

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

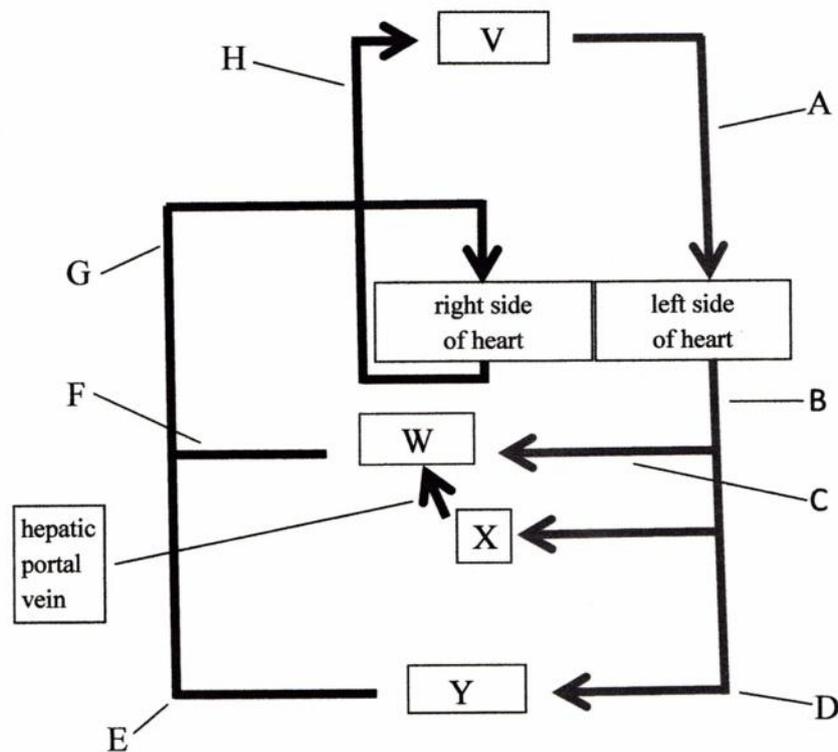
SECONDARY EDUCATION CERTIFICATE LEVEL

SEPTEMBER 2014 SESSION

SUBJECT: **Biology**
 PAPER NUMBER: I
 DATE: 1st September 2014
 TIME: 9:00 a.m. to 11:00 a.m.

ANSWER ALL QUESTIONS IN THIS PAPER IN THE SPACES PROVIDED.

1. The following diagram shows a simplified representation of the human circulatory system.



a. From the diagram above write the letter that represents the:

i) aorta: _____

ii) hepatic artery: _____

iii) pulmonary artery: _____

(3 marks)

b. Write the letter representing the organ where deamination takes place.

_____ (1 mark)

-
- c. Compare the type of blood that reaches the right side of the heart, with the blood that reaches the left side of the heart.
-

(2 marks)

- d. Name the tissue making up the heart.
-

(1 mark)

- e. Compare the circulation of blood in a normal artery and an artery that is narrow due to fat deposited inside it.
-

(1 mark)

- f. List TWO health problems, other than narrow arteries, related to circulation of blood resulting from a fat rich diet.
-

(2 marks)

(Total 10 marks)

2. Recent studies indicate that Malta has one of the highest incidence rates of diabetes in the EU, however a relatively low incidence of rickets.

- a. Rickets is a deficiency disease. Describe ONE symptom of rickets.
-

(1 mark)

- b. Give ONE reason for the low incidence of rickets in Malta.
-

(2 marks)

c. A considerable number of Maltese persons suffer from diabetes. Define the condition of diabetes.

(1 mark)

d. A student wrote that diabetes is also a deficiency disease. Explain why this statement is incorrect.

(1 mark)

e. Haemophilia is a genetic condition that prevents the blood from clotting when a blood vessel is injured. Explain why haemophilia is observed only in males.

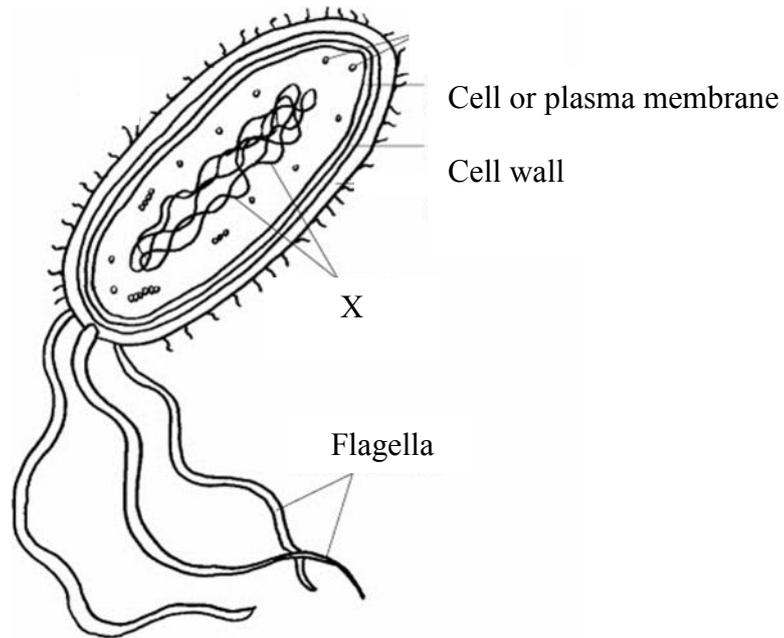
(2 marks)

