

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

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SUBJECT:	<b>Biology</b>
PAPER NUMBER:	I
DATE:	6 <sup>th</sup> September 2012
TIME:	9:00 a.m. to 11:00 a.m.

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

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

**The world's smallest frog discovered**

A frog species that appears to be the world's smallest has been discovered in Papua New Guinea. At 7mm long, *Paedophryae amanuensis* may be the world's smallest vertebrate. The team of researchers also found a slightly larger relative, *Paedophryae swiftorum*. The researchers suggest that the frogs' tiny size is linked to their habitat, in leaf litter on the forest floor. The researchers remarked that finding the frogs was not an easy task. The frogs were well camouflaged among leaves on the forest floors and they have evolved calls resembling those of insects, thus making them hard to spot. These small frogs are probably prey for a large number of relatively small invertebrates that don't usually prey on frogs. Predators may well include scorpions.

(adapted from [www.bbc.co.uk/news/science-environment](http://www.bbc.co.uk/news/science-environment))

- a. From the passage above write the term that best describes **each** of the following statements:
- i) dead plant material on the soil surface: \_\_\_\_\_
  - ii) organisms that do not have a backbone: \_\_\_\_\_
  - iii) arthropods characterized by the presence of three pairs of legs and one pair of antennae: \_\_\_\_\_
  - iv) organisms that are structurally similar that can produce fertile offspring. \_\_\_\_\_
  - v) the exact place where an organism lives: \_\_\_\_\_

(5 marks)

- b. A number of predators eat a variety of different prey species. Explain the advantage of this strategy.

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(2 marks)

- c. Explain the benefit of camouflage for the newly discovered frog species.

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(1 mark)

- d. i) Name the kingdom in which frogs are classified.

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(1 mark)

- ii) Name the class of vertebrates to which frogs belong.

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(1 mark)

- e. A study revealed that a number of frogs are being affected by a fungus called the chytrid fungus. The fungus coats the frog's skin and prevents pores in it from carrying out their function. Explain why this fungus is leading to the death of frogs.

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(2 marks)

**(Total: 12 marks)**

2. a. Distinguish between *passive* and *active* transport.

Passive: \_\_\_\_\_

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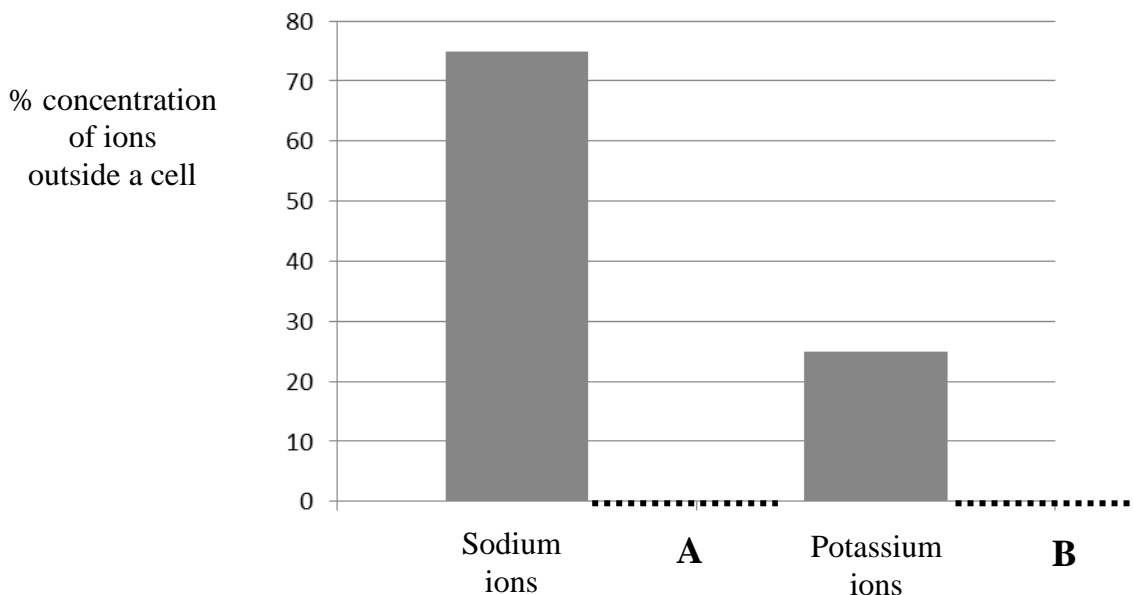
Active: \_\_\_\_\_

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(2 marks)

**DO NOT WRITE IN THIS SPACE**

- b. Onion epidermal cells were placed in a solution containing sodium and potassium ions. The bar chart shows the relative concentrations of sodium ions and potassium ions in the solution outside the onion epidermal cells.



