

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD  
UNIVERSITY OF MALTA, MSIDA**SECONDARY EDUCATION CERTIFICATE LEVEL****MAY 2012 SESSION**

---

SUBJECT:	<b>Biology</b>
PAPER NUMBER:	I
DATE:	9 <sup>th</sup> May 2012
TIME:	4:00 p.m. to 6:00 p.m.

---

**ANSWER ALL QUESTIONS IN THIS PAPER IN THE SPACES PROVIDED.**

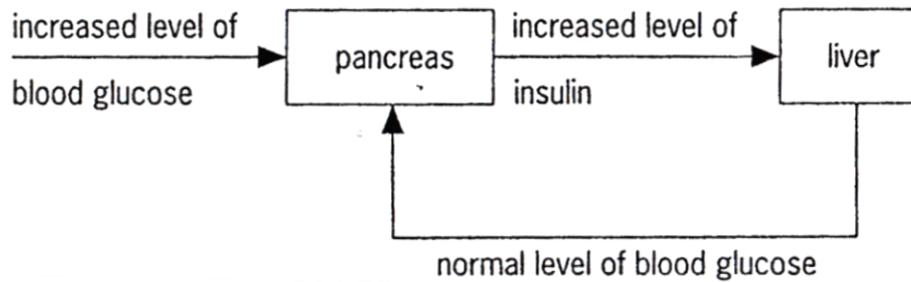
1. Read the following passage and fill in the blanks with the most appropriate term.

Different substances are found in the cytoplasm of cells. These include carbohydrates, lipids and proteins. Glucose is a \_\_\_\_\_. It is broken down in the process of aerobic respiration into \_\_\_\_\_ and \_\_\_\_\_, releasing energy. When yeasts carry out anaerobic respiration, they break down glucose into \_\_\_\_\_ and \_\_\_\_\_, releasing less energy in the process.

Proteins are long chains of \_\_\_\_\_. Protein molecules include the elements carbon, hydrogen, oxygen and \_\_\_\_\_. Some proteins act as \_\_\_\_\_ which make reactions go faster. The information needed to build up a protein is provided by the \_\_\_\_\_ molecule which has a characteristic double-helix shape and is found within the \_\_\_\_\_ of animal and plant cells.

(1 mark each)  
**(Total: 10 marks)**

2. The pancreas plays an important role in controlling blood glucose concentration. This is summarized in the diagram below:



- a. From the diagram above name the **TWO** organs that bring about the response.

Organ 1: \_\_\_\_\_

Organ 2: \_\_\_\_\_

(2 marks)

- b. Name the type of feedback involved in the system shown above.

\_\_\_\_\_

(1 mark)

- c. Insulin is produced by the pancreas. The pancreas also produces pancreatic juice that flows down the pancreatic duct into the duodenum.

- i) List **TWO** enzymes present in pancreatic juice.

Enzyme 1: \_\_\_\_\_

Enzyme 2: \_\_\_\_\_

(2 marks)

- ii) Pancreatic juice is slightly alkaline with a pH range of 7.1 to 8.2. Explain the importance of the alkaline nature of the pancreatic juice.

\_\_\_\_\_  
\_\_\_\_\_

(2 marks)

- iii) The duodenum forms the first part of the small intestine. Name the second part of the small intestine and give its function.

Name: \_\_\_\_\_

Function: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

(2 marks)

d. The liver breaks down many circulating hormones. Explain why it is important to breakdown circulating hormones after they perform their function.

---

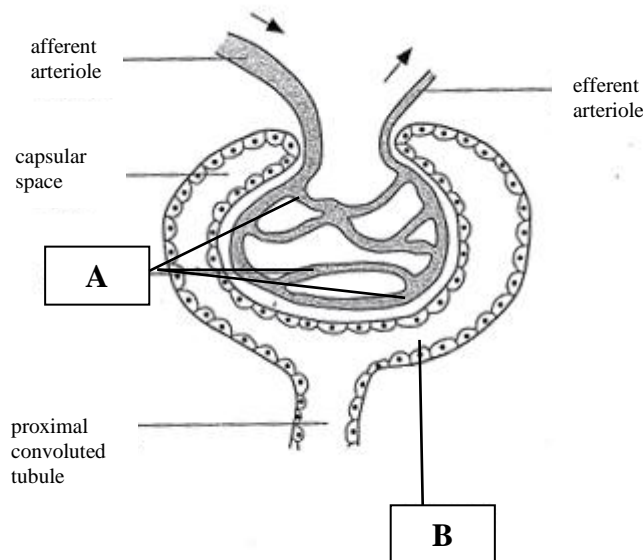


---

(1 mark)

(Total: 10 marks)

3. The following diagram shows part of the nephron.



a. Label parts A and B.

A: \_\_\_\_\_ B: \_\_\_\_\_

(2 marks)

b. The afferent arterioles are wider in diameter than the efferent arterioles. Explain the biological importance of this.

---



---

(1 mark)

c. The proximal convoluted tubules and distal convoluted tubules are long and winding. List **TWO** reasons why the proximal and distal tubules are long and winding.

Reason 1: \_\_\_\_\_

Reason 2: \_\_\_\_\_

(2 marks)

d. Give a biological explanation for **each** of the following statements:

i) The proximal and distal convoluted tubules have walls that are only one cell layer thick.

(1 mark)

ii) The cells of the proximal and distal convoluted tubules have numerous mitochondria.

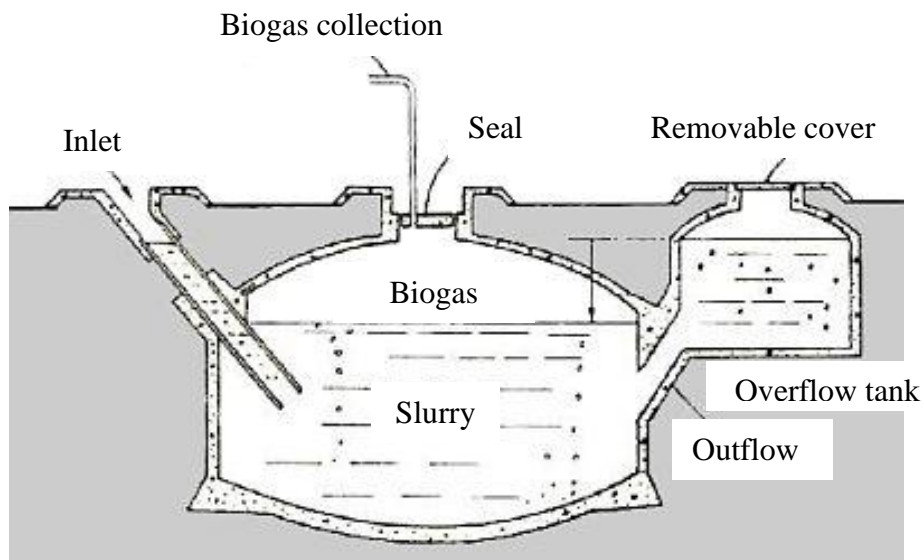
(2 marks)

e. The kidneys regulate the water content in blood and tissue fluids. Name this process of controlling the water potential in an organism.