f. Coeliac disease is a disorder of the small intestine. Many adults suffering from the disease suffer from vitamin deficiencies due to the reduced ability of the small intestine to properly absorb nutrients from food. List TWO structural characteristics of the small intestine that increase the efficiency of absorption.

(2 marks)

(Total: 9 marks)

3. The diagram below shows a bacterium.



a. Identify the structure labelled X in the diagram above: _____ (1 mark)

b. With reference to the diagram explain why bacteria are considered to be prokaryotic.

(1 mark)

c. Give ONE function of each of the following structures found in a bacterium:

i) flagellum;

(1 mark)

ii) cell wall;

(1 mark)

iii) cell membrane.

(1 mark)

d. The photograph below shows mushrooms growing in a mushroom farm.



(<http://hk-magazine.com/sites/default/files/u5828/mushrooms-farm.jpg>)

- i) Name the kingdom in which mushrooms are classified. _____ (1 mark)
 - ii) Explain why mushrooms do not need light to grow but plants do.
-

(2 marks)

e. The structure shown in the photo is typical of a phylum of plants



Name the structure shown in the photo and name the phylum of the plants that produce it.

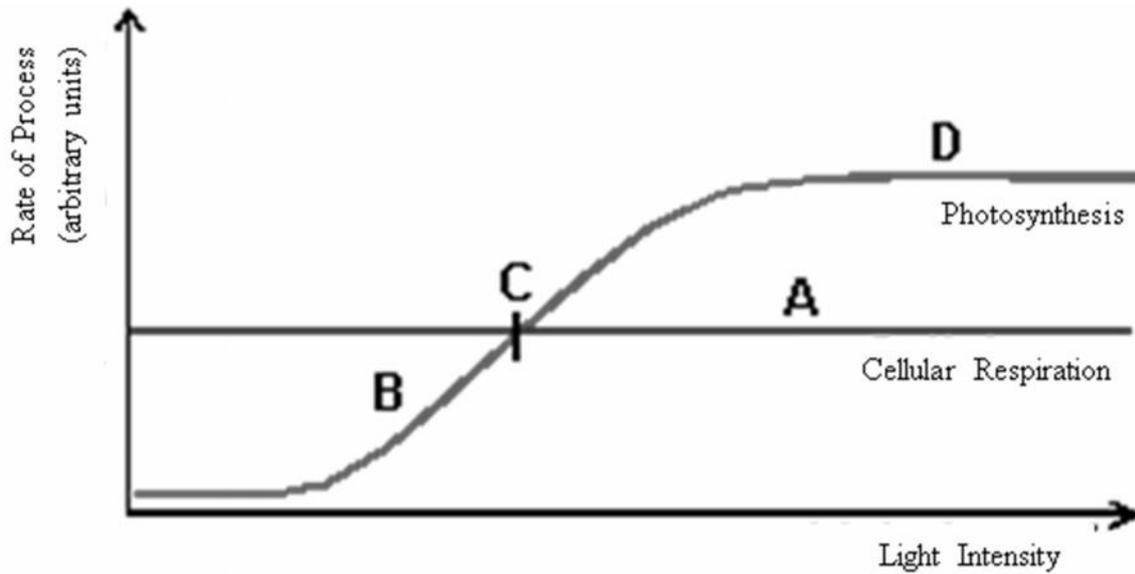
Structure: _____

Phylum: _____

(2 marks)
(Total 10 marks)

(<http://upload.wikimedia.org/wikipedia/commons/1/1d.jpg>)

4. The following graph shows the rates of cellular aerobic respiration and photosynthesis at varying light intensities.



- a. Write a word equation for aerobic cellular respiration.

_____ (2 marks)

- b. Explain why the rate of cellular respiration remains constant even though the light intensity changes.

_____ (2 marks)

- c. Explain the significance of point C in terms of uptake and release of oxygen and carbon dioxide in a plant.

_____ (3 marks)

d. At point D, the rate of photosynthesis does not change with light intensity. Name ONE other factor (apart from light intensity) which might be limiting the rate of photosynthesis.

(1 mark)

e. Stomata tend to open during the day at high light intensities.

i) Name the tissue where stomata are found.

