



SUBJECT: **Biology**
 PAPER NUMBER: I
 DATE: 28th August 2024
 TIME: 9:00 a.m. to 11:05 a.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.
- 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:

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

1. a. From the box below choose the correct biological term that best describes each situation listed in the table. Some terms may be used more than once.

parasitism mutualism intraspecific competition interspecific competition

Table 1.1: Relationships between organisms

Situation	Biological term
Bacteria that fix nitrogen in air after becoming established inside the root nodules of legumes such as peas.	
Male elephant seals battle over a harem of females to mate with.	
African savanna lions and cheetahs struggle for the same antelopes.	
Tick-feeding oxpeckers are often found clinging to grazing zebras.	
Cuckoos deposit their eggs in the nests of other species and remove one or more host eggs.	
Woodpeckers and squirrels frequently fight for nesting sites in the same holes in trees.	

(6)

b. One of the most invasive insect species in Europe is the harlequin ladybird which tends to eat native ladybirds. Originally from Central Asia, the harlequin ladybird was introduced in Europe to control aphids. The harlequin ladybird carries single-celled parasites called microsporidia. These don't harm the harlequin ladybirds themselves but, kill other species including the native seven-spot ladybirds.

i) Describe how the introduction of the harlequin ladybird may affect the population of native species of the seven-spot ladybird.

(1)

ii) From the text above, name the predator.

(1)

iii) Explain why the use of pesticides to control the harlequin ladybirds is considered as harmful to the ecosystem.

(2)

(Total: 10 marks)

2. The diagram in Figure 2.1 below shows the setup of an experiment which demonstrates an important biological process in a living system. The two pins, Pin A and Pin B show the levels of the water inside the cavity at the beginning and at the end of the experiment.

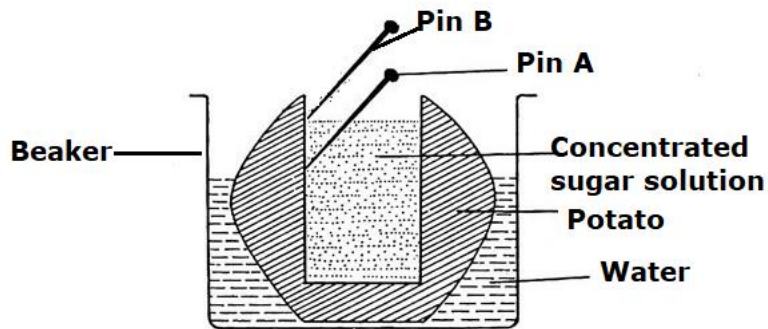


Figure 2.1: Experiment of biological process
(modified from <https://brainly.in/question/7834746>)

A potato is peeled and one side is flattened to serve as the base. A cavity is made in the potato and is filled with concentrated sugar solution and a pin mark is made to indicate the initial level (pin A). This potato is then placed in a beaker containing coloured water for some time.

a. Name the biological process taking place in this experiment.

_____ (1)

b. Explain why is this biological process considered as a special type of diffusion.

_____ (2)

c. i) Give **TWO** observations you would make from this experiment.

_____ (2)

ii) Pin B shows the final water mark. Describe, what causes the rise in water from Pin A to Pin B.

_____ (2)

d. Explain how plasmolysis is significant in the preservation of meat and in pickling.

_____ (3)

(Total: 10 marks)
Please turn the page.

3. The pictures A to E below show a number of fish that are not normally found in the Mediterranean Sea. These fish are defined as alien species.



A



B



C



D



E

Figure 3.1: Some alien species of the Mediterranean Sea
 (A - <https://churaumi.okinawa/sp/en/fishbook/00000098/>; B - <https://fishbase.mnhn.fr/photos/>
 C - <https://www.semanticscholar.org/paper> D - <https://www.thetimes.co.uk/article/>
 E - <https://adriaticnature.com/archives/850>)

a. Use the following dichotomous key to identify alien species A, B and E.

- 1. The body width is less than half the body length (without the caudal fin). Go to 2
 The body width is half or more than half the body length (without the caudal fin). Go to 3
- 2. Has a long beak-like lower jaw.....**Black-barred Halfbeak**
 Has a round lower jaw.....**Silver-Cheeked Toadfish**
- 3. Dorsal fin in one piece Go to 4
 Dorsal fin in two segments.....**Shrimp Scad**
- 4. Has longitudinal stripes on body.....**Indo-Pacific Sergeant**
 Has longitudinal stripes on head.....**Twobar Seabream**

A _____ B _____ E _____ (3)

b. Identify a characteristic of the group fish from Figure 3.1.

_____ (1)

c. Describe the function of gills in fish.

_____ (1)

d. Fish are ectotherms. Define the term ectotherm.

