



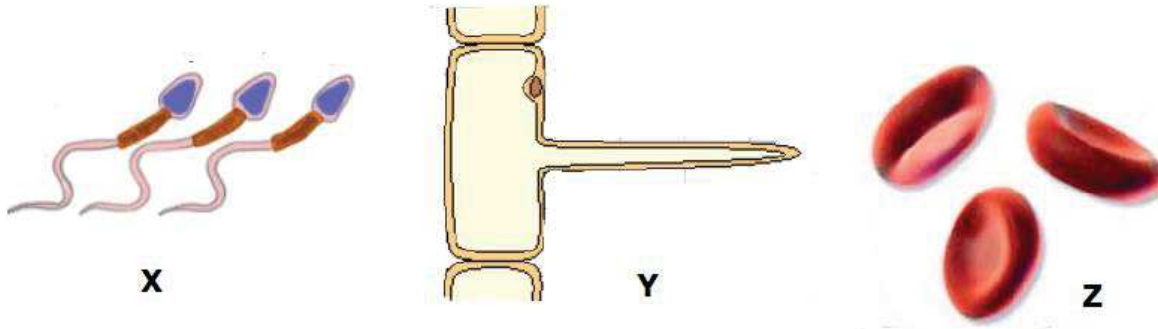

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SUBJECT: **Biology**  
 PAPER NUMBER: I  
 DATE: 29<sup>th</sup> August 2019  
 TIME: 9:00 a.m. to 11:05 a.m.

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

1. Figure 1.1 shows three specialised cells X, Y and Z.



Diagrams are not to scale.

X -<http://ibbiologyhelp.com>

Y -Science diagrams

Z -<https://microbiologyinfo.com>

Figure 1.1

a. i) Define the term 'specialised cells'.

\_\_\_\_\_

\_\_\_\_\_ (2)

ii) State precisely where in an animal you would expect cell **X** and cell **Z** to become specialised.

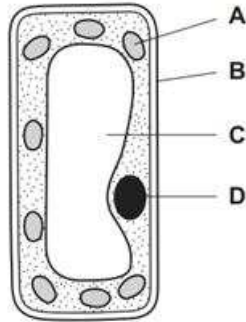
**X** \_\_\_\_\_ **Z** \_\_\_\_\_ (1)

iii) Y is a plant cell. Give **TWO** features shown in diagram Y that support this statement.

\_\_\_\_\_

\_\_\_\_\_ (1)

b. Figure 1.2 shows a diagram of a generalised plant cell.



<https://www.tes.com/teaching-resource/plant-and-animal-cell-worksheet-6311829>  
Figure 1.2

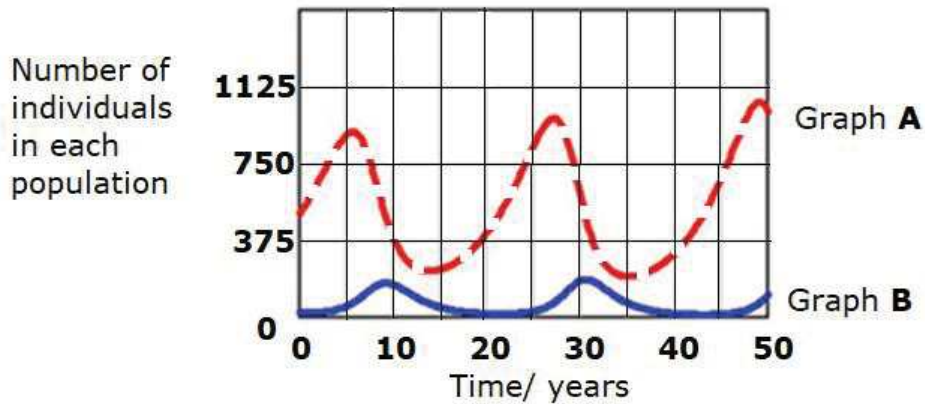
Name the parts **A** and **D** and give the function of each.

Part	Name	Function
<b>A</b>		
<b>D</b>		

(4)

**(Total: 8 marks)**

2. Isle Royale, the largest island in Lake Superior, located in North America, offers a unique closed environment in which to study predator-prey relationships between wolves and moose. Data collected over 50 years, showing interactions between these two species, is shown in Figure 2.1 below.



<http://mvhs.shodor.org/mvhsproj/moosewolf/moosewolf.html>  
Figure 2.1

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- a. Which populations are represented by Graphs A and B?

Graph A \_\_\_\_\_ Graph B \_\_\_\_\_ (1)

- b. Give **TWO** reasons for your answers in part (a).

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(2)

- c. A good predator-prey relationship should keep both populations in balance. Explain what is meant by this statement.

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(2)

- d. Wolves (*Canis lupus*) and coyotes (*Canis latrans*) are closely related species which compete for food and territory in Lake Superior.

- i) Name this type of competition.

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(1)

- ii) Give evidence that these two species are closely related.

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(1)

- iii) Competition is not exclusive to animals. Identify **THREE** resources which plants compete for.

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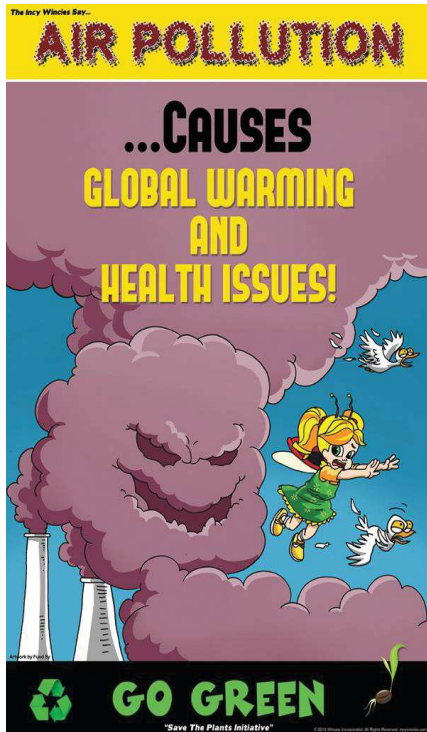
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(3)

**(Total: 10 marks)**

3. The following posters focus on current sustainability issues. Use your biological knowledge to explain these posters.

a.