(1 mark)

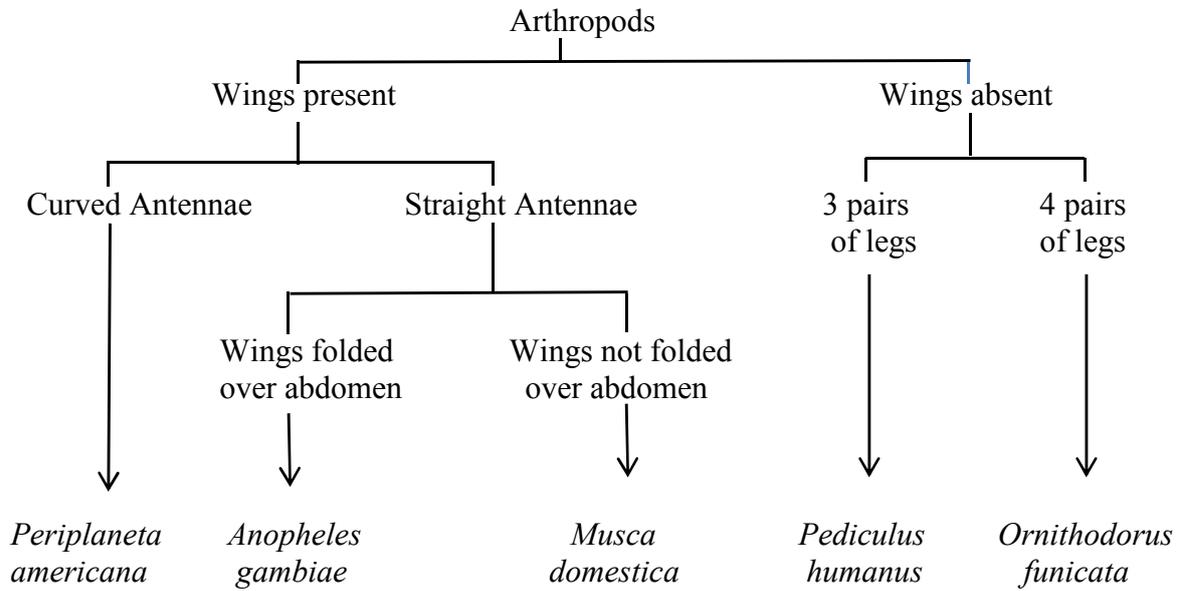
ii) Describe how the opening of stomata affects the uptake of water from the roots.

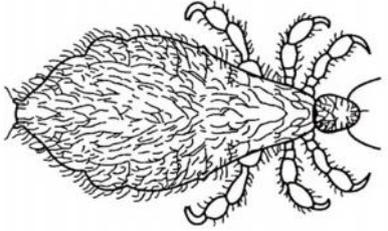
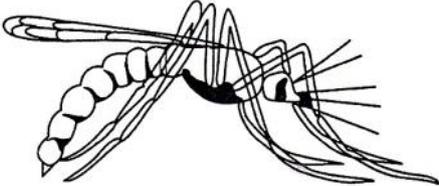
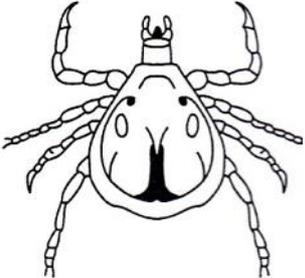
(2 marks)

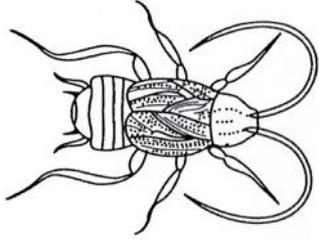
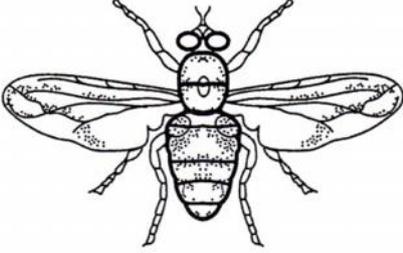
(Total: 11 marks)

Please turn the page.

5. a. Use the following identification key to write the scientific names of organisms A to E.



Organism	Diagram	Scientific name
A		
B		
C		

D		
E		

(5 marks)

b. All the organisms shown in this question are Arthropods. Describe ONE common structural characteristic visible in the diagrams that supports this statement.

