page.

.....
iii. The main type of ecosystem of Selmunett island is garigue. Define the term ecosystem.

_____ (2)

b. A student stated that the introduction of rats reduced herbivore biodiversity.

i. Define biodiversity and state **TWO** threats (other than invasive species) that reduce biodiversity.

_____ (4)

ii. In a food chain, herbivores have feeding relationships with both producers and other consumers. Using the words below, describe these relationships of herbivores with producers and consumers.

plant material, secondary consumers, autotrophic, primary consumers, carnivores

_____ (4)

c. Rats were probably introduced on Selmunett island through human activity upsetting the local ecosystem. Hunting and habitat destruction are two other negative effects of humans on biodiversity and ecosystems. Describe **TWO** specific actions that humans can take to protect living organisms.

_____ (4)

(Total:20 marks)



SUBJECT:	Biology
PAPER NUMBER:	II – Level 2-3
DATE:	6 th May 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 of sections A, B, C and D. 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	7	Total
Score								
Maximum	7	12	13	8	20	20	20	100

Section A: This section carries 40 marks.

1. a. Complex carbohydrates called polysaccharides are composed of smaller units called monosaccharides.

i. Continue the following statement:

Protein molecules are composed of smaller units called _____ and lipids are composed of _____ and _____. (1, 1)

ii. Name the **THREE** elements common to both lipids and proteins.

_____ (1)

b. Ethanol and water are used to test for one of the complex molecules mentioned in part a ii. Name this molecule and describe the changes one would observe in case of a positive result.

_____ (1)

c. Describe the link between the molecular size of carbohydrates and their solubility.

_____ (3)

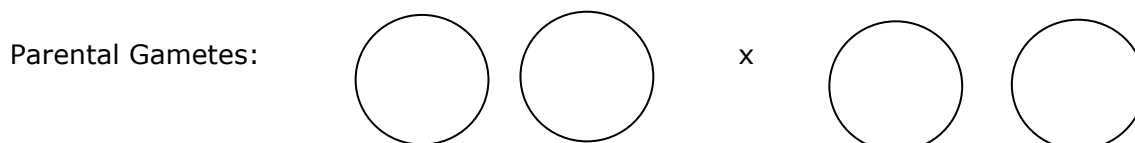
(Total: 7 marks)

2. Haemophilia is a sex-linked trait. It is a condition where blood clotting factors are lacking, leading to excessive loss of blood when blood vessels are injured.

a. A man with haemophilia plans to have a child with a woman who is a carrier for the condition. Fill in the genetic diagram below to determine the probability that this man has a son who does **not** have haemophilia.

In your answer let **X^H** represent the allele for normal blood clotting and **X^h** represent the allele for haemophilia.

Parental Genotypes: Man: _____ x Woman: _____



Woman /		
Man		

Probability that a son does **not** have haemophilia: _____ (5)

b. With reference to the genetic cross in part a., identify the genotype of the daughter that has the haemophilia condition.

Genotype: _____ (1)

c. Some members of European royal families carried the allele for haemophilia. When tests were carried out on molecules extracted from the remains of a dead prince, it was determined that the condition resulted due to a genetic mutation in a gene that codes for a protein in blood. The protein plays a role in blood clotting.

i. Identify the molecule that was extracted from the remains of the dead prince.

_____ (1)

ii. Distinguish between the terms 'gene' and 'allele'.

 _____ (2)

d. A student wrote that, "The Down Syndrome condition, similar to haemophilia, is also caused by a genetic mutation."

State whether this statement is true or false. Give a reason for your answer.

Statement is _____

Reason: _____

 _____ (3)

(Total: 12 marks)
Please turn the page.

3. Figure 3.1 shows an influenza virus.

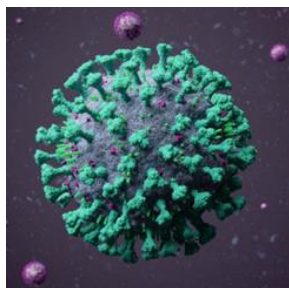


Figure 3.1: Image of an influenza virus

(Source: <https://shorturl.at/JUGSe>)

a. Since viruses do **not** have organelles, nuclei, or even ribosomes they are **not** able to replicate on their own. They must use host cells to create more viruses. Complete the table below by filling in steps 2 and 3.