(1 mark)

(Total 9 marks)

4. The following diagram shows the production of biogas.



a. Name the type of micro-organism present in the container that brings about the production of biogas.

(1 mark)

b. List **TWO** advantages of using biogas.

---

---

---

(2 marks)

c. i) Name the micro-organism that is involved in the production of wine.

---

(1 mark)

ii) Name the gas that is produced during the fermentation process.

---

(1 mark)

d. A biology student remarked that an increase in temperature will make the fermentation process go faster. Explain what happens to the fermentation process if the temperature in the container is:

i) 70°C;

---

(1 mark)

ii) 7°C.

---

(1 mark)

e. Some winemakers add sucrose to unfermented grapes.

i) What is the effect of this sucrose addition on the alcohol content of the wine produced?

---

(1 mark)

ii) What type of sugar is sucrose?

---

(1 mark)

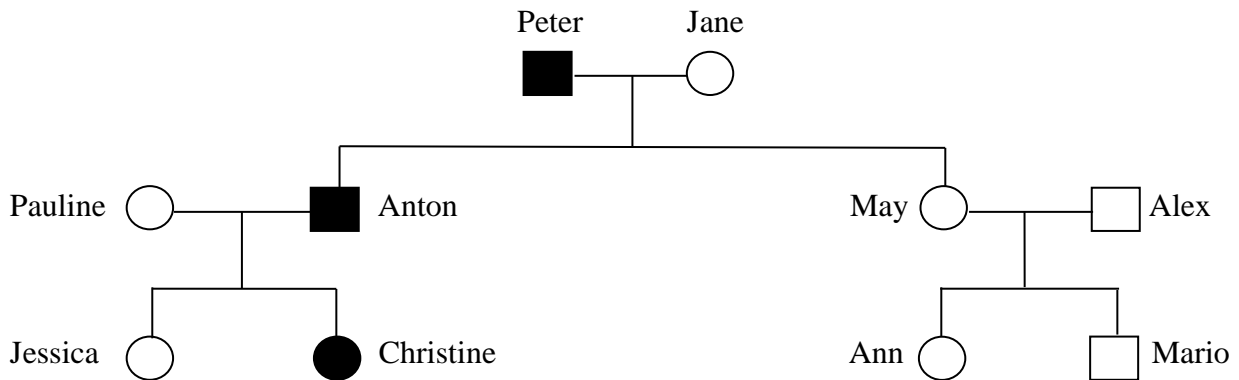
f. Fructose and glucose are both present in wine. List the **THREE** elements present in both fructose and glucose.

---

(1 mark)

**(Total 10 marks)**

5. Machado-Joseph Disease (MJD) is an autosomal dominant disorder, represented by **D**, that is characterised by slow progressive clumsiness in the arms and legs. The following diagram shows the pattern of inheritance of this disease in a particular family.



**Key:** ○ Normal female                      □ Normal Male  
 ● Female suffering from MJD              ■ Male suffering from MJD

a. Write the genotypes of:

i) Peter: \_\_\_\_\_;

ii) Anton: \_\_\_\_\_;

iii) Mario: \_\_\_\_\_.

(3 marks)

b. Christine, the only female in the diagram affected by MJD, and her husband Nicholas are expecting their first child. Nicholas is also affected by MJD. The genetic counsellor informed the couple that there is only 25% chance of having a child not affected with the disorder. Work out a genetic diagram to confirm the counsellor's prediction.

Parents:                      Christine                                      Nicholas

Genotype of parents

Gametes:

F1 generation:

Explanation: \_\_\_\_\_

(4 marks)

- c. Mario and his wife Tania are expecting their third child. Their first two children, Sam and Jack, are both affected by the disorder. The genetic counsellor informed the couple that due to Tania's genotype, all their future children will be affected with the disorder. Work out a genetic diagram to confirm the counsellor's prediction.

Parents: Mario Tania

Genotype of parents

Gametes:

F1 generation:

Explanation: \_\_\_\_\_

(4 marks)

**(Total 11 marks)**

6. Although the mauve stinger jellyfish (*Pelagia noctiluca*) does not seem to be in abundance this summer, other species are increasing, Alan Deidun, the biologist coordinating the "Spot the Jellyfish" campaign remarked. One notable example was the box jellyfish – *Carybdea marsupialis* – which has been sighted by numerous bathers. Although being largely transparent, the species is still relatively easy to spot and to identify since, unlike other species of jellyfish, it does not have a spherical umbrella but a squarish one, with four tentacles dangling down from its umbrella. The venom in box jellyfish is distinct from that in other conventional jellyfish and is used by the jellyfish to protect itself against predators such as the rabbit fish and turtles, besides being used for capturing prey.

(Adapted from *The Times of Malta*, Friday August 5, 2011)

- a. From the passage above write the term that best fits **each** of the following descriptions:

i) reptiles characterized by a special bony or cartilaginous shell: \_\_\_\_\_

ii) the type of organism that is attacked and eaten by another organism: \_\_\_\_\_

iii) elongated and flexible organs with stinging cells present in jellyfish: \_\_\_\_\_

(3 marks)

- b. Name the phylum to which jellyfish belong.

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

- c. A biology student wrote that the mauve stinger jellyfish and the box jellyfish belong to the same species. Use the information in the passage to give **ONE** reason why this statement is incorrect.

---

---

(2 marks)

- d. List **ONE** abiotic factor that can affect the seasonal changes of jellyfish populations in the Mediterranean Sea.

---

(1 mark)

- e. Give a biological explanation for **each** of the following statements:

- i) Jellyfish do not need a gas exchange system.

---

---

- ii) The population of jellyfish has increased as a result of overfishing.

---

---

- iii) Turtles are affected by transparent plastic bags thrown away in the sea.

---

---

(3 marks)  
(Total 10 marks)

*Please continue on the next page*



7. a. A student cut out potato cylinders of equal length and placed them in different solutions for one hour. The diagrams show the results obtained.

**Experiment A**

Potato cylinder placed in concentrated sugar solution.

Appearance at the start of the experiment



Appearance after 1 hour



**Experiment B**

Potato cylinder placed in pure water.

Appearance at the start of the experiment



Appearance after 1 hour



For **each** experiment describe the result obtained and give an explanation for it.