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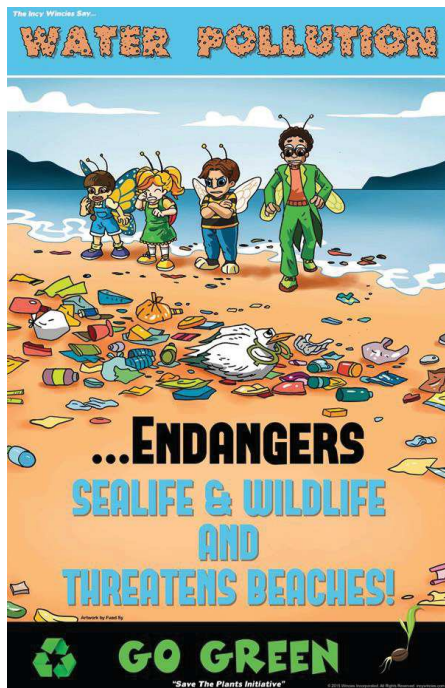
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(3)

<https://www.incywincies.com/product/air-pollution-environmental-poster/>

Figure 3.1

b.



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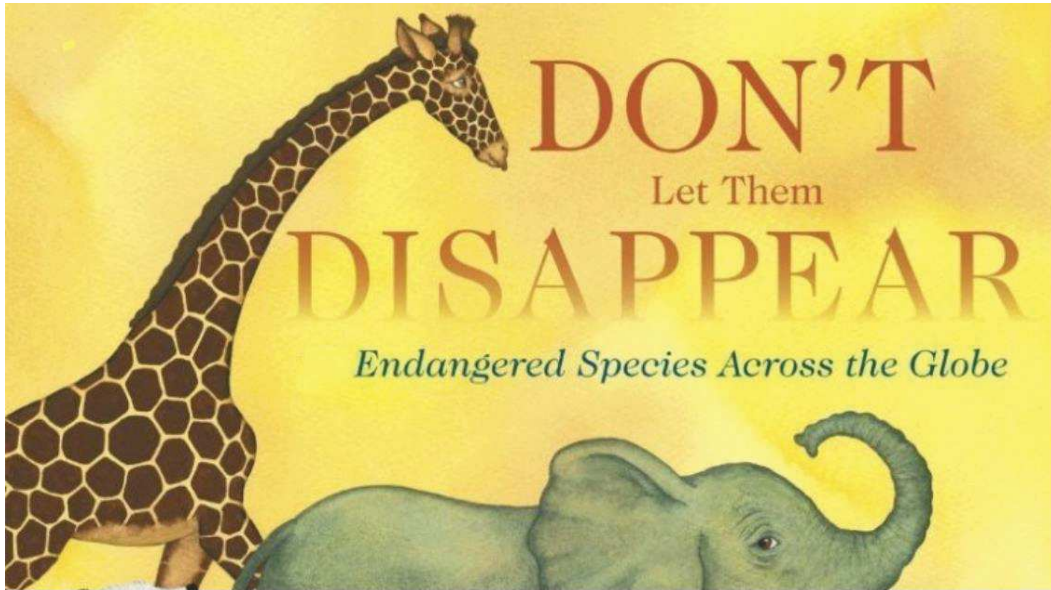
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(3)

<https://www.incywincies.com/product/water-pollution-environmental-poster/>

Figure 3.2

c.



<https://bookstr.com/article/chelsea-clinton-new-childrens-book-brings-awareness-to-endangered-species/>

Figure 3.3

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(4)

**(Total: 10 marks)**

4. A study on the effects of earthworms on soil nematodes (round worms), showed that the presence of earthworms decreases the number of nematodes in soil. Soil nematodes may be of two types: plant root parasites and saprotrophic decomposers.

a. Some nematodes are parasites. Define a parasite.

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(1)

b. State **ONE** structural characteristic, other than being round, of nematodes.

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(1)

c. Explain the importance of the presence of earthworms for plants growing in soil infested with parasitic nematodes.

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(3)

- 
- d. In the study, the researchers also found that earthworms and nematodes populations are highest during the rainy season and lowest during the dry season. Describe the importance of a moist environment for each of these organisms.

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(2)

- e. Describe the role of saprotrophic nematodes in soil.

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(3)

**(Total: 10 marks)**

5. a. Enzymes are defined as biological catalysts. Explain the meaning of the term catalyst.

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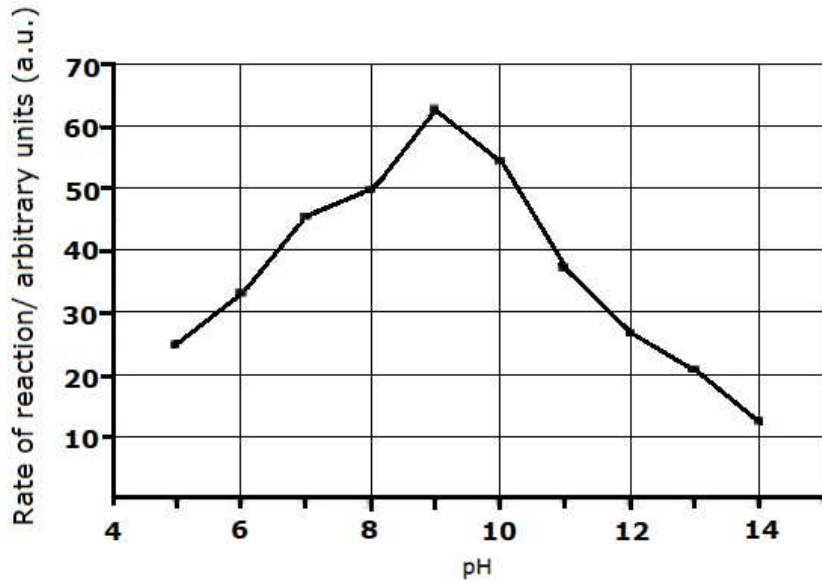
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(2)

- b. Using a diagram explain how an enzyme breaks down a substrate.

(3)

c. The graph below shows the rate of reaction of an enzyme at different pH levels.



