



L-Università
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
2023 SUPPLEMENTARY SESSION**

SUBJECT: **Biology**
 PAPER NUMBER: I
 DATE: 29th August 2023
 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	11	10	10	9	10	10	10	7	10	13	100

1. a. Table 1.1 lists some structures found in cells and their functions. Complete the table by filling the missing information. (6)

Table 1.1: Cellular structures and their function.

Structure	Function
	Controls what enters and leaves the cell
Nucleus	
	Site of photosynthesis
Permanent vacuole	
	Site of aerobic respiration
Cell wall	

- b. The *Amoeba* is a unicellular animal-like organism, whilst the cat is a multicellular animal.

- i) Distinguish between the terms unicellular and multicellular.

(2)

- ii) Table 1.2 compares the surface area (S.A.), the volume (V) and the surface area to volume ratio (S.A.:V) of the *Amoeba* and the cat. Fill in the table to indicate which organism has the larger surface area, volume and surface area to volume ratio. (3)

Table 1.2: Comparison of characteristics in an *Amoeba* and a cat

Characteristic	The characteristic is larger in:
Surface area (S.A.)	
Volume (V)	
Surface area to volume ratio (S.A.: V)	

(Total: 11 marks)

2. The Oriental hornet (*Vespa orientalis*) is the largest wasp to be found in Malta. These hornets capture other insects such as grasshoppers, flies, honeybees, and wasps with which they feed to their young as these need a protein-rich diet. The adults feed on a carbohydrate-rich diet consisting mainly of nectar, honeydew, and fruits.

a. Name the kingdom and the phylum in which insects are classified.

Kingdom: _____ Phylum: _____ (2)

b. Figure 2.1 shows a dorsal view of the Asian giant hornet. Similar to other insects its body is divided into a head, a thorax and an abdomen. On the diagram label **THREE** other visible structural characteristic features of insects. (3)

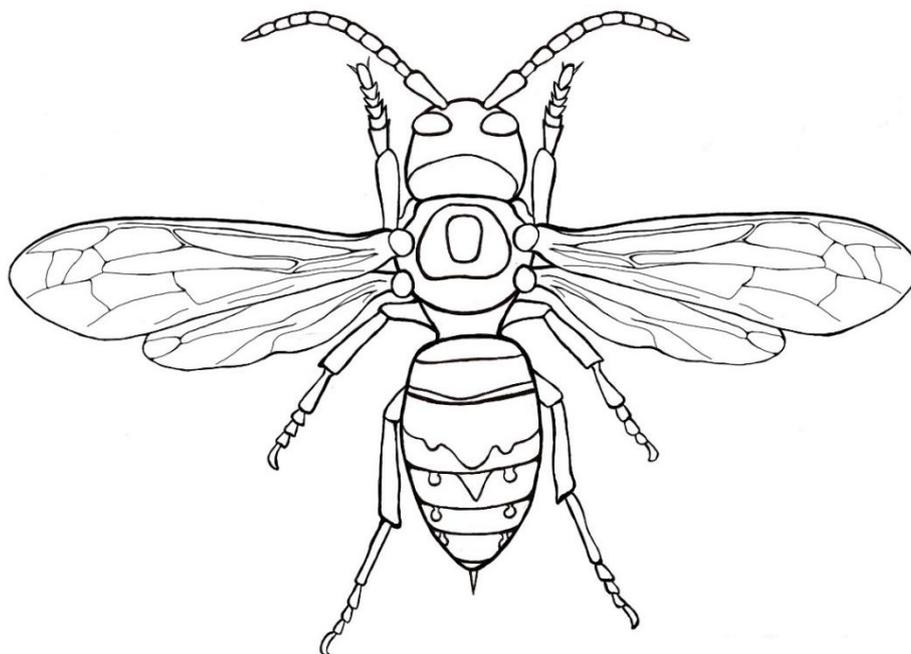
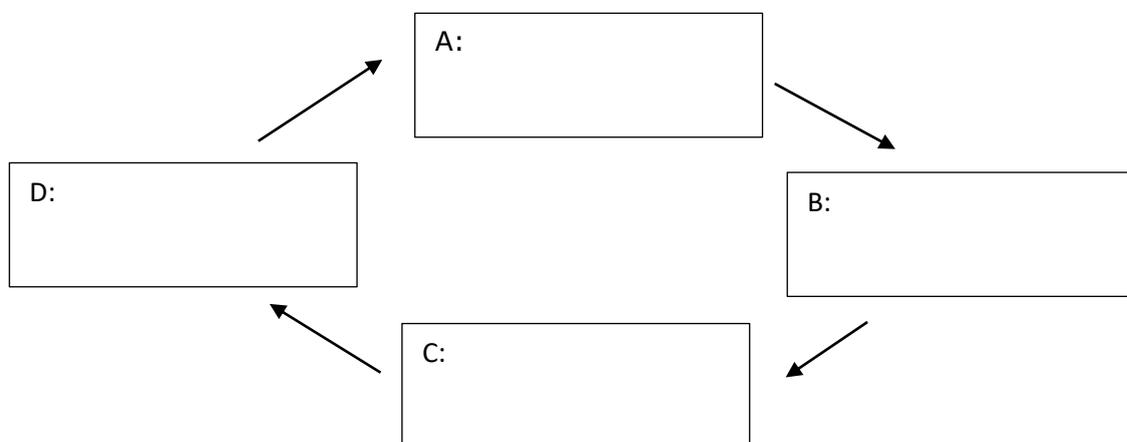


Figure 2.1: Diagram showing an Asian giant hornet
 (Source: <https://ucanr.edu/blogs/bugsqquad//blogfiles>)

c. The Oriental hornet shows complete metamorphosis. In the spaces provided fill in the missing terms, to name the stages involved in complete metamorphosis. (2)



This question continues on next page

d. The grasshopper shows incomplete metamorphosis. State **ONE** way how the life cycle of the grasshopper differs from that of the Oriental hornet.

_____ (1)

e. Explain why the young Oriental hornets are fed a protein-rich diet, whilst the adults feed on a carbohydrate-rich diet.