(1 mark)

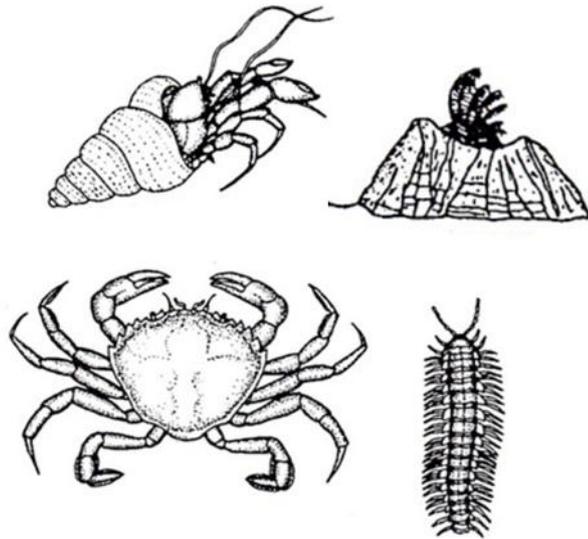
c. The diagram shows four Arthropods. Three are Arachnids and one is a Crustacean.



Draw a circle around the Crustacean and give a reason for your answer.

(2 marks)

d. The diagram shows another set of four Arthropods. Three are Crustaceans and one is a Myriapod.



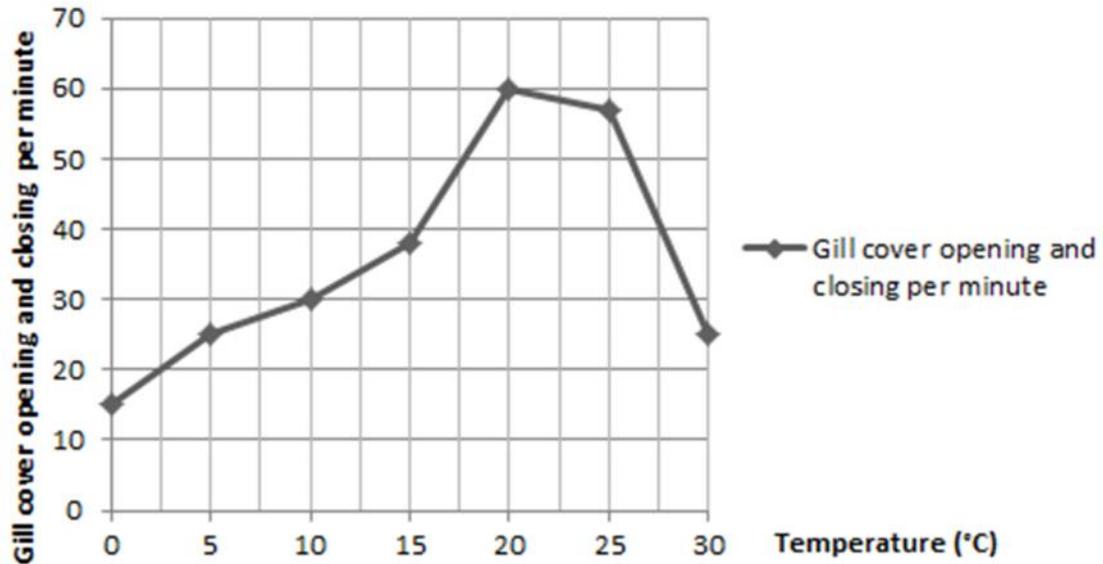
Draw a circle around the Myriapod and give a reason for your answer.

(2 marks)
(Total: 10 marks)

6. a. Name the biological apparatus used to:
- i) measure the rate of transpiration: _____
 - ii) observe a unicellular protist such as *Amoeba*: _____
 - iii) get a random count of plants in a grassland area: _____
 - iv) transfer few drops of a solution onto a tile. _____

(4 marks)

b. The graph shows the rate of oxygen uptake of a fish at different temperatures. The rate of oxygen uptake was determined by counting the number of times, the gill cover of the fish opened and closed during 1 minute intervals at various temperatures.



i) From the graph determine the optimum temperature of the surrounding water for the fish to survive.

(1 mark)

ii) Describe how the gill cover opening and closing per minute varies with increasing temperature.

(3 marks)

c. The metabolic rate of fish varies with the temperature of the surrounding water. Explain this observation.

(2 marks)

(Total 10 marks)

7. *Situs inversus* is an **autosomal recessive** genetic condition. The disease involves inverted positioning of the internal organs. This condition affects all major structures within the thorax and the abdomen.

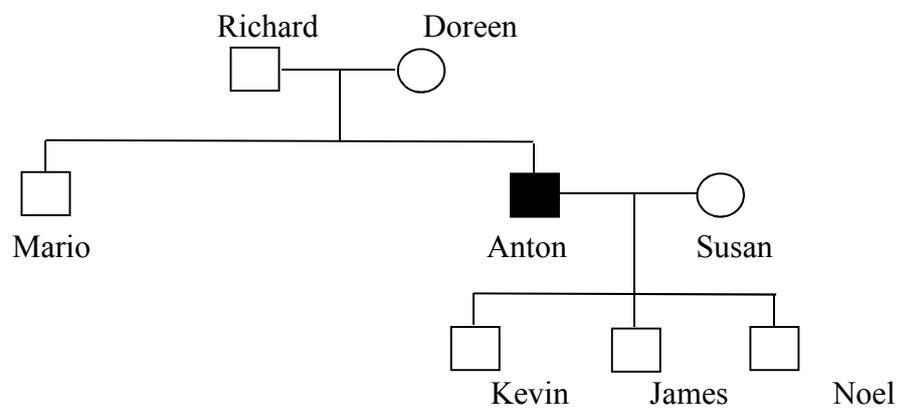
a. Name TWO organs located within the thorax in a human.