 _____ (2)

e. Below are four versions of the binomial name of the Silver-cheeked toadfish. Only one version is correct. Mark the correct version of the binomial name with a ✓. (1)

	<u>Lagocephalus Sceleratus</u>		Lagocephalus sceleratus
	<u>Lagocephalus sceleratus</u>		lagocephalus sceleratus

f. The habitat of fish A to E is normally the Atlantic, Pacific or Indian Ocean. Define the term habitat. (1)

_____ (1)

g. State **ONE** reason why fish A to E make the Mediterranean Sea their habitat. (1)

_____ (1)

(Total: 10 marks)

4. Natural disasters may stem from land use and misuse.

a. In 2023, a landslide in Sweden may have been triggered by a landfill and heavy rains. It is thought that excavated material placed on the top of a slope caused the landslide. A landfill is an engineered pit, in which layers of solid waste are filled, compacted and covered for final disposal. The bottom of the landfill is lined with impermeable materials.

i) Explain why landfills are used instead of dumping waste in an area.

_____ (2)

ii) Explain why landfills are lined at the bottom and covered at the top.

_____ (2)

iii) An environmental effect of landslides is the loss of soil in the area. Describe how the loss of soil may affect the flora and vegetation in the area of a landslide.

_____ (2)

b. A forest fire in Greece was the largest wildfire recorded in the European Union during the summer of last year. It affected pine and oak forests.

i) State **TWO** ways how these fires may affect the animals of the forests.

_____ (2)

ii) Pine trees are gymnosperms while oak trees are angiosperms. Distinguish between the two groups of plants.

_____ (2)

(Total: 10 marks)

5. a. Complete the text below by choosing the correct word from the box below. Each word can only be used once.

biomass weight ecosystem mass organisms high upright

A pyramid of biomass shows the total mass of the _____ involved at each trophic level of an _____. Biomass is calculated as the _____ of living organisms present at each trophic level in a given sample size. It can be represented as dry _____ in grams per unit area. These pyramids are not necessarily _____. There can be lower amounts of _____ at the bottom of the pyramid if the rate of primary production per unit biomass is _____. (7)

b. Which energy pyramid level contains the producers?
 _____ (1)

c. List **ONE** disadvantage of a pyramid of numbers.
 _____ (1)

d. Not all energy is passed from one level of the food chain to the next. Explain.
 _____ (1)

(Total: 10 marks)

6. Figure 6.1 shows a longitudinal section of a flower.

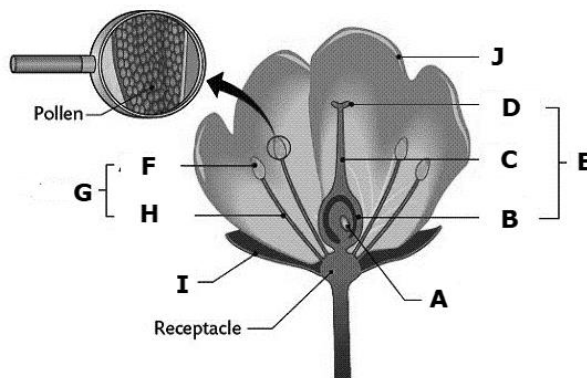


Figure 6.1: Longitudinal section of a flower
 (<https://nz.pinterest.com/pin/the-structure-and-functions-of-flowers--89157267602492096/>)

a. Label parts E, G, I, J: (4)

E _____ G _____

I _____ J _____

b. The table below, lists some events that occur during reproduction in a flower. Complete the table below, using letters from Figure 6.1 to show where each event occurs in a flower. Letters may be used more than once. Write only one letter in each box.

Table 6.1: Site of reproductive event

Event	Letter showing the specific structure where the event occurs
Female gametes are produced	
Male gametes are produced	
Fertilisation takes place	

(3)

c. Explain what happens in a flower from when pollination occurs to seed formation.

(3)

(Total: 10 marks)

7. a. Figure 7.1 shows a diagram of the protist *Amoeba*.

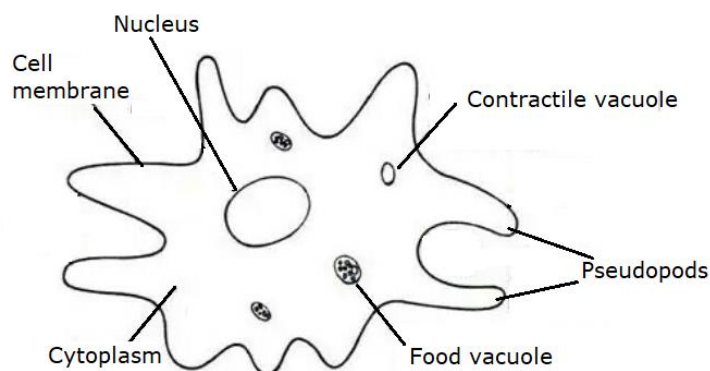


Figure 7.1: Diagram of the protist *Amoeba*

(Modified from: <https://brainly.in>)

i) State **ONE** characteristic of the phylum of protists.