Experiment **A**:

Result: \_\_\_\_\_

Explanation: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(3 marks)

Experiment **B**:

Result: \_\_\_\_\_

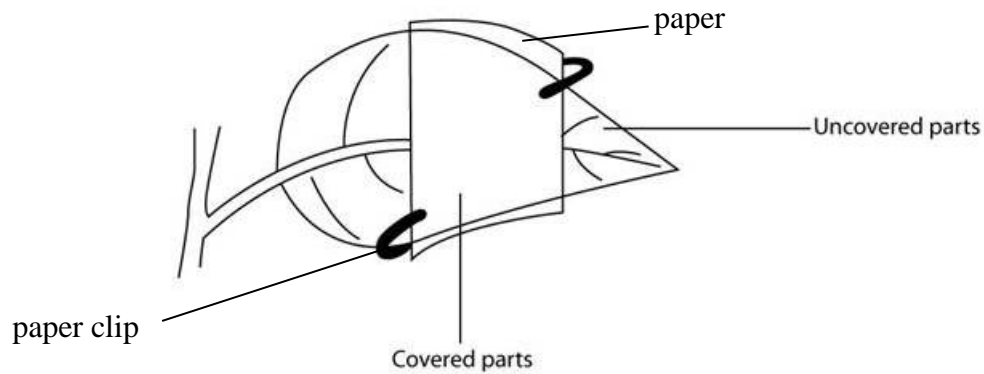
Explanation: \_\_\_\_\_

\_\_\_\_\_

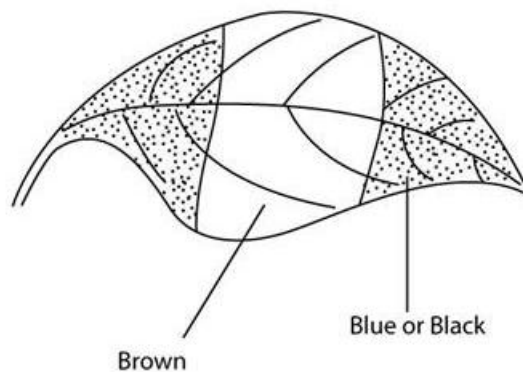
\_\_\_\_\_

(3 marks)

- b. In another experiment a biology student investigated the need of light for photosynthesis. In the experiment the leaf that was still attached to a plant was first destarched. It was then partly covered with a paper as shown in the figure below.



The leaf was left in bright light for 6 hours. Afterwards the paper was removed and the leaf tested for starch. The following diagram shows the result obtained.



- i) Describe how the biology student can test for the presence of starch in a leaf.

---



---

(2 marks)

- ii) Write down the result obtained and give an explanation for it.

Observation: \_\_\_\_\_

Explanation: \_\_\_\_\_

---

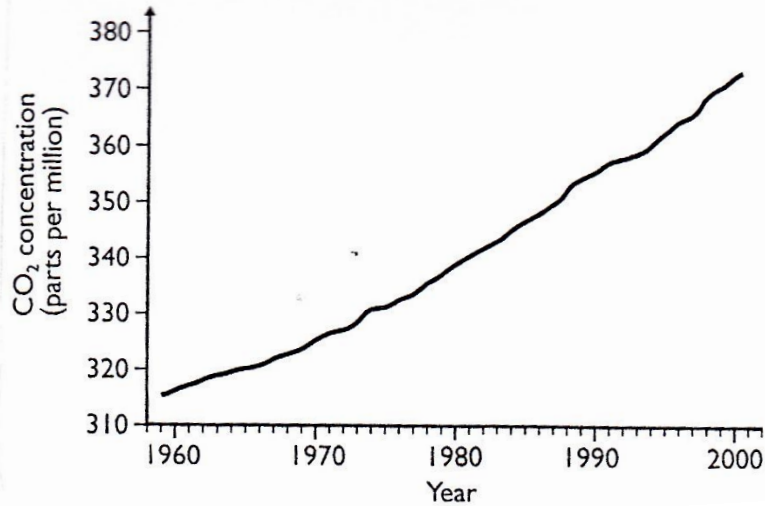


---

(3 marks)

**(Total 11 marks)**

8. The following graph shows the change in the level of atmospheric carbon dioxide from 1960 to 2000.



- a. From the graph above describe the change in the atmospheric level of carbon dioxide during the forty year period.

---

(1 mark)

- b. List **TWO** possible causes of the change described in 'a'.

---

---

(2 marks)

*Please turn the page.*

c. The following picture was drawn by a biology student to represent global warming.



List **TWO** consequences of global warming.

Consequence 1: \_\_\_\_\_  
\_\_\_\_\_

Consequence 2: \_\_\_\_\_  
\_\_\_\_\_

(2 marks)

d. Another student designed two posters (A and B) for a school-based competition entitled 'Environmental Choices'.



Poster A



Poster B

Describe the biological message in **each** poster.

Poster A: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Poster B: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ (4 marks)

**(Total 9 marks)**

**9. a.** The table below lists a number of characteristics related to the dentition of dogs and a sheep. For each statement in the table mark the box with a tick (✓) if correct and a cross (✗) if incorrect.

STATEMENT	DOGS	SHEEP
Incisors found on both upper and lower jaws.		
Molars wear down to form enamel ridges.		
Strong jaw muscles that allow extensive chewing of food.		
Jaw joint only allows up and down movement		

(4 marks)

**b. i)** Dogs and sheep are both classified as vertebrates. Give **ONE** characteristic feature of vertebrates.

\_\_\_\_\_

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

ii) Dogs and sheep are also classified as mammals. Give **TWO** characteristic structural features that dogs and sheep have that enable them to be classified in this class.

Characteristic 1: \_\_\_\_\_

\_\_\_\_\_

Characteristic 2: \_\_\_\_\_

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

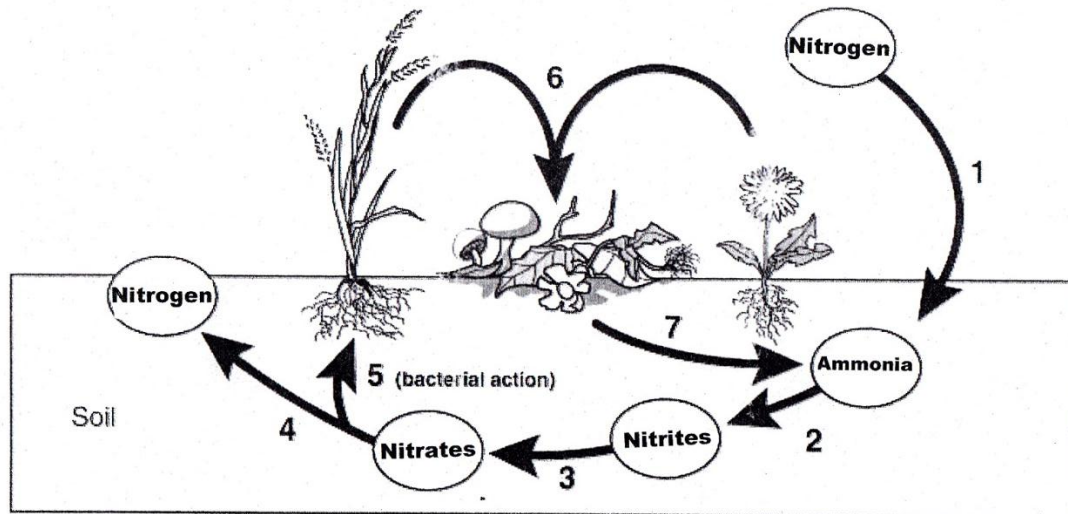
iii) Besides mammals there are four other classes of vertebrates. Name another **TWO**.