(2 marks)

b. Name TWO organs located within the abdomen in a human.

(2 marks)

The following family tree represents the inheritance of the disorder in a family



Key:	Normal female	Normal Male
	Female suffering from <i>Situs inversus</i>	Male suffering from <i>Situs inversus</i>

The following genetic diagrams A, B and C, represent the inheritance of this condition. **R** represents normal and **r** represents the *situs inversus* condition

Genetic diagram letter:	A
Parents	Rr x Rr
Gametes	R r R r
F1 generation	RR Rr Rr rr

Genetic diagram letter:	B
Parents	RR x Rr
Gametes	R R R r
F1 generation	RR Rr RR Rr

Genetic diagram letter:	C
Parents	RR x rr
Gametes	R R r r
F1 generation	Rr Rr Rr Rr

c. Write the letter of the genetic diagram that represents the cross between:

i) Richard and Doreen _____

ii) Anton and Susan. _____

(2 marks)

d. Noel and his wife Samira are told by the genetic counsellor that each of their future children will have a 50% chance of suffering from the *Situs inversus* condition. Give a genetic diagram to explain why there is this probability.

Parents:	Noel	Samira
Genotype of parents		
Gametes:		
F1 generation:		

(4 marks)

(Total: 10 marks)

8. Ecosystems undergo a process of change over time, brought about by replacing one plant (or animal) community with another in view of environmental changes.

a. Define the terms:

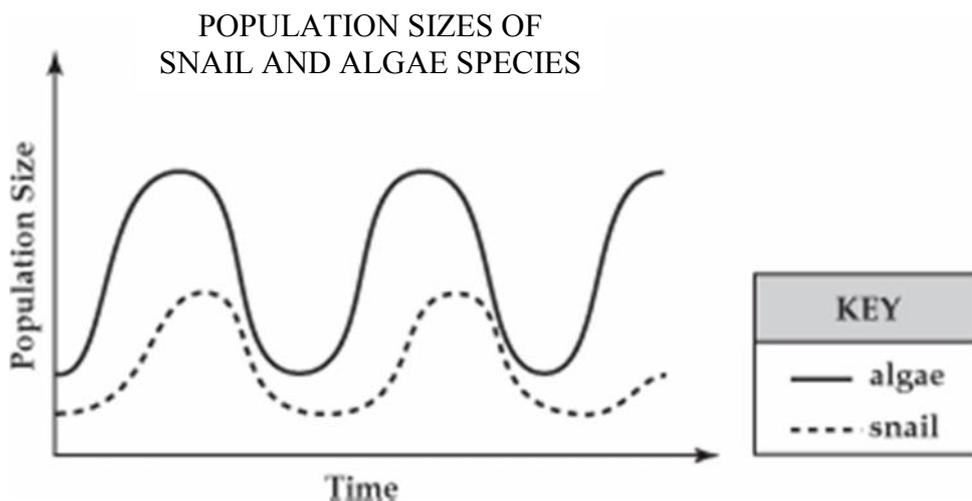
i) ecosystem;

(1 mark)

ii) plant community.

(1 mark)

b. The curve below shows the results of a study on the population sizes of a species of snail and a species of algae found in a freshwater ecosystem. The snail feeds on the alga.



(http://mdk12.org/instruction/clg/public_release/biology/G3_E5_I2.html)

Describe the way that the population of snails changes with time and explain why this pattern is observed.

Description: _____

Explanation: _____

(4 marks)

- c. Ecosystems are supported by energy from sunlight. Producers trap energy from the sun and this is transferred from one trophic level to another. Energy is lost in the process.
 - i) Give TWO reasons why out of 1,000,000 Joules (units of energy) of energy in sunlight in a given area only 10,000 Joules end up in the primary producers.
-
-
-
-

(2 marks)

- ii) Give ONE reason why out of 100 Joules in secondary consumers only 10 Joules are present in the tertiary consumers.
-
-

(2 marks)

(Total 10 marks)

Please turn the page.

9. Salivary amylase and pepsin are two important enzymes involved in digestion.

a. Fill in the following table:

Enzyme	Site of production	Optimum pH	Substrate acted upon	Product formed
Salivary Amylase			Starch	
Pepsin	Stomach			

(6 marks)

b. Starch is a carbohydrate. It is a common polysaccharide in plants.

i) What is a *polysaccharide*?