(1)

ii) Describe the role of the contractile vacuole in protists.

(2)

iii) Describe how food vacuoles are produced in an *Amoeba*.

(2)

b. Figure 7.2 shows a diagram of the fungus *Rhizopus*.

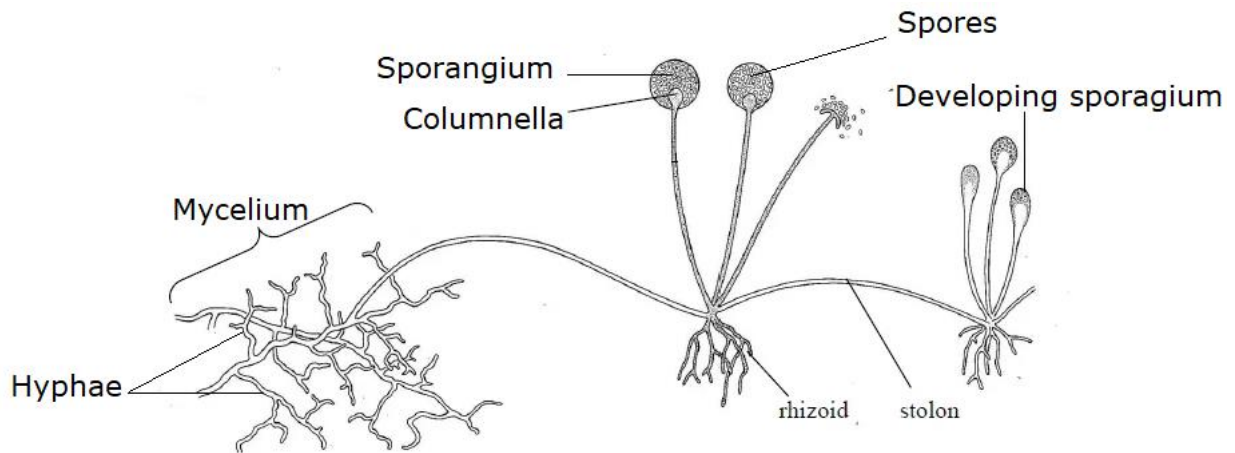


Figure 7.2: Diagram of the fungus
(<https://www.notesforshs.com/2022/11/rhizopus-bread-mould.html>)

i) Describe how the hyphae of a fungus obtain nutrients.

(3)

ii) Describe the role of the spores.

(2)

(Total: 10 marks)

8. Respiration involves chemical reactions that break down nutrient molecules in living cells to release energy.

a. Distinguish between aerobic and anaerobic respiration in terms of energy released.

(2)

b. Explain why energy from respiration is still used when asleep.

_____ (2)

c. i) Give **TWO** reasons why plants use aerobic respiration.

_____ (2)

ii) Rice plants are grown partly submerged in water in paddy fields. Explain why rice stems contain a large number of air spaces running along the length of the stem.

_____ (2)

d. List:

i) **ONE** example when anaerobic respiration takes over from aerobic respiration in humans.

_____ (1)

ii) **ONE** example when anaerobic respiration is used in industry processes.

_____ (1)

(Total: 10 marks)

9. a. Indicate whether each of the descriptions in Column 1 apply to A or B, of the items in Column 2. Write A only, or B only in the space provided.

Table 9.1: Photosynthesis

Column 1	Column 2	A only/B only
Type of energy stored in food molecules during photosynthesis	A: Chemical energy B: Heat energy	
Raw material/s essential for photosynthesis	A: Oxygen B: Carbon dioxide	

(2)

This question continues on next page.

b. Diagrams X, Y and Z in Figure 9.1, represent investigations on photosynthesis. The plants represented as X and Z were exposed to sunlight for 5 hours.

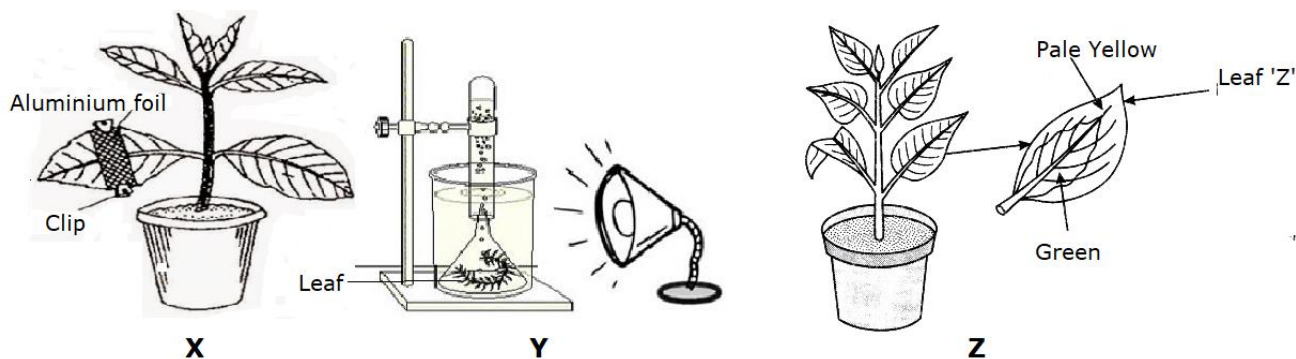


Figure 9.1: Photosynthesis investigations
Adapted from: <https://tongaatsecondary.co.za/gallery/GRADE%2011%20LS.pdf>

