

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

SEPTEMBER 2017 SESSION

SUBJECT:	Biology
PAPER NUMBER:	I
DATE:	30 th August 2017
TIME:	9:00 a.m. to 11:05 a.m.

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

1. Name the part of the circulatory system described by each of the statements below.

a.	Blood vessel that receives deoxygenated blood from the whole body	
b.	Controls backflow of blood between the left atrium and the left ventricle of the heart	
c.	Controls backflow of blood flowing into the aorta	
d.	Heart chamber that pumps blood with high pressure to the whole body	
e.	Heart chamber that receives oxygenated blood from the lungs	
f.	Blood vessel that pumps oxygenated blood to the whole body	
g.	Carries blood rich in nutrients from the ileum to the liver	
h.	Light-coloured liquid carrying salts, hormones, nutrients and metabolic waste	
i.	Blood components responsible for forming a scab to prevent further loss of blood	
j.	Substance in red blood cells that carries oxygen	

(Total: 10 marks)

2. a. Figure 2.1 and Figure 2.2 below show two local wild ferns.



Maltese Polypody
Polypodium vulgare

Figure 2.1



Maltese Maidenhair fern
Adiantum capillus-veneris

Figure 2.2

i) List **ONE** common structural characteristic feature of these two plants.

_____ (2)

ii) List **TWO** characteristic conditions of the habitat of these ferns.

_____ (2)

b. Explain the following statement:

Mosses are plants that typically have a very small size. Their structure limits their growth.

_____ (2)

c. Figure 2.3 shows three fruits labelled A, B and C.

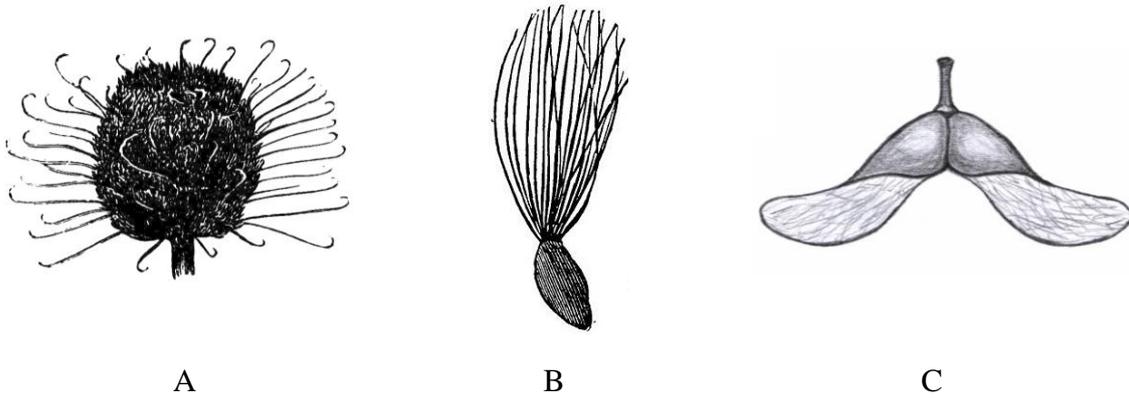


Figure 2.3 showing three fruits labelled A, B and C

List the fruit/s that use/s animal dispersal to spread the seeds they carry.

_____ (1)

d. Name the structure of a seed that:

i) develops into a shoot; _____ (1)

ii) is the main food source of the seed; _____ (1)

iii) allows the entry of water in the seed. _____ (1)

(Total: 10 marks)

Please turn the page.

3. Figures 3.1 and 3.2 below show two new insect species that have been discovered in 2016 and 2017 respectively:



Ilomantis ginsburgae
(Whole organism)
Figure 3.1

(Photograph A: <http://media3.s-nbcnews.com>)



Neopalpa donaldtrumpi
(Head of organism)
Figure 3.2

(Photograph B: <http://expatmedia.net>)

- a. Refer to Figure 3.1 and list **TWO** visible characteristics that show that *Ilomantis ginsburgae* is an insect.

_____ (2)

- b. Name the phylum to which *Ilomantis ginsburgae* and *Neopalpa donaldtrumpi* belong.

_____ (1)

- c. Another moth belongs to the same genus as *Neopalpa donaldtrumpi*. The species name of this moth is *neonata*. Write the full scientific name of this moth.

_____ (3)

- d. Explain why, no fertile offspring will form, if a male *Neopalpa donaldtrumpi* moth is crossed with a female moth of the *neonata*.

_____ (2)

- e. *Neopalpa donaldtrumpi* shows complete metamorphosis. List in the correct order the **FOUR** stages in its life cycle.

_____ (2)

(Total: 10 marks)

4. Distinguish between each of the following:

a. a Platyhelminth (flatworm) and an Annelid;

(2)

b. a community and a population of organisms;

(2)

c. the function of the duodenum and the ileum in the human body;

(2)

d. a herbivore and a carnivore in a food chain;

(2)

e. emulsification of fats and digestion of fats.

(2)

(Total: 10 marks)

Please turn the page.

5. Figure 5.1 below is a graph showing the relationship between the populations of a predator and a prey over a number of years.

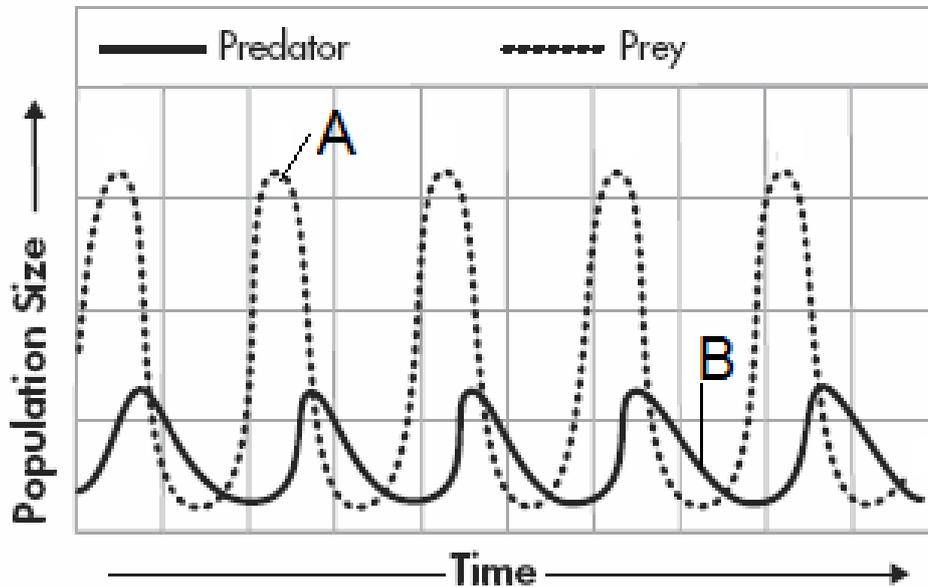


Figure 5.1: Graph showing the relationship between the populations of a predator and a prey

- a. Describe the population of the predator and the prey in the graph at point A and point B.