<https://www.researchgate.net/figure>

Figure 5.1

i) From Figure 5.1, determine the optimum pH at which the enzyme works.

\_\_\_\_\_ (1)

ii) State the rate of reaction at pH 14.

\_\_\_\_\_ (1)

iii) Describe what is happening to the enzyme at pH 14.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ (3)

**(Total: 10 marks)**

6. Researchers in Thailand identified a new snail eating species of turtle, *Malayemys khoratensis*. This turtle eats the fresh water snail *Filopaludina martensi*.

a. Turtles are reptiles. State **TWO** characteristics of reptiles.

\_\_\_\_\_  
 \_\_\_\_\_ (2)

- b. Two other turtles that have similar feeding habits to the snail eating turtle are *Malayemys subtrijuga* and *Malayemys macrocephala*. State **ONE** species name from the above binomial nomenclature of turtles.

(1)

- c. *Malayemys macrocephala* lives in shallow, warm waters with dense water vegetation. Give **ONE** reason for each of the following preferences.

This species:

- i) prefers warm to cold waters;

(3)

- ii) prefers regions of dense vegetation.

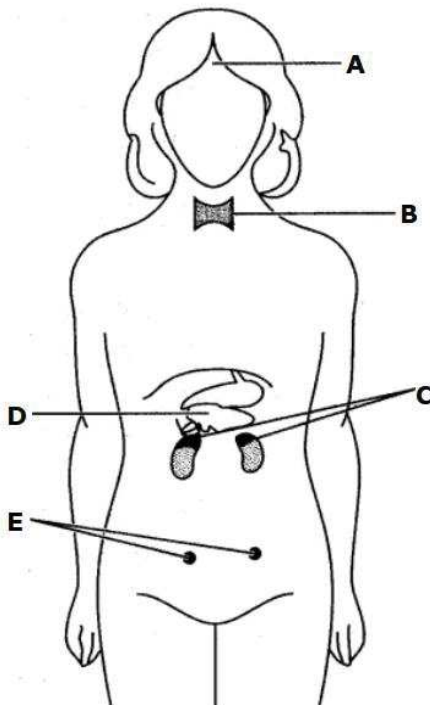
(2)

- d. Snails are molluscs. State **ONE** structural characteristic of molluscs.

(2)

**(Total: 10 marks)**

7. The diagram below shows the position of some of the endocrine glands in the female body.



<https://www.aplustopper.com/endocrine-system-icse-solutions-class-10-biology/>  
Figure 7.1



- a. Identify the endocrine gland/s as described by each statement in the first column of the table below. Include the letter shown in the diagram, which shows the position of the endocrine gland/s described, in the last column of the table.

Function/s of endocrine gland/s	Name of endocrine gland/s	Letter showing position of endocrine gland/s
Produce ova as well as the hormones oestrogen and progesterone.		
Secretes the hormones FSH, LH and ADH.		

(4)

- b. One function of the pancreatic gland is hormone production. Mention **ONE** other function of this gland.

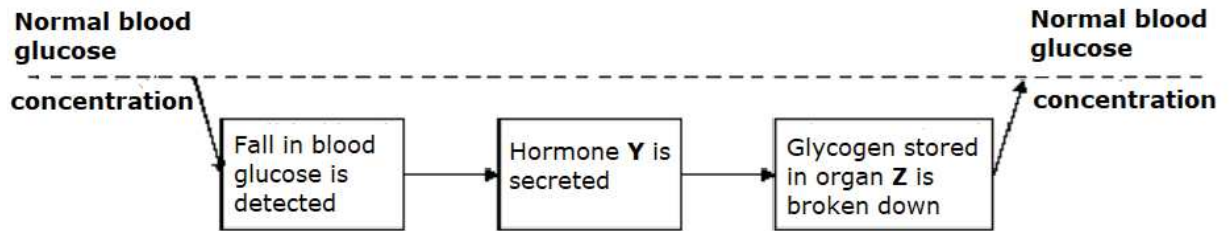
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(2)

- c. The following diagram shows some of the events which maintain a constant blood glucose concentration in humans.



<https://studylib.net/doc/6854915/diabetes-and-blood-glucose>  
Figure 7.2

Name:

i) Hormone Y: \_\_\_\_\_ (1)

ii) Organ Z: \_\_\_\_\_ (1)

- 
- d. Explain why the events shown in Figure 7.2 can be described as an example of feedback control.
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(2)

**(Total: 10 marks)**

8. Figure 8.1 shows a drawing of the external structure of a leaf.



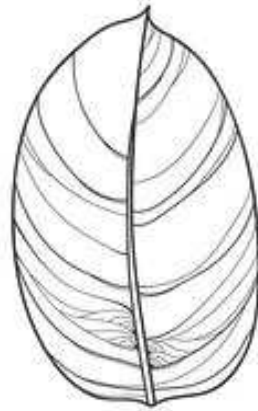
<http://www.arbolapp.es/en/guided-search/?v=D137>

Figure 8.1: External structure of a leaf

- a. On the diagram label the following structures:
- i) the leaf blade (or leaf lamina);
  - ii) the petiole;
  - iii) the midrib;
  - iv) a vein.

(2)

- b. Figure 8.2 shows two leaves, taken from two different species, A and B. The diagrams show the exact size of the leaves.



