



SUBJECT: **Biology**
 PAPER NUMBER: I
 DATE: 7th May 2018
 TIME: 4:00 p.m. to 6:05 p.m.

Answer **ALL** questions in this paper in the spaces provided.

1. The table below lists different parts of the human digestive system. It also includes an enzyme the part produces, the substrate it acts upon and the product/s produced.

a. Complete the table by filling in the missing information.

Part	Enzyme	Substrate	Product/s
Salivary gland	Salivary amylase		
Stomach		Large proteins	
Pancreas			Glycerol + 3 fatty acids
Small intestine		Maltose	

(8)

b. Explain why humans need to digest large molecules, such as proteins and polysaccharides.

_____ (2)

(Total: 10 marks)

Please turn the page.

2. Figure 2.1 shows a plant cell photomicrograph.

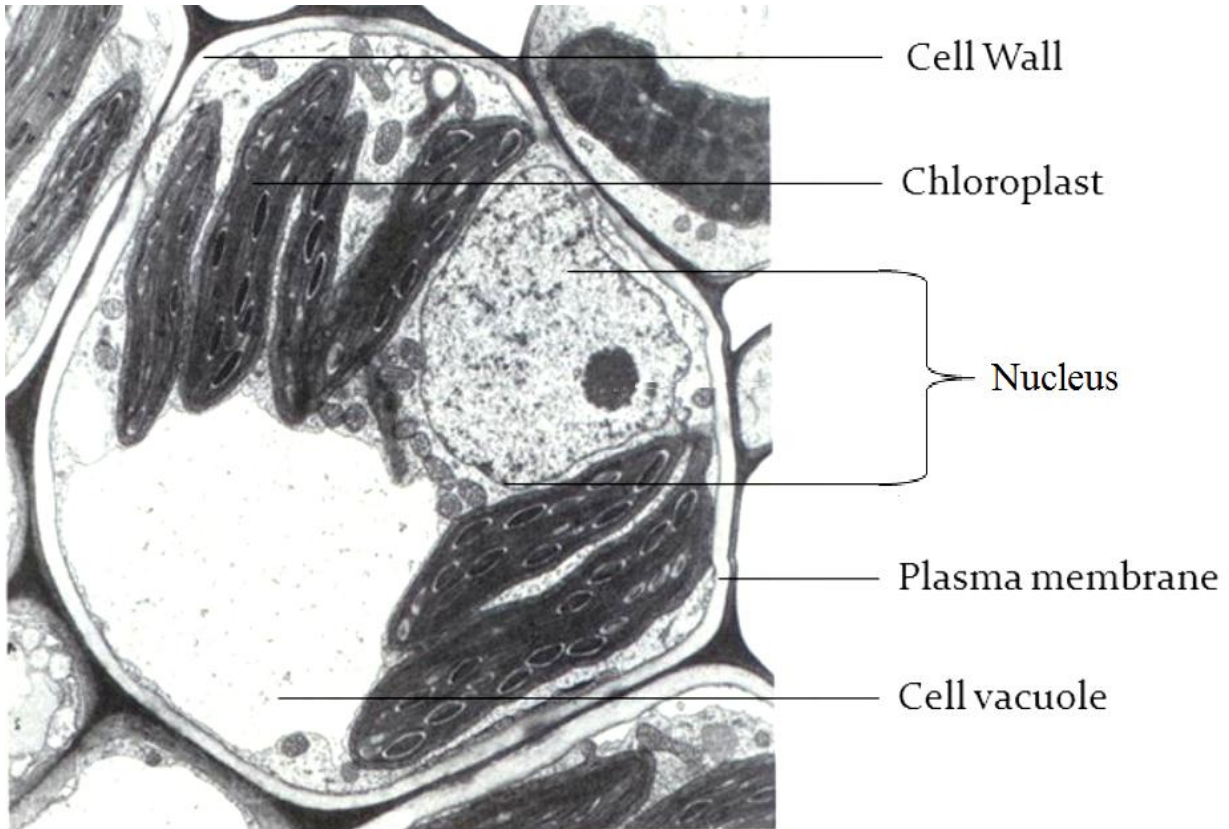


Figure 2.1: Photomicrograph of a plant cell
<http://slideplayer.com/slide/7764808/25/images/4/Electron+micrographs+of+a+plant+cell.jpg>

a. Use Figure 2.1 to explain why the cell is a eukaryotic cell.

(1)

b. List the cellular structure that contains:

Statement	Cellular structure
The watery cell sap	
The genetic information of the cell	
The polysaccharide cellulose	

(3)

c. Give the function of the following:

i) Plasma membrane;

(1)

ii) Cell wall.

(1)

d. Another plant cell showed a cell wall surrounding an empty space. Name the type of cell.

_____ (1)

e. Chloroplasts in a plant cell perform photosynthesis. Describe the role of chloroplasts in photosynthesis.

_____ (2)

f. Name **ONE** other organelle found in both animal and plant cells.

_____ (1)

(Total: 10 marks)

3. Photographs 3.1 to 3.4 show four animals found in Maltese coastal waters.

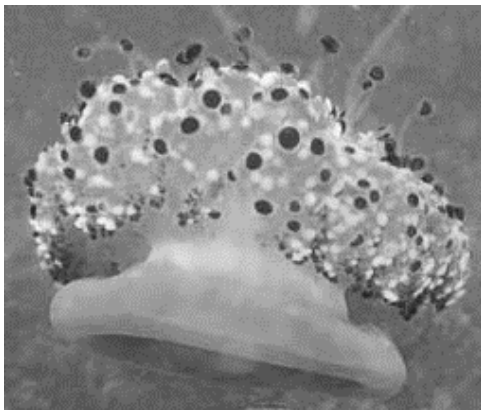


Photo 3.1
Cotylorhiza tuberculata
Fried egg jellyfish



Photo 3.2
Thassaloma pavo
Ornate wrasse



Photo 3.3
Diplodus sargus
White sea bream



Photo 3.4
Felimide luteorosea
Mediterranean Sea slug

This question continues on next page.

a. The table below lists different characteristics of animals. Mark with a tick (✓) if the characteristic is present in the animal/s shown in the photos 3.1-3.4 or a cross (✗) if the characteristic is absent. (5)

Characteristics	<i>Cotylorhiza tuberculata</i>	<i>Thassaloma pavo</i>	<i>Diplodus sargus</i>	<i>Felimide luteorosea</i>
Has a vertebral column				
Belongs to the phylum Coelenterata (Cnidaria)				
Body includes an alimentary canal with both a mouth and an anus				
Has tentacles with stinging cells				
Body covered in scales				

b. The Common Octopus, *Octopus vulgaris*, is another species found in Maltese coastal waters. Both the Octopus and the Mediterranean Sea slug are Molluscs. Give **TWO** characteristics of the body of molluscs.

(2)

c. *Delphinus delphis*, the Short-beaked Common Dolphin, is a mammal also found in Maltese coastal waters.

i) Name the gas exchange organ in the Short-beaked Common Dolphin and in the Ornate wrasse shown in photo 3.2.

Short-beaked Common Dolphin: _____

Ornate wrasse: _____ (1)

ii) Give **TWO** differences observed in the production and care of offspring in the Short-beaked Common Dolphin and in the Ornate wrasse.

Difference 1: _____

Difference 2: _____

(2)

(Total: 10 marks)

4. In an experiment to determine the water content of soil, a soil sample was placed in an evaporating basin which was then weighed. It was next placed in an oven kept at a temperature of 105°C and it was left there for 24 hours, when it was taken out, allowed to cool down, and reweighed. The sample was found to have lost weight.

a. The soil could have been dried much more quickly by using a much higher temperature. Why is it not advisable to use very high temperatures?

(1)

b. Describe how one may improve the accuracy of the experiment and make sure that all the water had been driven off.

(2)

The results obtained were as follows:

Weight of:	Weight / g
Evaporating basin	60
Evaporating basin and soil before heating	200
Evaporating basin and soil after heating	180

c. Calculate the percentage water content of the soil sample. (Show your working.)

Ans: _____ (3)

d. The basin with the soil from the first experiment, was next heated as strongly as possible over a direct Bunsen burner flame for half an hour. The basin and soil were allowed to cool and a further reduction in weight was recorded. Explain why heating the soil more strongly causes a further reduction in weight.

(1)

e. Describe a simple experiment a student may carry out to separate the remaining soil components left behind.

(3)

(Total: 10 marks)

5. The graphs drawn in Figure 5.1 show the changes in the breathing rate before, during and after exercise for a trained athlete and an untrained person.