On the bar chart above:

- i) Draw a bar on dotted line **A** to show a possible concentration of sodium ions inside the onion cell, at the start of the experiment, if sodium is to enter the cell passively. (1 mark)
  - ii) Draw a bar on dotted line **B** to show a possible concentration of potassium ions inside the cell, if potassium enters the cell actively. (1 mark)
- c. Define the term *osmosis*.

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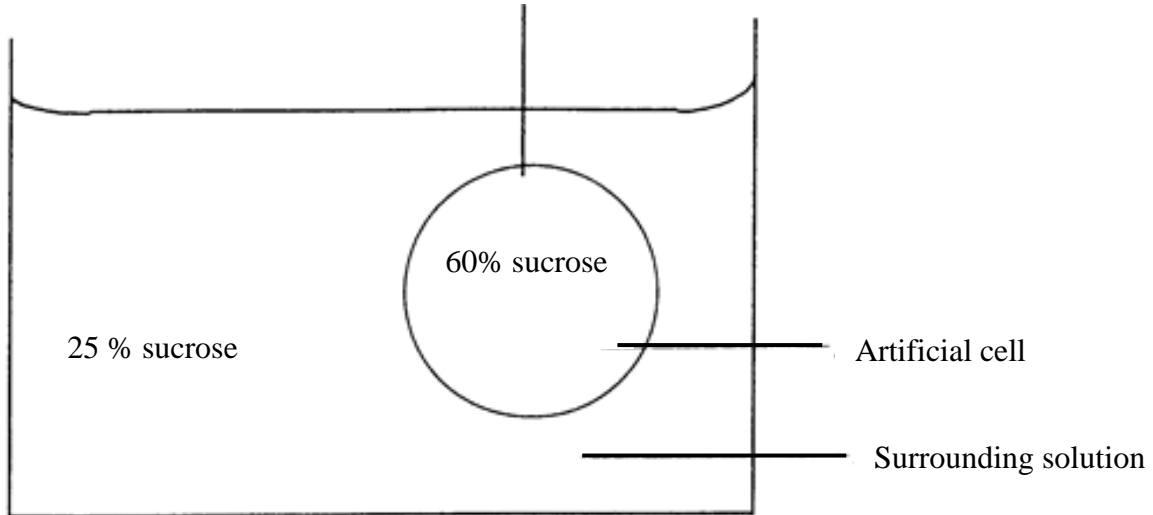
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(2 marks)

*This question continues on the next page.*

**DO NOT WRITE IN THIS SPACE**

- d. The diagram shows an artificial cell filled with sucrose solution. It is immersed in another solution of sucrose. The membrane of the artificial cell allows water to pass through but prevents the passage of sucrose.



On the diagram draw an arrow to show the direction of movement of water. On the lines provided below give a reason for your answer.