Prey population at A: _____
 _____ (1)

Predator population at B: _____
 _____ (1)

- b. Give an example of a vertebrate predator and its invertebrate prey.

Vertebrate predator: _____

Invertebrate prey: _____ (1)

- c. Predators are important for the prey species. Give **ONE** reason for this statement.

 _____ (2)

d. Give **TWO** reasons why the prey population tends to be higher than the predator population in the given graph.

(2)

e. Name **ONE** adaptation for a successful prey.

(1)

f. A farmer sprayed fungicide on the area where these predators and prey live. After a month, she realised that the bodies of both dead predators and prey were taking longer to decompose. Give **ONE** reason for this observation.

(2)

(Total: 10 marks)

Please turn the page.

6. Figure 6.1 below shows the apparatus setup to investigate the rate of enzyme-catalysed activity at different pH levels.

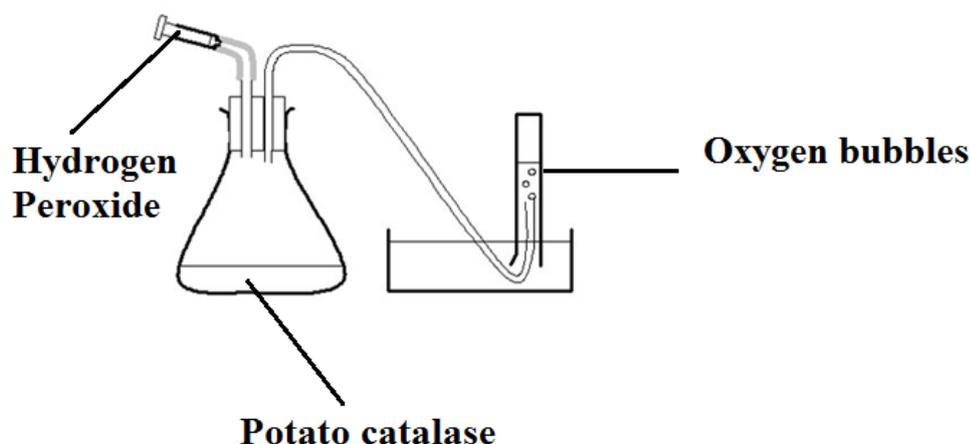


Figure 6.1: The apparatus used to investigate the effect of pH on enzyme-catalysed activity

The investigation was repeated 5 times with the potato catalase at different pH levels. The number of bubbles produced in 5 minutes was counted for each experiment. The results obtained are given in the table below.

pH level	2	4	7	9	11
No. of oxygen bubbles	8	15	34	21	12

Table 6.1: The number of oxygen bubbles produced in five minutes at different pH values

- a. From the table of results, state the optimum pH for potato catalase. Give **ONE** reason for your answer.

Optimum pH: _____ (1)

Reason: _____ (1)

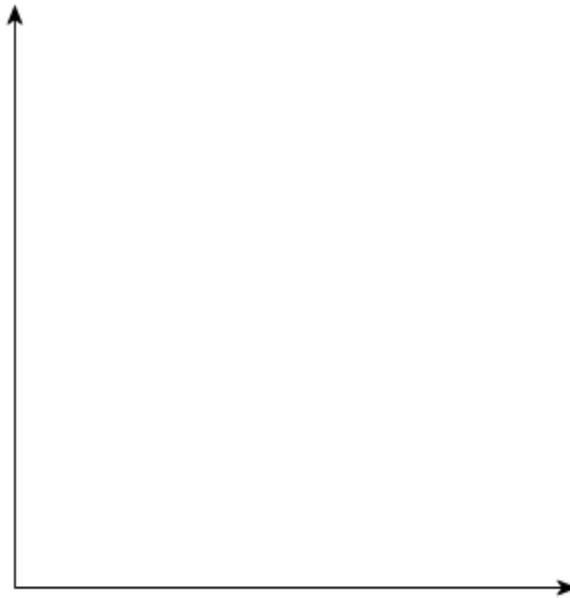
- b. Name **ONE** variable kept constant during this investigation.

_____ (1)

- c. The students who carried out the experiment presented the results as a graph. On the axis on page 9:

i) label the y-axis and the x-axis; (2)

ii) sketch the expected shape of the graph for this experiment. (1)



d. In this investigation, name:

i) the substrate; _____ (1)

ii) the product. _____ (1)

e. A student repeated the experiment and changed the substrate with another substance. No reaction occurred. Give **ONE** reason for this.

_____ (1)

f. The student also boiled the enzyme before adding the substrate. Again no reaction occurred. Explain.

_____ (2)

(Total 11 marks)

Please turn the page.

7. When Maria and Alex decided to conceive, the doctor told Maria to chart her basal body temperature at the same time every day, first thing before getting out of bed in the morning. This will help her detect any small change in temperature. The day after ovulation, hormonal changes cause the basal body temperature to rise by 0.4 to 1.0°C and this rise lasts till the next menstruation. Maria started menstruation on the 10th of March and recorded her temperatures as shown on Figure 7.1 below.