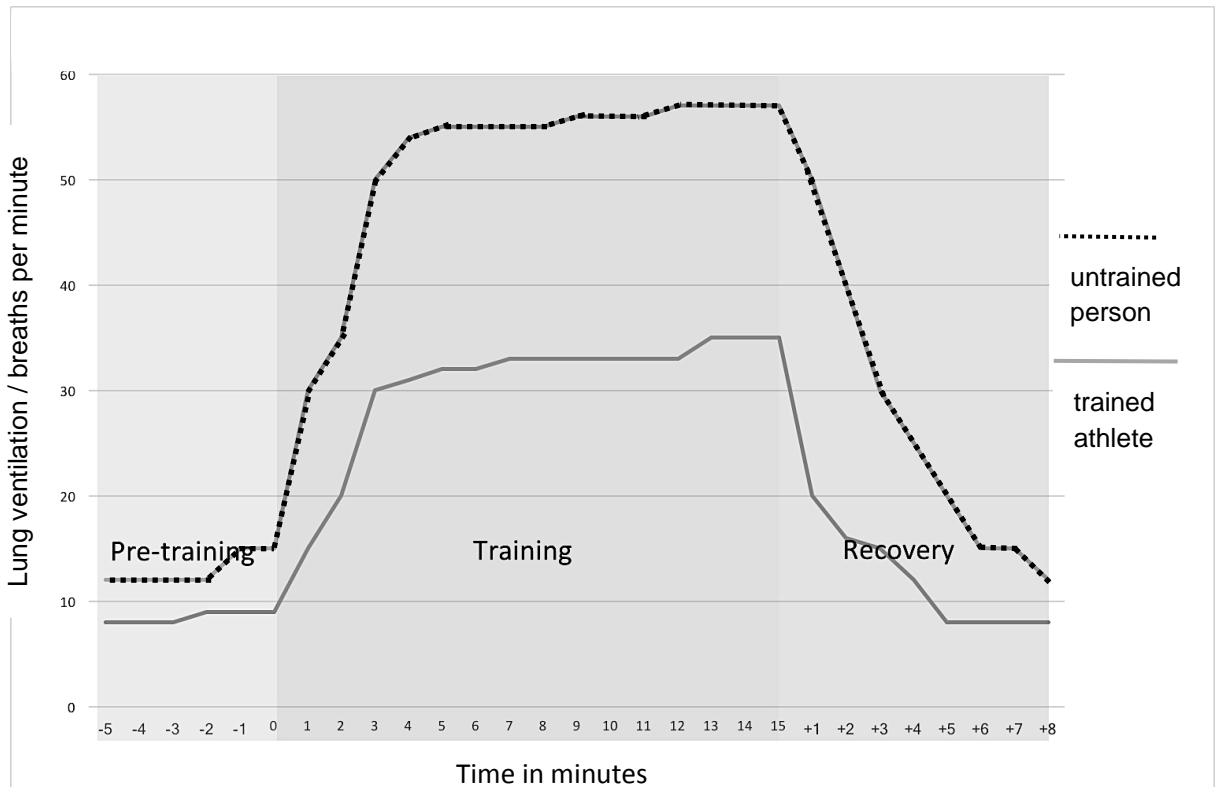


Figure 5.1: Changes in breathing rate before, during and after exercise in a trained athlete and an untrained person
<https://www.pdhpe.net/wp-content/uploads/2017/05/Immediate-ventilation-rate-response-to-training.png>

a. Describe **ONE** difference between the breathing rate of a trained and an untrained individual for each of the following: (Do not quote the same difference more than once.)

i) before training starts;

(1)

ii) during the training phase;

(1)

iii) during recovery i.e. after training was over.

(1)

b. Explain why the breathing rate changes during exercise.

(2)

The graph in Figure 5.2 shows the changes in heart rate occurring before, during and after training.

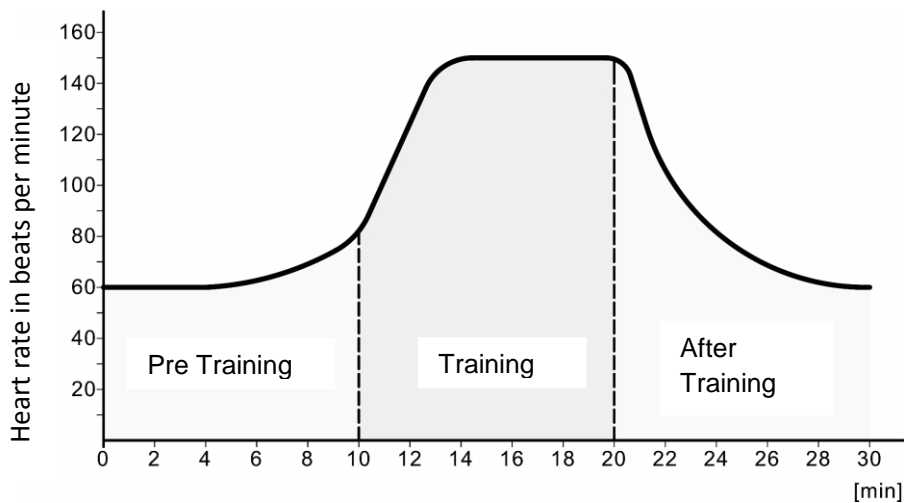


Figure 5.2: Changes in heart rate before, during and after training
<http://www.fsps.muni.cz/emuni/data/reader/book-4/08.html>

c. The graph in Figure 5.2 shows an increase in heart rate during training. Explain the importance of this change.

(3)

d. List **TWO** adaptations that enable the lungs to function efficiently as a gas exchange surface.

Adaptation 1: _____

Adaptation 2: _____

(2)

(Total: 10 marks)

Please turn the page.

6. A seed becomes dehydrated and dormant as it develops on the parent plant. The seed will not become active and begin to grow until its environment is suitable.

a. Give **THREE** characteristics of an environment that 'is suitable' for germination.

Characteristic 1: _____

Characteristic 2: _____

Characteristic 3: _____ (3)

b. Some germinating bean seeds were pinned to a cork disc that had a layer of damp cotton wool pinned to its surface. The disc was held vertically and after 5 days the bean seedlings had grown as shown below, in Figure 6.1.

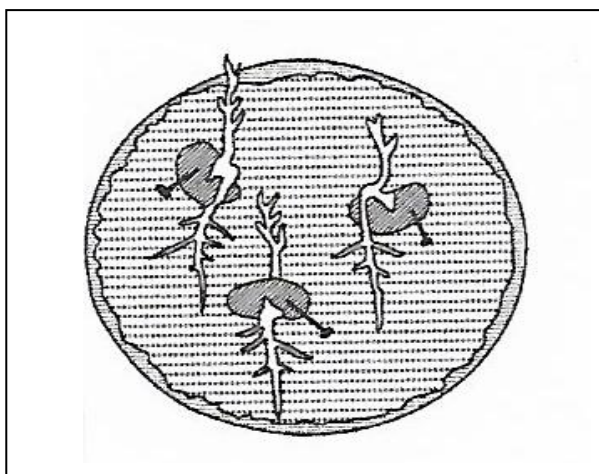


Figure 6.1: Germinating seedlings pinned to a cork disc

i) On the diagram, label the shoot (plumule) and the root (radicle). (2)

ii) Name the response to gravity as shown by the root and suggest whether it is a positive or negative response.

Name: _____

Positive / Negative: _____ (2)

iii) Give **TWO** reasons why the root grows before the shoot during germination.

Reason 1: _____

Reason 2: _____

_____ (2)

- iv) Plant growth is controlled by a group of substances called auxins which cause cells to elongate. Bending is brought about as the cells on one side of the root elongate more than the cells on the other side.

In the space provided draw a diagram showing the appearance of a root at the end of the experiment and label the side where the more elongated cells are found. (2)

- c. The disc with the seeds can be attached to a clinostat, as shown below in Figure 6.2. The disc was rotated slowly.

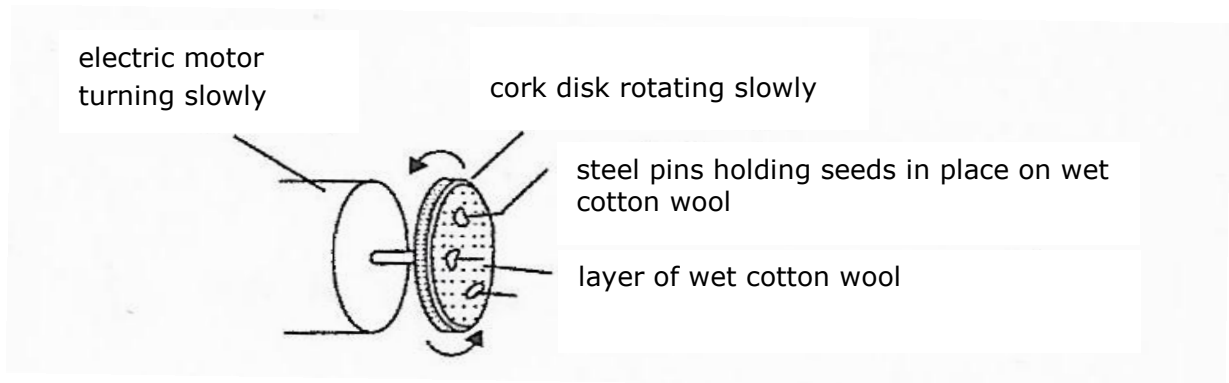


Figure 6.2: Cork disc with germinating seedlings attached to a clinostat

Source: *Biology Practice Book, Hodder Education*

Describe the predicted direction of growth of the roots of the seeds pinned to the cork, when the disc is rotating.

(1)

(Total 12 marks)

Please turn the page.

7. Haemophilia is a human genetic disease where the blood of affected individuals fails to clot. Figure 7.1 shows the pedigree diagram showing the inheritance pattern of this condition over a number of generations.

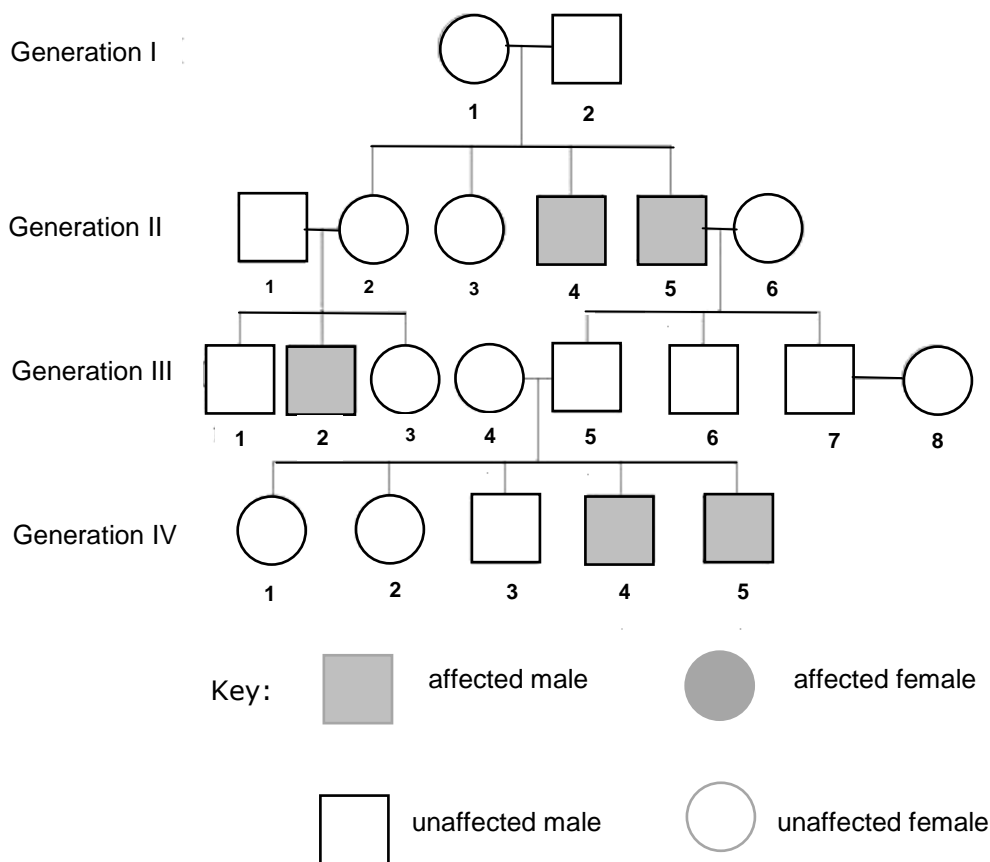


Figure 7.1: Pedigree diagram showing inheritance of haemophilia

a. Distinguish between a gene and an allele.