Class 1: \_\_\_\_\_ Class 2: \_\_\_\_\_

(2 marks)

**(Total: 10 marks)**

10. The diagram below shows the Nitrogen cycle.



a. From the diagram above write the number that represents **each** of the following processes:

- i) Denitrification; \_\_\_\_\_
- ii) decay: \_\_\_\_\_
- iii) nitrogen fixation by lightning: \_\_\_\_\_

(3 marks)

b. Fertile soil is rich in nitrogen compounds. Explain why this is important.

---



---

(2 marks)

c. Acacia trees (*Faidherbia albida*) have nitrogen-fixing qualities and are being used in sub-Saharan Africa to increase soil fertility. These long-living trees have root nodules containing nitrogen-fixing bacteria.

- i) Name the relationship between the bacteria found in the root nodules and the trees.

---

(1 mark)

- ii) List **ONE** advantage, other than soil fertility, of Acacia trees to the surrounding community.

---



---

(2 marks)

- iii) Explain how the planting of numerous Acacia trees in an area will affect the carbon dioxide concentration in the surrounding air.

---



---

(2 marks)

**(Total: 10 marks)**

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD  
UNIVERSITY OF MALTA, MSIDA**SECONDARY EDUCATION CERTIFICATE LEVEL****MAY 2012 SESSION**

---

SUBJECT:	<b>Biology</b>
PAPER NUMBER:	IIA
DATE:	10 <sup>th</sup> May 2012
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 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.**

Coronary heart disease (CHD) is one of the main cardiovascular diseases that causes a number of deaths. The main cause of CHD is atherosclerosis, a condition where cholesterol and fats accumulate in blood vessel walls, reducing their diameter. Several risk factors may increase the chance of developing this condition. These include obesity, smoking, old age and a fat rich diet. A diet including excessive carbohydrates may also contribute to the condition. Atherosclerosis is a long and complicated process which develops over a number of years eventually leading to blockage of blood vessels. This leads to serious effects on blood pressure and on organs supplied with blood from blocked vessels.

The coronary arteries supply the heart with blood. If atherosclerosis develops here less oxygen reaches the heart muscle and waste products accumulate. This is particularly evident during exercise. It may result in chest pains, referred to as angina, but most commonly it results in heart attack. A heart attack occurs if cholesterol deposits detach from the wall of an artery and lead to the formation of a blood clot. If the clot blocks the coronary artery, damage or death of the heart muscle results. A heart attack requires immediate medical treatment to reduce damage to heart muscle. Heart attacks may be treated by re-opening the blocked coronary artery. Oxygen is supplied and drugs are used to allow the coronary arteries to relax. The blood clot is broken down to prevent it from enlarging. Drugs used include aspirin and heparin which tend to inhibit the action of platelets.

Recently a technique called angioplasty has been developed to treat a heart attack. In this procedure a tiny wire is inserted in the coronary artery. Then a small balloon is inflated, pressing cholesterol deposits against the artery wall and increasing the internal diameter of the artery. The balloon is removed and a metal tube, called a stent, is then inserted. This prevents the artery from narrowing again.

Treatment with angioplasty and drugs such as heparin has improved the survival rates in patients suffering heart attacks. However it is more important to prevent atherosclerosis by reducing risk factors.

(Adapted from Mamas M., *Heart attacks: clots and balloons*; Biologist Vol 24, No 1. Sep. 2011)

- a. Explain why ‘a diet including excessive carbohydrates may also contribute to the condition’ of atherosclerosis. (2 marks)
- b. i) Draw a diagram to represent a molecule of fat. (2 marks)  
 ii) Explain why a blocked blood vessel has serious effects on the organ that it transports blood to. (1 mark)
- c. Why is the effect of atherosclerosis particularly evident during exercise? (2 marks)
- d. Aspirin and heparin inhibit platelet action. How is this important in the treatment of heart attack? (2 marks)
- e. Summarize the roles of the small balloon and the stent in the angioplasty technique. (2 marks)
- f. Using the information in the passage, suggest **ONE** way how to prevent atherosclerosis. (1 mark)
- (Total 12 marks)**

2. Measles is a highly contagious respiratory disease caused by a virus. Since 2009, measles virus transmission has increased and outbreaks have become widespread in 2011. The following table compares the number of reported measles cases for a range of age groups in France and Spain during 2011.

Age group (years)	France % new cases	Spain % new cases
<1	6.8	12.7
1-4	12.8	17.6
5-9	11.0	7.4
10-14	14.8	6.9
15-19	17.8	7.8
>20	36.8	47.6

(Source: [www.cdc.gov/mmwr/preview](http://www.cdc.gov/mmwr/preview))

- a. On the graph paper provided draw **TWO** bar charts on the same axes to show the percentage number of measles cases for the six age groups listed in the table. For each age group draw the bars next to each other. Label the bars clearly. (6 marks)
- b. The total number of reported cases in 2011 is as follows: France: 14,025 and Spain: 2,745. Calculate the number of persons aged 20 and above who were actually infected by the measles virus in:  
 i) France;  
 ii) Spain. (2 marks)
- c. Compare the percentage measles cases in both countries across the range of age groups. (3 marks)
- d. Measles is caused by the measles virus, of the genus *Morbillivirus*. Name the **TWO** parts making up the general structure of a virus. (2 marks)
- (Total 13 marks)**