_____ (2)

(Total: 10 marks)

3. Figure 3.1 shows a Mediterranean sea food web.

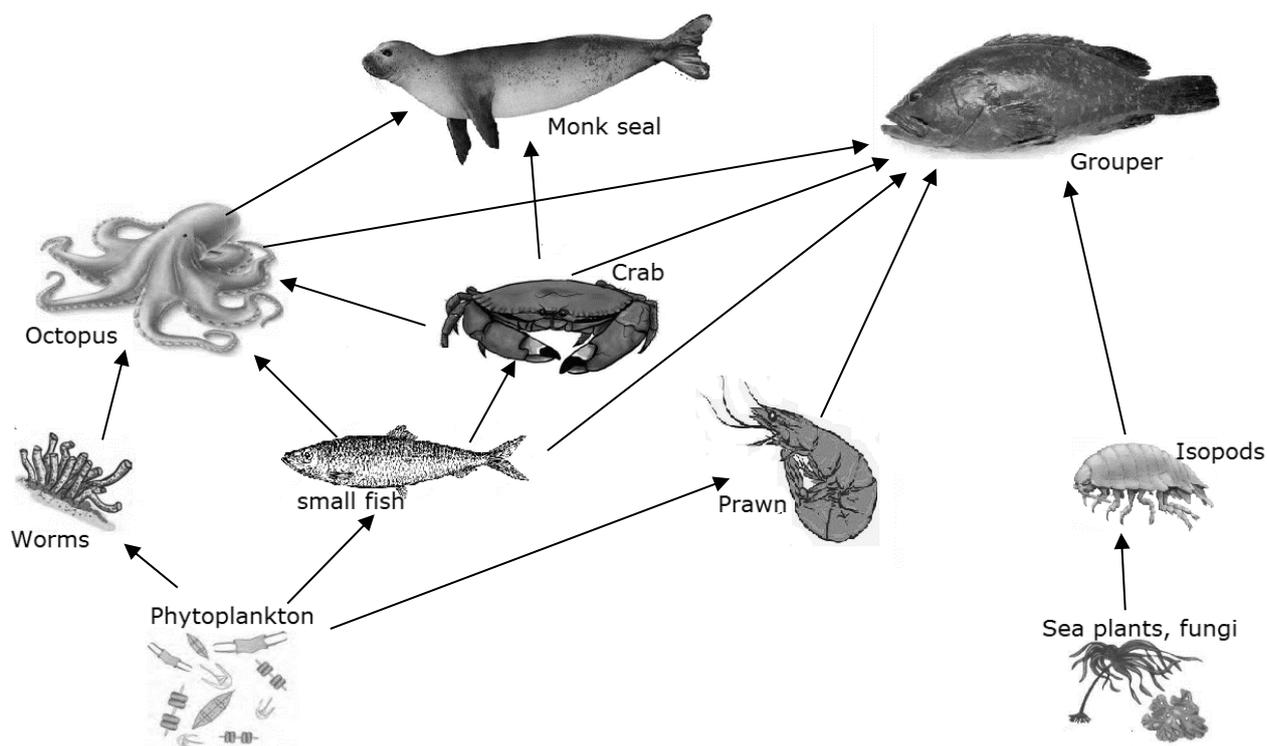


Figure 3.1: Mediterranean sea food web
(Adapted from <https://prezi.com/wi8fmgllqqh6/food-chain-mediterranean-ecosystem/>)

a. From Figure 3.1 identify:

i) a producer; _____ (1)

ii) a secondary consumer. _____ (1)

b. Use Figure 3.1 to draw a food chain with only four trophic levels. Draw the food chain in the space provided. (2)

c. i) Describe what would happen to the isopod population if fishermen caught large numbers of crabs. Give **ONE** reason for your answer.

(2)

ii) Describe what would happen to the small fish population if fishermen caught large numbers of crabs. Give **ONE** reason for your answer.

(2)

d. Worms can fall under the phyla of platyhelminthes, nematodes or annelids. Distinguish between platyhelminthes and nematodes.

(2)

(Total: 10 marks)

4. Figure 4.1 shows a drawing of a reflex arc.

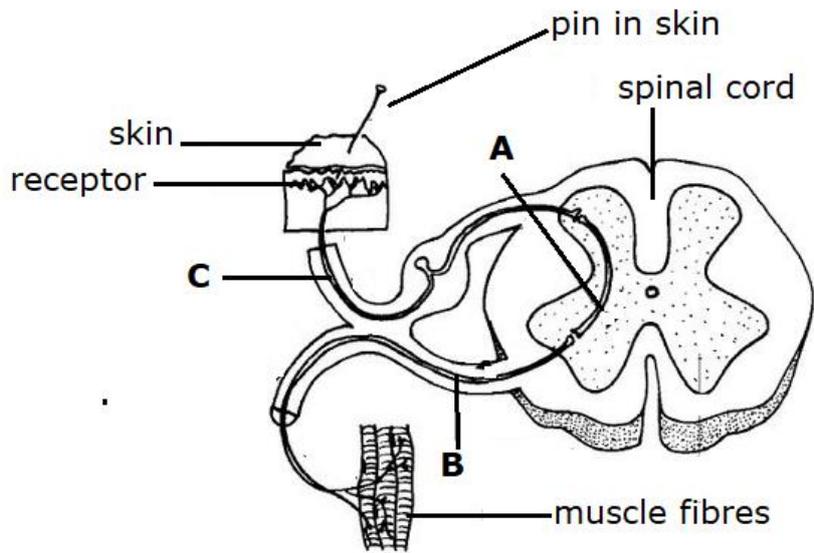


Figure 4.1: Drawing of a reflex arc
(Source: <https://biology-igcse.weebly.com/-simple-reflex-arc.html>)

This question continues on next page.

a. Name structures labelled B and C on Figure 4.1.

B _____ C _____ (2)

b. On Figure 4.1 draw arrows to show the direction of the movement of impulse. (1)

c. In Figure 4.1, the pin in the skin produces a stimulus that produces a response in the muscle fibres. The muscles are also known as _____ . (1)

d. Explain why a reflex action impulse does **not** travel to the brain. (2)

e. Below are three statements concerning the central nervous system. Use the terms found below to match the given statement with the correct term. (3)

Cerebellum Autonomic Medulla Oblongata Cerebrum Synapse

Statement	Term
The part of the brain responsible for muscular coordination.	
Space between two neurones where chemical messages still pass from one neurone to another.	
The part of the brain concerned with unconscious activities such as controlling the heart beat rate.	