(1mark)

ii) Describe how a student can test for the presence of starch on a piece of potato tissue.

(2 marks)

(Total: 9 marks)

10. a. List TWO biological reasons for the message in **each** of the posters below.

i)



(http://rly.zcache.com/save_the_trees_postcards-94ef528c97004d83a46e4a8731aa6f21_vgbaq_8byvr_512.jpg)
(2 marks)

ii)



(<http://i251.photobucket.com/albums/gg294/wafpaf/graphics/wildlife/wildlife1.gif>)
(2 marks)

iii)



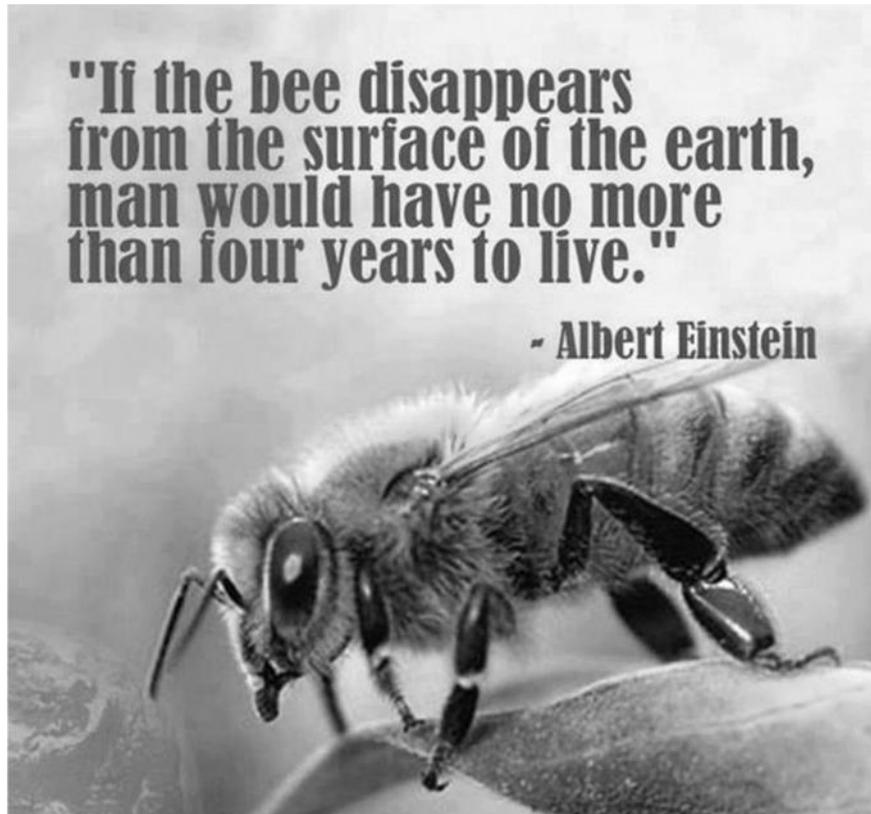
http://app2.nea.gov.sg/images/default-source/anti-pollution-and-radiation-protection/chemical-pollution/protect_the_ozone_layer.jpg?sfvrsn=2
(2 marks)

iv)



(<http://www.hippychopper.com/REUSE.gif>)
(2 marks)

b. The following poster was put on a noticeboard in a biology lab.



(http://ct.politicomments.com/ol/pc/sw/i53/2/3/13/pc_2ab897f8d38829de2a8685972f09f888.jpg)

i) Name ONE major threat to the bee population.

(1 mark)

ii) Explain the importance of bees in an ecosystem.

(2 marks)

(Total: 11 marks)

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UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

SEPTEMBER 2014 SESSION

SUBJECT:	Biology
PAPER NUMBER:	IIB
DATE:	1 st September 2014
TIME:	4:00 p.m. to 6:00 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 6 of this paper you need the graph paper in the booklet.

Answer ANY FOUR (4) questions. Each question carries 25 marks.

1. Gas exchange is an essential process in all living organisms.
 - a. Distinguish between the process of gas exchange and cellular respiration. (2 marks)
 - b. Copy and complete the table below:
(Note: DO NOT WRITE THE SAME CHARACTERISTIC MORE THAN ONCE.)