**Section B: Answer any THREE questions from this section.**

**3.** Bacteria are prokaryotes. Some are heterotrophs while others are autotrophs.

- a. List **TWO** structural characteristics of prokaryotes. (2 marks)
- b. Distinguish between the terms *heterotrophs* and *autotrophs*. (2 marks)
- c. Humans use different micro-organisms including bacteria to produce useful substances and food stuffs. Bacteria are added to pasteurised milk to produce yoghurt.
  - i) Explain why milk is pasteurised before producing yoghurt. (2 marks)
  - ii) Outline briefly how bacteria act on milk to produce yoghurt. (4 marks)
- d. Ta' Barkat sewage treatment plant at Xgħajra has significantly reduced the amount of raw sewage disposal at sea.
  - i) Air is pumped in one of the sewage tanks where bacteria are metabolically active. Explain the importance of this process. (2 marks)
  - ii) Give **TWO** reasons why it is important to reduce raw sewage disposal at sea. (4 marks)
  - iii) Describe **ONE** way how the purified water by-product of sewage treatment may be used. (1 mark)
- e. Insulin was the first hormone to be synthesized using genetic engineering.
  - i) Define the term *genetic engineering*. (2 marks)
  - ii) Genetic engineering uses recombinant DNA. What is recombinant DNA? (2 marks)
  - iii) Explain the function of plasmids in genetic engineering. (2 marks)
- f. Explain the following statement:  
*In food preparation, a clean, sterile surface is necessary.* (2 marks)

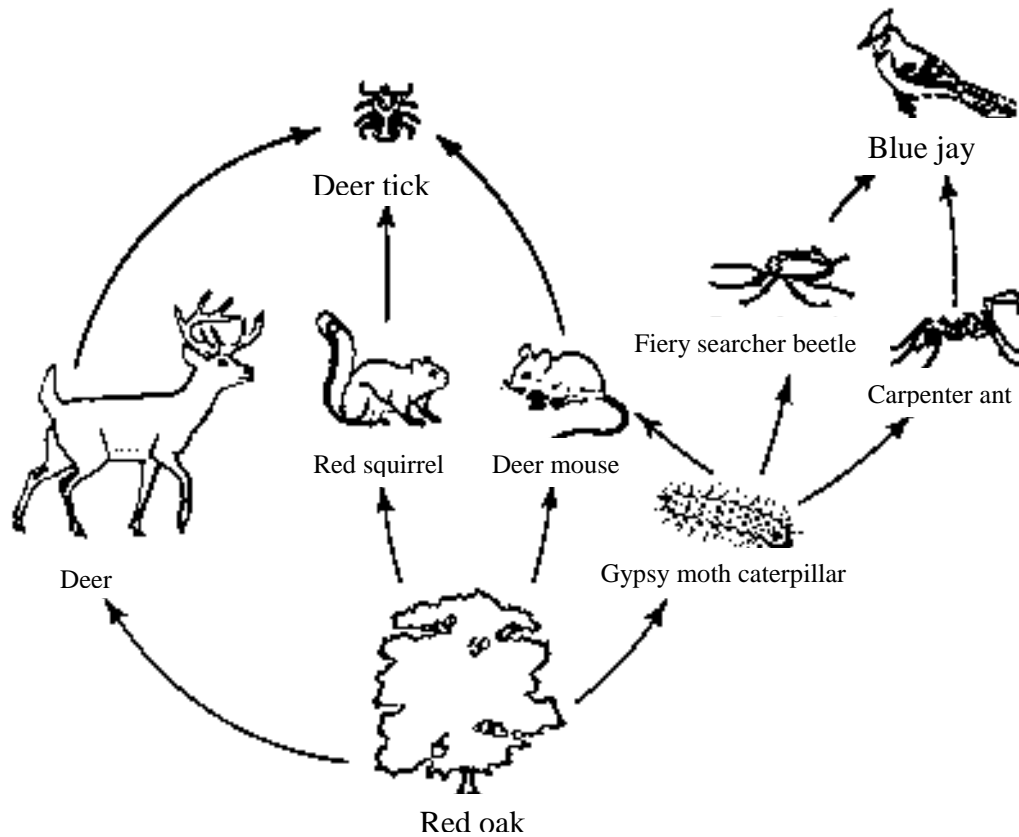
**(Total: 25 marks)**

**4.** Comment on the biological significance of **each** of the following statements.

- a. Mutations may be caused by different factors. (3 marks)
- b. Fish farming is a possible way of limiting the decrease in fish stock, however it has a number of disadvantages. (5 marks)
- c. Classification systems are used to give organisms scientific names. (4 marks)
- d. Transpiration may have some useful effects in plants. (4 marks)
- e. It is advantageous for a farmer to grow crops such as celery, lettuce and tomatoes in glasshouses. (6 marks)
- f. Salivary glands release their secretions in a duct but the thyroid gland lacks ducts. (3 marks)

**(Total: 25 marks)**

5. The diagram below represents a foodweb in a forest ecosystem.



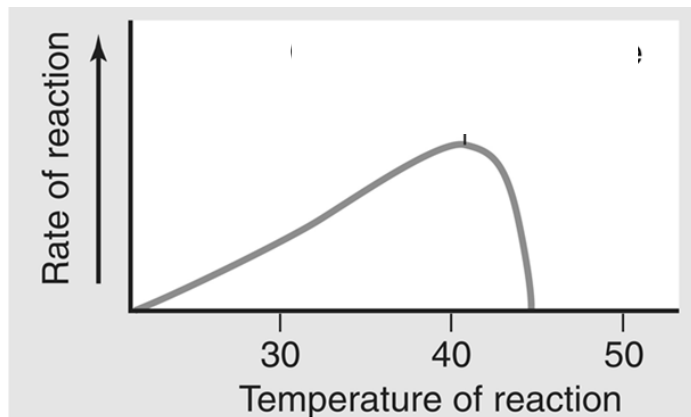
([http://mdk12.org/instruction/clg/public\\_release/biology/G3\\_E5\\_I2.html](http://mdk12.org/instruction/clg/public_release/biology/G3_E5_I2.html))

- Define the term *ecosystem*. (2 marks)
  - Predict what happens to the organisms shown in the food web if the red oak tree is removed. Give **ONE** reason for your answer. (3 marks)
  - Explain why removing the fiery searcher beetle from the food web may lead to:
    - a decrease in the amount of carpenter ants; (2 marks)
    - an increase in deer mice. (2 marks)
  - The deer tick is a parasite. Several deer ticks may be present on the deer mouse, which is one of its possible hosts. Define the term *parasite*. (2 marks)
  - Sketch a pyramid of numbers to reflect the feeding relationship between the following organisms shown in the food web above:
    - red oak, gypsy moth caterpillar, carpenter ant and blue jay; (3 marks)
    - red oak, gypsy moth caterpillar, deer mouse and deer tick. (4 marks)
  - Describe how the nutrients that are present in the blue jay may be returned to the red oak. (2 marks)
  - Energy flow decreases along the food chain from the red oak to the blue jay. Give **THREE** reasons for this. (3 marks)
  - The red oak tree is a dicot. List **TWO** characteristic features of its leaves. (2 marks)
- (Total 25 marks)**

6. Consider the following statements.

- The enzyme amylase breaks down starch into maltose.
- When iodine solution is added to starch a blue-black colour appears.
- The blue-black colour disappears if starch is broken down into maltose

- a. i) A biology student was supplied with amylase solution, starch solution, iodine solution together with all other necessary laboratory apparatus to investigate the effect of temperature on the rate of breakdown of starch. Describe the method the student can use to perform this investigation. (8 marks)
- ii) Give **TWO** precautions the student should follow when performing this investigation. Give a reason for **each** precaution. (4 marks)
- iii) The curve below shows a sketch of the expected results.