Which investigation (X, Y or Z) is designed to test for the following?

i) Chlorophyll is necessary for photosynthesis. _____ (1)

ii) Oxygen is produced during photosynthesis. _____ (1)

iii) Light is required for photosynthesis. _____ (1)

c. i) From Figure 9.1, list the **TWO** investigations (from X, Y or Z) that use a chemical to test whether photosynthesis took place.

_____ (2)

ii) Name the molecule that is being tested in these two investigations.

_____ (1)

d. Explain why all animals, including humans, are dependent on green plants.

_____ (2)

(Total: 10 marks)

10. a. In an investigation on enzyme activity at different temperatures, the following results were obtained.

Temperature (°C)	10	20	30	40	50	60
Rate of reaction (arbitrary units)	0.5	1.1	2.1	3.7	2.8	1.1

i) On the graph paper provided overleaf, plot graph of rate of reaction (arbitrary units) against temperature (°C). Put temperature (°C) on the x-axis. Join the points free hand. (4)

ii) Describe the general trend of the graph up to 40 °C and then after 40 °C.

_____ (2)

b. Use your biological knowledge to explain the trend of the graph after 40 °C.

_____ (2)

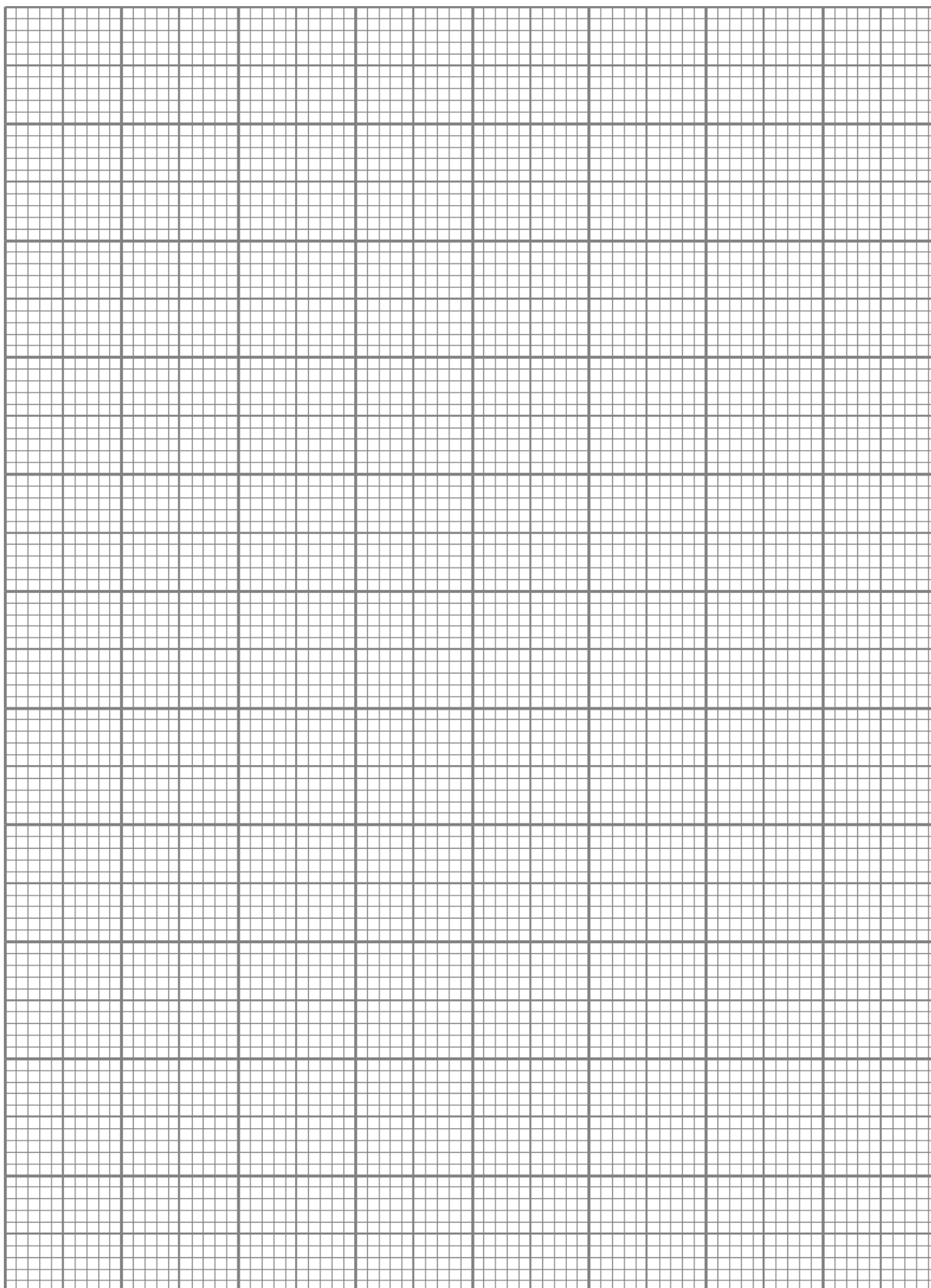
c. Enzymes are proteins. Write a general description of the structure of a protein.