**Species A**



**Species B**

<https://t4.ftcdn.net/jpg>

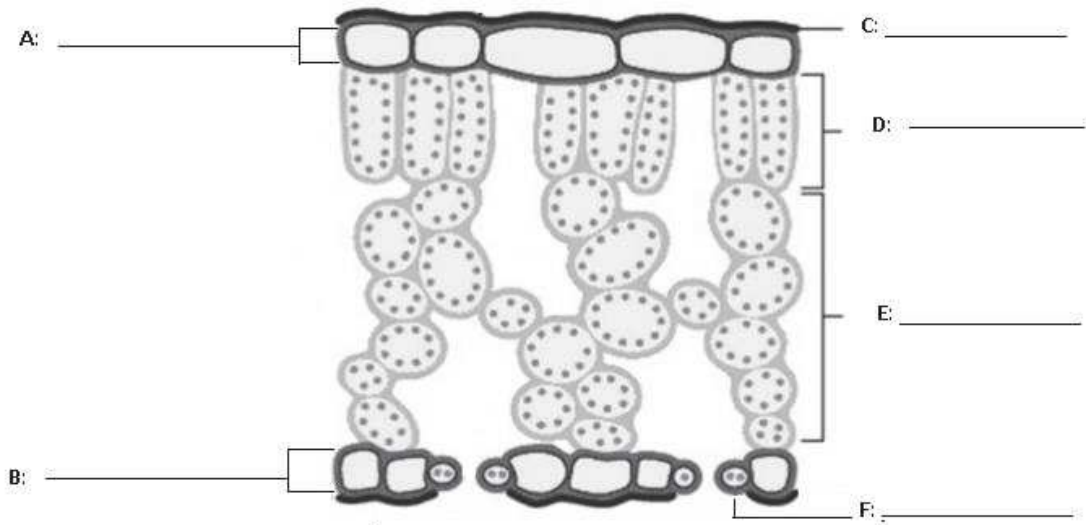
Figure. 8.2: Two leaves, taken from Species A and B respectively

State which leaf is expected to show the highest rate of photosynthesis. Give a reason for your answer.

Leaf taken from species: \_\_\_\_\_ (1)

Reason: \_\_\_\_\_

- c. Figure 8.3 shows a simplified diagram of the internal structure of a leaf. On Figure 8.3, in the spaces provided, label structures A – F. (3)



<https://image.slidesharecdn.com>

Figure 8.3: Internal structure of a leaf

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d. With reference to Figure 8.3 explain:

i) how layer **D** ensures a high rate of photosynthesis;

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(2)

ii) how air spaces in layer **E** ensure a high rate of photosynthesis.

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(2)

e. State the role of the space between cells **F** in photosynthesis.

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(1)

**(Total: 12 marks)**

9. The cells in the stigma contain sugar. A group of students investigated whether the concentration of sugar solution affects the growth of pollen tubes through the stigma. They prepared sugar solutions of 5%, 10%, 15%, 20% and 25% concentrations. They put a drop of each sugar solution in separate cavity slides; added pollen from the same kind of flower to each one, and covered with a cover slip. After keeping the slides in a warm place for 30 minutes, the pollen tubes were examined for tube growth.

a. Draw a labelled diagram to show the growth of a pollen tube through a carpel.

(3)

- 
- b. The students wish to extend the activity by investigating how cold or warm weather may affect the growth of the pollen tubes. Briefly state what they need to do.

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(2)

- c. Pollen grains from a wind pollinated flower and from an insect pollinated flower were observed under a light microscope. Describe the difference in pollen grains produced by each type of flower.

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(2)

- d. List **THREE** differences between wind pollinated flowers and insect pollinated flowers. Do **not** include type of pollen.

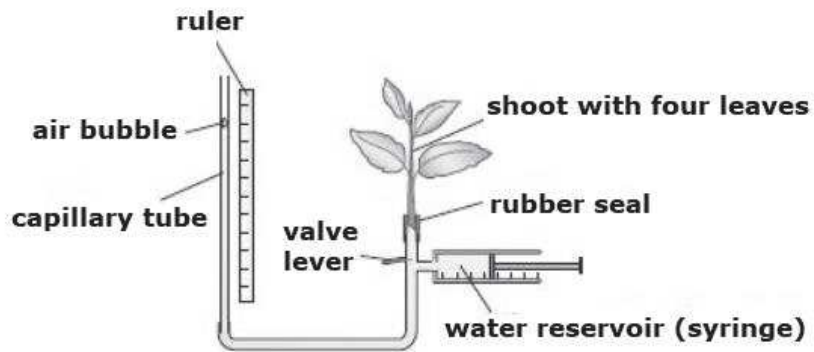
Wind pollinated flowers	Insect pollinated flowers

(3)

**(Total: 10 marks)**

***Please turn the page.***

10. Students investigated the rate of water loss from a leafy shoot, having four leaves, using a simple potometer as shown in Figure 10.1.