Step 1	Virus enters the body, attaching itself to a host cell releasing its genetic material into host cell.
Step 2	
Step 3	
Step 4	New viruses infect new cells.

(2)

b. Explain why doctors refrain from prescribing antibiotics to treat influenza.

(1)

c. In May 2024 the World Health Organization released an updated list of antibiotic-resistant bacteria which pose the greatest threat to human health.

These bacteria have built-in abilities to find new ways to resist treatment and can pass along genetic material that allows other bacteria to become drug-resistant as well. Resistant bacteria pose a particular threat in hospitals and nursing homes. Describe how bacteria may become resistant to antibiotics.

(3)

d. Fill in the following table to show the differences between transmissible and non-transmissible diseases.

Feature	Transmissible Diseases	Non-Transmissible Diseases
Transmission		
Causes		
Example		

(3)

e. It is common knowledge that some non-transmissible disease may be preventable. Explain **TWO** ways how a non-transmissible disease may be preventable through lifestyle changes.

_____ (2)

f. Some humans react to allergens showing symptoms of sneezing, itching and runny nose. Explain the term allergen.

_____ (2)

(Total: 13 marks)

Please turn the page.

4. A young person starts monitoring the breathing rate at the start of an exercise routine consisting of a two-minute walk, followed by a step-up exercise for six minutes. Afterwards the person stops exercising and stays at rest.

The graph in Figure 4.1 shows how the breathing rate varies whilst the young person is exercising.

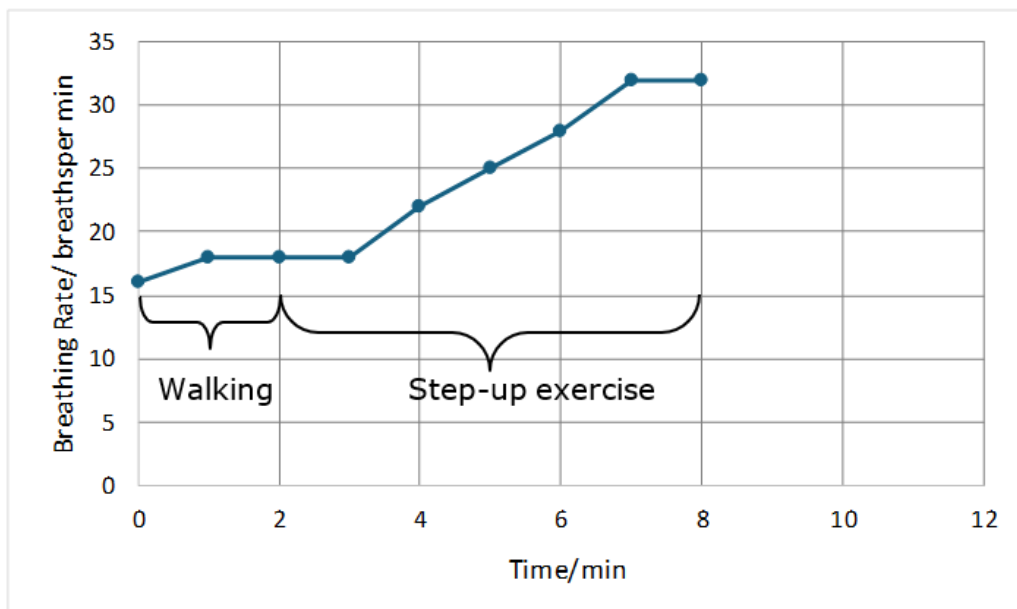


Figure 4.1 Graph showing variation of breathing rate during exercise.

a. i. Predict the expected breathing rate, after 8 minutes, when the young person stops the exercise routine.

(2)

ii. Give a reason for your answer.

(2)

b. During which part of the exercise is the young person most likely to produce lactic acid in the muscles? Give a reason for your answer.

(2)

c. Describe the purpose of ventilation in ensuring an efficient gas exchange in the alveoli.

(2)

(Total: 8 marks)

Section B: This section carries 20 marks.