(Total: 9 marks)

5. A group of students wanted to test osmosis in carrot tap root. They cut carrot cores that were identical in size. Each carrot core was put in a sugar solution of a different concentration. After 24 hours the carrot cores were pat dried and reweighed. Table 5.1 shows the results obtained.

Table 5.1: Table of results of osmosis investigation

Concentration of sugar solution /mol dm ⁻³	Initial mass /g	Final mass /g	Mass change /g	% change in mass
0.0	3.6	4.2	+ 0.6	+ 16.7
0.2	3.0	3.2	+ 0.2	
0.4	3.0	2.7	- 0.3	- 6.7
0.6	3.4	2.9	- 0.5	- 14.7
0.8	2.7	2.1	- 0.6	- 22.2
1.0	3.3	2.4	- 0.9	- 27.3

(Source: <https://media.cheggcdn.com/study>)

- a. Explain why the carrot cores were all cut identical in size. (1)

- b. Calculate the % change in mass at 0.2 mol dm⁻³. Use the space below to show your working. (1)

% change in mass at 0.2 mol dm⁻³ _____

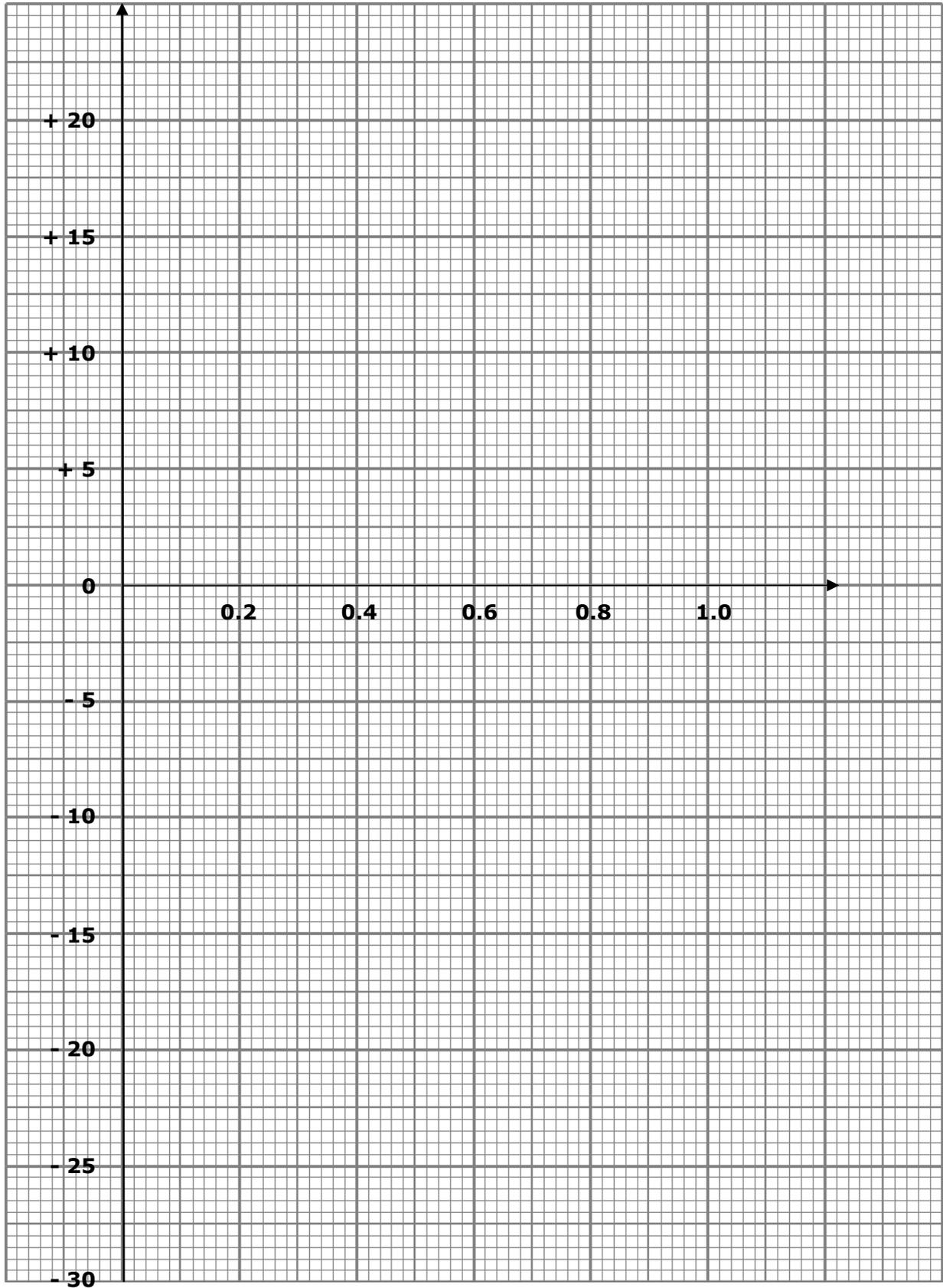
- c. Plot a graph of % change in mass (y-axis) against the concentration of sugar solution in mol dm⁻³ (x-axis). The axes have been drawn for you on the graph paper in the next page. Use a ruler to join the plots. (4)

- d. Explain why at 0.0 mol dm⁻³ the carrot core increased in mass while at 1.0 mol dm⁻³ the carrot core decreased in mass.

(4)

(Total: 10 marks)

Title: _____



6. Gluten is a protein naturally found in some grains including wheat, barley, and rye. Some people are allergic to gluten and must follow a gluten-free diet.

Figure 6.1 shows a bar chart comparing the biological molecules found in a gluten-containing food and a gluten-free food.