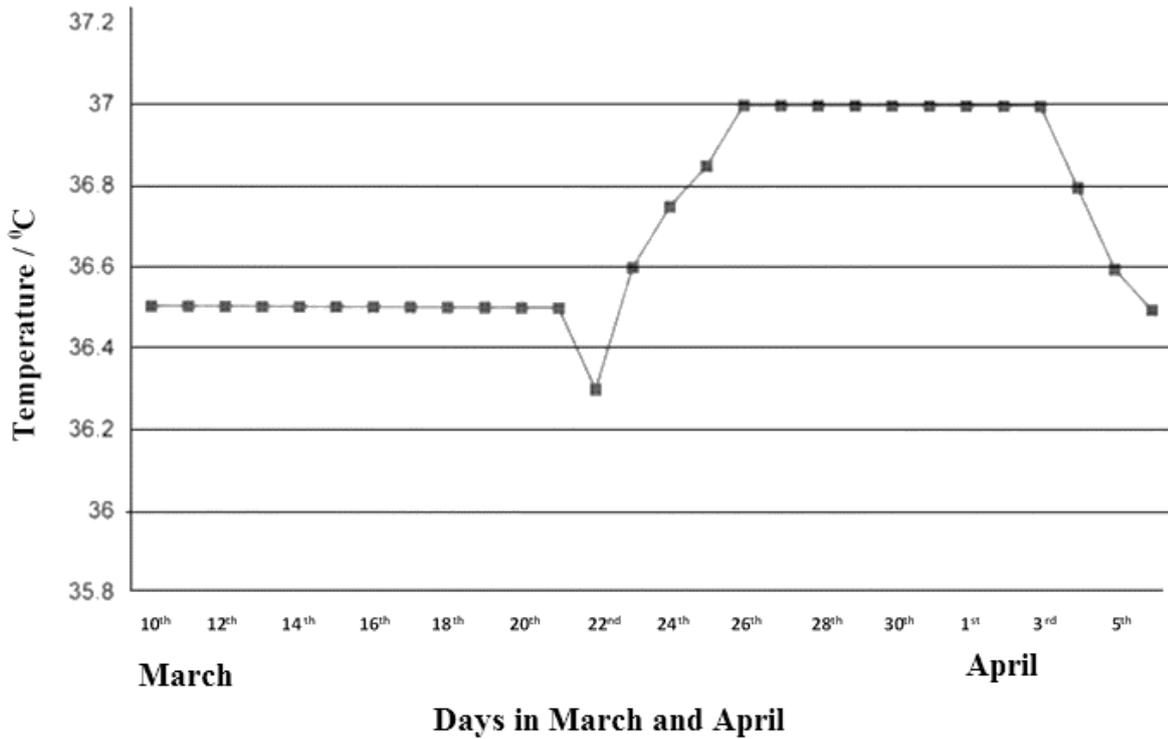


Figure 7.1: Maria’s basal body temperature between the 10th March and the 5th April

- a. What was Maria’s body temperature on the:
 - i) 15th of March: _____ (1)
 - ii) 22nd of March: _____ (1)

- b. The doctor told Maria to measure her basal body temperature at the same time every day, first thing before getting out of bed in the morning. Explain why this was important.

_____ (1)

- c. Use the graph to give the date when Maria is most likely to have her next menstruation.

_____ (1)

d. Ovulation is caused by the release of a hormone. Name this hormone and name the endocrine gland that produces it.

Name of hormone: _____ (1)

Name of endocrine gland: _____ (1)

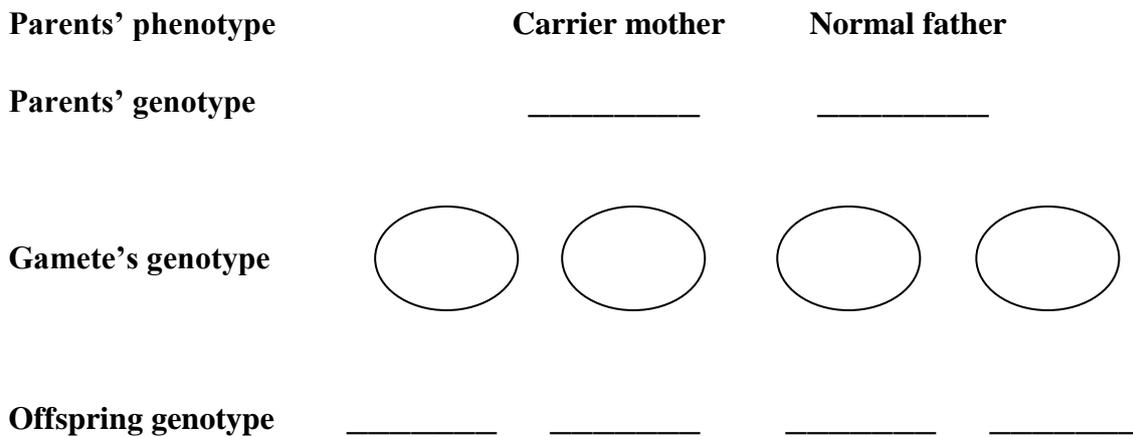
e. Physical changes that take place in a boy's and girl's body at puberty are controlled by hormones.

State how hormones travel along the body.

(1)

f. After 21 weeks of pregnancy the couple was informed that they are expecting a boy. Maria is a carrier for colour-blindness. Alex has normal vision. Colour blindness is a sex-linked trait.

Using the letter **B** for normal and **b** for colour blindness, complete the genetic diagram to indicate the percentage probability that the child will be a boy with normal vision.



Probability of child having normal vision: _____ (4)

(Total: 11 marks)

Please turn the page.

8. a. Figure 8.1 below shows 5 different pyramids of numbers A – E.

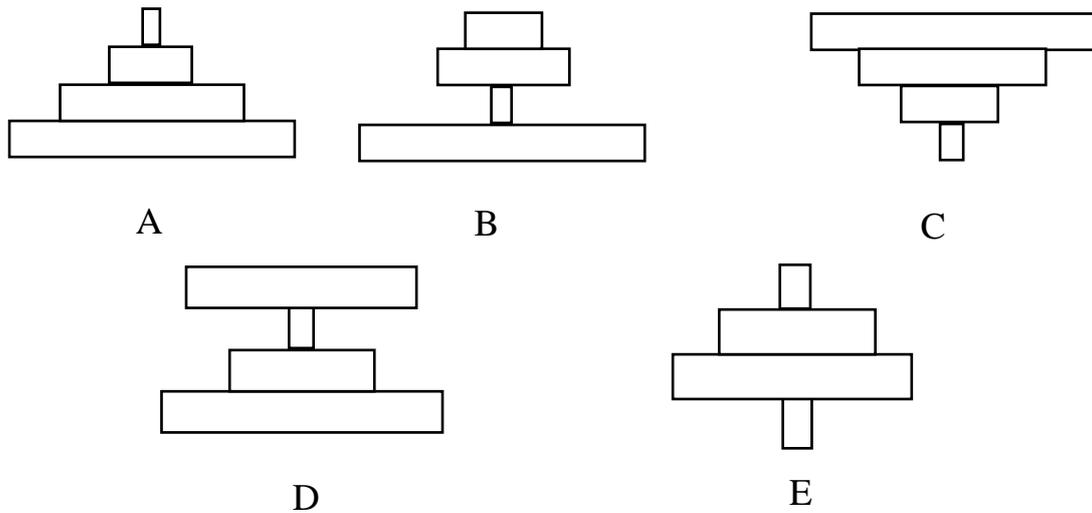


Figure 8.1: Five different pyramids of numbers

In the table below, write the letter of the pyramid that best matches the description of feeding relationships of different organisms. Each letter is to be used only once.