5. Show me your beak and I'll tell you what you eat

The following illustration shows four different types of finches collected and studied by Charles Darwin during the second voyage of HMS Beagle to the Galápagos Islands in 1835.

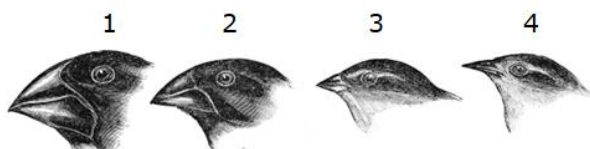


Figure 5.1: Darwin's Finches
(Source: https://en.wikipedia.org/wiki/Darwin%27s_finches)

The Galápagos finches are a classic example of the adaptation of organisms to new ecological contexts. There are currently 14 recognized species of these, 13 living in the Galápagos Islands. They are unique to the islands and vary in size from 10 to 20 cm and weigh between 8 and 38 grams. They share common features of nest architecture, egg pattern, and courtship displays. They differ little except in the shapes of their beaks, feeding behaviour, song, structure, and feathers.

Darwin observed that small variations in beak shape enabled the different species to specialise in eating different types of food: seeds, insects, cactus flowers and fruits. The variations in beak shape reduced competition between the finches for food.

Darwin implied, in his Journals of Researches, 1845, that within a closely related group of birds living on a particular island chain, there was a wide range of variations in their physical features. He suggested that this diversity might have arisen from a single ancestral bird species that gradually adapted to different environments and ways of life on the islands.

Species change gradually through time in response to changes in the environment. Evidence indicates that the Galápagos Islands have undergone many changes in sea level, elevation and climate.

(Adapted from: <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/darwins-finches>)

a. i. Referring to the text, explain how environmental factors have influenced the gene pool of finches on the Galápagos Islands.

(3)

ii. Name **ONE** factor that influences the most advantageous beak shape for survival among Darwin's finches.

(1)

iii. Describe the changes in the genes that bring about natural selection.

(2)

This question continues on next page.

iv. Explain how sexual reproduction increases the rate of evolution.

(3)

v. Beak size and shape in Galápagos finches is an example of continuous variation. Distinguish between continuous and discontinuous variation.

(2)

vi. Evidence indicates that the volcanic Galápagos Islands have undergone many changes in the environment such as sea level, elevation and climate. Name **TWO** other abiotic factors that possibly challenged the survival of finches.

(2)

vii. Changes in climate force species to adapt to new conditions. State what happens to a species if it fails to do so.

(1)

b. i. Mosses have developed several unique adaptations that allow them **not** only to survive but also to flourish in diverse terrestrial environments. They are often among the first colonizers of disturbed sites, helping establish new plant communities after events like deforestation or wildfires. State **TWO** adaptations that enable mosses to live on land.

(2)

ii. The success of ferns as land plants is attributed to their effective reproductive strategies and adaptability to various environmental conditions. Evolutionary success of ferns contributed to the formation of extensive forests which played a vital role in oxygenating the atmosphere.

Explain **TWO** other ways fern forests contributed to life on land.

(2)

iii. The evidence for evolution is provided by fossils. Use the list below to choose the correct word or phrase to complete the sentences.

present day, single-celled, long time scales, preserved, hard, extinct

The sequence in time of the fossil record equates with the increasing complexity of living organisms from unicellular to multicellular organisms. Fossils provide evidence of evolution over _____. Fossils of now extinct species can be linked to _____ species. (2)

(Total: 20 marks)

Please turn the page.

Section C: This section carries 20 marks.

6. A group of students were asked to perform an experiment to investigate the effect of light intensity on the rate of photosynthesis. The apparatus was set up as shown in Figure 6.1.