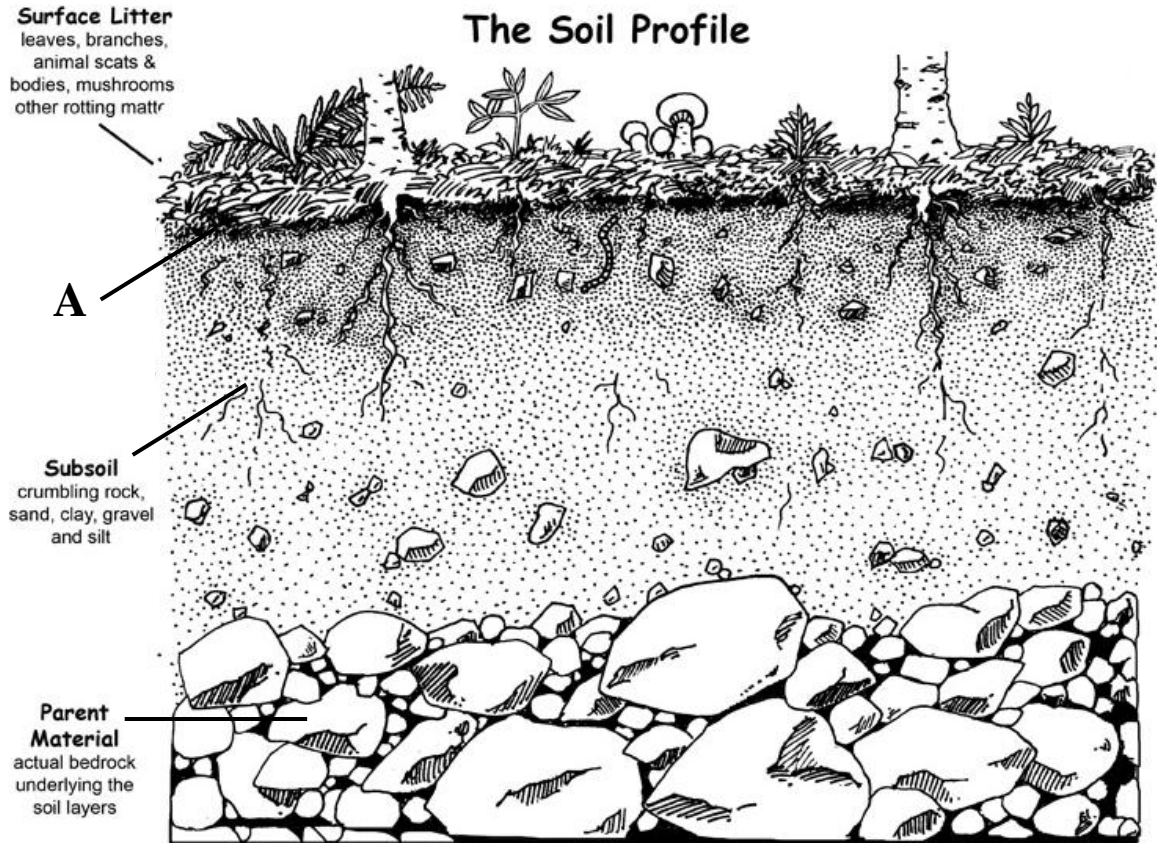
Reason: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(3 marks)  
**(Total: 9 marks)**

3. The following diagram shows a section through various soil layers.



(<http://www.exploringnature.org>)

a. Name layer A.

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

b. A farmer grows the same crop, year after year, on the same piece of land. List **TWO** disadvantages of this agricultural practice.

Disadvantage 1: \_\_\_\_\_

\_\_\_\_\_

Disadvantage 2: \_\_\_\_\_

\_\_\_\_\_

(2 marks)

**DO NOT WRITE IN THIS SPACE**

- c. The following diagram shows a poster for a campaign aimed at preventing forest fires.



Describe the effect of forest fires on:

- i) greenhouse gas emissions

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(1 mark)

- ii) soil.

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(1 mark)

- d. A biology student designed the following poster for a school-based competition entitled 'Biodiversity'.



*(www.birdorable.com)*

Give a biological explanation of the poster.

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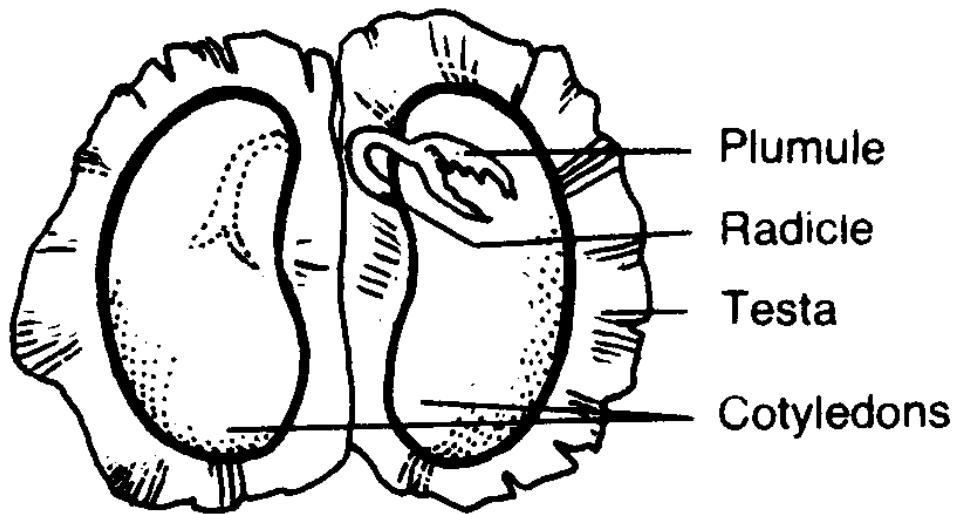
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(3 marks)

**(Total: 8 marks)**

DO NOT WRITE IN THIS SPACE

4. The diagram shows a dissected dicot seed.



- a. Use the labels in the diagram to name the structure that best matches **each** description in the table below:

Description	Structure
Protects the plant embryo and cotyledons	
Develops into a root upon germination	
Develops into a shoot upon germination	
Provides a store of starch	

(4 marks)

- b. Give **ONE** difference between the seed in the diagram above and a monocot seed.