(2)

b. i) How many affected males and females are there in the pedigree diagram in Figure 7.1?

Males: _____ Females: _____ (1)

ii) What does this pattern of inheritance suggest about how the gene that produces haemophilia is inherited?

(1)

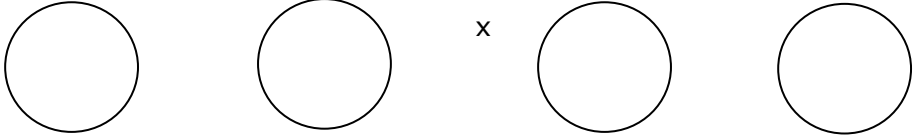
c. The allele that produces haemophilia is recessive. Give **ONE** reason for this statement.

(2)

d. With reference to the pedigree diagram in Figure 7.1, complete the Punnett square below to explain how persons 1 and 2 from Generation I who were both healthy, had affected children who suffered from haemophilia.

In your answer let X^N represent the allele for normal blood clotting and X^n represent the allele for haemophilia.

Parental Genotypes: Mother : _____ x Father: _____

Parental Genes:  x

Mother		
Father		

(4)

e. What is the probability that person 2 in Generation II is a carrier of the allele for haemophilia?

(1)

(Total 11 marks)

Please turn the page.

8. This question is about feeding relationships.

a. Explain why green plants are described as producers.

(2)

b. Figure 8.1 shows a food web that summarises feeding relationships in a field.

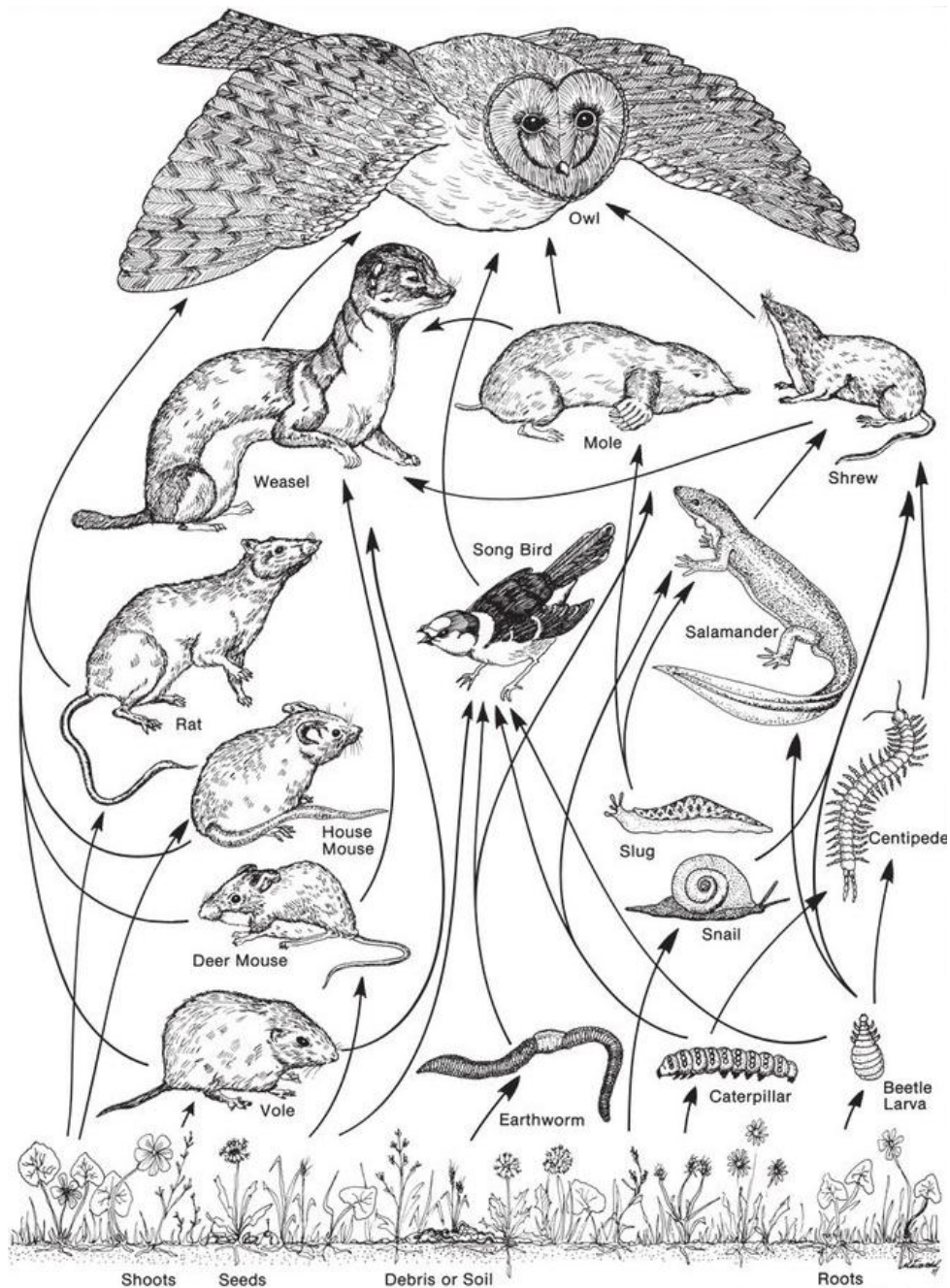


Figure 8.1 A food web showing feeding relationships in a field
https://cdn.shopify.com/s/files/1/0180/2491/products/food-chain-poster_1024x1024.jpg?v=1350682176

Use the food web in Figure 8.1, to draw a food chain with four trophic levels that includes the Deer Mouse. (Do **not** draw the organisms.)

(2)

c. Give **ONE** reason why the House Mouse and the Deer Mouse are at the same trophic level.

(1)

d. If all the Centipedes in the population are killed by a disease. What effect would this have on:

i) Beetle Larvae;

(1)

ii) Song Birds?

(1)

e. How does a food web differ from a food chain?

(2)

f. In a pyramid of biomass, what does the base of the pyramid represent?

(1)

(Total 10 marks)

Please turn the page.

9. A group of students decided to investigate the effect of green tea on the heartrate of the crustacean *Daphnia*. *Daphnia* are small microscopic crustaceans with the heart visible under the magnification of the light microscope.

They put a number of *Daphnia* in water and in three different concentrations of green tea. The following results were obtained.

Table 9.1: The effect of different green tea concentrations on the heart rate of *Daphnia*

Green tea concentration in g/100ml	No. of Heart beats per minute			
	Trial 1	Trial 2	Trial 3	Average
0.0	191	190	189	190
0.1	188	184	186	186
1.0	170	171	175	172
10	160	153	158	157

Adapted from [http://www.all-science-fair-projects.com/print project 1431 129](http://www.all-science-fair-projects.com/print_project_1431_129)

a. When counting the number of heart beats per minute, the students made certain that the solution surrounding the *Daphnia* did not dry up. Give **ONE** reason for this.

(2)

b. Explain why the students performed three trials at each green tea concentration provided and then worked out the average.

(2)

c. i) Use the graph paper provided to draw a line graph showing the average number of heart beats per minute (on the y axis) against the concentration of green tea (on the x axis). Use a ruler to join the points. (4)

A large grid of graph paper, consisting of 10 columns and 15 rows of small squares, intended for writing a conclusion.

ii) Write down the conclusion for this investigation.

(2)

(Total: 10 marks)
Please turn the page.

10. Figure 10.1 shows two photomicrographs. Photomicrograph A shows onion cells placed in distilled water while photomicrograph B shows onion cells that have been left in a sugar solution.

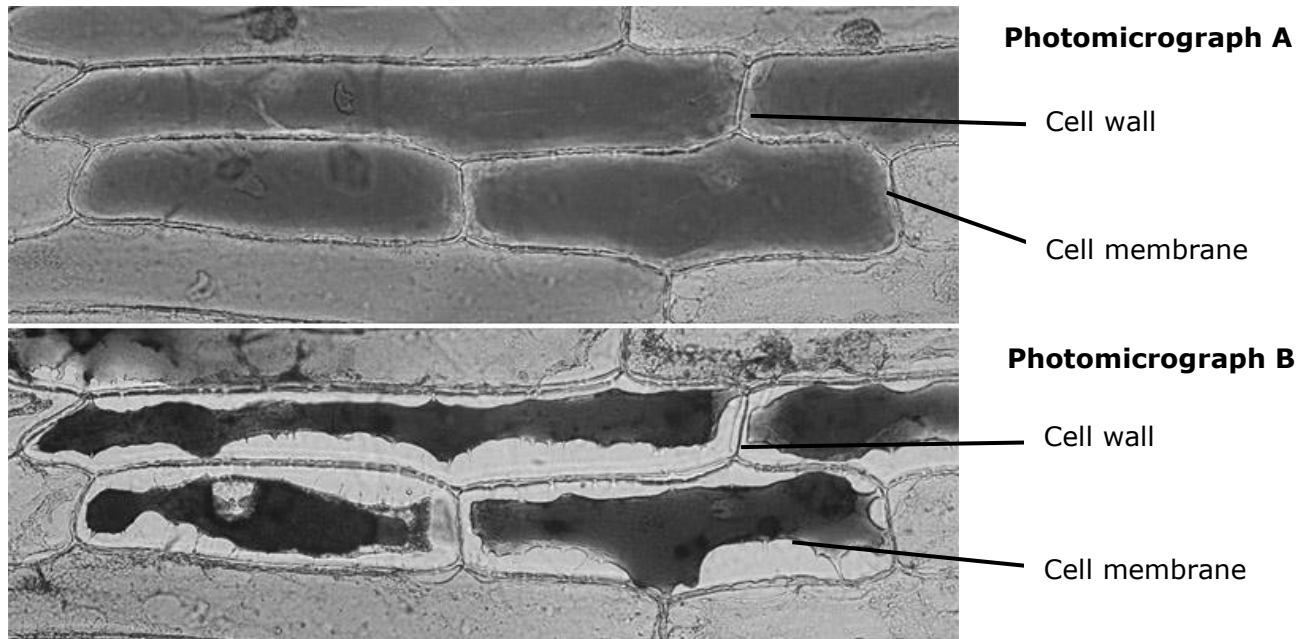


Figure 10.1 Photomicrographs of onion cells in different solutions
<https://blogs.cornell.edu/cibt/files/2015/05/Red-Onion-Cell-Station-CIBT.pdf>

a. Identify the photomicrograph that shows a fully turgid cell.