Explain why the rate increases up to a temperature of 40°C but decreases at higher temperatures. (2 marks)

- b. i) Name **TWO** glands that produce amylase in the body. (2 marks)
- ii) List **TWO** reasons why amylase does not act on starch in the stomach. (3 marks)

c. Bile and pancreatic juice involved in digestion of fats.

- i) Describe the role of both secretions in this process. (4 marks)
- ii) Explain why bile must be released before pancreatic juice for the efficient digestion of fats. (2 marks)

**(Total: 25 marks)**

7. a. Compare the number of chromosomes in a human skin cell with that in a human sperm cell.

(2 marks)

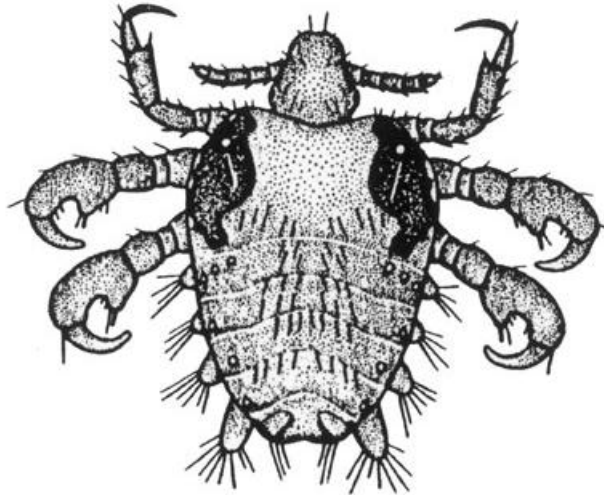
b. Name the type of cell division that produces gametes from normal cells and list the site in a human female body where this process takes place. (2 marks)

c. Describe the role of **each** of the following in a female:

- i) vagina; (3 marks)
- ii) oviduct; (1 mark)
- iii) ovary; (3 marks)
- iv) uterus. (2 marks)

d. List **TWO** physical changes that can indicate that a female is pregnant. (2 marks)

- e. During the ninth month of pregnancy, the female undergoes shortness of breath. Give a reason for this observation. (1 mark)
- f. A young female had a contraceptive implant in which tubes of progestin (a form of progesterone) were implanted under the skin. Name **TWO** hormones that are not released from the pituitary gland as a consequence of this. (2 marks)
- g. The following diagram shows the parasitic crab louse *Phthirus pubis*. It takes its name from its resemblance to a small crab. The organism causes a sexually transmitted disease, commonly called Crabs.



(Source:www.medscape.com)

- i) Name the phylum to which this parasitic ‘crab’ louse belongs. (1 mark)
- ii) From the diagram list **TWO** structural features of the crab louse. (2 marks)
- iii) The crab louse develops from an egg to an adult by means of incomplete metamorphosis. Explain the term *incomplete metamorphosis*. (2 marks)
- iv) Give **ONE** reason the crab louse survives well in a relatively dry environment. (2 marks)
- (Total: 25 marks)**

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

**SECONDARY EDUCATION CERTIFICATE LEVEL**

**MAY 2012 SESSION**

---

SUBJECT:	<b>Biology</b>
PAPER NUMBER:	IIB
DATE:	10 <sup>th</sup> May 2012
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 1 of this paper you need the graph paper in the booklet.***

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

1. Measles is caused by the measles virus, of the genus *Morbillivirus*. The following table shows the percentage number of reported measles cases in France during 2011 for a range of age-groups.

Age group (years)	France % new cases
<1	6.8
1-4	12.8
5-9	11.0
10-14	14.8
15-19	17.8
>20	36.8

*(Source: www.cdc.gov/mmwr/preview)*

- a. On the graph paper provided, draw a bar chart to show the percentage number of measles cases in France for the range of age groups indicated. (6 marks)
- b. The total number of reported cases in France amounts to 14,025. Calculate the number of children aged up to 9 years who were actually infected by the measles virus in 2011. (3 marks)
- c. From the bar chart describe the trend of measles cases in France in 2011. (3 marks)
- d.
  - i) Draw a labelled diagram to show the general structure of a virus. (4 marks)
  - ii) Give **TWO** differences between the structure of a virus and the structure of a bacterium. (2 marks)
  - iii) Give **TWO** differences between the structure of a bacterial cell and the structure of a palisade cell. (2 marks)
- e. Severe measles is more likely to occur among poorly nourished young children especially those with insufficient amounts of Vitamin A.
  - i) Explain how a low intake of Vitamin A affects eyesight in children. (1 mark)
  - ii) Name **TWO** other deficiency diseases and state their cause. (4 marks)

**(Total: 25 marks)**

2. Coronary heart disease (CHD) is one of the main heart diseases that cause a lot of deaths. CHD is caused mainly by atherosclerosis, a condition where cholesterol and fats accumulate in artery walls. Several risk factors may increase the chance of developing this condition. These include obesity, smoking, old age and a fat rich diet.

- a. i) Give **ONE** structural differences between an *artery* and a *vein*. (2 marks)  
ii) Describe how the amount of oxygen in blood differs between most of the arteries and most of the veins. (2 mark)
- b. Draw a diagram to represent a molecule of fat. (4 marks)

Atherosclerosis eventually blocks the artery. This leads to serious effects on organs supplied with blood from the blocked artery.

- c. Explain why a blocked artery has serious effects on the organ to which it transports blood. (3 marks)
- d. The coronary arteries supply the heart muscle with blood. If atherosclerosis develops here, less oxygen reaches the heart muscle and waste products accumulate. This is felt most during exercise. It may result in chest pains but most commonly it results in heart attack.
- i) Name **TWO** other arteries that are attached to the heart and clearly name the heart chamber that they are attached to. (4 marks)  
ii) Why is the effect of atherosclerosis felt most during exercise? (4 marks)
- e. A heart attack occurs if cholesterol deposits lead to the formation of a blood clot which blocks the coronary artery. This causes damage or death of heart muscles. A heart attack requires immediate medical treatment to reduce damage to heart muscle. Heart attacks may be treated by using drugs that allow the coronary arteries to relax. Other drugs used include aspirin and heparin which inhibit the action of platelets.