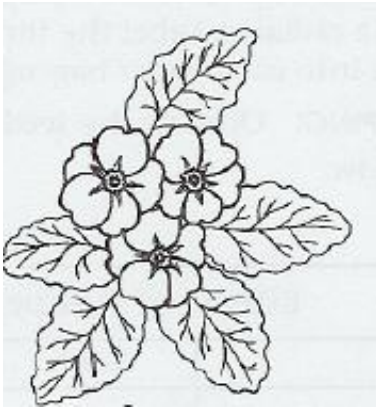
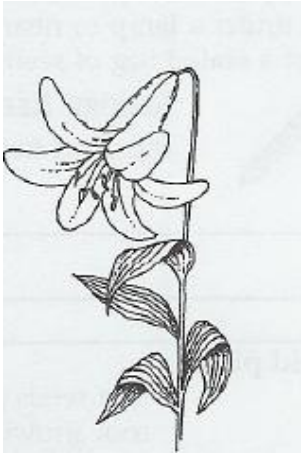
(1 mark)

- c. Name **ONE** group of plants that do not produce seeds.

(1 mark)

**DO NOT WRITE IN THIS SPACE**

- d. i) The table below shows 2 types of flowers. Identify which flower is a monocot and which is a dicot. In the space provided under each picture write **M** for monocot and **D** for dicot.

Swamp mallow	Lemon fawn lily
	

(2 marks)

- ii) List **two** visible features used to identify each type of plant shown in the table above as a monocot or a dicot.

Feature 1: \_\_\_\_\_

\_\_\_\_\_

Feature 2: \_\_\_\_\_

\_\_\_\_\_

(2 marks)

**(Total 10 marks)**

5. Seedlings from 100g of maize seeds were grown in the dark for 10 days. The seedlings were then analysed and compared for the presence of cellulose, starch, organic material and ash with 100g of ungerminated seeds. The following table shows the results obtained.

	Dry mass of ungerminated seeds (g)	Dry mass of seedlings after 10 days (g)
Cellulose	2	5
Starch	63	9
Other organic material	13	27
Ash	2	4
<b>Total dry mass</b>	<b>80</b>	<b>45</b>



- a. Calculate the percentage difference in the amount of cellulose in seedlings and ungerminated seeds.

Answer: \_\_\_\_\_  
(3 marks)

- b. Explain why:

- i) the seedlings contain more cellulose than the ungerminated seeds;

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

- ii) the amount of starch in seedlings is much less than in ungerminated seeds.

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

- c. The spotted maize beetle is a pest in maize fields feeding on newly planted maize seeds, causing damage before and after germination. The adult beetles are found in large numbers in January and February, feeding on pollen from a wide variety of plants.

- i) Name the part of the flower that produces pollen.

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

- ii) What is contained in the pollen grains?

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

- iii) Name the part of the flower where pollen grains land and produce a pollen tube when transferred by insects or wind.

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

**DO NOT WRITE IN THIS SPACE**

- d. List **TWO** differences in the structure of the pollen grains produced by wind-pollinated and insect-pollinated flowers.

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(2 marks)

**(Total 11 marks)**

6. The following table compares the heart of a person before gaining fitness and after gaining fitness.

	Before gaining fitness	After gaining fitness
Amount of blood pumped out of the heart during each beat (cm <sup>3</sup> )	64	80
Heart Volume (cm <sup>3</sup> )	120	140
Heart rate (beats/min)	72	63

- a. Describe how the change in heart volume affects the amount of blood pumped at each beat after gaining fitness.

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(1 mark)

- b. Explain why the heart rate is reduced after gaining fitness.