<http://doctoronnie.com>

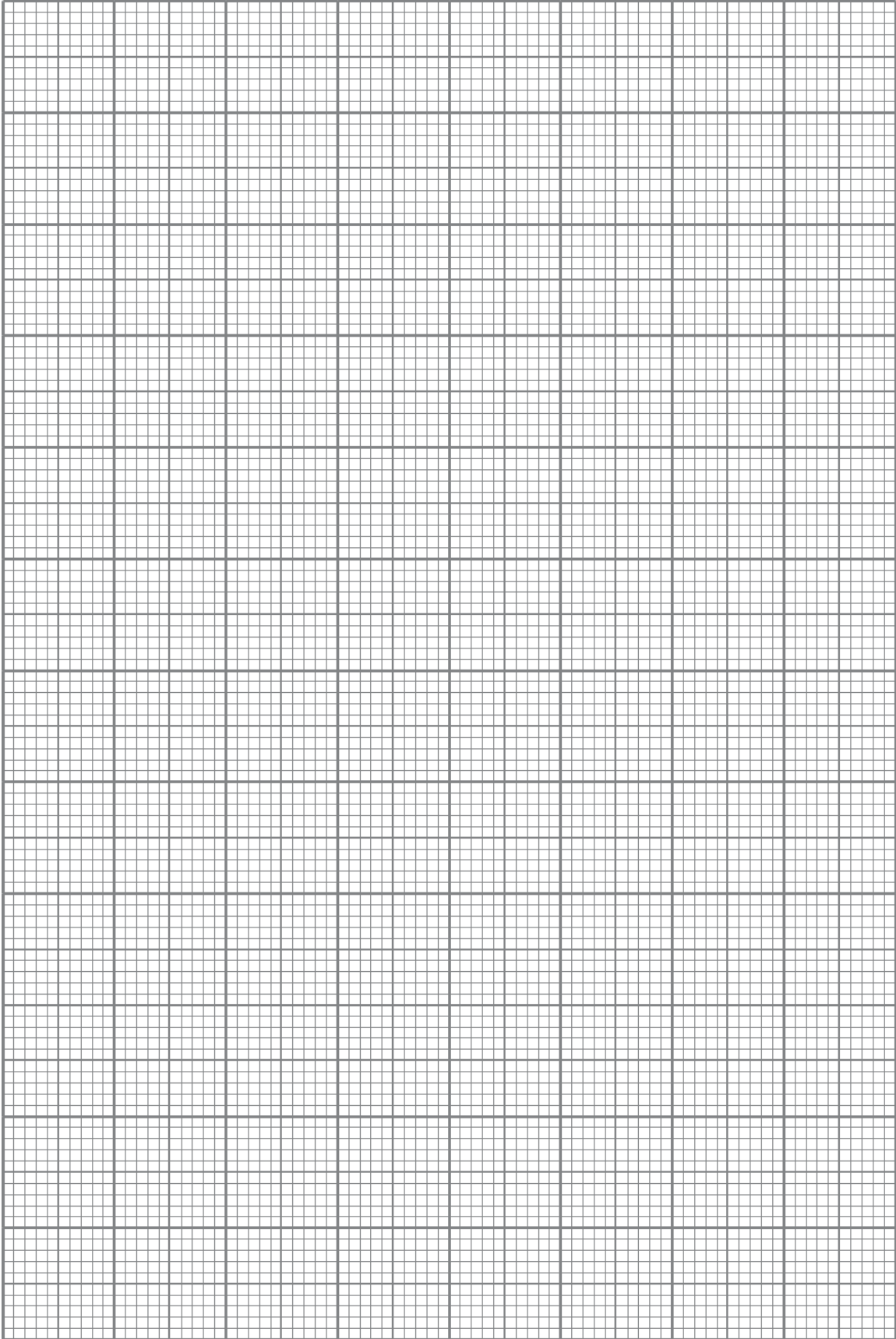
Figure 10.1: A simple potometer

They set up the apparatus in a laboratory and measured the distance moved by the air bubble in the capillary tube from the original position, every minute. They repeated the experiment twice.

The table below shows the results obtained.

Time / min	Distance moved by bubble / mm		Average distance moved by bubble / mm
	Trial 1	Trial 2	
0	0	0	0
1	14	16	15
2	30	26	28
3	44	34	
4	52	50	51
5	66	64	65

- Calculate the average distance moved by the air bubble in the third minute. Write your answer in the table of results. (1)
- Use the graph paper provided to draw a line graph showing the average distance moved by the air bubble (on the y axis) against time (on the x axis). Use a ruler to draw the best line of fit. (4)



- c. Use the graph to calculate the rate at which the air bubble moved up the capillary tube. Show your working in the space provided.

Ans: \_\_\_\_\_ mm/min  
(2)

- d. The experiment was repeated in different conditions. For each condition state if the rate of transpiration will be higher or lower than the rate calculated in part (c).

<b>Conditions</b>	<b>Higher / Lower rate of transpiration</b>
Shoot replaced with one having 20 leaves.	
Shoot replaced with one having 4 leaves of same size, with sunken stomata and a thicker waxy cuticle.	
Same shoot placed in a dark room.	

(3)

**(Total: 10 marks)**






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SUBJECT: **Biology**  
 PAPER NUMBER: IIB  
 DATE: 29<sup>th</sup> August 2019  
 TIME: 4:00 p.m. to 6:05 p.m.

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Write your answers on the booklet provided. Write down the number of the questions you answer on the front page of your answer booklet.

**Answer any FOUR questions.**

1. Two students carried out a biological investigation to study osmosis on slices of a raw cucumber. They cut four equal slices and weighed them. Then they put an equal amount of sugar, baking powder and salt on three of the slices. The fourth slice was left untreated. After 30 minutes the cucumber slices were weighed again. The table below shows the results of the experiment:

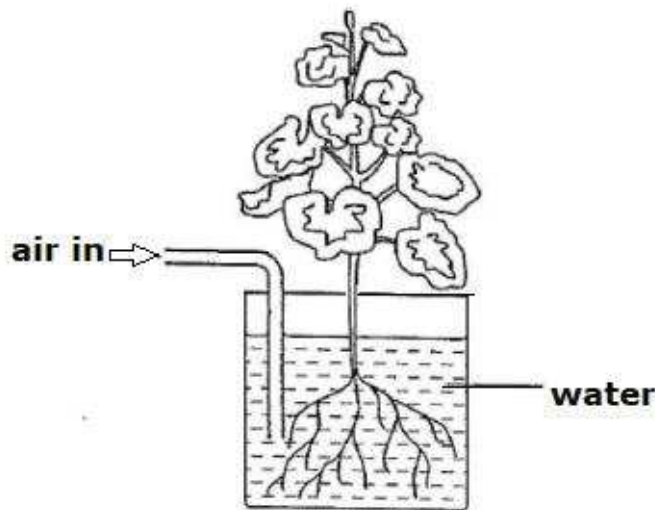
Slice	Treatment	Weight of cucumber at start of experiment/ g	Weight of cucumber at end of the experiment/g
1	Sugar	10	6
2	Baking Powder	10	7
3	Salt	10	6
4	No treatment	10	10

- a. Define the term osmosis. (2)
- b. i) Explain why the weight of cucumber slices 1, 2 and 3 decreased. (2)  
 ii) Explain why the decrease in weight of cucumber slice 1 was higher than the decrease of cucumber slice 2. (2)
- c. One of the students wrote that 'The four slices were cut equally to ensure a fair test'. The teacher who corrected the work asked the student to give a better explanation for taking this precaution. Explain how cutting the cucumber slices equally ensured a fair test. (2)
- d. The students observed that cucumber slices 1, 2 and 3 were no longer firm and crisp but rather soft and moist. Cucumber slice 4 remained crisp and firm.  
 i) Draw a simple diagram to show the appearance of a cell taken from cucumber slice 1. In your diagram show and label the following structures: cell wall, cell membrane and cytoplasm. (5)  
 ii) The students wrote that the cells in cucumber slice 4 were turgid. Explain this statement. (2)  
 iii) Describe a way how the cucumber slices 1, 2 and 3 may be made crisp again. Give a reason for your answer. (3)
- e. Plant roots take up mineral ions by active transport, a process that needs ATP.  
 i) Explain why ATP is needed for active transport. (2)  
 ii) Name the process that produces ATP in plant roots and name the organelle where it occurs. (2)  
 iii) Give **THREE** differences between osmosis and active transport. (3)