_____ (2)

(Total: 10 marks)

Please turn the page.

DO NOT WRITE ABOVE THIS LINE



SUBJECT:	Biology
PAPER NUMBER:	IIB
DATE:	28 th August 2024
TIME:	4:00 p.m. to 6:05 p.m.

Write your answers on the booklet provided. Write down the number of the questions you answer on the front page of your answer booklet. Start a new page for each question that you answer. Please note that for question 5 of this paper you need the graph paper in the booklet.

Answer FOUR questions from this paper. Each question carries 25 marks.

1. The first phase in holozoic nutrition is ingestion, whereby food is taken into the body. The last stage is egestion, in which any food that cannot be digested/absorbed is passed out of the anus.
 - a. Describe in order, the other three phases, taking place between ingestion and egestion. (6)
 - b. i) Describe how and where the body digests the protein present in a boiled egg. (6)
 ii) Explain what may happen to the amino acids produced during the digestion of an egg, if the body takes in a very high amount of protein in food. (2)
 iii) Name **ONE** product of digestion other than amino acids, that moves from the small intestine into the capillaries of the villi. (1)
 - c. Give **ONE** result of muscle contraction at:
 - i) the oesophagus; (2)
 - ii) the stomach. (2)
 - d. i) Patients who have the gall bladder removed during surgery are recommended to follow a low-fat diet (low fat or fat free dairy products). Outline **ONE** reason for such a recommendation. (2)
 ii) The surgical removal of part of the colon may result in dehydration among other things. Explain why this happens. (2)
 - e. 'The liver is a chemical factory, a food store and a central heating system'. List any **TWO** functions of the liver. (2)

(Total: 25 marks)
2. a. The deep part of the Pacific Ocean is a habitat to organisms called siphonophores. Each siphonophore is a colony of specialised individuals that have different functions such as movement, capturing prey, waste removal, and reproduction. Siphonophores are cnidarians (coelenterates). Siphonophores feed on crustaceans and small fish among other animals.
 - i) List **TWO** characteristics of animals of the phylum cnidaria (coelenterate). (2)
 - ii) State the phylum of the class crustacea. (1)
 - iii) Give **TWO** characteristic features of this phylum. (2)
 - iv) Name **ONE** other class of this phylum. (1)
 - v) Give **ONE** characteristic of the class crustacea. (1)

b. In 2020, a very long, thin siphonophore was discovered. It was calculated to be about 45m long. Worms are also described as long and thin. The animal kingdom consists of three phyla of worms: Platyhelminthes, Nematodes and Annelids.

- i) Give **ONE** other characteristic of Platyhelminthes. (1)
- ii) Distinguish between Nematodes and Annelids. (2)

c. One group of annelids are leeches. Many species of leeches have suckers. One species, *Hirudo medicinalis*, the European medicinal leech, is used to stimulate circulation in tissues in humans. Proteins in the saliva of leeches stop platelets from clumping together.

- i) Describe platelets. (2)
- ii) State where they are found. (1)
- iii) Explain what will happen when the proteins stop platelets from clumping together. (3)

d. Some species have parasitic relationships with other species of the animal kingdom or other kingdoms. Different species of parasitic protists including *Schistosoma mansoni* and *Plasmodium malariae*, cause glomerular injuries in the kidneys of humans.

- i) Define the term parasitic relationship. (2)
- ii) Are the two parasitic protists above closely related? Give **ONE** reason for your answer. (2)
- iii) Is the glomerulus found in the cortex or medulla of the kidney? (1)
- iv) Describe the glomerulus found in kidneys. (2)
- v) State the role of the glomerulus. (2)

(Total: 25 marks)

3. Congenital heart disease is heart disease present at birth. One common congenital heart defect is the atrial septal defect. This is an abnormal opening in the wall that separates the upper right and left heart chambers.

a. Name the heart chamber that:

- i) pumps oxygen-rich blood to the body; (1)
- ii) pumps oxygen-poor blood to the lungs; (1)
- iii) receives oxygen-rich blood from the lungs. (1)

b. Describe what happens in a child suffering from atrial septal defect with an abnormal opening between the upper right and left chambers of the heart. (3)

c. Stenosis is another congenital heart defect that involves narrowing or obstruction in the heart valves, arteries or veins.