Description	Letter of pyramid
Fruit eating birds feed on fruit of a berry tree. Many lice suck up blood from the fruit eating birds. Several fungi live on lice.	
Many caterpillars feed on a single ash tree. The caterpillars are eaten by robins. Owls eat robins.	
Water fleas feed on algae. Stickleback (fish) feed on water fleas. Pike (fish) eat sticklebacks.	
Cattle feed on grass. Ticks suck up blood from the cattle. Egrets (birds) snatch ticks from the cattle backs.	
Rabbits eat grass. The fox hunts the rabbit. Ear mites infect the fox.	

(5)

b. Explain why a pyramid of biomass is a more accurate representation of the transfer of energy in an ecosystem rather than a pyramid of numbers.

(2)

c. Give **THREE** reasons why only about 10% of the energy is transferred from one trophic level to another in an ecosystem.

Reason 1: _____

Reason 2: _____

Reason 3: _____

_____ (3)
(Total: 10 marks)

9. Soil erosion is a natural phenomenon. Misuse of resources of land, water and soil lead to a faster rate of soil erosion. Today, this is one of the most difficult and pressing problems for humans.

a. Describe the process of soil erosion.

_____ (2)

b. List **TWO** natural causes of soil erosion.

_____ (2)

Contour farming is an important agricultural practice which reduces soil erosion in cultivated lands.

c. i) Describe the agricultural practice known as contour farming.

_____ (2)

ii) State **ONE** other benefit of contour farming besides the reduction of soil erosion.

_____ (1)

This question continues on the next page.

-
- d. Crop rotation is another important agricultural practice. It involves varying the crops planted in the same field. State **THREE** purposes of crop rotation.

Purpose 1: _____

Purpose 2: _____

Purpose 3: _____

_____ (3)

(Total: 10 marks)

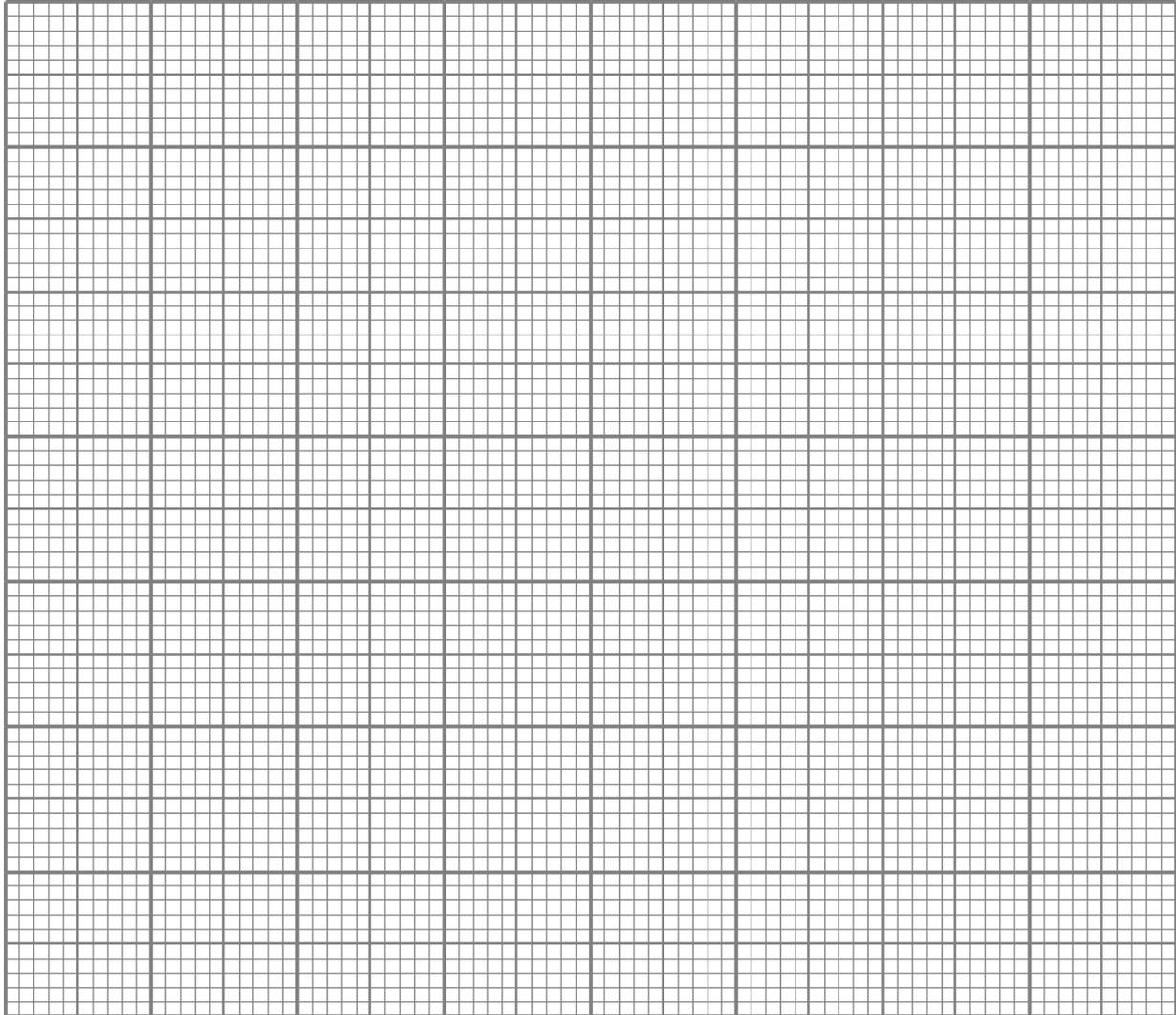
- 10.** The pancreas and the liver help to keep the concentration of glucose in the blood within a narrow, normal range.