**(Total: 25 marks)**

2. a. Write a short note to distinguish between the following biological processes:
- i) ingestion and egestion; (2)
  - ii) absorption and assimilation; (2)
  - iii) emulsification of fats by bile salts and digestion of fats by lipase. (4)
- b. Write a short note to indicate exactly where the following organs are in the alimentary canal and **ONE** function of each:
- i) oesophagus; (3)
  - ii) duodenum; (3)
  - iii) large intestine. (3)
- c. Plants do not carry out digestion but carry out photosynthesis.
- i) Write a word equation to show the process of photosynthesis. (2)
  - ii) The process of digestion involves the breakdown of large molecules into smaller ones. State how photosynthesis is different. (2)
  - iii) The leaves of plants that lack magnesium will turn yellow as they cannot build up chlorophyll. State how this will affect the ability of the plant to photosynthesize and give a reason for your answer. (2)
  - iv) There are no photosynthetic organisms at a depth of 1000 m in oceans. Give a reason for this observation. (2)
- (Total: 25 marks)**

3. In 2015, NASA published its strategy for human exploration and colonisation of Mars. To live on Mars, astronauts would need to live in an enclosed environment that provides them with food, water and breathable air. Hydroponics, a method of growing plants without soil by using mineral nutrient solutions in a water solvent, could be used to grow plants.

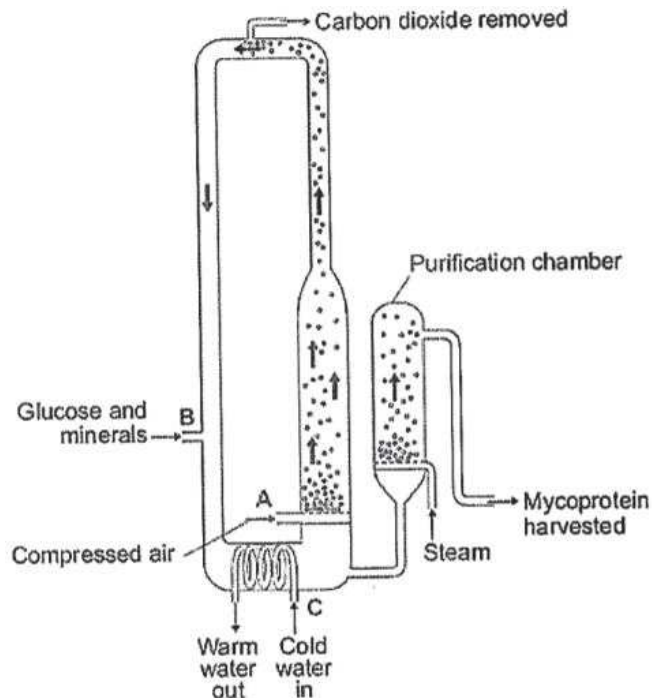


Source: OCR Science Biology 2001

Figure 3.1

- a. i) Astronauts could use plants for food. Explain the other benefits that growing plants would provide for them. (4)
- ii) Why is it necessary to bubble air through the solution in which plants grow? (2)
- iii) Name **TWO** other environmental factors which need to be controlled for the plants to grow well. (2)

- b. Astronauts could also produce food such as quorn, using a fermenter. Quorn is a fungus-based meat substitute which contains mycoprotein. The fungus *Fusarium venenatum*, is grown in continually oxygenated water in large, sterile fermentation tanks. Glucose and fixed nitrogen are added as a food for the fungus, as are vitamins and minerals to improve the food value of the product. The following diagram shows a fermenter used for growing *Fusarium venenatum*.

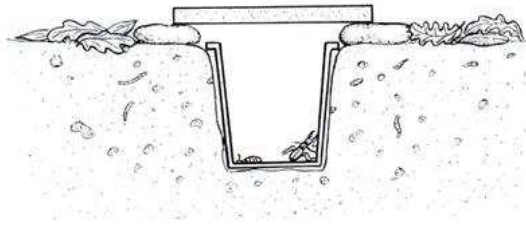


<https://mathsmadeeasy.co.uk/wp-content/uploads/2019/04/Triple-only-Food-production.pdf>  
Figure 3.2

- i) Bubbles of air enter the fermenter at A. Give **TWO** functions of the air bubbles. (2)
  - ii) Why is glucose added to the fermenter at B? (2)
  - iii) The fermenter is prevented from overheating by the cold water flowing in through the heat exchanger coils at C. Explain what causes the fermenter to heat up. (2)
  - iv) It is important to prevent microorganisms other than *Fusarium* from growing in the fermenter. State **TWO** reasons why this is important. (4)
- c. i) Write the word equation for anaerobic respiration in yeast. (3)
- ii) List **TWO** differences between aerobic and anaerobic respiration. Present your answer in table form. (4)

**(Total: 25 marks)**

4. During a fieldwork exercise, a group of students set up a number of pitfall traps in the country side as shown in the Figure 4.1 below. They were left overnight and checked, in the morning, for any organisms that were trapped.