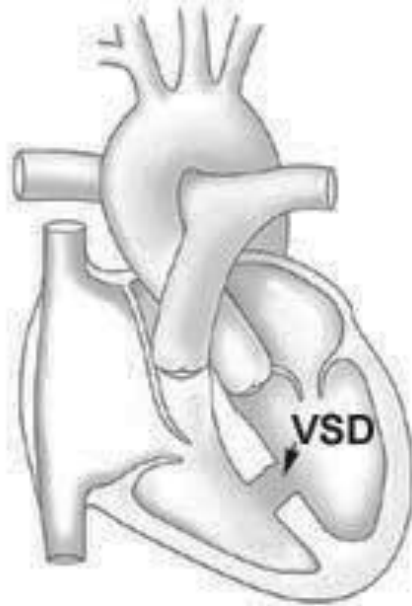
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(2 marks)

- c. A ventricular septal defect (VSD) is a hole in the part of the septum (wall) that separates the ventricles in the heart.



Compare the flow of oxygenated blood from the left ventricle in a normal child and a child suffering from VSD.

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(2 marks)

- d. Suggest what type of change in the heart rate would be expected in a child suffering from VSD.

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(1 mark)

- e. Atrial septal defect (ASD) is a hole in the part of the septum (wall) that separates the upper chambers of the heart.

Name the upper chamber of the heart that:

- i) receives blood from the vena cava;

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(1 mark)

**DO NOT WRITE IN THIS SPACE**

ii) receives blood from the pulmonary veins.

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(1 mark)

f. Explain why children with ASD or VSD suffer from shortness of breath.

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(2 marks)

**(Total 10 marks)**

7. **Table 7.1** shows nutrition facts labels of a particular brand of breakfast biscuits. **Table 7.2** shows the % of recommended daily requirements provided by the same brand of breakfast biscuits.

**Table 7.1**

<b>Nutrition Facts</b>	
<b>Amounts per 50g serving</b>	
Total Fat	11g
Cholesterol	0 g
Sodium	0.008 g
Total Carbohydrate	37g
Dietary fibre	9g
Sugars	4g
Protein	12g

**Table 7.2**

<b>Nutrition Facts</b>	
<b>% of daily recommended allowance provided per 50g serving</b>	
Vitamin A	0%
Vitamin C	1%
Calcium	9%
Iron	17%

(adapted from <http://morningsunshinebreakfastcookie.com/page/2/>)

**DO NOT WRITE IN THIS SPACE**

Use the information in the nutrition facts label to answer the following questions.

a. Give **ONE** reason why:

- i) an obese person should avoid including these biscuits in his or her diet.

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

- ii) a diabetic person may consider including these biscuits in his or her diet.

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

- iii) a person suffering from anaemia was asked by his doctor to include these biscuits in his or her diet.

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

b. Give **ONE** advantage that the biscuits include Calcium.

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

c. The label also suggests that a serving of breakfast biscuits provides 12% of the calories needed every day. It notes that the total daily energy values of calories needed may vary. List **TWO** factors that may increase the amount of energy calories needed by a person.

Factor 1: \_\_\_\_\_

Factor 2: \_\_\_\_\_

(2 marks)  
**(Total 10 marks)**

**DO NOT WRITE IN THIS SPACE**

8. In producing liquid-centred chocolates, a sucrose paste is put at the centre of chocolates. The enzyme sucrase is injected in the chocolate centre and sucrose is digested to liquid glucose and fructose.

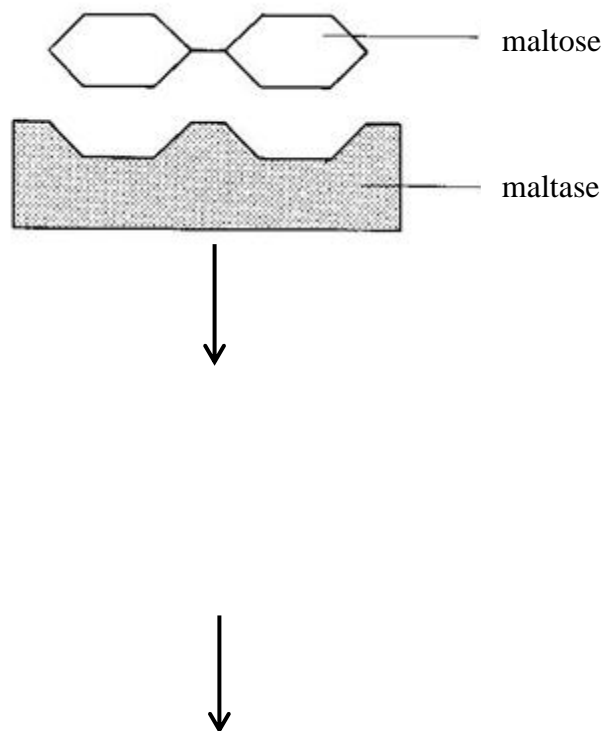
a. From the information given in the paragraph above, name **ONE** monosaccharide and **ONE** disaccharide.