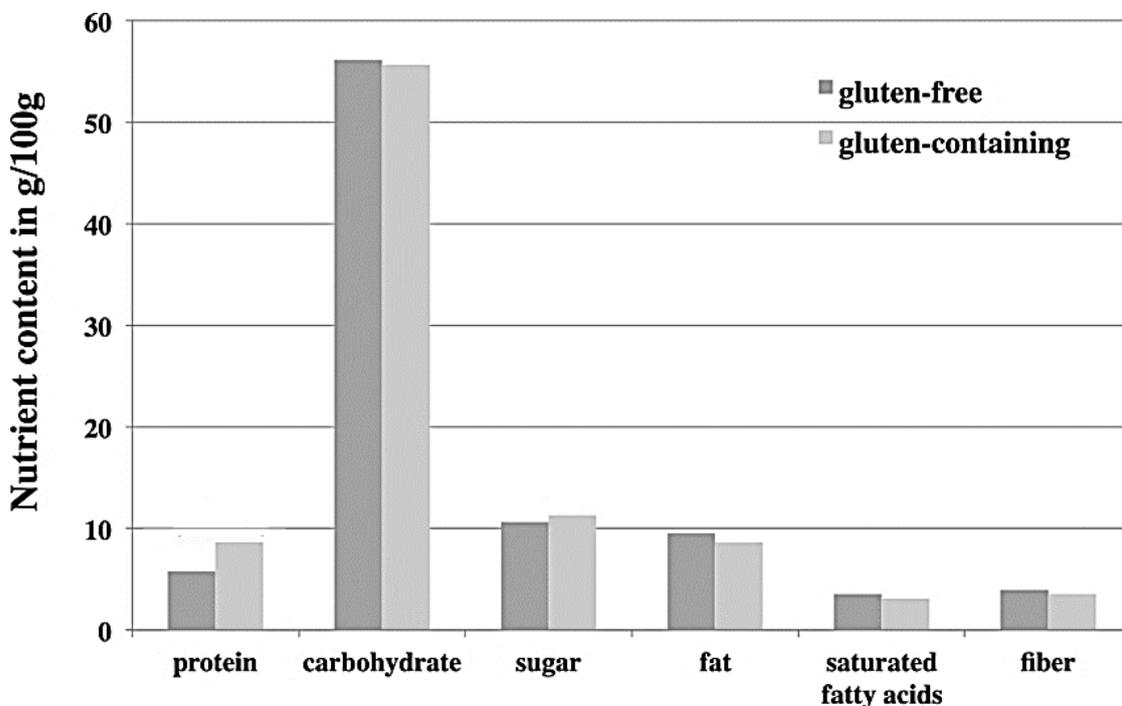


Figure 6.1: Bar chart showing biological molecules in gluten-containing and gluten-free food. (Source: <https://www.researchgate.net>)

a. i) Name the element that is present in gluten but is absent in both carbohydrate and fat. _____ (1)

ii) Name **ONE** type of food that persons following a gluten-free diet need to eat to compensate for the lower amount of protein in gluten-free food. _____ (1)

b. i) Distinguish between carbohydrates and sugars. _____ (2)

ii) Distinguish between carbohydrates and fats. _____ (2)

c. Refer to figure 6.1 and state if the following statements are correct or incorrect. Give a reason for your answer.

- i) Gluten-free food may increase the chance of developing heart disease more than the gluten-containing food.

Correct / Incorrect: _____

Reason: _____

_____ (2)

- ii) Gluten-free food may decrease the chance of constipation more than the gluten-containing food.

Correct / Incorrect: _____

Reason: _____

_____ (2)

(Total: 10 marks)

7. Within the human body, both aerobic and anaerobic respiration are important to muscle function.

- a. Table 7.1 compares aerobic and anaerobic respiration. Fill in the table to show two differences between aerobic and anaerobic respiration. (2)

Table 7.1: Comparison of aerobic and anaerobic respiration

Parameter	Aerobic respiration	Anaerobic respiration
Breakdown of glucose		
Amount of energy released		

b. During vigorous exercise, muscle cells can switch from aerobic to anaerobic respiration.

- i) Explain why muscle cells switch the type of respiration they perform during vigorous exercise.

_____ (1)

- ii) State the biological importance of the ability of muscle cells to switch from aerobic to anaerobic respiration.

_____ (2)

- iii) Nerve cells in the brain do not have the ability to switch from aerobic to anaerobic respiration. Explain why this is a disadvantage.

(2)

- c. Anaerobic respiration or fermentation is involved in the production of wine and yoghurt. Table 7.2 compares the production of the two products. Fill in the missing information in the table to compare the two processes. (3)

Table 7.2: Comparison of the production of wine and yoghurt

Characteristic	Production of wine	Production of yoghurt
Type of fermentation	Alcoholic	
Type of organism involved		Bacteria
Product/s formed	Alcohol and carbon dioxide	

(Total: 10 marks)

8. An experiment was carried out to determine the rate of germination of bean seeds when they were soaked for 8 hours in water only or a solution containing copper (Cu) ions. Each sample contained 80 seeds.

Figure 8.1 shows the percentage (%) rate of germination of seeds after 9 days of soaking with water or a solution containing copper ions.

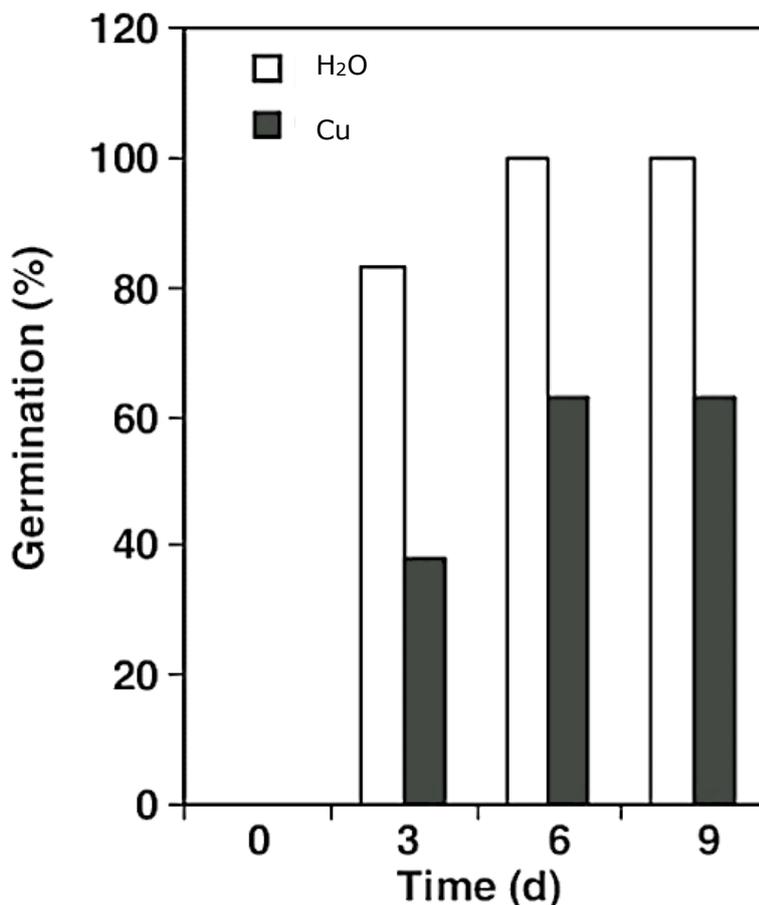


Figure 8.1: Barchart showing the effect of water and copper on germination
(Source: <https://www.researchgate.net>)