_____ (1)

b. i) Describe in detail the appearance of cells in photomicrograph B.

_____ (2)

ii) Explain what has brought about this change.

_____ (2)

iii) Name the process that has led to the changes in cells in the photomicrographs.

_____ (1)

c. Describe what would happen to animal cells if they were to be put in pure distilled water.

_____ (1)

(Total: 7 marks)

SUBJECT:	Biology
PAPER NUMBER:	IIA
DATE:	8 th May 2018
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.

Please note that for question 2 of this paper you need the graph paper in the booklet.

SECTION A: Answer ALL questions in this section. This section carries 25 marks.

1. Read the following passage and then answer the questions that follow.

Parasites affecting reptiles in Malta

A scientist compared parasites affecting local reptile species living in the wild, with parasites affecting imported reptile species. The latter are often kept as pets in homes. The aim of the study was to determine if any parasites found on the imported pet species were transferred to the local species.

In the study, eight species of mite were collected from wild reptiles. Three species of mite and a single tick were collected from imported reptile species. Only one species was found affecting both local and imported reptiles. Mites and ticks are ectoparasites i.e. parasites living on the surface of the organism. This evidence was not clear enough to allow the scientist to conclude that the parasitic mite was transferred from imported to local reptile species.

Four groups of endoparasites i.e. parasites living inside the organism, were found affecting local reptiles and three groups were found in imported pet reptiles. The endoparasites included nematodes. It was not possible to determine if these nematodes were transferred from the pet reptile species to the local species.

46.2% of imported pet reptiles carried endoparasites compared to 35.3% of reptile species living in the wild. This may be due to pet reptiles living in overcrowded conditions, stress, and living in a confined space that may allow the parasite to re-infect the host. Contrastingly only 6.5% of imported pet reptiles had ectoparasites, compared to 38.8% of the reptiles living in the wild. This may be because ectoparasites are easier to be observed by the pet's owners than endoparasites and so pet reptiles are more likely to be treated with anti-parasite medication.

Three species of wild Maltese reptiles: *Chalcides ocellatus*, *Podarcis filfolensis* and *Tarentola mauritanica*, were found to be potential hosts for up to three species of ectoparasites, while no ectoparasites were extracted from *Chamaeleo chamaeleon* and *Hemidactylus turcicus*. *Chalcides ocellatus* was found to potentially host at least three species of endoparasites while two species were extracted from *C. chamaeleon*. The other species of reptiles living in the wild were found to host at most a single endoparasite species.

(Adapted from Sultana L., Parasitism in selected indigenous and naturalized Maltese reptiles in relation to imported species; in Biology Symposium Abstracts 2016, UOM)

- a. i) Define the terms parasite. (1)
- ii) Distinguish between ectoparasites and endoparasites. (1)
- b. Mites and ticks are both arachnids. List **ONE** structural characteristic observed in both mites and ticks allowing them to be identified as arachnids. (1)
- c. List **ONE** structural characteristic of nematodes. (1)
- d. List **ONE** structural characteristic shared by all types of reptiles living in Malta, which distinguishes them from other vertebrate groups. (1)
- e. Explain how overcrowding may lead to a greater chance that pet reptiles are infected with parasites. (2)
- f. Write down the scientific name of the reptile that is most likely to be affected by parasites. (1)
- g. The scientist used the scientific names to identify the species of wild Maltese reptiles mentioned in the last paragraph. Give **ONE** advantage of this. (2)
- h. Write a conclusion for this study. (2)

(Total: 12 marks)

2. Two groups of barley seedlings were grown in a culture solution containing all the ions necessary for healthy plant growth as shown in Figure 2.1

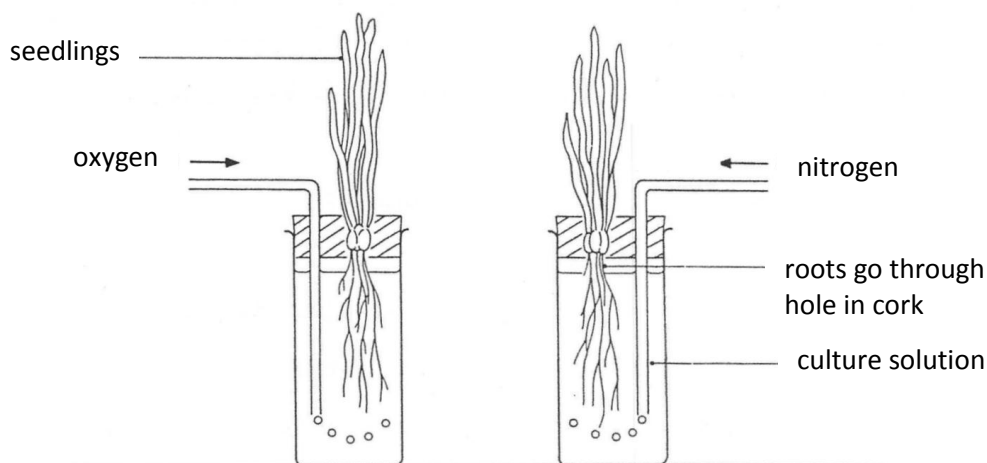


Figure 2.1 Barley seedling growing in a culture solution
Adapted from Nuffield foundation / biosciences federation 2008

The plants were provided with sulfate ions containing radioactive sulfur atoms — ³⁵S. Oxygen was bubbled through one of the solutions containing one group of seedlings, while nitrogen was bubbled through the other solution containing the second group of seedlings. Nitrogen gas is not harmful to seedlings, but plants do not use gaseous nitrogen.

The amount of radioactive sulfate ions taken up by the seedlings was measured every half-hour for 4 hours. The results are shown in Table 2:

Table 2: Total amount of sulfate ions taken up in the presence of oxygen and the presence of nitrogen

Time (minutes)	Total amount of sulfate ions taken up (arbitrary units)	
	With oxygen (aerobic)	With nitrogen (anaerobic)
0	0	0
30	220	140
60	290	190
90	350	210
120	390	225
150	430	238
180	490	250
210	500	250
240	530	250

- a. On the graph paper provided (use the 2 mm grid scale), draw a graph to show the variation in the total amount of sulfate ions taken up over 240 minutes in the presence of oxygen. Join the points of the graph with straight lines. Plot the time on the x-axis. Using the same pair of axes plot the variation in the total amount of sulfate ions taken up over 240 minutes in the presence of nitrogen. Join the points of this graph with straight lines. (6)
- b. Calculate the rate of sulfate ion uptake in arbitrary units per minute for the time interval between 60 and 120 minutes:
 - i) in the presence of oxygen (1)
 - ii) in the presence of nitrogen (1)
- c. Compare the uptake of radioactive sulfate ions by the seedlings supplied with oxygen with the uptake of ions by the seedlings supplied with nitrogen. (2)
- d. Explain why the bubbling of oxygen through the culture solution has the observed effect on the uptake of sulfate ions by the barley roots. (2)
- e. Name **ONE** variable that should have been controlled during the experiment. (1)

(Total: 13 marks)

SECTION B: Answer any THREE questions from this section.

3. Figure 3.1 below show three nuclei with their chromosomes

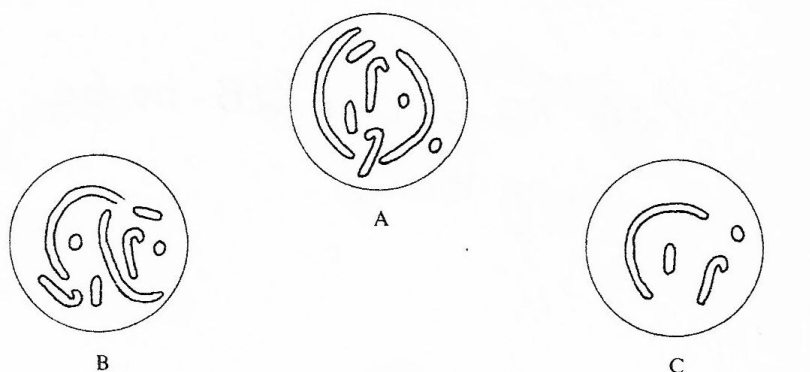


Figure 3.1: Nuclei A, B and C with chromosomes

- a. Nuclei B and C developed from nucleus A. Identify which nucleus was formed by mitosis and which nucleus was formed by meiosis. (2)

This question continues on next page.

- b. Apart from the intestine, name **TWO** places in the human body where mitosis occurs. (1)
- c. For each of the following organisms, name **TWO** structures where meiosis occurs:
 - i) a flowering plant and
 - ii) the human body? (2)
- d. Cell C has fewer chromosomes than cell A. Explain the importance of this observation. (2)
- e. Cells in the wall of the intestine divide by mitosis to replace cells lost as food passes through.

Chromosomes contain DNA. Figure 3.2 shows a graph summarising the changes in the DNA content of a cell in the wall of the small intestine as it divides by mitosis.