- i) Name the valve that allows blood to flow from the heart's lower left chamber to the aorta. (1)
- ii) Explain the effect of narrowing of the pulmonary valve. (4)

d. Epstein's anomaly is a rare condition in which the tricuspid valve is located lower than normal and has abnormal flaps. Describe how the position of the tricuspid valve in a child with Epstein's anomaly affects the size of the:

- i) upper right chamber; (2)
- ii) lower right chamber. (2)

- e. A child is born with a condition in which the pulmonary artery and the aorta are reversed. This child's aorta is connected to the lower right heart chamber while the pulmonary artery is connected to the lower left heart chamber.
- List **TWO** effects of this condition. (4)
 - In this condition, the aorta may be pinched in and narrowed in one spot. List **TWO** effects of this narrowing. (2)
 - The aorta is the largest artery. Explain why a pulse can be felt over an artery lying near the skin surface. (4)

(Total: 25 marks)

4. a. Figure 4.1 below represents the nitrogen cycle.

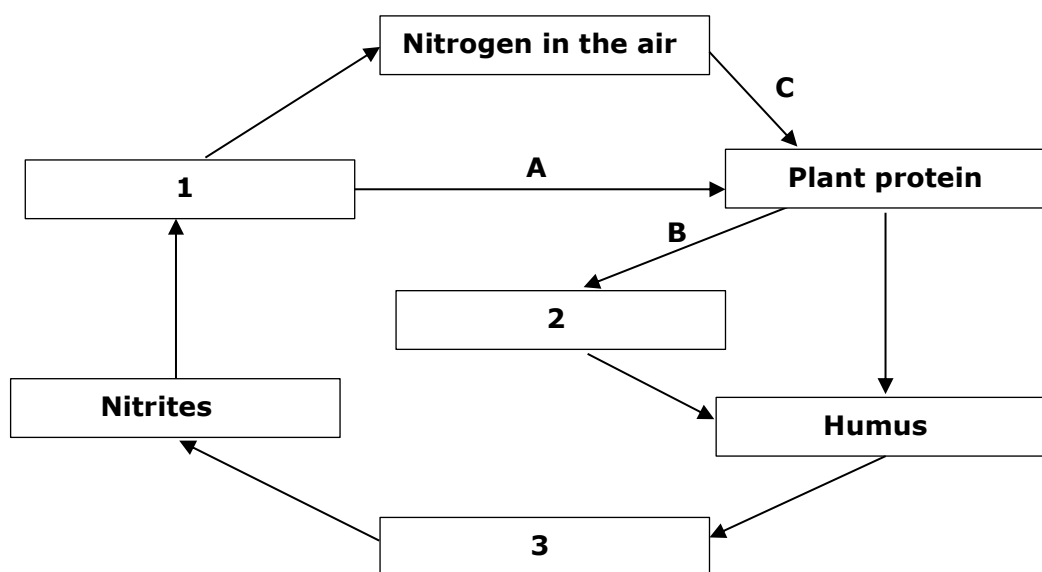


Figure 4.1: The Nitrogen Cycle

- Ammonia, animal protein, and nitrates are molecules represented by numbers 1, 2, and 3 on the diagram above. State which molecule is being represented by numbers 1, 2 and 3 on the diagram. (3)
 - Name the process that takes place at A. (1)
 - Name the process that takes place at B. (1)
 - In some plants, nitrogen in the air can be changed into plant protein. This is shown by arrow C. Explain how this happens. (3)
- b. List **THREE** ways which are responsible for the loss of nitrogen from the soil. (3)
- c. Explain the importance of recycling elements, such as nitrogen, in nature. (2)
- d. Explain why is the nitrogen cycle important to farmers? (3)
- e. Explain why leguminous plants such as clover, are able to survive in soil low in nitrates. (2)
- f. Do excess nitrate fertilisers harm the environment? Explain your answer. (7)

(Total: 25 marks)

Please turn the page.

5. a. Figure 5.1 shows the diagram of the cross-section of a dicot stem.

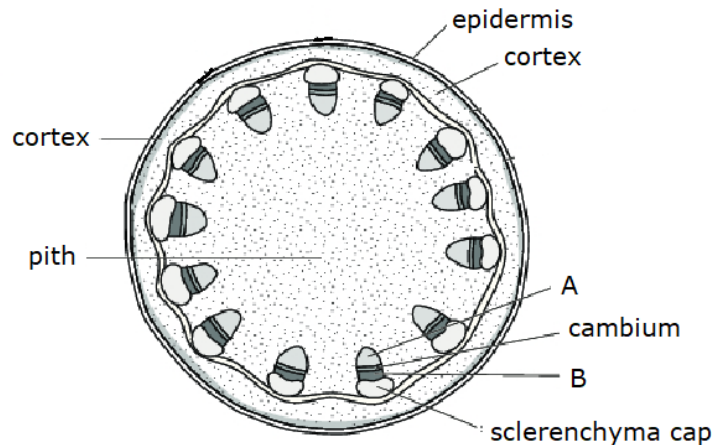


Figure 5.1: Cross-section of dicot stem

(https://learn.mindset.africa/sites/default/files/resourcelib/emshare-show-note-asset/1644_fdoc.pdf)