a. i) Explain why there are no germinating seeds in day 0.

(1)

ii) Explain why it is important to include a large number of seeds in the experiment.

(1)

iii) Explain why it is important to include the same number of seeds in both samples.

(1)

b. Use the bar chart in figure 8.1 to describe the effect of the solution containing copper ions on the percentage germination of bean seeds

(2)

c. In another study, a group of scientists investigated the effect of different types of soil on the growth of wild okra (a plant). In the investigation they grew the wild okra in three types of soil: clay, sandy and loam soil.

After 5 weeks following germination, they determined the degree of growth of the wild okra plants by measuring the following variables: plant height, stem diameter and the number of leaves on each plant.

The results are summarized in table 8.1.

Table 8.1: The effect of different soil types on the growth of the wild okra

Type of soil	Average plant height / cm	Average stem diameter / cm	Average number of leaves
Clay soil	47.13	0.69	62
Sandy soil	63.69	0.72	76
Loam soil	53.44	0.53	51

(Adapted from <https://www.arcjournals.org/pdfs/ijrsb/v2-i11/21.pdf>)

Determine the type of soil that is best used to grow wild okra. Support your answer with evidence from the experimental results

(2)

(Total: 7 marks)

Please turn the page.

9. This question is about digestion in humans.

- a. Table 9.1 summarizes the processes of digestion of carbohydrates, proteins, and lipids. It lists the enzymes involved, the sites where they are produced and where they act, the optimum pH and the digestive process they catalyse. Complete the table by filling in the missing information. (6)

Table 9.1: The processes of digestion of carbohydrates, proteins, and lipids

Enzyme	Produced by	Site of action	Optimum pH	Digestion
Carbohydrate digestion				
	Salivary glands	Mouth		Starch to maltose
Pancreatic amylase	Pancreas		Basic	
Maltase	Small intestine	Small intestine		

Enzyme	Produced by	Site of action	Optimum pH	Digestion
Protein digestion				
	Gastric glands	Stomach		Protein to peptides
Trypsin			Basic	Proteins to peptides

Enzyme	Produced by	Site of action	Optimum pH	Digestion
Fat digestion				
	Pancreas	Small intestine	Basic	

b. The digestion of lipids involves both mechanical and chemical digestion. Distinguish between mechanical digestion and chemical digestion.

_____ (2)

c. Bile is a yellow-green digestive fluid.

Name the organ which produces bile and state the function of bile.

Organ: _____

Function of bile: _____

_____ (2)

(Total: 10 marks)

10. Figure 10.1 shows a diagram of the internal structure of a dicot leaf.

a. Label the various parts of the leaf. (6)

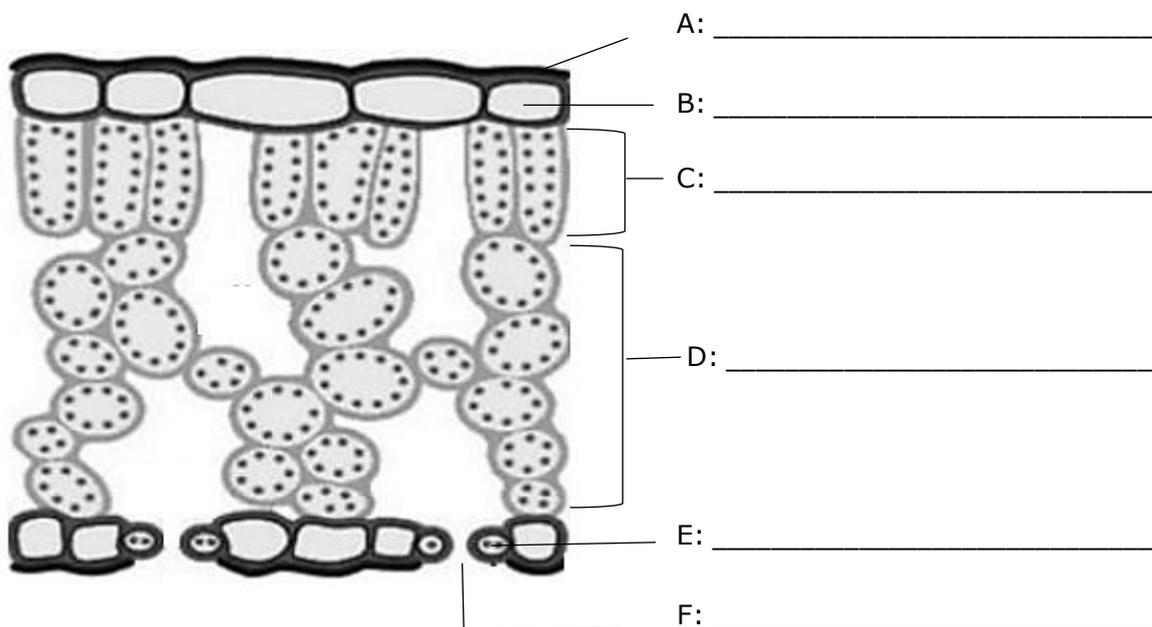


Figure 10.1: Cross section through a dicot leaf
 (Source <https://qsstudy.com/draw-labelled-diagram-internal-structure-dicot-leaf>)

b. Leaves are the main organs in plants where photosynthesis takes place. They show adaptations to increase the rate of photosynthesis. Explain how the following characteristics shown in Figure 10.1 increase the rate of photosynthesis:

i) the presence of chloroplasts in layers C and D;

(1)

ii) layer A is transparent;

(1)

iii) the presence of several structures labelled F.