- a. Table 10.1 shows how blood glucose concentration varies in a healthy young adult between 7.00 and 15.00.

Table 10.1: The changes in blood glucose level in mg/100ml between 07.00 and 15.00

Time	Blood glucose level in mg/100ml
07.00	80
08.00	120
09.00	90
10.00	78
11.00	100
12.00	80
13.00	125
14.00	100
15.00	90

Plot a graph to show the changes in blood glucose levels during a period of eight hours. Plot time on the x-axis and blood glucose level on the y-axis. Use a ruler to join the points. (6)



b. Give **ONE** reason why the blood glucose level increased between 12.00 and 13.00.

(1)

c. Name the hormone that causes a decrease in blood glucose level.

(1)
(Total: 8 marks)

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UNIVERSITY OF MALTA, MSIDA**SECONDARY EDUCATION CERTIFICATE LEVEL****SEPTEMBER 2017 SESSION**

SUBJECT:	Biology
PAPER NUMBER:	IIB
DATE:	30 th August 2017
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.

Answer any FOUR questions.

1. Karl maintains his body healthy by following a balanced diet. He decided to eat some salmon, accompanied by potatoes and carrots covered with a cheesy sauce.
- a. Define the term balanced diet. (1)
- b. i) Humans use teeth to breakdown food into smaller pieces. Give **TWO** reasons why this process is important during digestion. (2)
- ii) Salivary glands in the mouth secrete the digestive juice saliva. Name the enzyme found in saliva, the substance it acts upon and the product formed. (3)
- iii) Give **ONE** reason why the pancreas releases the same enzyme released from the salivary glands when the partially digested food reaches the duodenum. (2)
- c. As food is swallowed, it slides down the larynx into the oesophagus. At the same time, the bolus (food) is prevented from entering the trachea.
- i) Describe how the food is prevented from entering the trachea. (2)
- ii) Give **TWO** differences between the trachea and the oesophagus. (2)
- iii) Describe how the bolus moves down the oesophagus. (2)
- d. Pepsinogen is released in the stomach. Pepsinogen is the inactive form of pepsin.
- i) Explain why the cells lining the stomach release the inactive form of pepsin. (2)
- ii) Pepsinogen has some extra amino acids that block the active site of pepsin. Explain how this makes pepsinogen inactive. (2)
- e. Karl believes that salmon has a high amount of proteins. Describe a test he could do to confirm whether protein was present in salmon. (2)
- f. Digestion of all large molecules ends in the small intestine. Describe how fats are broken down. In your account, include the following terms: bile, fatty acids, large globules, lipase, glycerol, small globules, liver and gall bladder. (5)

(Total: 25 marks)

2. Students carried out an experiment to investigate whether carbon dioxide is necessary for a plant to carry out photosynthesis. Figure 2.1 below shows how they set up the apparatus. They poured a small quantity of soda lime in a glass bottle fitted with a split cork. After de-starching the plant, one of its leaves was placed inside the bottle such that half of the leaf remained inside the bottle and the other half was outside. After checking that all connections were air-tight with Vaseline, the setup was placed in direct sunlight for about four hours.

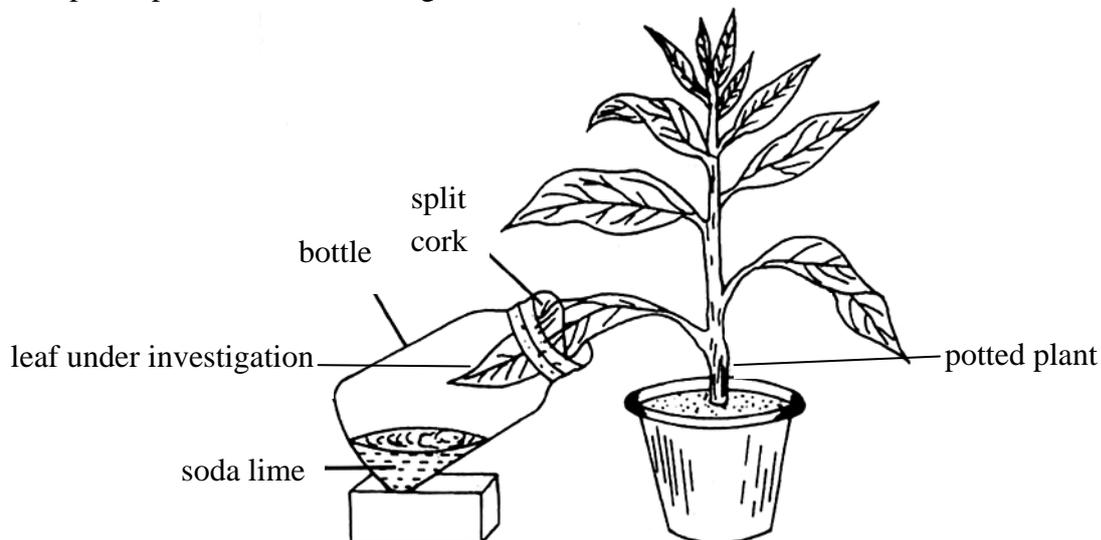


Figure 2.1: Apparatus set-up to investigate whether carbon dioxide is necessary for photosynthesis

- a. Explain why:
 - i) the plant was de-starched before starting the experiment; (2)
 - ii) all connections were air-tight with Vaseline; (2)
 - iii) soda lime was placed in the glass bottle. (2)
- b. After four hours, students tested the leaf under investigation for the presence of starch. List the steps involved in this test. (4)
- c. Describe the observations made when testing the leaf under investigation for starch. (4)
- d. A plant was kept in light for the first 16 hours of the experiment and in dark for the last eight hours. The graph in Figure 2.2 shows how the concentration of starch varied in a plant over a period of 24 hours.