Organism	Name of gas exchange surface	ONE characteristic that ensures a fast rate of gas exchange
Protoctist		
Plant		
Insect		
Fish		
Human		

(15 marks)

- c. Explain why plants release oxygen and take in carbon dioxide during the day but release carbon dioxide and take in oxygen during the night. (2 marks)
 - d. The openings leading to the gas exchange surfaces in plants and insects may open and close.
 - i) Name the openings leading to the gas exchange surfaces of plants and insects respectively. (2 marks)
 - ii) Explain why the ability to close these openings is important for both plants and insects. (2 marks)
 - e. Explain why the rate of gas exchange in humans increases during vigorous exercise. (2 marks)
- (Total: 25 marks)**

2. Angiosperms include species that live in water. A common dicot aquatic plant is the Water Lily and a common monocot aquatic plant is the Canadian Pondweed. The leaves of the Water Lily float on the water surface. They are attached to the bottom by means of a stem and root-like structures. The Pondweed is completely submerged under water.
- a. Give ONE characteristic of the Water Lily leaf and ONE characteristic of the Water Lily flower that shows that the Water Lily is a dicot. (2 marks)
- b. The Pondweed absorbs water over its whole surface. In order for this to occur it does not have a cuticle. It does not have proper roots but root-like structures that allow it to attach to the bottom of the pond.
- i) Give the property of the cuticle that prevents water from passing through. (1 mark)
 - ii) Give a reason why the Pondweed also lacks xylem tissue. (2 marks)
 - iii) Give TWO characteristics of xylem tissue. (2 marks)
 - iv) Write a short note describing how terrestrial plants (i.e. plants that live on land) absorb **water** and **mineral ions** from soil. In your answer include the terms active transport and osmosis. (5 marks)
- c. The Water Lily forms large colourful flowers.
- i) What type of pollination is used to pollinate the flower of the water lily? (1 mark)
 - ii) Give ONE function of the following structures in a flower: anthers and carpel. (2 marks)
- d. Aphids are insect parasites that tend to live on the Water lily leaves. Several aphids may infest a single plant in a serious aphid infestation. A way how to control an aphid infestation is to put a newspaper sheet on top of the leaves and leaving it there for several hours. This will drown the aphids.
- i) Give ONE advantage of this method compared to spraying insecticide to kill the aphids. (2 marks)
 - ii) Explain why this method of aphid control may reduce the rate of photosynthesis in the Water Lily. (2 marks)
 - iii) The Water Lily is the producer in the ecosystem in a freshwater pond. Define the term *producer*. (2 marks)
 - iv) Sketch a pyramid of **numbers** to represent the relationship between the Water Lily and the aphids. Explain the shape drawn. (4 marks)
- (Total 25 marks)**

3. For **each** statement point out the mistake, re-write the correct form of the statement and give a biological explanation for your answer.

- a. Tapeworms and earthworms are two different types of annelids. (3 marks)
- b. Molluscs are vertebrate animals usually with a hard shell. (3 marks)
- c. Plants living in dry habitats such as deserts have leaves with a large surface area. (3 marks)
- d. Blood plasma is mainly made up of cells. (3 marks)
- e. Ferns and mosses lack xylem and phloem. (3 marks)
- f. Height and blood group type are two characteristics showing continuous variation. (3 marks)
- g. In both mitosis and meiosis the cell duplicates into two genetically identical daughter cells. (4 marks)
- h. Sheep and lions have a diastema. (3 marks)

(Total: 25 marks)

4. The Western Whip Snake (*Coluber viridiflavus*) and the Algerian Whip Snake (*Coluber algirus*) inhabit the Maltese Islands.

- a. i) Give the species name of the Algerian whip snake. (1 mark)
- ii) What information shows that the two species are closely related? (2 marks)
- b. The Western Whip snake lives along valleys, maquis and rocky ground. It feeds on lizards, small mammals, gecko, young birds, frogs and large insects.
 - i) Define the term *habitat*. (2 marks)
 - ii) Describe the type of vegetation found in maquis habitat. (1 mark)
 - iii) From the above list of prey, name ONE other reptile. (1 mark)
 - iv) Mammals and birds are both prey of snakes. Give ONE common characteristic of both mammals and birds and ONE characteristic of each group. (3 marks)
- c. The cat snake, *Telescopus fallax*, is another snake species found on the Maltese Islands. It is the only poisonous snake having venom which kills its prey.
 - i) Venom contains several proteins. Name the elements found in protein. (2 marks)
 - ii) List TWO other functions of proteins in organisms. (2 marks)
- d. Some types of venom break down red blood cells.
 - i) Name the molecule that carries oxygen inside red blood cells. (1 mark)
 - ii) Explain how the structure of the red blood cell helps it to perform its function. (4 marks)
 - iii) Venom may also decrease the ability of blood to clot. Give TWO reasons why blood clotting is important for an animal. (3 marks)
- e. Other venom types stop nerves from conducting impulses.
Draw a labelled diagram of a motor neuron. (3 marks)

(Total: 25 marks)

5. Pancreatic Exocrine Insufficiency (PEI) is a condition caused by deficiency of pancreatic enzymes in the small intestine.