(1)

c. Photosynthesis is a chemical process. State the role of the chemicals listed in table 10.1 in the process: (4)

Table 10.1 The role of certain chemicals in photosynthesis.

Chemical	Role
Water	
Oxygen	
Glucose	
Chlorophyll	

(Total: 13 marks)



SUBJECT:	Biology
PAPER NUMBER:	IIB
DATE:	29 th August 2023
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 questions 4 and 5 of this paper you need the graph paper in the booklet.

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

1. a. The Short-leaved pocket moss (*Fissidens incurvus*) and the Don's thread moss (*Bryum donianum*) are two species of non-vascular plants found on the Maltese Islands. The shoots of the Short-leaved pocket moss typically grow between 2 to 5 mm long whilst the Don's thread moss rarely grows more than 14 mm.

The Mediterranean clubmoss, also known as Tooth-leaved clubmoss (*Selaginella denticulata*) is a simple vascular plant. It grows in shaded, moist areas in valleys. It typically grows between 4 to 10 cm long.

- i) Name the phylum to which the Short-leaved pocket moss and Don's thread moss belong. (1)
 - ii) Explain why fertilization of the female gamete of the Short-leaved pocket moss with a male gamete from Don's thread will **not** lead to the growth of a fertile plant. (1)
 - iii) Using evidence from the text above, state why the use of common names rather than scientific names is confusing. (2)
 - iv) Explain why the stem of the Mediterranean clubmoss is much longer than the stem of the Short-leaved pocket moss and Don's thread moss. (3)
- b. The Mediterranean clubmoss grows in shaded, moist areas in valleys. The Maiden-hair fern (Tursin il-bir, *Adiantum capillus-veneris*) grows in the entrances of caves, wells, and moist rocks in valleys. It is a vascular plant, and although it has a waxy cuticle, it still needs a damp environment to reproduce. The Mediterranean thyme (Sagħtar, *Thymbra capitata*) lives in soil patches in garigue.
- i) From the text identify the plant that is a pteridophyte. (1)
 - ii) From the three plants mentioned in the text above, identify the **TWO** plants that have the thinnest waxy cuticle. Support your answer with evidence from the text. (4)
- c. The Maltese national tree is the Sandarac Gum Tree (Siġra tal-Għargħar, *Tetraclinis articulata*). It grows naturally in maquis but is also grown in natural parks. The Sandarac Gum Tree is a conifer.

Some flowering plants in the Maltese Islands have become extinct in the wild but are reared at Argotti Gardens and at the University of Malta. These include Horsetail knotweed (Lewza ta' Skarsa, *Polygonum equiseteforme*). It forms pink or white flowers, typically found in groups of two or three. Each flower has 5 petals.

- i) Name the reproductive structure of the Sandarac Gum Tree. (1)
- ii) State **ONE** difference between the seeds formed by the Sandarac Gum Tree and the seeds formed by the Horsetail knotweed. (1)
- iii) From the text choose the phrase that indicates that the Horsetail knotweed is a dicotyledon. (1)
- iv) A student wrote, 'The Horsetail knotweed is insect pollinated.' State if you agree or disagree with this statement. Give a reason for your choice. (2)

d. Another rare plant is the General's root (Għerq il-Ġeneral, *Cynomorium coccineum*). This is a parasitic plant which feeds on the roots of few coastal plant species. This plant has a dark red to purplish-black colour and consists of stems arising from an underground rhizome (horizontal stem). The stem is erect and fleshy, covered with many small-scale leaves. It forms many small flowers. Originally the General's root was incorrectly classified as a fungus.

- i) Using the information in the text, identify **TWO** structures that show that the General's root is a plant and not a fungus. (2)
- ii) Name a structure inside a cell taken from the leaf of the General's root that is absent in the cell of a fungus. Give a reason for your choice. (2)
- iii) Plants produce roots, but fungi produce hyphae. Explain how the function of a root in a plant is different from the function of a hypha in a fungus. (2)
- iv) Using the information in the text, identify **ONE** feature that shows that the General's root can grow in coastal areas, i.e., areas where soil lacks water. Give a reason for your choice. (2)

(Total: 25 marks)

2. The following statements are incorrect. Write down the correct statement and explain why the statement is incorrect.

- a. Annelids have a soft, unsegmented body. They are covered with a waxy cuticle to reduce water loss. (4)
- b. The water balance of the blood is maintained by the hormone ADH secreted by the renal cortex. The hormone acts on the glomerulus and changes the amount of water reabsorbed. (5)
- c. Trophic movement is caused by an external stimulus but is unaffected in direction by the stimulus. (5)
- d. Hind gut fermenters of herbivores, such as the rabbit, have pointed canine teeth and a four chambered stomach. (6)
- e. High levels of carbon dioxide in the air causes ozone depletion. (5)

(Total: 25 marks)

3. The clownfish (*Amphiron ocellaris*) forms a mutualistic relationship with the sea anemone (*Heteractis magnifica*). The anemone provides protection as it has several tentacles armed with stinging cells, and shelter. The clownfish provides the anemone nutrients in the form of waste while also scaring off potential predator fish.
- a.
 - i) State the phylum of the sea anemone. (1)
 - ii) Explain why the clownfish is a vertebrate, whilst the sea anemone is an invertebrate. (2)
 - iii) The sea anemone has a sac-like body plan. Draw a labelled diagram to show a sac-like body plan. (2)
 - iv) Describe how the body plan of the clownfish is different from that of the sea anemone. (2)
 - v) Explain why the sea anemone carries out gas exchange over its whole body, but the clownfish carries out gas exchange in the gills. (2)
 - b.
 - i) Define the term mutualistic relationship. (2)
 - ii) A student suggested that nitrogen-fixing bacteria in root nodules of leguminous plants is another example of a mutualistic relationship. State if this is correct and give **TWO** reasons for your answer. (3)
 - iii) Explain how a parasitic relationship is different from a mutualistic relationship. (1)
 - iv) Clownfish disease is caused by an animal-like protist, *Brooklynella hostilis*. This parasite causes cells lining the gills to become larger. Explain why this causes the clown fish to absorb less oxygen from water. (2)
 - c. All clownfish are born males. A clownfish group consists of a dominant sexually active male and female and from 1 to 4 young sexually inactive males. When the female dies, the dominant male changes sex to become the dominant female and one of the young becomes the dominant male.