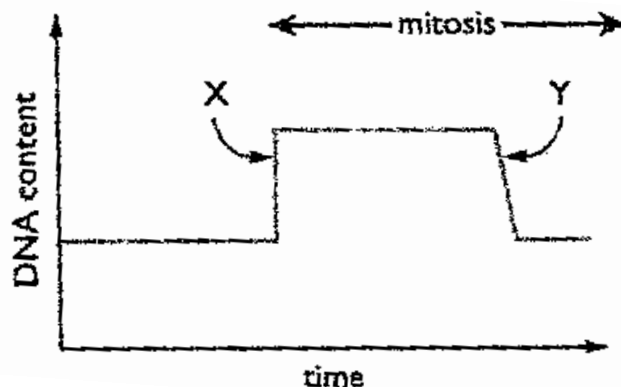


Figure 3.2: Graph summarising the changed in DNA content of a cell in the wall of the small intestine during mitosis

- i) Explain why it is essential that the amount of DNA is doubled at the point marked X on the graph before mitosis starts? (2)
- ii) State what happens inside the cell at the point marked Y on the graph. (1)
- f. Give **ONE** difference between a sperm cell and cells in a developing foetus. (2)
- g. Explain what determines if a fertilised ovum develops into a girl rather than a boy. (1)
- h. The foetus is surrounded by amniotic fluid and an amniotic sac. State the functions of the
 - i) amniotic fluid; (2)
 - ii) amniotic sac. (2)
- i. Describe the role of the placenta in maintaining pregnancy. (3)
- j. List the structures, in the correct sequence, through which sperms pass after leaving the penis until they reach and fertilise an ovum. (4)
- k. One common cause of infertility in women is blockage of the fallopian tubes. Explain how this causes infertility. (1)

(Total: 25 marks)

4. Table 4 lists seven new species discovered in the last few years:

Table 4: Newly discovered species

	Common name	Scientific name	Taxonomic group
1	Vangunu giant rat	<i>Uromys vika</i>	Mammal
2	Tapanuli orangutang	<i>Pongo tapanuliensis</i>	Mammal
3	Pink Floyd pistol shrimp	<i>Synalpheus pinkfloydi</i>	Crustacean
4	Wizard hat amoeba	<i>Arcella gandalfi</i>	Protist
5	Game of Thrones ant	<i>Pheidole drogon</i>	Insect
6	Casanova millipede	<i>Illacme tobini</i>	Myriapod
7	Waterfall centipede	<i>Scolopendra cataracta</i>	Myriapod

- a. List **TWO** characteristics that scientists study to determine if a new species has been discovered. (2)
- b. Identify the organism that is microscopic in size. Give **ONE** reason for your answer. (3)
- c. i) List the common names of the **FOUR** Arthropods listed in the table. (2)
- ii) List **TWO** common features that all Arthropods share. (2)
- iii) Describe how the number of legs of the Game of Thrones ant and the Casanova millepede differ. (2)
- d. List **TWO** distinguishing structural characteristics that the Vangunu giant rat and the Tapanuli orangutang share. (2)
- e. Another species that was discovered recently is *Pheidole viserion*. Use the information to determine the taxonomic group to which it belongs. Give a reason for your answer. (3)
- f. In October 2017, newspapers reported the rediscovery of the giant stick insect, *Dryococelus australis*, in Lord Howe’s Island in Australia. This species was considered to be extinct since 1920’s after rats from a ship that ran off the island had eaten all the population of giant stick insects.
 - i) Define the terms extinction and population. (2)
 - ii) Give **TWO** reasons why a species may become extinct. (2)
 - iii) The giant stick insect is possibly the rarest insect species in the world, as only thirty individuals are known to exist. Give **TWO** ways how this species may be protected. (2)
- g. Describe how the process of eutrophication may destroy whole populations of organisms living in small freshwater lakes. (3)

(Total: 25 marks)

5. Glucose, a monosaccharide, is involved in several reactions in the cells of organisms including the formation of polysaccharides starch, glycogen and cellulose and in aerobic respiration and fermentation pathways.

a. Lactic acid fermentation is used to preserve foods. Figure 5.1 summarises the process of yoghurt production from the fermentation of sugars in milk to lactic acid.

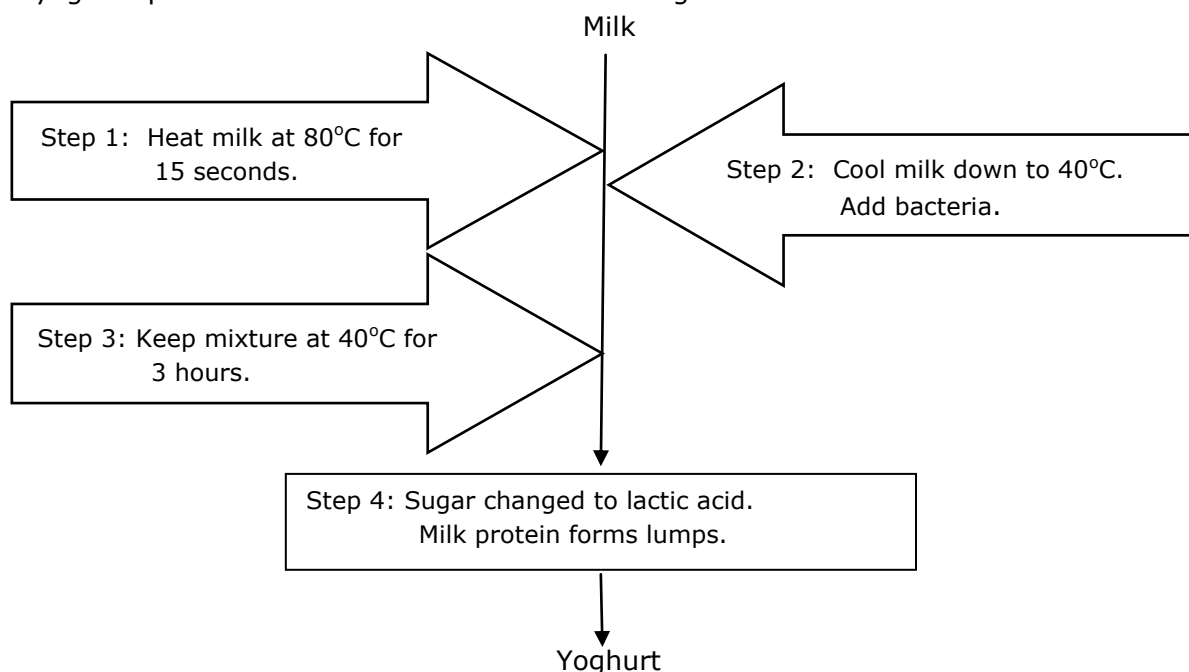


Figure 5.1: Production of yoghurt

Adapted from <http://oldschool.com.sg/module/PublicAccess/>

- i) Name the disaccharide found in milk. (1)
 - ii) State **ONE** major condition necessary for lactic acid fermentation to take place. (1)
 - iii) Name the process taking place in step 1. Explain the function of this process for lactic acid fermentation. (3)
 - iv) Give **ONE** reason why the bacteria and milk mixture is kept at 40°C for a long time. (2)
 - v) Explain why lactic acid fermentation is considered a way to preserve foods. (3)
- b. A fermentation pathway is also part of a beer brewing process.
- i) Name the type of organism used in the beer brewing process. (1)
 - ii) Briefly explain the fermentation pathway in beer brewing. (4)
- c. A blood test was taken from a person with gastric flu who was unable to eat for the past few hours. The person's blood glucose levels were found to be within the normal range.
- i) Describe the process involved in keeping the person's blood glucose level at a normal level. In your description include the organs, glands and hormone/s and pathways involved in this process. (5)
 - ii) Explain why when the above occurs, the glucose level remains within a normal level and does not continue to increase. (2)
- d. Lactose and glucose are both reducing sugars. Describe a test that may be performed to test for the presence of reducing sugars in a solution. (3)

(Total: 25 marks)

6. Figure 6.1 below shows two leaves A and B, each having the petiole in a closed test tube full of water. Each is hung on a spring balance. Leaf A has a waxy cuticle on the upper epidermis and stomata on the lower epidermis. Leaf B a waxy cuticle on the upper epidermis and a lower epidermis covered with petroleum jelly. Both leaves were cut from the same plant.

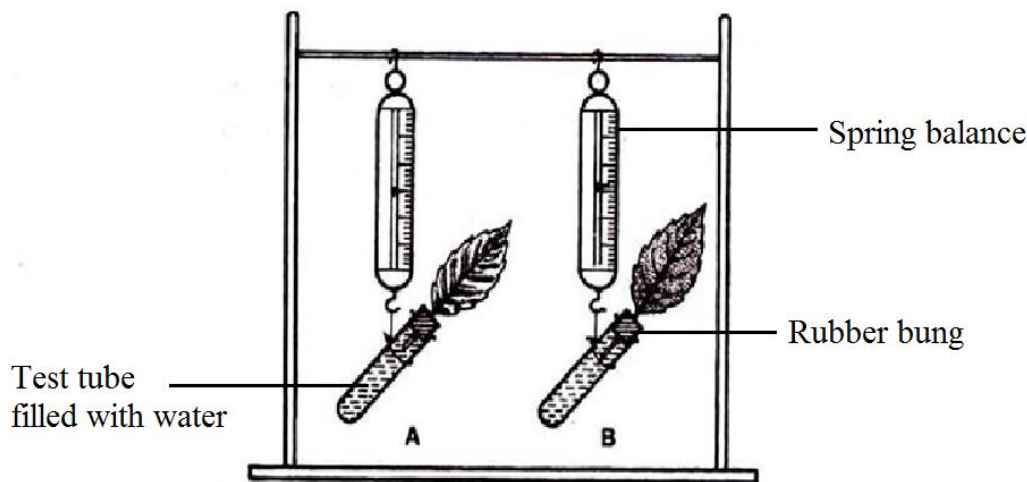


Figure 6.1 Apparatus set up showing leaves A and B
http://cdn.biologydiscussion.com/wp-content/uploads/2016/09/clip_image055_thumb2.jpg

- a. i) Explain why it is important for the leaves to be cut from the same plant. (2)
- ii) List **TWO** variables that must be kept constant in this investigation. (2)
- iii) Table 6 shows the results obtained in the experiment:

Table 6: Results

Leaf and test-tube	Initial weight/g	Final weight/g	Change in weight/g
A	40.7	39.9	0.8
B	38.7	38.7	0.0

<http://www.biologydiscussion.com/experiments/top-13-experiments-on-transpiration-plants/56605>

- Explain why the weight of set up A, decreased. (3)
- iv) Using your biological knowledge, indicate how results will change, if a fan is switched on near the experimental set up. Explain your answer. (4)
- b. The student performing the investigation predicted that if leaf B was replaced with a similar leaf with small silvery hairs on the lower epidermis from another species of plant, the change in weight of apparatus B would be larger than that of apparatus A. Discuss. (4)
- c. Figure 6.2 shows a cross-section of the monocotyledonous plant *Aloe*, a succulent plant. The drawing on the right is a magnified part of the leaf.