- a. i) Which region of the small intestine does the pancreatic duct lead to? (1 mark)
 - ii) Explain why a person suffering from PEI shows symptoms of undernourishment even though his or her diet is regular and balanced. (2 marks)
 - b. Patients suffering from this condition are given enzyme replacement therapy. Name TWO enzymes secreted by the pancreas. For **each** enzyme list the substrate and the product/s of the reaction catalysed. (You may present your answer in table format.) (6 marks)
 - c. As a result of PEI, the pH of the small intestine falls below pH 5. This stops the enzymes present from acting.
 - i) Explain why the food entering the small intestine has a low pH. (3 marks)
 - ii) Give ONE reason why pancreatic enzymes stop working at a low pH. (3 marks)
 - d. One cause of PEI is blockage of the pancreatic duct and the bile duct by growth of tumours.
 - e. i) Name the organ where bile is produced and the structure where it is stored. (2 marks)
 - ii) Explain the importance of bile in digestion. (2 marks)
 - f. Carnivores and herbivores have teeth and jaws adapted to the food they ingest.
 - i) Canines are prominent in carnivores. Describe the appearance of a canine tooth and give ONE function that canines carry out. (3 marks)
 - ii) Herbivores have large teeth at the back of their mouth. Name these TWO types of teeth and give their function. (3 marks)
- (Total: 25 marks)**

6. A group of students were involved in fieldwork at the Sand dunes at Ramla Bay.

- a. Sand dunes in the area are protected and special authorisation is necessary to work in the area. Many of the floral species of the sand dunes are indigenous i.e. they only grow naturally in a local region.
 - i) Explain why it is important to protect sand dune environments. (2 marks)
 - ii) Give TWO characteristics of the soil present in sand dunes. (2 marks)
- b. Students investigated the number of plants along a region of the sand dune. The table below shows the list of different plants and the number of plants observed.

Common name	Number of plants
Sand Couch Grass	124
Sea Rocket	10
Sea Medick	92
Wall Barley	6
Sea Spurge	7

- i) On the graph paper provided (use the 1 cm grid scale) draw a bar chart showing the number of plants recorded for each species. (6 marks)
- ii) The sand couch grass was observed growing in bunches. Explain how this is advantageous to the sand dune. (2 marks)
- iii) Sand grasses grow by vegetative propagation using rhizomes. Explain the importance of this way of reproducing. (2 marks)

- c. Explain the following adaptations observed in the plant species growing in the sand dunes:
- i) The leaves of the Sea Medick are covered with dense silvery hairs. (3 marks)
 - ii) The Maltese Salt tree secretes salt from its leaves. (2 marks)
- d. The students moved to the rocky area of the beach and studied the population of Periwinkles (sea snails) and barnacles. Measurements from the mean sea level indicated that the highest number of barnacles was 60 cm from the sea shore while the highest number of periwinkles was recorded at 100 cm from the shore line.
- i) Give ONE reason why the highest number of organisms of the two species was at different distances from the shore. (2 marks)
 - ii) Barnacles are crustaceans. Name the phylum of this class. (1 mark)
 - iii) Periwinkles are molluscs. Give ONE characteristic feature of molluscs. (2 marks)
 - iv) Periwinkles feed on algae. Give their trophic level in a food chain. (1 mark)
- (Total: 25 marks)**

7. a. Waste materials accumulate in water in fish ponds. Explain how this can lead to mass death of fish in the ponds. (3 marks)
- b. It is advisable to keep fish numbers low in ponds. Give ONE reason for this. (2 marks)
- c. In fish farms the water in the ponds is agitated mechanically. Explain the advantage of this. (2 marks)
- d. Explain why it is highly recommended to include fish as part of a balanced diet. (2 marks)
- e. Draw a diagram of a bony fish and label the following structures
i) mouth ii) operculum iii) a dorsal fin and v) the tail fin. (7 marks)
- f. Describe ONE biological function of i) the operculum and ii) the tail fin. (2 marks)
- g. Bony fish living in fresh water produce very dilute urine.
Name the part of the nephron that is responsible for ultrafiltration and briefly describe the process of ultrafiltration. (3 marks)
- h. A recent study shows that more than 900 new species (alien species) have been found in the coastal environments of the Eastern Mediterranean Sea in recent years. The invasion of alien species is affecting the whole food chain.
Give ONE reason why the invasion of alien species affects the whole food chain. (2 marks)
- i. Many fish swim together in groups called shoals. Suggest ONE advantage of this behaviour. (2 marks)
- (Total: 25 marks)**

Please turn the page.

8. Give biological explanations for the following statements:

- a. Dog owners are given the advice to put flea repellent collars on their pet dogs. (3 marks)
- b. When cells from cherries stored in sugar were observed under the microscope, they were all plasmolysed. (4 marks)
- c. Young grasshoppers have a similar appearance as adult grasshoppers, but caterpillars have a different shape from adult butterflies. (9 marks)
- d. Apples are sweet and tasty to animals. The seeds inside them have a thick seed coat. (5 marks)
- e. Persons drinking excessive amount of energy drinks may put on weight. (4 marks)

(Total: 25 marks)