Scientists do not know exactly how a male clownfish changes into a female. It is possible that female clownfish produces some sort of chemical signal that keeps males from becoming female.

In terms of what's going on biologically in the clownfish, it seems that the dominant male has functioning testes and some inactive cells that can become ovaries under the right conditions. When the female dies, the testes in the dominant male degenerate and ovaries form from the inactive ovarian cells.

- i) From the text identify the structures in the dominant sexually active male and female that produce gametes. (2)
- ii) Identify the type of reproduction shown by the clownfish. Give **ONE** reason for your answer. (2)
- iii) The sex hormones in a dominant male clown fish change if it becomes a female clownfish. Assuming that the sex hormones in clownfish are like those in humans, name **ONE** sex hormone found in the blood of the dominant male and **TWO** sex hormones found in the blood of the female clownfish. (1)
- iv) The concentration of the male sex hormone in a young sexually inactive male clownfish is lower than the concentration of the male sex hormone in a dominant sexually active male clownfish. State if this is correct and give a reason for your answer. (3)

(Total: 25 marks)

4. The role of the vascular bundles in plants is the passage of water, mineral ions, and sugars.
- Draw a cross-section of a dicot stem to include the vascular bundles. Label each section of the vascular bundle. (4)
 - In an experiment on transpiration, a group of students investigated the effect of a heater, a fan and lamp on the rate of transpiration. They also observed the rate of transpiration by using a potometer, in two different plants: an English Ivy and a Zebra Plant. The plants were left under each different experimental condition for an hour. Below, in Table 4.1 are the results obtained.

Table 4.1: Rate of transpiration in different conditions

Plant	Rate of transpiration (ml/hr)			
	At room temperature	With heater	With fan	With lamp
English Ivy	1.8	3.1	5.1	2.1
Zebra Plant	4.2	6.1	7.6	3.2

(Adapted from: <https://iwant2study.org>)

- Describe the process of transpiration in dicotyledonous plants. (2)
 - Describe how the process of transpiration leads to the absorption of water in the roots. (3)
 - On the graph paper provided (use the 2 mm grid scale) draw a bar chart of rate of transpiration and each condition of **both** plants. Put rate of transpiration on the y-axis. (6)
 - Explain why when a heater was used, the rate of transpiration increases. (2)
 - Explain why when a fan was used, the rate of transpiration almost doubles. (2)
- c. In another investigation on translocation, aphids feeding on plants are used. Aphids can be used to collect sap at various sites along a stem's length as in the Figure 4.1 below. The results obtained are in Table 4.2. Radioactive carbon dioxide is used.

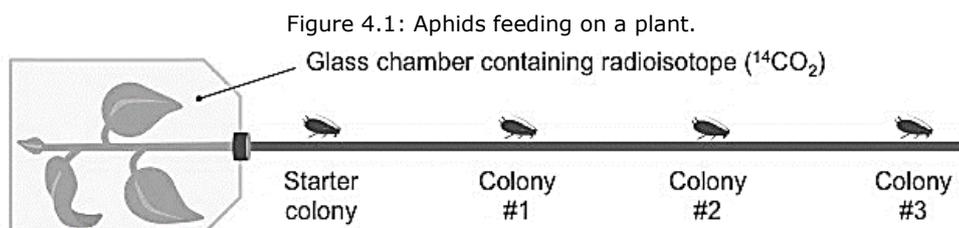


Table 4.2: Results of translocation investigation

Colony Number	1	2	3
Distance from starter colony (cm)	20	40	60
Time for radioactivity to travel from starter colony (hours)	1.25	2.40	3.80
Rate of phloem transport (cm hr^{-1})	16.0	16.7	15.8

(Source: <https://ib.bioninja.com.au>)

- Give **ONE** reason why the jar encloses the leaves of the plant. (1)
- State **ONE** conclusion obtained from the results in Table 4.2. (2)
- Name the polysaccharide that is synthesised with excess sugar and explain the importance of this store. (1, 2)

(Total: 25 marks)

5. Table 5.1 represents the body weight, metabolic rate and food eaten per day by different mammals.

Table 5.1: Body weight, metabolic rate and food eaten per day by different mammals

Mammal	Body weight (kg)	Metabolic rate (cm ³ Oxygen/g hr)	Food eaten per day (kg)
Rat	0.1	800	0.09
Hare	2.0	480	1.20
Dog	8.0	300	3.00
Man	60.0	150	4.00

- a. On the graph paper provided (use the 2mm grid scale), draw a graph that shows the relationship of metabolic rate to increasing body weight. Plot body weight on the x-axis. Use a ruler to join the plots. (6)
- b. i) Use the graph to determine the relationship between metabolic rate and body mass. Give a reason for your answer. (2)
 ii) From the graph estimate the metabolic rate of an animal whose body weight is 35 kg. (1)
- c. Express the food eaten per day of the following mammals as a percentage of their body weight:
 i) rat; (2)
 ii) man. (2)
- d. Explain why there is a difference in the percentages of food eaten per day in the rat and man calculated in part c. (3)
- e. Use the information in Table 5.1 to describe how an increase in body mass affects the breathing rate of a mammal. (2)
- f. Explain why a reptile requires less food than a mammal of the same weight. (6)
- g. List **ONE** factor that affects the basic metabolic rate in an animal. (1)
- (Total: 25 marks)**
6. a. The processes of mitosis and meiosis are both types of cell division.
- i) State **TWO** reasons why cell division is important to **all** organisms. (2)
 ii) Give **THREE** differences, between mitosis and meiosis. Present your answer in the form of a table. (6)
- b. At times, during the process of meiosis, abnormalities in the procedure occur, resulting in genetic conditions. Microcephaly, a condition where the baby's head is small at birth occurs when part of chromosome 21 is missing, and Y chromosome infertility, where part of chromosome 23 (Y chromosome) is missing, are two examples of such human conditions.
- i) Name the units of inheritance of chromosomes and describe their role in a cell. (2)
 ii) The symptoms of these conditions are more severe or less severe depending on the size of the missing part of the chromosome. Explain why. (4)

This question continues on next page.

c. Duchenne muscular dystrophy causing muscle wastage is an X-linked disorder. The mutated allele that is responsible for the condition is a recessive allele.