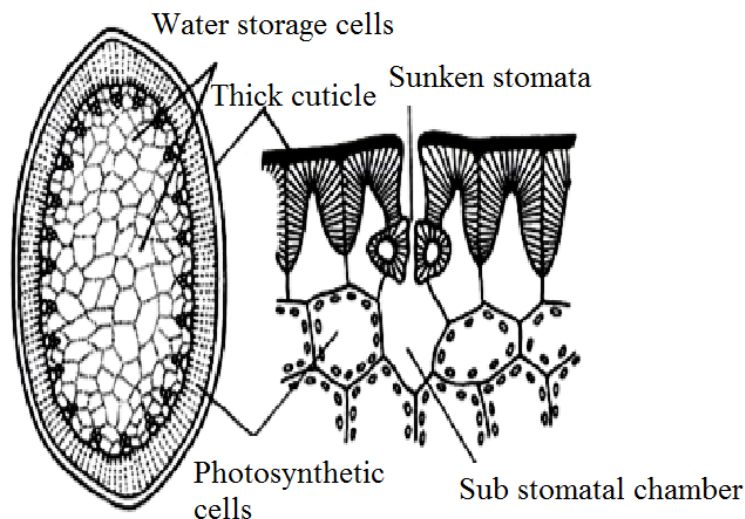


Figure 6.2 Cross-section through an *Aloe* plant

<http://cdn.biologydiscussion.com/wp-content/uploads/2015/01/image106.png>

- i) From the diagram, list **TWO** adaptations that show that the plant conserves water. (2)
- ii) Photosynthetic cells produce starch and may be stored. Describe how one may test for the presence of starch on a piece of potato tissue. (2)
- iii) Give **TWO** characteristics of monocotyledonous plants. (2)
- d. The transition of plants from an aquatic environment to a terrestrial one has brought about many evolutionary adaptations for plants to survive on land. Give **ONE** adaptation for each of the following divisions:
- i) Mosses: (2)
- ii) Gymnosperms. (2)

(Total: 25 marks)

Please turn the page.

7. A group of students investigated the effect of carbon dioxide on the rate of photosynthesis. They cut circular discs from a leaf and placed them in a beaker filled with sodium hydrogen carbonate solution. This solution will be a source of carbon dioxide.

Before the experiment, time was allowed for the hydrogen carbonate solution to fill the air spaces in the leaf. This causes the leaf discs to sink down to the bottom.

The beaker was then placed under a light source and the time taken for the leaf discs to rise recorded. Figure 7.1 shows the apparatus setup and the position of leaf discs at the start and the end of the experiment.

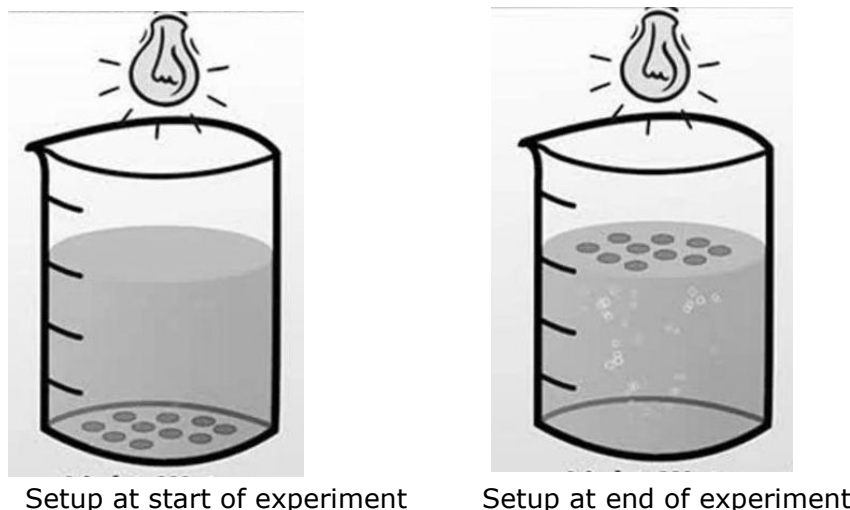


Figure 7.1: Apparatus set up used to investigate the effect of carbon dioxide on photosynthesis
Adapted from https://study.com/cimages/videopreview/ap-biology-lab-5-photosynthesis-v2_125508.jpg

- a. Write a word equation summarising the process of photosynthesis. (2)
- b.
 - i) Name the tissue in the leaf where air spaces are present. (1)
 - ii) Explain why the leaf discs sink to the bottom of the beaker when sodium hydrogen carbonate fills the air spaces. (2)
 - iii) Explain why the leaf discs rise to the surface as the experiment proceeds. (4)
- c. Explain why the leaf discs will not rise to the surface if:
 - i) the sodium hydrogen carbonate solution is replaced with pure distilled water. (2)
 - ii) the apparatus is placed in a dark cupboard. (2)
- d. Predict if the leaf discs will rise to the surface more quickly or more slowly if:
 - i) they are placed in a more concentrated solution of hydrogen carbonate. Give **ONE** reason for your answer. (3)
 - ii) the experiment is performed at a lower temperature. Give **ONE** reason for your answer (3)
- e. Giraffes are the largest ruminant herbivores on Earth. They generally eat leaves from trees and are often observed chewing.
 - i) Explain why the giraffes 'are generally observed chewing'. (2)
 - ii) Define the term ruminant. (2)
 - iii) Some herbivores a horny pad instead of incisors on the front of the top jaw. Explain why. (2)

(Total: 25 marks)



SUBJECT:	Biology
PAPER NUMBER:	IIB
DATE:	8 th May 2018
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.

Please note that for question 2 of this paper you need the graph paper in the booklet.

Answer any **FOUR** questions.

1. A scientist studied parasites in species of reptiles in Malta. He compared the parasites in reptiles living in the wild with parasites affecting imported reptile species. The latter are often kept as pets in homes. The aim of the study was to determine if any parasites found on the imported pet species were transferred to the local species.
- Define the term parasite. (2)
 - What term is used to describe the organism that is affected by a parasite? (1)

The scientist collected eight species of mite from wild reptiles. He also collected three species of mite and a single tick from pet reptile species. Only one species was found affecting both local and imported reptiles. Mites and ticks are ectoparasites i.e. parasites living on the surface of the organism. This evidence was not clear enough to allow the scientist to conclude that the parasitic mite was transferred from imported to local reptile species.

- Define the term species. (2)
- All the ectoparasites mentioned are arachnids. List **ONE** distinguishing structural characteristic observed in both mites and ticks allowing them to be classified as arachnids. (2)
- List **ONE** distinguishing structural characteristic shared by all types of reptiles living in Malta. (2)

Four groups of endoparasites i.e. parasites living inside the organism, were found in reptiles living in the wild and three groups were found in imported pet reptiles. The endoparasites included nematodes. It was not possible to determine if these nematodes were transferred from the pet reptile species to the local species.

- Distinguish between an ectoparasite and an endoparasite. (2)
 - List **TWO** structural characteristics of nematodes. (2)
 - Give **ONE** difference between the external appearance of an annelid and that of a nematode. (2)

The study showed that 46.2% of imported pet reptiles carried endoparasites compared to 35.3% of reptile species living in the wild. This may be due to pet reptiles living in overcrowded conditions, stress, and living in a confined space that may allow the parasite to re-infect the host. Contrastingly only 6.5% of imported pet reptiles had ectoparasites, compared to 38.8% of the reptiles living in the wild.

- Summarise the results obtained in the form of a table. (5)
- Explain how overcrowding may lead to a greater chance that pet reptiles are infected with parasites. (3)

This question continues on next page.

Three species of wild Maltese reptiles: *Chalcides ocellatus*, *Podarcis filfolensis* and *Tarentola mauritanica*, were found to be potential hosts for up to three species of ectoparasites, while no ectoparasites were extracted from *Chamaeleo chamaeleon* and *Hemidactylus turcicus*.

h. The scientist used the scientific names to identify the species of wild Maltese reptiles mentioned in the last paragraph. Give **ONE** advantage of this. (2)

(Adapted from Sultana L., Parasitism in selected indigenous and naturalized Maltese reptiles in relation to imported species; in Biology Symposium Abstracts 2016, UOM)

(Total: 25 marks)

2. Two groups of barley seedlings were grown in a culture solution containing all the ions necessary for healthy plant growth as shown in Figure 2.1

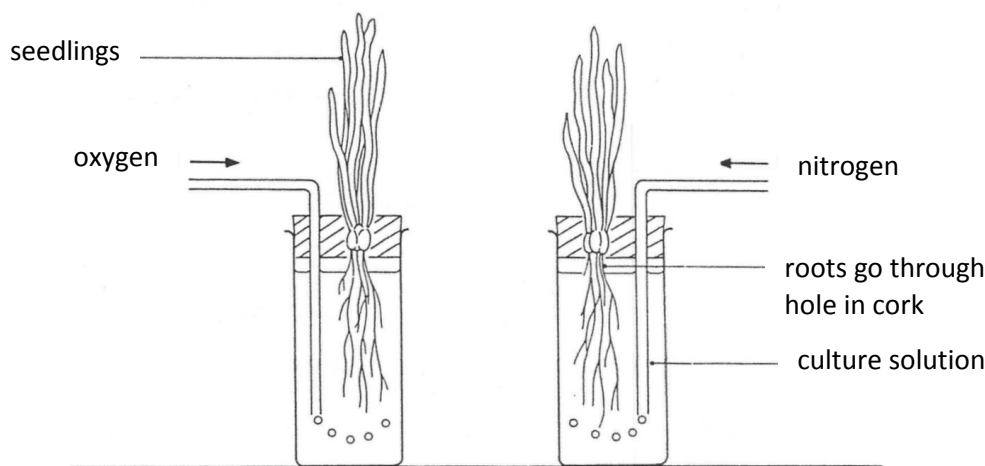


Figure 2.1 Barley seedling growing in a culture solution
Adapted from Nuffield foundation / biosciences federation 2008

The plants were provided with sulfate ions containing radioactive sulphur atoms — ³⁵S. Oxygen was bubbled through one of the solutions containing one group of seedlings, while nitrogen was bubbled through the other solution containing the second group of seedlings. Nitrogen gas is not harmful to seedlings, but plants do not use gaseous nitrogen.