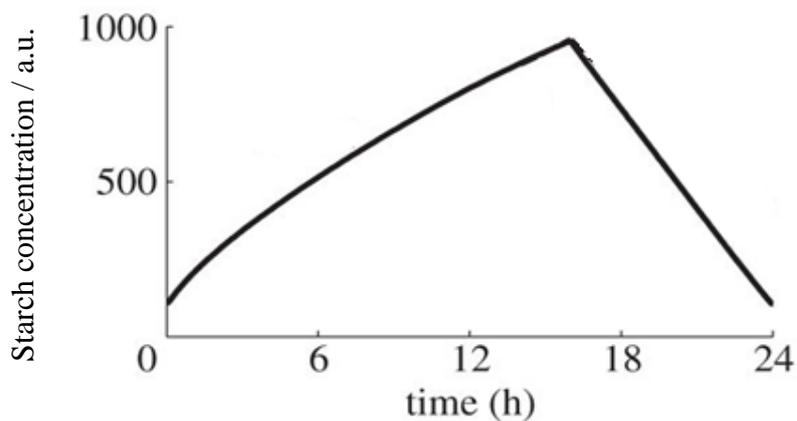


Figure 2.2: Graph showing variation of starch concentration in a plant over a period of 24 hours

- i) Explain why the concentration of starch increased during the first 16 hours of the experiment. (3)
 - ii) Explain why the concentration of starch decreased during the last eight hours of the experiment. (1)
- e. An experiment was carried out to investigate the effect of translocation of the products of photosynthesis towards fruits growing on a tree. A ring of phloem tissue was removed from part of the stem bearing 3 fruits, labelled A, B and C as shown in Figure 2.3.

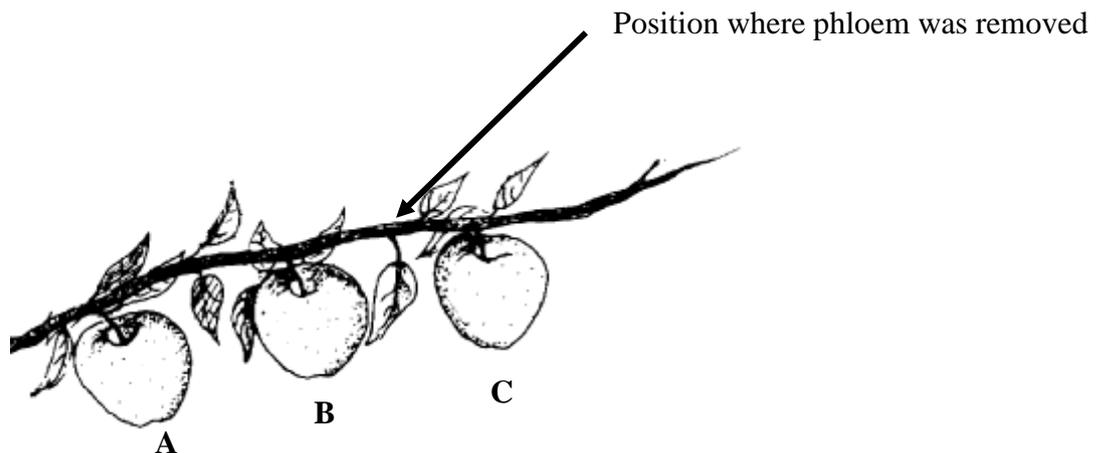


Figure 2.3: A stem bearing three fruits and showing the position where phloem was removed.

The diameter of the three fruits was measured every week for three weeks.

- i) Name the carbohydrate that is translocated in phloem. (1)
 - ii) Write the letter/s of the fruit/s that will show a decrease in diameter after three weeks. Explain your answer. (3)
- f. The plants used in both experiments were dicots. List **THREE** characteristics that these plants share. (3)

(Total: 25 marks)

3. The production of wine depends on the process of anaerobic respiration in yeast.

- a. i) State the kingdom in which yeast is classified and name **ONE** other organism that belongs to this kingdom. (2)
 - ii) State if yeast cells are eukaryotic or prokaryotic. Give a reason for your answer. (2)
 - iii) Yeast cells are surrounded by a cell wall. State how this cell wall is different from that in plant cells. (2)
- b. Write **TWO** word equations to distinguish between aerobic and anaerobic respiration in yeast cells. (4)
- c. Anaerobic respiration occurs in humans during vigorous exercise.
- i) Name the compound formed when humans perform anaerobic respiration. (1)
 - ii) Give **TWO** reasons why vigorous exercise leads to lack of oxygen and therefore anaerobic respiration in humans. (4)

- d. Give **ONE** reason in each case for the following observations:
- i) during the fermentation of wine, temperature is kept at about 30°C; (2)
 - ii) at the end of the fermentation process, all yeast cells are dead; (2)
 - iii) fermentation is not allowed to be completed in the production of sweeter wines. (2)

e. A student was asked to perform Benedict's test to determine if there was reducing sugar in sweet white wine.

- i) Describe the expected result if reducing sugar is present and the expected result if reducing sugar is absent in the sweet white wine. (2)
- ii) Explain why it is difficult to interpret results if Benedict's test is performed on red wine. (2)

(Total: 25 marks)

4. Water is possibly the most important molecule on planet Earth as life started in it. Water is essential for the survival of all living organisms.

a. Name the elements present in water. (2)

b. Draw a diagram to draw the water cycle. In your diagram, include the following labels: evaporation, condensation, precipitation and collection (or accumulation). (4)

c. State how the following properties of water are important for living organisms:

- i) water is a transparent liquid; (2)
- ii) water is a liquid at room temperature; (2)
- iii) several substances dissolve in water; (2)
- iv) water flows easily through narrow tubes. (2)

d. Terrestrial organisms have developed different methods to reduce water loss.

- i) List **THREE** ways how plants are adapted to reduce water loss. (3)
- ii) List **TWO** ways how insects are adapted to reduce water loss. (2)

e. Humans control the amount of water in their blood by changing the concentration of urine. The nephrons in the kidney play an important role in this. Describe how the nephron re-absorbs water from the filtrate before urine is removed from the body. (2)

f. State how the amount of water re-absorbed from the nephron to the blood varies in the following situations and give a reason for your answer:

- i) when a person drinks one litre of water; (2)
- ii) when a person has not drunk any water for four hours. (2)

(Total: 25 marks)

5. In January 2017, Malta introduced a law against smoking in cars carrying passengers under the age of 18.
- Give **TWO** ways how this law is safeguarding the health of passengers in the car. (3)
 - Nicotine is a harmful chemical in cigarette smoke. Explain how this chemical may affect the smoker's health. (2)
 - Carbon monoxide is a poisonous gas also found in cigarette smoke.
 - Describe the effect of carbon monoxide on haemoglobin. (2)
 - Explain how this leads the smoker to become breathless. (2)
 - List in the correct order the pathway of air from when it enters the nose till the time it reaches the alveoli. (3)
 - Figure 5.1 below shows an alveolus from a human lung.