- i) Define the term 'recessive'. (1)
- ii) This disease is mainly predominant in males rather than females. Explain why. (5)
- iii) A female who is a carrier of the disease reproduces with a normal male. Using the symbol of X^D for the normal dominant allele and the symbol X^d for the mutated recessive allele, draw a genetic diagram to show the possible outcomes of the offspring. Give the percentage probability of the offspring being a male with Duchenne muscular dystrophy. (4, 1)

(Total: 25 marks)

7. Caves have their own ecosystems. Life survives in caves by adapting to the unusual habitat. Because sunlight does not penetrate beyond the area just inside the entrance, plants only grow at the entrance of the cave. Therefore, the cave ecosystem is based on nutrients entering the cave via water and outside organisms venturing into the cave and depositing guano (bat excrement), eggs, debris, or their carcasses. These nutrients are in turn used by the organisms that spend their entire life cycles in the cave environment.

(Source: <https://www.nps.gov/grba/learn/nature/cave-life.htm>)

- a. i) Define the term habitat. (1)
- ii) Explain why the presence of sunlight and plants is important in an ecosystem. (3)
- iii) From the paragraph above, identify another abiotic factor other than sunlight. (1)
- b. Carbon is a nutrient that is cycled in these caves.
 - i) Name **TWO** groups of organic molecules that contain carbon and are found in organisms and give **ONE** importance of **each** of these molecules. (2, 2)
 - ii) Briefly describe how the plants growing at the entrance and animals inside the cave obtain and cycle nitrogen. (4)

Fungus and microscopic bacteria break down the organic material that accumulates in caves. Although some animals can feed on guano directly, most depend on these decomposers for food. Millipedes and tiny crustaceans feed on the fungus and microbes. Cave beetles prey on these animals and eat the eggs of cave crickets. Cave spiders and centipedes are also predators of millipedes and tiny crustaceans in the cave ecosystem. Salamanders and cave fish are top carnivores in a food chain and feed upon cave spiders, centipedes, and cave beetles. With each link in the food chain, there is less food energy available for the next link because some energy is lost in each transfer.

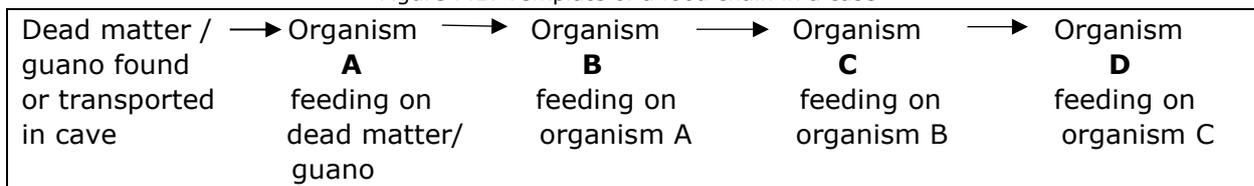
(Adapted from <https://mostateparks.com/page/55121/food-chains-and-pyramids>)

c. From the text, identify:

- i) a saprotroph; (1)
- ii) a carnivore. (1)

- d. Being in a specific ecosystem, food chains of organisms in caves follow the template shown in Figure 7.1.

Figure 7.1: Template of a food chain in a case



Using the information in the paragraph above, write the names of organisms **A** to **D** with the appropriate organisms. (4)

- e. Describe how energy is lost in each transfer. (2)
- f. From the paragraph identify:
 i) an arachnid; (1)
 ii) a vertebrate. (1)
- g. Scientists observing the animals that live in the deep end of caves and never travel out of the cave have adaptations such as lack of pigmentation, reduced eyesight, or no eyes and for arthropods long sensory antennae. Explain why. (2)

(Total: 25 marks)

8. The report *National strategy for the Environment for 2050 – Recognizing Malta’s environmental challenges* states that, ‘It is recognized that our environment: effects our well-being; is intrinsic to our quality of life; is a precious resource, especially in an island as small as ours; is subject to intense pressures; and underpins our economic development’.

(Source: ERA org.mt)

- a. Identify **THREE** environmental challenges that Malta experiences. (3)
- b. i) Describe **TWO** different ways how land is used for agricultural practices. (2)
 ii) State **TWO** examples of poor land use for agricultural practices. (2)
 iii) Predict **TWO** consequences of poor land use for agricultural practices. (2)
- c. The Maltese national plant, the Maltese Rock Centaury (*Widnet il-Baħar*, *Cheirolophus crassifolius*), is an endangered species. The Yellow Iris (*Fjurdulis tal-ilma*; *Iris pseudacorus*) was extinct in the wild and has been transplanted and conserved back in nature in a wetland area in Gozo.
 i) Distinguish between extinct species and endangered species. (2)
 ii) Many of the causes resulting in a species becoming endangered, have some form of human involvement. List **TWO** ways how humans may cause a species to become endangered. (2)
- d. Animal husbandry is the field of agriculture that deals with breeding and taking care of farm animals.
 i) A student wrote, “One of the advantages of animal husbandry is the production of manure.” Explain how the production of manure is an advantage. (2)
 ii) Sometimes animals in farms are overcrowded. Explain why overcrowding is a disadvantage. (2)

This question continues on next page.

- e. Fish farming in Malta includes the culture of European sea bass (Spnott, *Dicentrarchus labrax*) and Gilthead sea bream (Awrat, *Sparus aurata*) with a small production of Meagre (Gurbell, *Argyrosomus regius*) and Amberjack (Aċċola, *Seriola dumerili*).

The following statements describe either a beneficial or a harmful effect of fish farming. State if each statement describes a beneficial or a harmful effect, and give a reason for your choice: (8)

Statement 1: Fish farming decreases the number of fish caught from natural populations.

Statement 2: A lot of antibiotics are given to fish reared in fish farms.

Statement 3: Fish in fish farms are genetically similar.

Statement 4: Fish reared in fish farms are sold at a cheaper price.

(Total: 25 marks)