The amount of radioactive sulfate ions taken up by the seedlings was measured every half-hour for 4 hours. The results are shown in Table 2.

Table 2: Total amount of sulfate ions taken up in the presence of oxygen and the presence of nitrogen

Time (minutes)	Total amount of sulfate ions taken up (arbitrary units)	
	With oxygen (aerobic)	With nitrogen (anaerobic)
0	0	0
30	220	140
60	290	190
90	350	210
120	390	225
150	430	238
180	490	250
210	500	250
240	530	250

- On the graph paper provided (use the 2 mm grid scale), draw a graph to show the variation in the total amount of sulfate ions taken up over 240 minutes in the presence of oxygen. Join the points of the graph with straight lines. Plot the time on the x-axis. (6)
- Use the graph to calculate the rate of sulfate ion uptake in arbitrary units per minute in the presence of oxygen for the time interval between 60 and 120 minutes. (2)
- Use the table to calculate the rate of sulfate ion uptake in arbitrary units per minute in the presence of nitrogen for the time interval between 60 and 120 minutes. (2)
- Give **TWO** differences between the uptake of radioactive sulfate ions by the seedlings which were supplied with oxygen, with the uptake of sulfate ions by the seedlings that were supplied with nitrogen. (4)
- Name **ONE** variable that should have been controlled during the experiment. (2)
- Suggest **ONE** way how the investigator can make results more reliable. (2)
- Name the process taking place in the barley plant root cells that uses the oxygen bubbled through the solution. (2)
- The sulfate ion concentration inside the root is higher than the sulfate ion concentration in the solution. Explain how the process mentioned in your answer to part (g) affects the uptake of sulfate ions by the roots. (4)
- Name **ONE** other mineral ion that plants need for healthy growth and which is taken up from the soil. (1)

(Total: 25 marks)

3. Figure 3.1 below shows two leaves A and B, each having the petiole in a closed test tube full of water. Each is hung on a spring balance. Leaf A has a waxy cuticle on the upper epidermis and stomata on the lower epidermis. Leaf B a waxy cuticle on the upper epidermis and a lower epidermis covered with petroleum jelly. Both leaves were cut from the same plant.

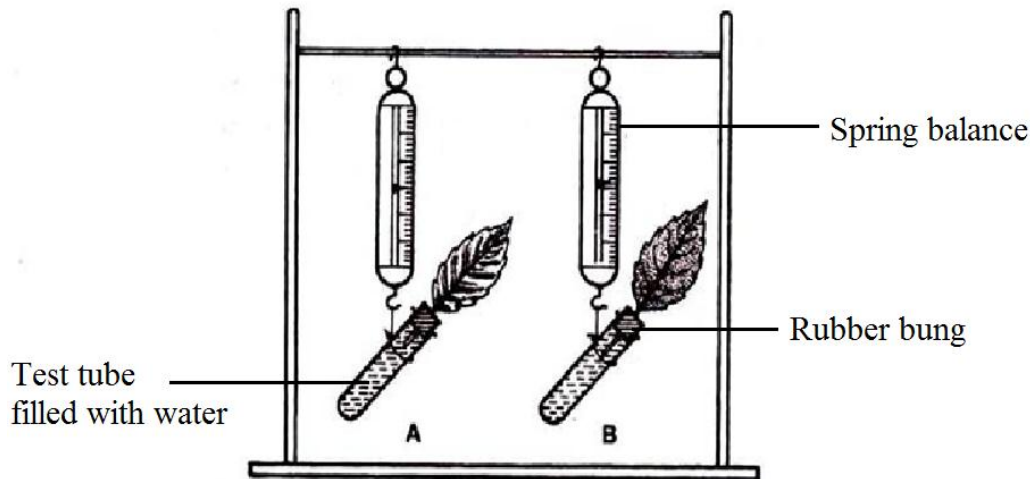


Figure 3.1 Apparatus set up showing leaves A and B
http://cdn.biologydiscussion.com/wp-content/uploads/2016/09/clip_image055_thumb2.jpg

- List **ONE** variable that must be kept constant in this investigation. (2)
 - Table 3 shows the results obtained in the experiment:

Table 3: Results

Leaf and test-tube	Initial weight/g	Final weight/g	Change in weight/g
A	40.7	39.9	
B	38.7	38.7	0.0

<http://www.biologydiscussion.com/experiments/top-13-experiments-on-transpiration-plants/56605>

- Calculate the change in weight of apparatus A. Show your working. (1)
 - iii) Name the process that brings about the change in weight of apparatus A and explain what brings about the change in weight. (3)
 - iv) Using your biological knowledge, indicate how results for leaf A will change, if a fan is switched on near the experimental setup. Explain your answer. (3)
 - v) Using your biological knowledge, predict if there will be any changes in the results for leaf B if a heater is switched on near the experimental setup. Explain your answer. (3)
- b. Figure 3.2 shows a cross-section of the monocotyledonous plant *Aloe*, a succulent plant. The drawing on the right is a magnified part of the leaf.

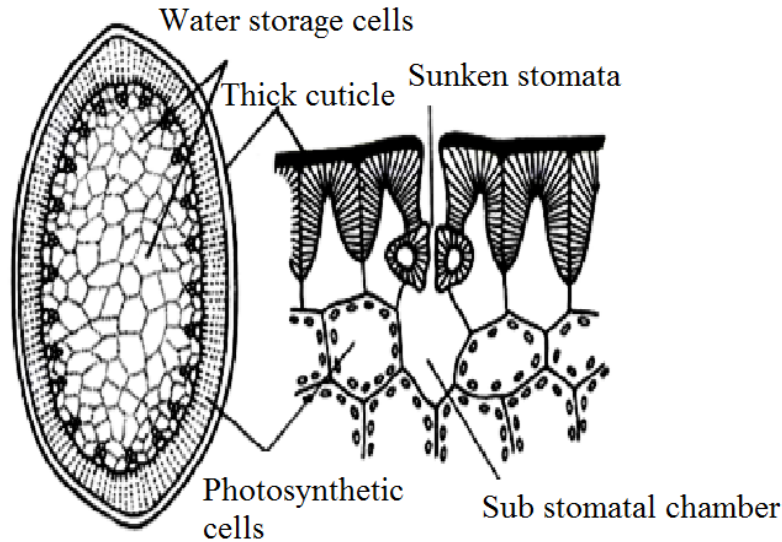


Figure 3.2 Cross-section through an *Aloe* plant
<http://cdn.biologydiscussion.com/wp-content/uploads/2015/01/image106.png>

- i) From the diagram list **TWO** adaptations that show that the plant is adapted to conserve water. (2)
 - ii) Name the cells in the epidermis that surround the stomata. (1)
 - iii) Explain why the sub stomatal chamber in the photosynthetic layer is important. (2)
 - iv) Give **TWO** characteristics of monocotyledonous plants. (4)
- c. State **ONE** adaptation for each of the following that allows them to survive on land:
- i) Mosses: (2)
 - ii) Gymnosperms. (2)

(Total: 25 marks)

4. Figure 4.1 shows the human female reproductive system.

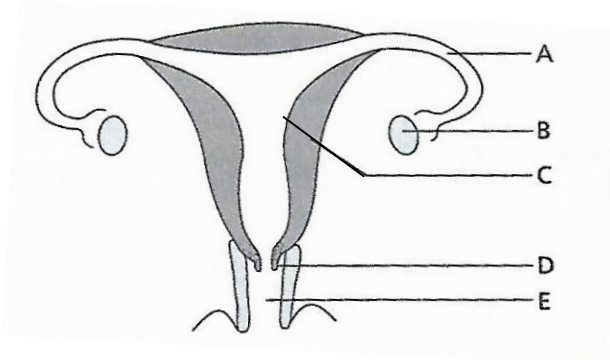


Figure 4.1: The human female reproductive system

- a. Which letter on the diagram shows where:
- i) meiosis takes place;
 - ii) fertilisation occurs;
 - iii) an egg cell is produced;
 - iv) a placenta develops.
 - v) sperm deposition occurs. (5)
- b. One method of birth control which can be used by a woman involves cutting structures A (in Figure 4.1 above). Explain how this treatment prevents conception. (2)
- c. Figure 4.2 below show three nuclei with their chromosomes.

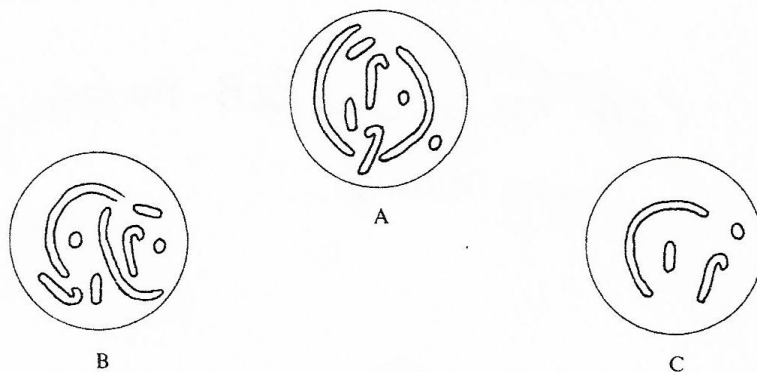


Figure 4.2: Nuclei A, B and C with chromosomes

Nuclei B and C developed from nucleus A. Identify which nucleus was formed by mitosis and which nucleus was formed by meiosis. (2)

- d. i) Name **TWO** places in the body where mitosis occurs. (2)
- ii) Name **TWO** places in a flowering plant where meiosis occurs. (2)
- e. Give **ONE** difference between a sperm cell and cells in a developing foetus. (2)
- f. Explain what determines if a fertilised ovum develops into a girl rather than a boy. (3)
- g. i) One role of the placenta is to exchange substances between the foetus and the mother. Name **THREE** of these substances which are exchanged between the foetus and the mother. (3)
- ii) Describe **TWO** other roles of the placenta in maintaining pregnancy. (4)

(Total 25 marks)

5. Control and co-ordination of body functions are under both nervous and hormonal control. Insulin and glucagon are hormones that help to keep the blood glucose level within an acceptable range.