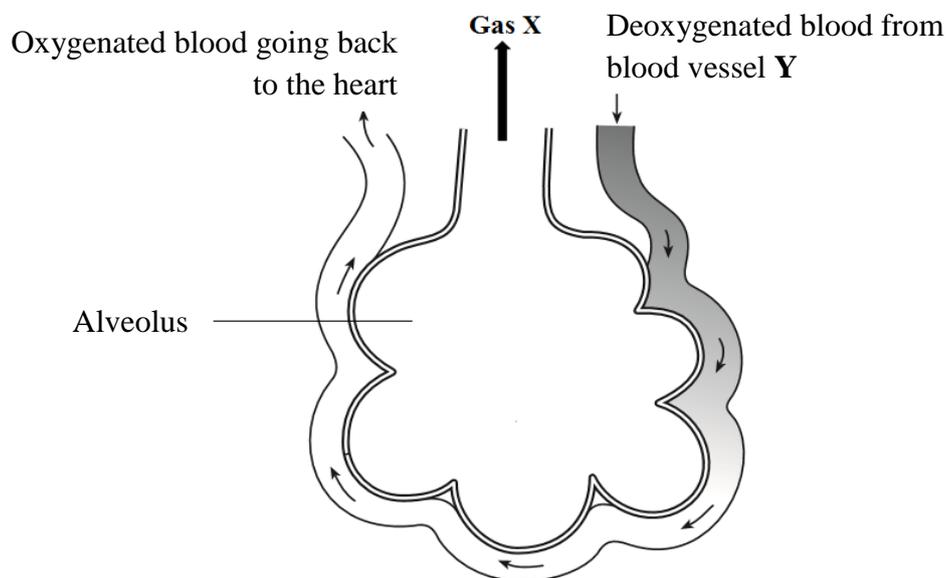


Figure 5.1: An alveolus

- Name gas **X** and blood vessel **Y**. (2)
 - List **THREE** adaptations that enable alveoli to perform their function efficiently. (3)
- f. Gaseous exchange occurs by diffusion.
- Define the term diffusion. (2)
 - Explain why diffusion is a passive process. (1)
 - State **TWO** ways how active transport is different from diffusion. (2)
- g. Apple snails have a gas exchange system that includes both a gill and a lung. Apple snails live in tropical waters which dry up in certain periods of the year.
- Name the phylum that apple snails belong to. (1)
 - Give **ONE** advantage that the presence of both a gill and a lung give to apple snails. (2)

(Total: 25 marks)

6. Vertebrate groups have several distinguishing characteristics. The type of body covering can be used to distinguish amongst the different groups.
- List the **FIVE** different vertebrate groups and describe the body covering of each group. Present your answer in table format. (10)
 - Explain why the frogs and toads need to keep their body covering constantly wet. (2)
 - Figure 6.1 shows a section through the human skin.

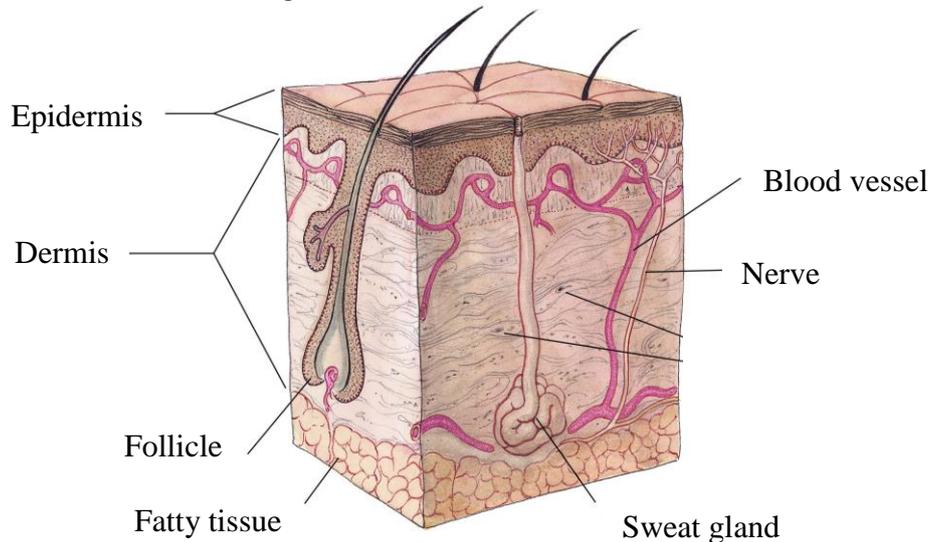


Figure 6.1: A section through the human skin

- Refer to structures shown in Figure 6.1, and describe **THREE** ways how a person may reduce his/her body temperature from 37.9 °C to 37.5 °C. (6)
 - State how the fatty tissue beneath the dermis helps humans to maintain a constant body temperature. (2)
- d. Special neurons in the skin detect temperature changes in the external environment and send this information to the central nervous system. State whether the neurons in the skin are sensory or motor neurons. Give **ONE** reason for your choice. (3)
- e. Polar bears live mainly in Alaska, spending most of their time on the ice or hunting in water. Explain how a polar bear's body covering helps keep it warm whilst standing on the ice but it is less effective when it is swimming. (2)

(Total: 25 marks)

7. *Amoeba* and *Euglena* are two unicellular Protists. *Amoeba* is an animal-like Protist whilst *Euglena* is a plant-like Protist.
- Distinguish between unicellular and multicellular organisms. (2)
 - Plant-like Protists show autotrophic nutrition whilst animal-like Protists show heterotrophic nutrition. Distinguish between autotrophic and heterotrophic nutrition. (2)
 - Euglena* have flagella and an eye spot. The eye spot is sensitive to light.
 - Explain how the flagellum in *Euglena* is linked with autotrophic nutrition. (2)
 - Explain how the eyespot in the *Euglena* is linked with autotrophic nutrition. (2)

d. Unlike *Euglena*, *Amoeba* shows heterotrophic nutrition. Using diagrams, describe how the *Amoeba* feeds. (3)

e. Figure 7.1 shows an *Amoeba* placed in a beaker of fresh water.