Describe the role of platelets in blood. (2 marks)

- f. A technique called angioplasty has been developed to treat a heart attack. In this procedure a tiny wire is placed in the coronary artery. Then a small balloon is inflated, pressing cholesterol deposits against the artery wall and increasing the internal diameter of the artery. The balloon is removed and a metal tube, called a stent, is then inserted to prevent the artery from narrowing again. Although treatment has improved the chance of surviving, a heart attack, it is more important to prevent atherosclerosis by reducing risk factors.

(Adapted from Mamas M., *Heart attacks: clots and balloons*; Biologist Vol 24, No 1. Sep. 2011)

Use information in the paragraph to describe the functions of the small balloon and the stent in the angioplasty technique. (4 marks)

**(Total: 25 marks)**

**3. Surfaces in animals and plants evolved to increase gaseous exchange.**

- a. List **FOUR** characteristics of a gas exchange surface. (4 marks)
- b. A respiratory test was administered on an elderly person suffering from the respiratory condition emphysema, the following results were obtained.

	Breaths / min	Volume of air inhaled / exhaled at rest / cm <sup>3</sup>
Elderly suffering from emphysema	19	500
Normal rate	10 - 12	600 - 650

- i) List **ONE** type of lifestyle which may cause emphysema. (1 mark)
- ii) Give **ONE** reason why a person suffering from emphysema takes more breaths per minute than a healthy person. (2 marks)
- c. In an investigation to determine the change in the total amount of air inhaled and exhaled after a session of physical training, a student was given two months daily training. The volume of air was measured before the training period began and at the end of the two month training course. These were the results obtained.

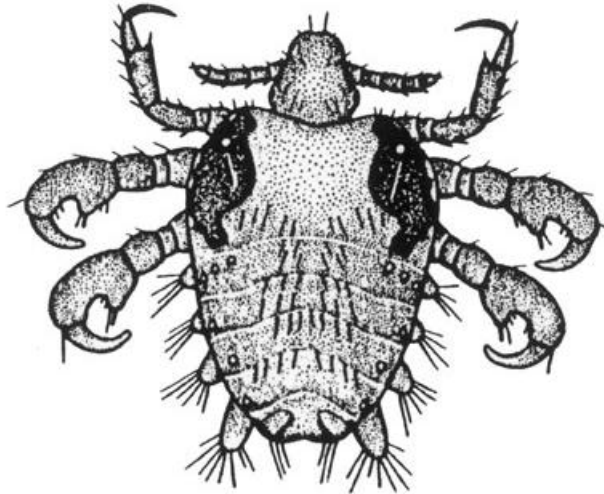
	Lung volume / cm <sup>3</sup>
Before training period	4800
After 2 months	5260

- i) Describe how an increase in lung volume affects gaseous exchange. (1 mark)
- ii) Describe the changes in the breathing and heart rate during exercise. Explain why these changes occur (3 marks)
- iii) Name the part of the brain that controls both the breathing rate and the heart rate. (1 mark)
- d. In plants, gaseous exchange occurs at a high rate in the leaf. This organ is also responsible for photosynthesis.
- i) Gaseous exchange occurs through stomata. Name the cells which surround the stomata. (1 mark)
- ii) Explain why oxygen is released through the stomata during the day but none is released during the night. (4 marks)
- iii) Write a word equation to summarize the process of photosynthesis. (3 marks)
- iv) Explain why large and broad leaves have a higher rate of photosynthesis than small and narrow leaves. (2 marks)
- e. Explain the following statement:  
Plants that live in water have floating leaves; their stomata are located on the upper epidermis while submerged leaves lack stomata altogether. (3 marks)

**(Total: 25 marks)****4.**

- a. Explain why meiosis is referred to as reduction division. (2 marks)
- b. Compare the number of chromosomes in a human gamete with that in a zygote. (2 marks)

- c. In animals, meiosis takes place in testes and ovaries. Name the **TWO** sites in a plant where meiosis takes place. (4 marks)
- d. Name the site in the female body where **each** of the following processes takes place:
- i) fertilization; (1 mark)
  - ii) implantation; (1 mark)
  - iii) ovulation; (1 mark)
  - iv) copulation. (1 mark)
- e. Females shed the inner lining of the uterus approximately every 28 days. Name this process. (1 mark)
- f. Why should a woman who wants to become pregnant have sexual intercourse close to day 14 of her cycle? (2 marks)
- g. The following diagram shows the parasitic crab louse *Phthirus pubis*. Although it resembles a crab it is actually an insect. The organism causes a sexually transmitted disease.



(Source:www.medscape.com)

- i) Name the phylum to which this parasitic ‘crab’ louse belongs. (2 marks)
- ii) List **TWO** structural features of the crab louse, visible in the diagram. (4 marks)
- iii) The crab louse develops from an egg to an adult by means of incomplete metamorphosis. Explain the term *incomplete metamorphosis*. (2 marks)
- iv) Explain why the presence of a waxy cuticle on the surface of the crab louse, allows it to survive well in a dry environment. (2 marks)

**(Total: 25 marks)**

5. Bacteria are prokaryotes. Some have a heterotrophic mode of nutrition while others are autotrophs. Bacterial cells reproduce asexually.
- a. What is a *prokaryote*? (2 marks)
  - b. Explain how bacteria reproduce asexually. (2 marks)
  - c. Distinguish between the terms *heterotrophs* and *autotrophs*. (4 marks)



- d. Humans use bacteria to produce useful substances and food stuffs. The bacteria *Lactobacillus bulgaricus* and *Streptococcus thermophilus* are used in yoghurt preparation. These bacteria are added to pasteurised milk to produce yoghurt.
- Why is milk pasteurized? (2 marks)
  - Describe the role of bacteria in fermentation of lactose in yoghurt production. (2 marks)
- e. Ta' Barkat sewage treatment plant at Xghajra has significantly reduced the amount of raw sewage disposal in the surrounding Mediterranean Sea.
- Give **TWO** reasons why it is important to reduce raw sewage disposal at sea. (4 marks)
  - Write a word equation to summarize the process of aerobic respiration. (2 marks)
- f. Insulin was the first hormone to be synthesized by genetic engineering. Explain the term *genetic engineering*. (3 marks)
- g. Explain why the Health Department strongly advises that high temperatures must be used to cook frozen food. (4 marks)
- (Total: 25 marks)**

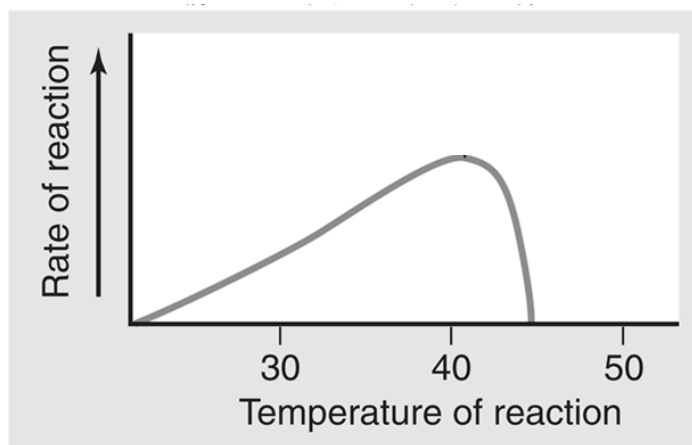
6. A student was asked to plan an experiment to investigate the effect of temperature in the breakdown of starch by the enzyme amylase.