- a. Define the term hormone. (2)
- b. Under which conditions would you expect:
- i) insulin to be secreted? (1)
 - ii) glucagon to be secreted? (1)
 - iii) What changes do these two hormones bring about when they are secreted? (2)
 - iv) Describe how insulin and glucagon bring about the changes you described in your answer to part b iii). (4)
- c. Co-ordination of body activities can also be under nervous control. When a person touches a very hot object, he /she will quickly withdraw the hand away from the painful stimulus.
- i) What is this type of action called? (1)

This question continues on next page.

- ii) Draw a diagram to accurately show how nerve cells involved in withdrawing the hand away from a painful stimulus are arranged. Your drawing should also show clearly the arrangement of the cells in relation to the spinal cord and the direction of the impulse. (10)
- iii) Describe how neurons communicate together, even though they do not physically touch each other. (2)
- d. Describe **TWO** ways in which nervous communication differs from hormonal communication. Present your answer in table form. (2)

(Total: 25 marks)

6. Table 6 lists seven new species discovered in the last few years:

Table 6: Newly discovered species

	Common name	Scientific name	Taxonomic group
1	Vangunu giant rat	<i>Uromys vika</i>	Mammal
2	Tapanuli orangutang	<i>Pongo tapanuliensis</i>	Mammal
3	Pink Floyd pistol shrimp	<i>Synalpheus pinkfloydi</i>	Crustacean
4	Game of Thrones ant	<i>Pheidole drogon</i>	Insect
5	Casanova millipede	<i>Illacme tobini</i>	Myriapod
6	Waterfall centipede	<i>Scolopendra cataracta</i>	Myriapod

- a. List **ONE** characteristic that scientists may study to determine if a new species has been discovered. (2)
- b. List the common names of the **FOUR** Arthropods listed in Table 6. (2)
- c. Describe how the number of legs of the Game of Thrones ant and the Casanova millepede differ. (2)
- d. Explain why the Game of Thrones ant is more likely to survive in less humid environments than an Annelid. (2)
- e. List **TWO** distinguishing structural characteristics that the Vangunu giant rat and the Tapanuli orangutang share. (2)
- f. Another species that was discovered recently is *Pheidole viserion*. Use the information to determine the taxonomic group to which it belongs. Give a reason for your answer. (4)
- g. In October 2017, newspapers reported the rediscovery of the giant stick insect, *Dryococelus australis*, in Lord Howe’s Island in Australia. This species was considered to be extinct since 1920’s after rats from a ship that ran off the island had eaten all the population of giant stick insects.
 - i) Define the term population. (2)
 - ii) Give **TWO** reasons why a species may become extinct. (2)
 - iii) The giant stick insect is possibly the rarest insect species in the world, as only thirty individuals are known to exist. Give **ONE** way how this species may be protected. (2)
- h. Write a note to describe how the process of eutrophication may destroy whole populations of organisms living in small freshwater lakes. (5)

(Total: 25 marks)

7. A group of students studied the effect of carbon dioxide on the rate of photosynthesis. They cut circular discs from a leaf and placed them in a beaker filled with sodium hydrogen carbonate solution. This solution will be a source of carbon dioxide.

Before the experiment, time was allowed for the hydrogen carbonate solution to fill the air spaces in the leaf. This causes the leaf discs to sink down to the bottom.

The beaker was then placed under a light source and the time taken for the leaf discs to rise recorded. Figure 7.1 shows the apparatus setup and the position of leaf discs at the start and the end of the experiment.

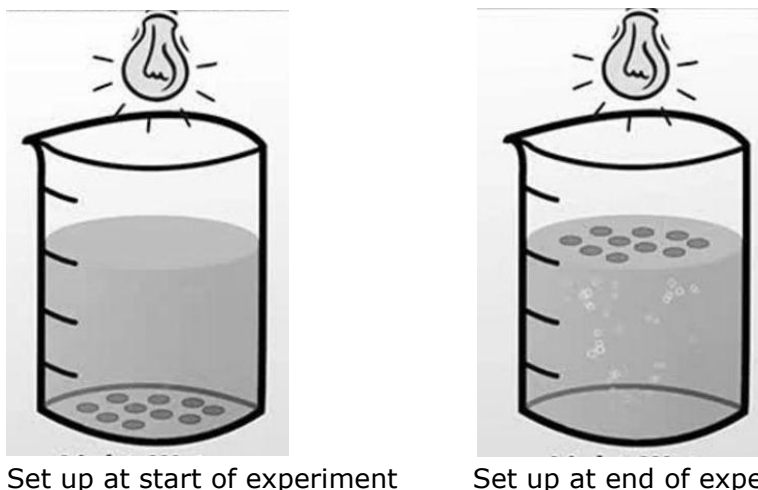


Figure 7.1: Apparatus set up used to investigate the effect of carbon dioxide on photosynthesis
Adapted from https://study.com/cimages/videopreview/ap-biology-lab-5-photosynthesis-v2_125508.jpg

- a. Write a word equation summarising the process of photosynthesis. (2)
- b. Draw a well-labelled diagram showing the cross section of a typical leaf. (5)
- c. The leaf discs sink to the bottom of the beaker when sodium hydrogen carbonate fills the air spaces as this makes the leaf denser than the solution. Use this information and your own biological knowledge to explain why the leaf discs rise to the surface as the experiment proceeds. (4)
- d. Explain why the leaf discs will not rise to the surface if:
 - i) the discs are placed in pure distilled water instead of sodium hydrogen carbonate. (2)
 - ii) the apparatus is placed in a dark cupboard. (2)
- e. i) Explain why the leaf discs will rise to the surface more quickly if they are placed in a more concentrated solution of hydrogen carbonate. (2)
- ii) Explain why the leaf discs will rise to the surface more slowly if a lamp that is less bright is used. (2)
- f. Giraffes are the largest ruminant herbivores on Earth. They generally eat leaves from trees and are often observed chewing.
 - i) Explain why the giraffes 'are generally observed chewing'. (2)
 - ii) Give **ONE** characteristic of dentition of ruminant herbivores and explain how this characteristic makes them adapted to their mode of nutrition. (4)

(Total: 25 marks)

Please turn the page.

8. Glucose, a monosaccharide, is involved in several reactions in the cells of organisms including the formation of polysaccharides starch, glycogen and cellulose and in aerobic respiration and fermentation pathways.

- a. i) Name the elements that make up glucose molecule. (1)
- ii) Glucose is a reducing sugar. Describe a test that may be performed to test for the presence of glucose in a solution. (3)
- b. Lactic acid fermentation is used to preserve foods. Figure 8.1 summarises the process of yoghurt production from the fermentation of sugars in milk to lactic acid.

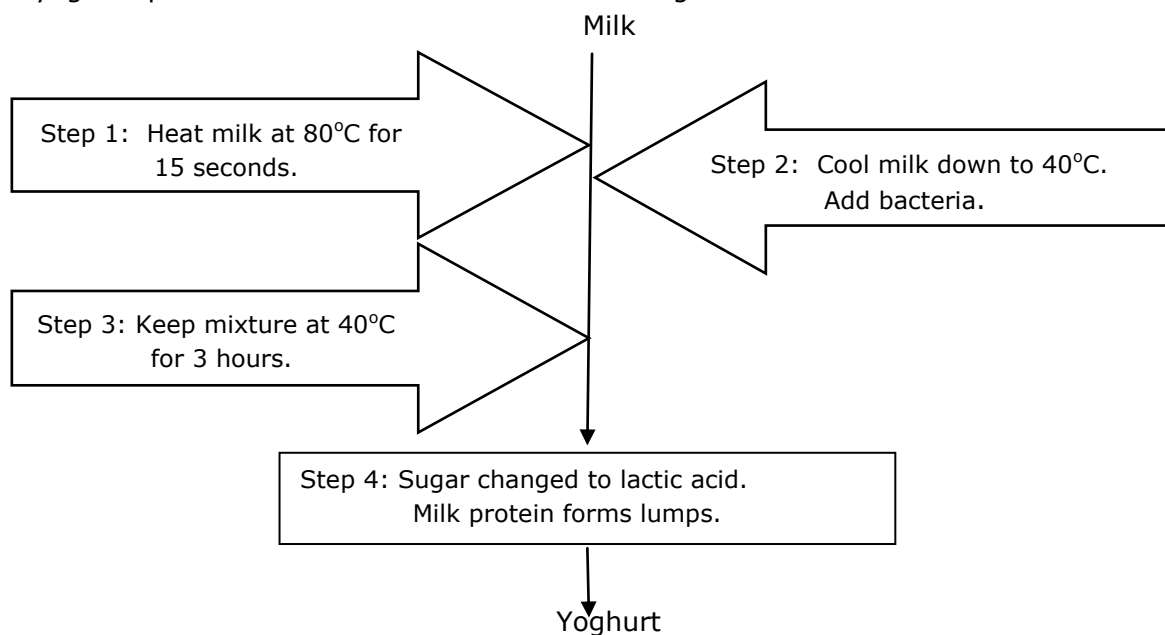


Figure 8.1: Production of yoghurt

Adapted from <http://oldschool.com.sg/module/PublicAccess/>

- i) Name the disaccharide found in milk. (1)
- ii) Write a word equation showing the process of lactic acid fermentation. (2)
- iii) Name the process taking place in step 1. Explain the function of this process for lactic acid fermentation. (3)
- iv) Give **ONE** reason why the milk is cooled down before bacteria are added. (2)
- v) Explain why the sugar and bacteria mixture is kept for a number of hours at the same temperature. (2)
- c. A different fermentation pathway is also part of a beer brewing process.
 - i) Name the type of organism used in the beer brewing process. (1)
 - ii) Write a word equation showing the process of fermentation involved in beer brewing. (2)
 - iii) Explain why there is a limit to the level of alcohol in beer. (2)
- d. Starch and cellulose are both found in plant cells.
 - i) Name the sites in a cell where starch and cellulose are found. (2)
 - ii) Starch is found in seeds and tubers. Explain the importance of such a food storage in these structures. (2)
 - iii) Describe how one may test for the presence of starch on a piece of potato tuber. (2)

(Total: 25 marks)