<http://extreme-macro.co.uk/pitfall-trap/>

Figure 4.1: A pitfall trap

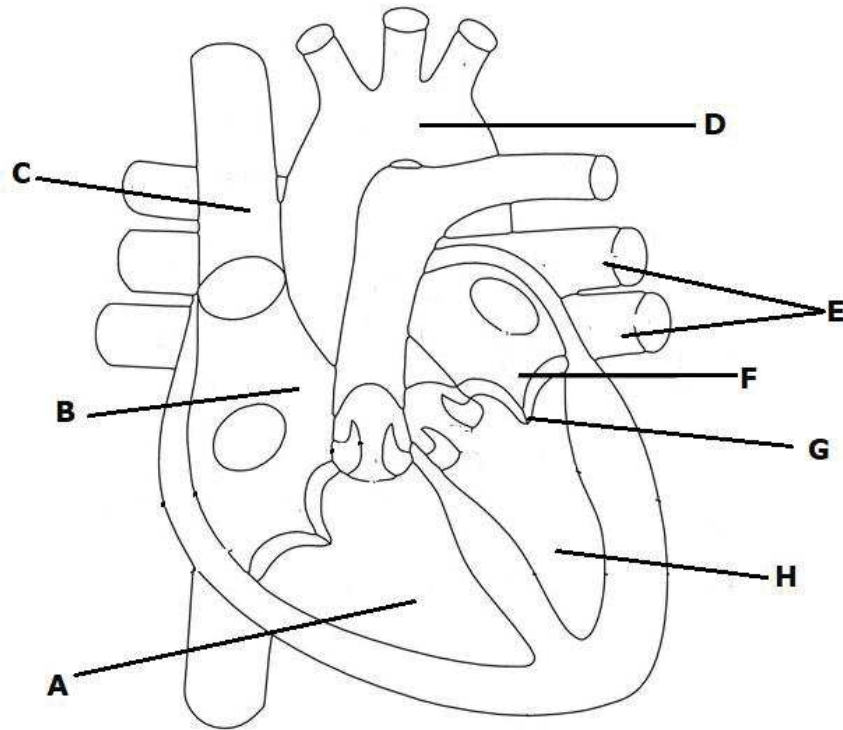
- a. In one of the pitfall trap students found the following organisms:

Number of organisms found	Latin Name	Common English Name	Common Maltese Name
2	<i>Staphylinus olens</i>	Devil's coach horse	Katarina gholli denbek
1	<i>Harminius spiniger</i>	Common click beetle	Ħanfusa tas-Salt

- i) Both species of beetles caught are insects. Give **TWO** structural characteristics that these organisms share. (2)
- ii) Beetles are Arthropods. Name the kingdom to which the beetles belong and give **TWO** characteristics of all organisms in this kingdom. (3)
- iii) Refer to either the common English or common Maltese name to explain why common names of these organisms tend to be misleading. (2)
- b. i) The organisms trapped in the pitfall traps left in the maquis and the woodland areas were different. Give **ONE** reason why. (2)
- ii) This fieldwork was performed in April. When the fieldwork was repeated in January, no insects were trapped. Give **ONE** reason why. (2)
- c. The Soil Centipede, *Himantharium gabrielis* (Xini tal-Ħamrija) lives in the soil. It burrows in the soil in search of worms and insect larvae. The Common Earthworm, *Allobophora sp.* (Ħanex tal-Ħamrija) also burrows in the soil, eating decaying plant and animal matter.
- i) Although both organisms have several segments, the Soil Centipede is an Arthropod whilst the Common Earthworm is an Annelid. Give **ONE** other similarity and **ONE** difference between the two organisms. (4)
- ii) The Common Earthworm comes to the surface only at night, in order to pull leaf litter into its hole. Explain why it does not come to the surface during the day. (2)
- iii) After heavy rains, Common Earthworms come out of their burrows as the soil is water logged. Give a reason for this behaviour. (2)
- iv) Explain why the Soil Centipede is described as carnivorous. (2)
- d. Another common organism in the Maltese country side is the Maltese Wall Lizard, *Podarcis filfolensis* (Gremxula ta' Malta). The Maltese Wall Lizard eats ants and termites.
- i) State the phylum and the class to which the Maltese Wall Lizard belongs. (2)
- ii) Ants and termites are also insects. State the phylum to which ants and termites belong and list **ONE** other class found in this phylum. (2)

**(Total: 25 marks)**

5. The following figure shows a section through a human heart.



<https://www.researchgate.net/figure>

Figure 5.1: Cross-section of the heart

- a.
  - i) Name the structures labelled A, C, D, E and G. (5)
  - ii) The muscle in the wall of chamber H is much thicker than that in the wall of chamber A. Explain why this increase in thickness is of value to the heart. (2)
  - iii) If part G was not functioning properly, the blood would not flow efficiently. Why do you think this is so? (3)
  - iv) List **THREE** differences between the composition of the blood in D and the blood in C. (3)
  
- b. In an embryo, the wall between chambers A and H on the diagram, has a hole in it which connects the two chambers.
  - i) Name the organ in an embryo which will be bypassed by most of the blood. (1)
  - ii) Some babies are born with an incomplete closure of this hole. Why will babies with a hole in the heart tire easily? (2)
  
- c.
  - i) How might a diet containing excess fats affect the structure of vessel D? (2)
  - ii) What effect might this have on the health of the person concerned? (1)
  
- d. The hormone erythropoietin results in the production of red blood cells and so raises the red blood cell count. Some athletes inject this hormone into their bodies to try to improve their athletic performances. How does this treatment cause such an improvement? (3)
- e. Sometimes, when a soldier stands to attention for a long time, s/he faints. This is because the blood does not circulate properly. Why is this so? (3)

**(Total: 25 marks)**

6. Palm oil is an edible vegetable oil, high in saturated fats, which is derived from the fruits of the African oil palm, *Elaeis guineensis* and to a lesser extent from the American oil palm, *Elaeis oleifera* and the maripa palm, *Attalea maripa*.
- a. Palm trees are monocotyledonous plants (monocots).
    - i) Which phylum do monocots belong to? (1)
    - ii) Give **THREE** characteristics of monocots. (3)
  - b. Fungi are parasites to palm trees. Draw a labelled diagram of a mould fungus. (3)
  - c. Most palm trees grow in rainforests where the climate is warm and humid. Mosses are often found growing on rainforest tree trunks, creating a velvety carpet not more than 5 cm thick.
    - i) Give **ONE** reason why mosses cannot grow taller than this size. (1)
    - ii) Give **TWO** reasons why mosses require moist environments to live. (2)
    - iii) Other plants commonly found in rainforests are ferns. Although these plants still require a damp environment, they colonise drier areas than mosses. Give **TWO** differences between mosses and ferns. (2)
  - d. Environmentalists argue that the farming of palm oil trees is extremely bad for the planet. This is because a lot of rainforest land is being cleared to make space for palm oil plantations.
    - i) In preparing rainforest land for palm oil plantation, machinery used to cut down trees burns fuel which produces greenhouse gases. Name **ONE** greenhouse gas. (1)
    - ii) Greenhouse emissions in turn result in climate change. Give **TWO** effects of climate change. (2)
  - e. Richard Walker, managing director of supermarket chain, Iceland, visited the Kalimantan rainforests in Borneo to see the impact of the palm oil industry first hand.
    - i) He described the scene that he saw as a 'horizon to horizon monoculture' where once rainforest stood. Give the meaning of the term monoculture. (2)
    - ii) Describe the effect that such plantations have on biodiversity in the region. (2)
  - f. Indonesia and Malaysia produce more than 85% of the world's palm oil and are the only remaining home to orangutans. Fewer than 80,000 of these animals survive today, their habitats being under constant threat. Below is a photograph of an orangutan and its young.