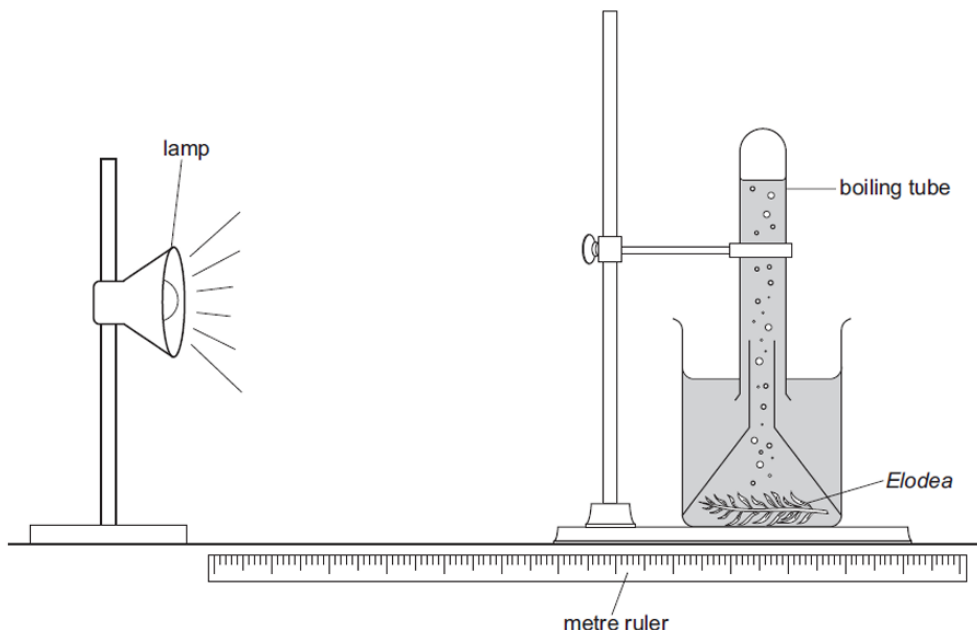


Figure 6.1 Apparatus set-up to investigate the effect of light intensity on the rate of photosynthesis.

(Source: www.eduqas.co.uk)

- a. The students were also given another beaker of water. On Figure 6.1 mark with an X, the place where the beaker should be placed to prevent heat from the lamp from affecting the rate of photosynthesis. (1)
- b. The students varied the distance of the lamp from the *Elodea**. They determined the rate of photosynthesis by counting the number of bubbles produced per minute. Table 6.1 shows the results obtained.