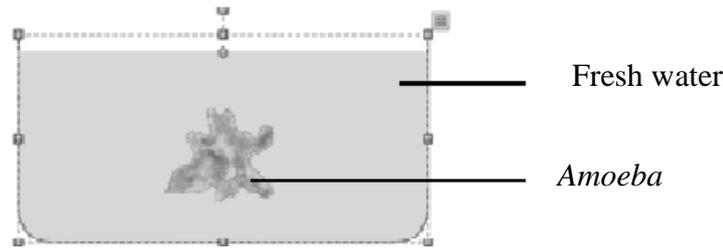


Diagram not in correct proportion
 Figure 7.1: An *Amoeba* in a beaker of fresh water

- i) Copy the diagram above and on it show the direction of the flow of water as a result of osmosis. Give a reason for your answer. (3)
- ii) Define the term osmosis. (3)
- iii) The *Amoeba* has a contractile vacuole. Explain why the contractile vacuole allows the *Amoeba* to survive when placed in fresh water. (3)
- iv) Give **ONE** reason why the *Amoeba* died when it was placed in salty water. (2)

f. *Mixotricha paradoxa* is a Protist that lives in the intestines of the termite (ant) species *Mastotermes darwiniensis*. This Protist breaks down cellulose in wood eaten by the termite. Without the presence of *Mixotricha*, the termite dies.

- i) Name the association between the termite and the Protist. (1)
- ii) Give **ONE** reason why the termite dies if *Mixotricha* is not present in its intestines. (2)

(Total: 25 marks)

8.

- a. Man-made Chlorofluorocarbons (CFCs) are the main cause of depletion of ozone in the stratosphere which has several effects. Give **ONE** positive effect and **TWO** negative effects of ozone depletion. (3)
- b. In a fish farm, a large number of fish are grown in cages in the sea. Suggest **TWO** reasons why fish in the cages grow faster than fish of the same species that are free in the sea. (4)
- c. 90% of fish stocks (populations) in the Mediterranean Sea are ‘overfished’. Countries in the Mediterranean are asked to ensure sustainable fishing, that is, they make sure that fishing allows the recovery of the fish stocks. The UN Food and Agriculture Organisation says that fish stocks continue to decrease around the world despite increasing efforts to control catches. State **TWO** ways how sustainable fishing may be ensured. (4)
- d. The red spider mite is a pest on fruit trees. It increases in numbers quickly causing damage to the fruit crop.
 Different predatory mite species exist which feed on red spider mites. When the number of red spider mites was about 1000 per fruit tree, the farmer researched the use of predatory mites on the fruit trees.

In his research the farmer read the following:

Phytoseiulus persimilis is the most commonly used predatory mite to control the red spider mite. It is now widely used in preference to pesticides. *Phytoseiulus* feed on all life stages of glasshouse red spider mite.

Amblyseius californicus is another predatory mite used to control the red spider mite. Unlike *Phytoseiulus*, *Amblyseius* is a predator of various species of spider mite, and can also feed and reproduce on pollen.

- i) Name the type of pest control that the farmer is researching and give **ONE** reason why this type of pest control ‘is now widely used in preference to pesticides.’ (3)
 - ii) Describe how the introduction of the predatory mites affects the number of red spider mites. (1)
 - iii) After nine weeks of introducing the predatory mite *Amblyseius*, the farmer noticed that although there were no more red spider mites there were still predatory mites present on the fruit trees. Explain how this could lead to other problems for the farmer. (3)
 - iv) The farmer still preferred to use *Amblyseius* instead of *Phytoseiulus* as a predatory mite. Use the information from the paragraphs above, to give **ONE** reason why the farmer preferred *Amblyseius*. (2)
- e. Figure 8.1 shows four different Arachnid species labelled A - D. Use the key to identify each one of them.

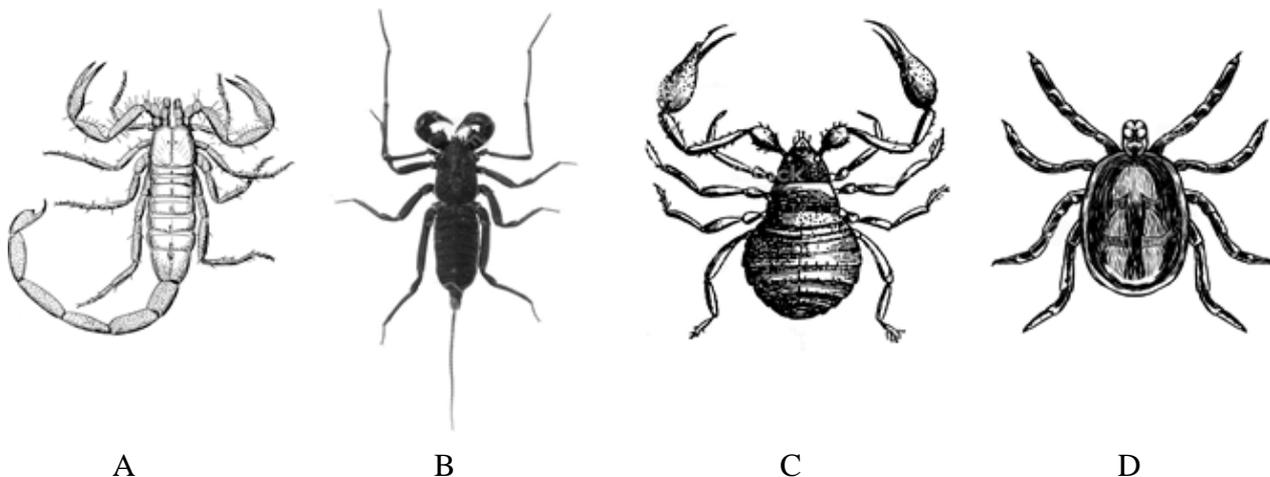


Figure 8.1: Four different Arachnid species

Pincers present	Go to 2
Pincers absent	Tick
No tail attached to abdomen	Pseudoscorpion
Tail attached to abdomen	Go to 3
Sting visible at tip of tail	Scorpion
Sting not visible at tip of tail	Whip scorpion (4)

- f. Red spider mites are also arachnids. Give **ONE** feature that would show it is an Arachnid. (1)
- (Total: 25 marks)**