The student was asked to consider the following statements.

- The enzyme amylase breaks down starch into maltose.
- When iodine solution is added to starch a blue-black colour appears.
- The blue-black colour disappears if starch is broken down into maltose

- a. Devise a procedure using amylase, starch and iodine solution to investigate how temperature affects the rate of breakdown of starch by amylase. In your answer:
- list all the apparatus used; (2 marks)
  - indicate **FOUR** temperatures that will be used and describe how the amylase and starch will be kept at these temperatures; (3 marks)
  - describe the method that will be used and how results will be obtained. (4 marks)
- b. Describe **ONE** precaution one should follow when performing this investigation and give a reason for it. (4 marks)

- c. The graph below shows a sketch of the expected results.



Explain why:

- i) the rate increases up to a temperature of 40°C; (2 marks)
- ii) the rate decreases at temperatures higher than 40°C. (2 marks)

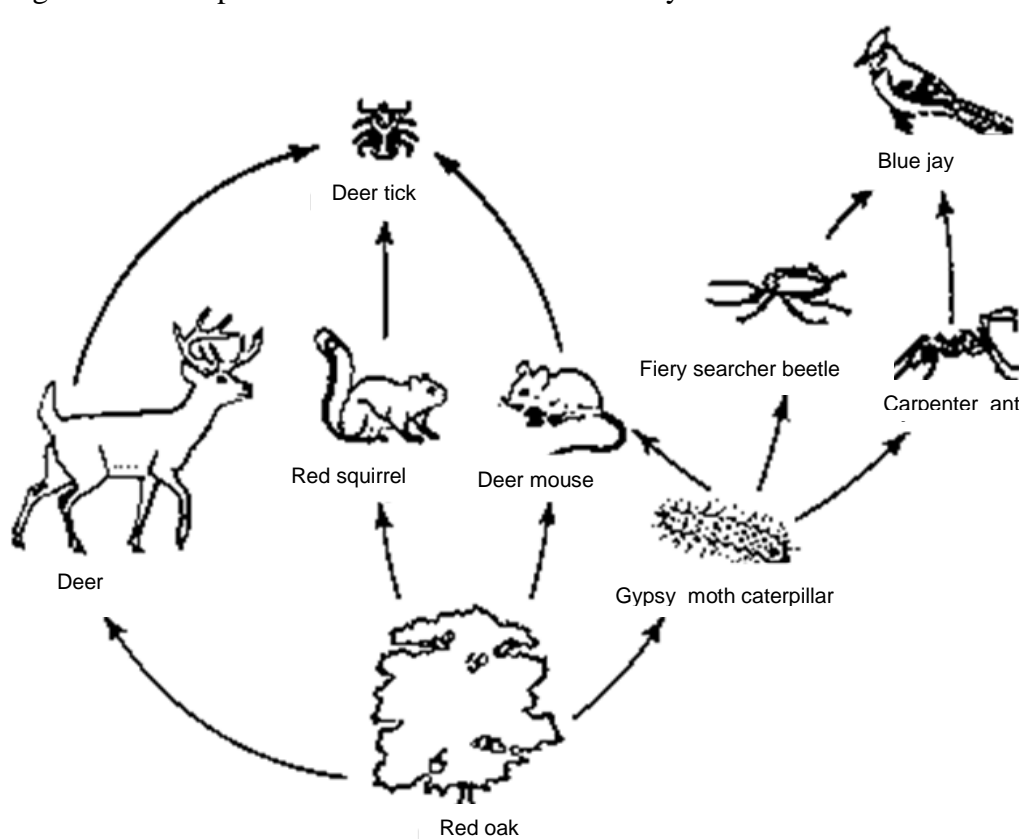
- d. i) Name **TWO** glands that produce amylase in the body. (2 marks)
- ii) Give **ONE** reason why amylase does not act on starch in the stomach. (2 marks)

e. Bile and pancreatic juice are both involved in digestion of fats.

- i) Name the organ that produces bile and name the organ that stores bile before it is released in the duodenum. (2 marks)
- ii) What is the function of bile in the digestion of fats? (2 marks)

**(Total: 25 marks)**

7. The diagram below represents a foodweb in a forest ecosystem.



([http://mdk12.org/instruction/clg/public\\_release/biology/G3\\_E5\\_I2.html](http://mdk12.org/instruction/clg/public_release/biology/G3_E5_I2.html))

- a. Define the term *ecosystem*. (2 marks)
- b. The red oak tree is the producer.
  - i) Name the process it performs to introduce energy in the food web. (1 mark)
  - ii) Explain what happens to the organisms in the food web if the red oak is removed. (2 marks)
- c. Explain why removing the fiery searcher beetle from the food web may lead to:
  - i) a decrease in the amount of carpenter ants; (2 marks)
  - ii) an increase in deer mice. (3 marks)
- d. The deer tick is a parasite. Several deer ticks may be present on the deer mouse, which is one of its possible hosts. Define the term *parasite*. (2 marks)

- e. Explain why the deer mouse can be considered both a primary consumer as well as a secondary consumer. (2 marks)
- f. Sketch a pyramid of numbers to reflect the feeding relationship between the following organisms shown in the food web above: red oak, gypsy moth caterpillar, carpenter ant and blue jay. (4 marks)
- g. Describe how the nutrients that are present in the blue jay may be returned to the red oak. (3 marks)
- h. Energy flow decreases along the food chain from the red oak to the blue jay. Give **TWO** reasons for this. (4 marks)

**(Total 25 marks)**

**8.** Comment on the biological importance of **each** of the following statements.

- a. Classification systems are used to give organisms scientific names. (4 marks)
- b. Farmers benefit if they grow crops such as celery, lettuce and tomatoes in glasshouses. (6 marks)
- c. Sheep do not have cells that secrete enzymes in their rumen (the first chamber in the stomach) but they can still breakdown cellulose. (5 marks)
- d. Deforestation affects both soil erosion and mineral leaching. (5 marks)
- e. Some flowers have stamens hanging out whilst other have stamens hidden within the flower itself. (5 marks)

**(Total: 25 marks)**