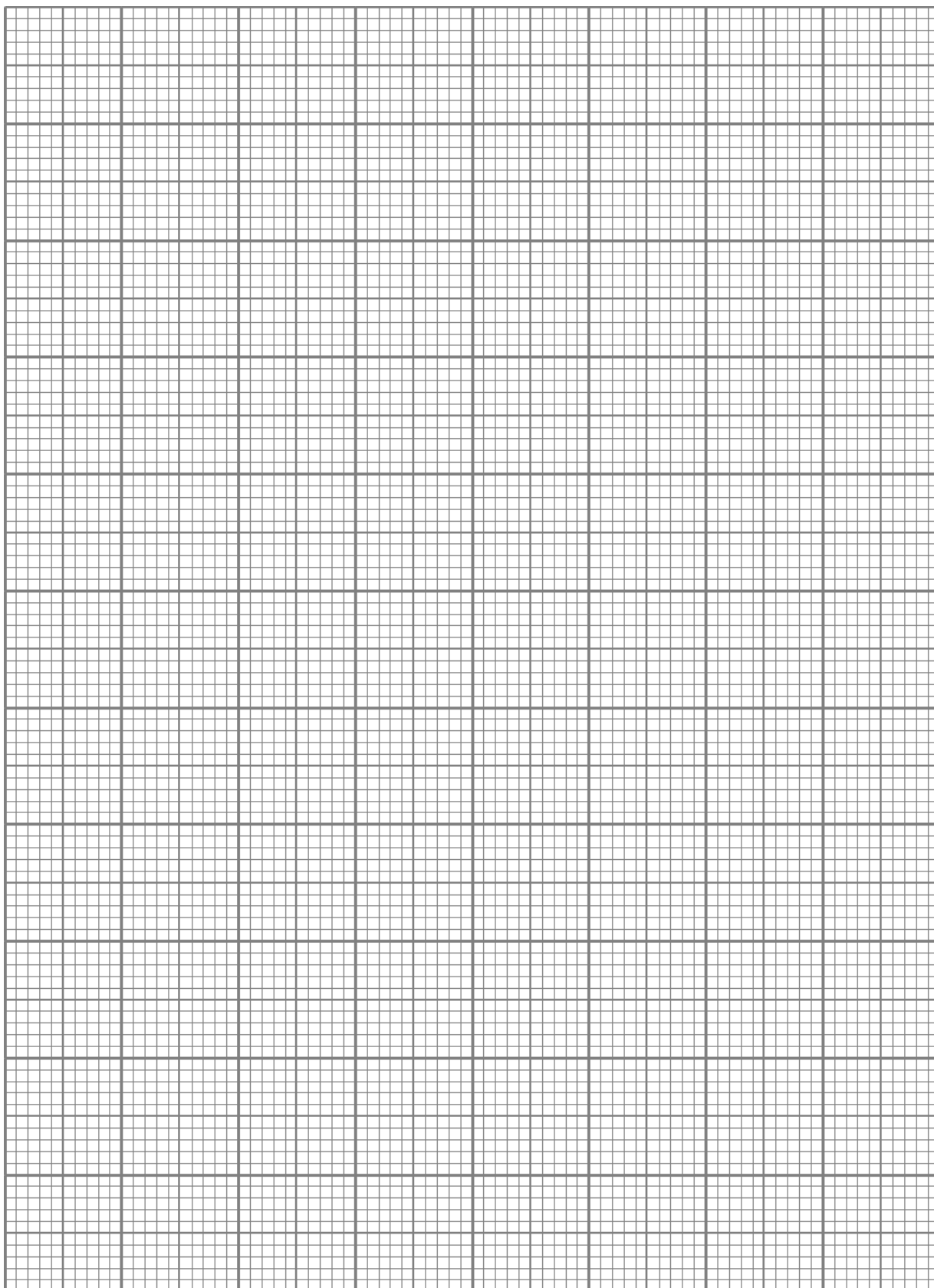
Table 6.1 Table of results obtained

Distance from Lamp (cm)	Average (bubbles/min)
10	24.0
20	24.0
30	23.5
40	21.0
50	15.5
60	10.5
70	5.0

On the graph paper on the next page, plot a graph of the average number of bubbles per minute against the distance from the lamp in cm. Use a ruler to join the plots. (5)

* The word *Elodea* is a scientific name and is therefore in italics.

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This question continues on next page.

c. With reference to the graph explain why:

i. The rate of photosynthesis is lowest when the lamp is 70 cm away from the plant.

_____ (2)

ii. The rate of photosynthesis remains the same when the lamp is 20 cm or less away from the plant.

_____ (2)

d. It was difficult for the students to count all the bubbles of oxygen produced per minute. Describe how the experiment can be improved to overcome this drawback.

_____ (2)

e. Predict the rate of photosynthesis in bubbles / min in the conditions shown in the table below. Give a reason for **each** answer.

Condition	Predicted rate of photosynthesis (bubbles /min)	Explanation
Lamp is switched off in a completely dark lab.		
Lamp is placed 5 cm away from the <i>Elodea</i> .		
The temperature of the water containing the <i>Elodea</i> is increased to 100 °C.		

(6)

f. Explain why a higher maximum rate of photosynthesis is obtained if the experiment is repeated with a larger piece of *Elodea*.

_____ (2)

(Total: 20 marks)

Section D: This section carries 20 marks

7. The Selmunett lizard is very likely extinct. There have been no sightings of this sub-species of lizard since 2007. The primary cause of its decline is attributed to over-predation by introduced rats, which significantly impacted the lizard population on Selmunett island.

a. Explain how the presence of rats on Selmunett island effects the ecosystem, and the population of rats, Selmunett lizards and any lizards' prey.

(4)

b. Explain the difference between intraspecific and interspecific competition and discuss how these may limit population size distribution.

(6)

c. The Selmunett lizard was considered as an endemic species. Distinguish between the term endemic and indigenous species.

(4)

This question continues on next page.

d. Rats were probably introduced on Selmunett Island through human activity upsetting the local ecosystem. Hunting and habitat destruction are two negative effects of humans on biodiversity and ecosystems.

i. Describe **TWO** specific actions that humans can take to protect living organisms.

(4)

ii. Other than predation and competition, explain **ONE** negative effect on the environment resulting from the uncontrolled growth of the rats.

(2)

(Total: 20 marks)

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