- i) List the tissues A and B that make up the vascular bundle. (2)
- ii) State which structure, A or B, is made up of dead cells. (1)
- iii) State which structure, A or B, has companion cells. (1)
- iv) Draw a cross-section of a dicot root showing the distribution of vascular tissue. Label the vascular tissues of your diagram appropriately. (4)
- v) Explain how water is absorbed by the roots and how it travels to the vascular tissue. (6)

b. In an experiment on transpiration, a group of students, hung 4 identical sized leaves (A to D) from the same plant, on a string. Some sides of the leaves were coated with petroleum jelly* as shown in Figure 5.2.

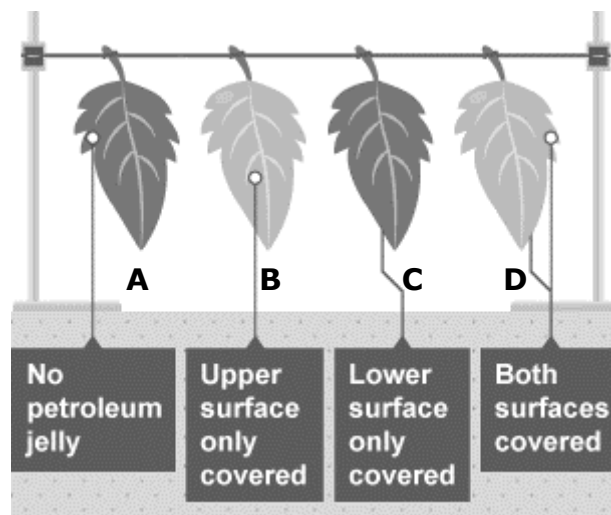


Figure 5.2: Transpiration experiment

(<https://www.bbc.co.uk/bitesize/guides/z3w4k7h/revision/5>)

* Petroleum jelly is the name of the substance in Vaseline™

Each leaf was weighed before and after the investigation. The percentage (%) decrease in mass was calculated. Table 5.1 shows the conditions applied to each leaf and the results obtained.

Table 5.1: Results of Transpiration investigation

	Leaf A	Leaf B	Leaf C	Leaf D
Surface coated with petroleum jelly	None	Upper	Lower	Both
Percentage (%) decrease in mass	40	36	4	2

(<https://www.bbc.co.uk/bitesize/guides/z3w4k7h/revision/5>)

- i) Define the term transpiration. (2)
- ii) On the graph paper provided (use the 2 mm grid scale), draw a bar chart of percentage (%) decrease in mass and the condition of the leaves of the plant. Put percentage (%) decrease in mass on the y-axis. (6)
- iii) Which surface of the leaf includes the highest amount of stomata? Substantiate your answer using the results from the investigation. (3)

(Total: 25 marks)

6. *Podogymnura intermedia* is a new gymnure species that was discovered in 2023. With its golden-brown fur and pointed nose it looks similar to a shrew but belongs to a group of mammals known as gymnures. They are also known as hedgehogs.

- a. Write the species name of the new gymnure discovered in 2023. (1)
- b. i) What is the advantage of fur in mammals? (1)
ii) Describe how fur allows for the above advantage. (2)
- c. Gymnures are primarily carnivorous. They come out to forage at night to search the forest floor and hunt various arthropods, small reptiles and amphibians.
 - i) Write the biological term that describes organisms hunted by carnivores. (1)
 - ii) Describe **TWO** characteristics typical of carnivores that enable them to hunt other organisms efficiently. (4)
 - iii) Describe **ONE** way how ectothermic reptiles and amphibians avoid extreme high temperatures. (2)
 - iv) Mammals are **not** ectotherms. Explain. (2)
 - v) Ectotherms are less active in cooler temperatures and have to warm up in the morning sun before they are more active. Give the disadvantage of this. (2)
- d. Internal fertilisation takes place in most reptiles while in amphibians fertilisation is external.
 - i) Define the term fertilisation. (2)
 - ii) Describe **ONE** advantage of internal fertilisation in reptiles. (2)
- e. i) Describe the skin of amphibians. (2)
ii) List **TWO** advantages of the dry scaly skin in reptiles. (4)

(Total: 25 marks)

Please turn the page.

7. The nervous system and the endocrine system both co-ordinate several functions of the human body.

a. Describe **THREE** ways how co-ordination by the nervous system is different from that of the endocrine system. (3)

b. Insulin and glucagon are two hormones of the endocrine system.