<http://www.allaboutwildlife.com/endangered-rainforest-species-orangutans>

Figure 6.1

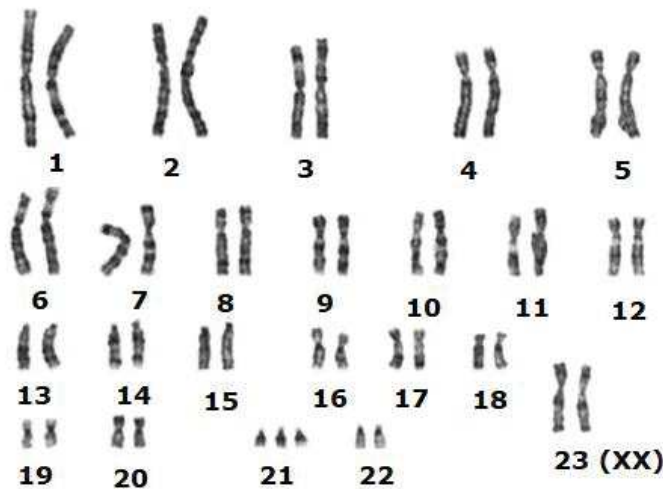
- i) Using Figure 6.1, name the class of vertebrates to which orangutans belong. (1)
- ii) Give **THREE** characteristics of this class. (3)
- iii) Orangutans are an endangered species. State **TWO** ways in which an endangered species can be conserved. (2)

**(Total: 25 marks)**

7. Both mitosis and meiosis are types of cell division in which one cell gives rise to more than one cell.

- a. Indicate whether each of the following descriptions applies for mitosis, meiosis or both.
  - i) Daughter cells are not the same as the parent cell; (1)
  - ii) Associated with asexual reproduction and growth; (1)
  - iii) Produces haploid daughter cells; (1)
  - iv) Chromosome number is unchanged; (1)
  - v) Produces gametes. (1)

b. World Down Syndrome Day is annually observed on March 21 to raise public awareness of Down syndrome, a chromosomal condition that is associated with altered intellectual capabilities and a characteristic facial appearance. The figure below shows the karyotype of a person with Down syndrome.



<https://embryology.med.unsw.edu.au>

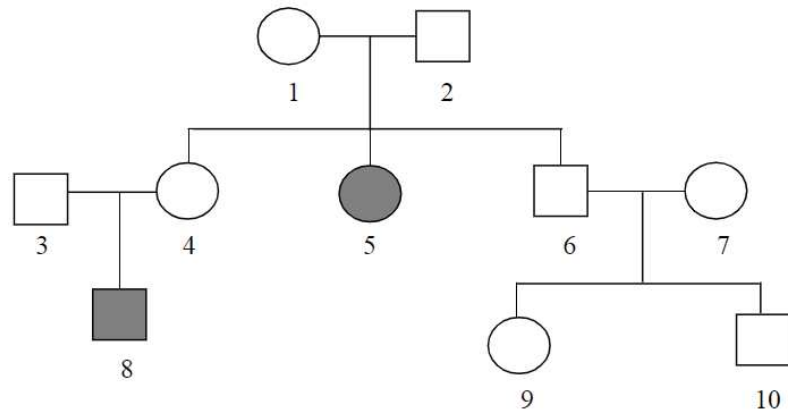
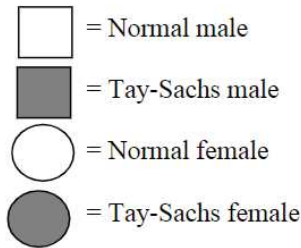
Figure 7.1

- i) Describe a chromosome. (3)
- ii) Give the number of chromosomes in a person with Down syndrome. (1)
- iii) The most common type of Down syndrome is known as trisomy 21 type. With reference to the figure above, explain what causes this type of Down syndrome. (2)
- iv) State whether this person with Down syndrome is a male or a female. (1)
- v) Down syndrome is caused by a chromosomal mutation. Define the term mutation. (2)
- vi) A mutagen is a physical or chemical agent which can increase frequency of mutations. Give **THREE** examples of mutagens. (3)

- c. Tay-Sachs disease is a fatal genetic disorder caused by a recessive allele, **t**. It results in the destruction of nerve cells in the brain and spinal cord. The most common type, known as infantile Tay-Sachs disease, becomes apparent around three to six months of age with the baby losing the ability to turn over, sit, or crawl.

The diagram below shows the family tree for a family with no history of the disease.

Key:



<https://studylib.net/doc/7086095/pedigree-charts-and-multiple-alleles-practice>

Figure 7.2

- i) State the genotypes for persons 1 and 2. Give evidence for your answer. (3)
- ii) State the possible genotype for person 6. (1)
- iii) If individual 8 marries a heterozygous female, what is the percentage chance of the offspring being affected? You may use a Punnett square to illustrate your answer. (4)

**(Total: 25 marks)**

8. The following statements are incorrect. Explain why and write down the correct statement.

- a. An ecosystem is only made up of a community. (5)
- b. Plants are consumers that produce organic energy rich carbon compounds. (4)
- c. Nitrification is the process where nitrates are converted into nitrogen gas by nitrogen fixing bacteria. (6)
- d. Herbivores are always found at the first trophic level of a food chain. (4)
- e. When living organisms decompose in closed fresh water ponds, the amount of oxygen in the water increases. (6)

**(Total: 25 marks)**