- i) Name the organ that produces and secretes these two hormones. (1)
- ii) List **ONE** stimulus that results in insulin secretion. (1)
- iii) These two hormones are described as antagonistic (have opposite effects to one another) hormones. Explain, with reference to the functions of these two hormones, how these two hormones act opposite each other. (2)
- iv) These antagonistic hormones maintain homeostasis. Explain. (1)

c. The diagram in Figure 7.1 below, shows the knee-jerk reflex.

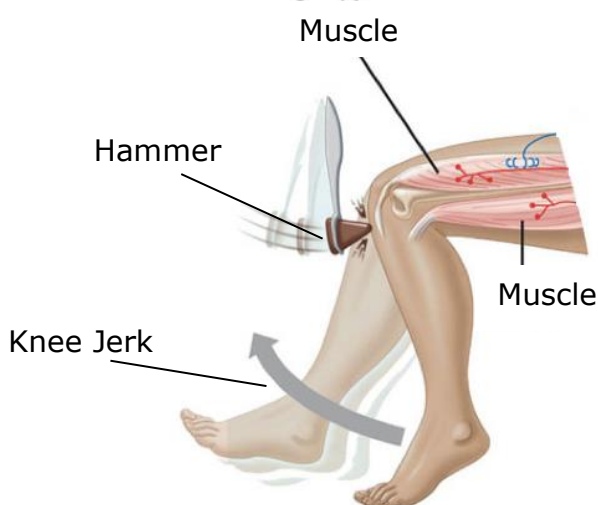


Figure 7.1: The knee-jerk reflex
 (<https://quizlet.com/236517883/knee-jerk-reflex-patellar-reflex-diagram/>)

- i) Define a reflex action. (2)
- ii) Describe how the knee-jerk reflex occurs using the following biological terms: (7)

Stimulus; Response; Motor neurone; Relay neurone; Sensory neurone; Effector; Receptor.

d. Two persons A and B conducted a simple investigation about reflex action times. Person A sat with her elbow resting on the edge of a table while person B held a ruler with the bottom of the ruler level with the thumb of person A. Person B dropped the ruler and person A caught the ruler. The time taken was recorded. This experiment was repeated for two more times. The results obtained are found in Table 7.1.

Table 7.1: Experiment on reflex action

Test No.	1	2	3
Time taken to catch the ruler (s)	0.16	0.15	0.14

- i) Work out the average time in seconds person A took to catch the ruler. Show your calculations. (2)
- ii) State why the reaction time was tested three times. (1)

- iii) Give **ONE** variable the persons would have kept constant in this experiment. (1)

The two persons then tested the effect of caffeine on reflex actions. Half an hour after drinking coffee, the above procedure was repeated. Table 7.2 shows the results obtained.

Table 7.2: Effect of caffeine on reflex action

Test No.	1	2	3
Time taken to catch the ruler (s)	0.11	0.14	0.12

- iv) Compare the two sets of results in Tables 7.1 and 7.2 and describe the effect of caffeine on reflex actions. (2)

- e. Describe the role of synapses in the transmission of impulses. (2)

(Total: 25 marks)

8. Malta has five near real time air quality monitoring stations that determine the concentrations of most pollutants every 15 minutes. The main air pollutants monitored in near real time are ozone, sulphur dioxide, nitrogen oxides, carbon monoxide and particulate matter.

- a. List **ONE** source of:

- i) carbon monoxide; (1)
 ii) sulphur dioxide; (1)
 iii) nitrogen oxides. (1)

- b. "The ozone layer sits in the stratosphere between 15 km and 30 km above the Earth and shields us and other living things from the sun's harmful ultraviolet radiation. Ozone layer depletion could have serious effects on human health and the environment."

(<https://www.eea.europa.eu/>)

- i) Name the chemical that causes ozone layer depletion. (1)
 ii) List **TWO** effects on human health and the environment caused by ozone layer depletion. (2)
 iii) Ground level ozone damages agricultural crops and reduces crop yields. List **TWO** other factors that can lead to reduced crop yields. (2)

- c. Particulate matter is made up of tiny suspended particles of solids in the air. These particles may include dust, dirt, soot and smoke. Particles less than 2.5 micrometres in diameter can penetrate deeply into the lung, irritate and corrode the alveolar wall, and consequently impair lung function.

- i) List **TWO** reasons why the particulate matter concentration in Malta is 21.1 times above the recommended limit given by the World Health Organisation. (2)
 ii) Describe the path the air particles take as they are inhaled from the nose until they arrive at the alveolar wall. (3)
 iii) Explain why the lungs will not work properly when the alveolar wall ruptures. (4)
 iv) Describe the mechanisms of inhalation of air. (4)

- d. Sulphur dioxide aggravates asthma and can reduce lung function. Asthma is a chronic lung disease caused by inflammation and muscle tightening around the airways. Describe **TWO** possible symptoms of asthma. (4)

(Total: 25 marks)