Monosaccharide: \_\_\_\_\_

Disaccharide: \_\_\_\_\_

(2 marks)

b. i) Using the explanation given above complete the diagram to show the action of the enzyme maltase on maltose. Label the diagrams.



(4 marks)

ii) Explain why when the enzyme amylase is used instead of invertase, sucrose is not digested.

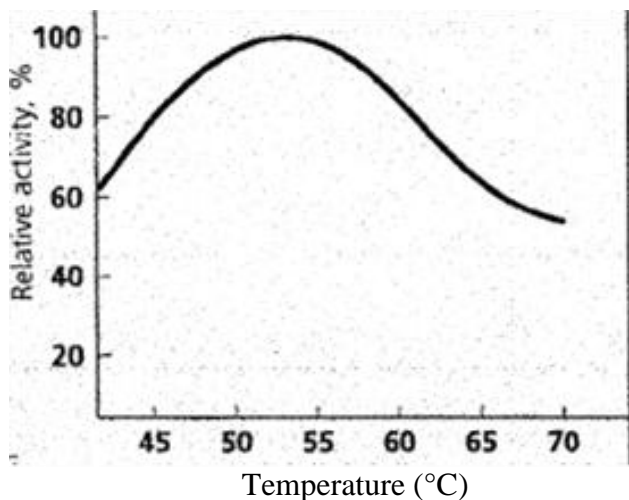
\_\_\_\_\_

\_\_\_\_\_

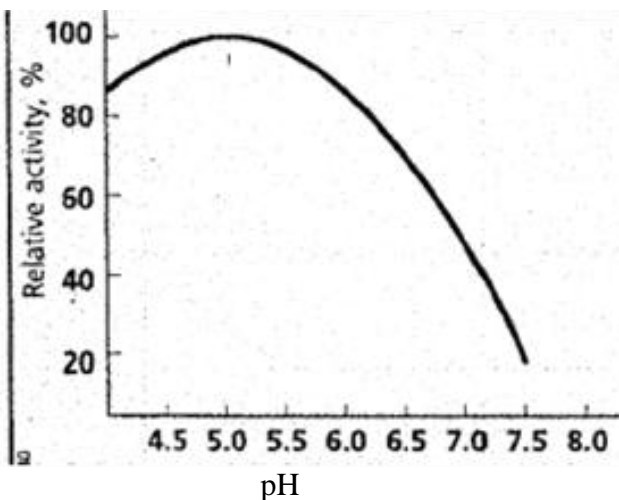
(3 marks)

DO NOT WRITE IN THIS SPACE

- c. The enzyme cellulase is used in the process of denim stone-washing. The two graphs below show the activity of the enzyme cellulase at different temperatures and pHs respectively.



Graph of Relative activity against temperature



Graph of Relative activity against pH

From the graphs above list the temperature and pH that give maximum relative activity of the enzyme.

- i) Temperature: \_\_\_\_\_ °C  
 ii) pH: \_\_\_\_\_

(2 marks)  
 (Total 11 marks)

9. The list below includes eight structures found in organisms of different kingdoms.

**Spiracles, Xylem, Nephron, Contractile vacuole,  
 Alveoli, Permanent vacuole, Phloem, Sweat gland**

- a. From the list above write the structure that matches each of the functions given. (Note: not all structures will be used.)

- i) site of gaseous exchange of respiratory gases in mammals: \_\_\_\_\_  
 ii) expels water to out of the cell: \_\_\_\_\_  
 iii) tissue made up of hollow, dead cells: \_\_\_\_\_  
 iv) conducts products of photosynthesis in vascular plants: \_\_\_\_\_  
 v) secretes a salty fluid; important in body temperature regulation: \_\_\_\_\_

(5 marks)

- b. Some organisms have different structures for similar functions. Complete the following sentence by filling in the blank space with the most appropriate structure:

If the spongy mesophyll is the site of gaseous exchange in plants, the \_\_\_\_\_ are the site of gaseous exchange in fish.

(1 mark)

**DO NOT WRITE IN THIS SPACE**

- c. Chromosomes are structures found in cell nuclei in eukaryotic cells. Give the function of chromosomes in cells.

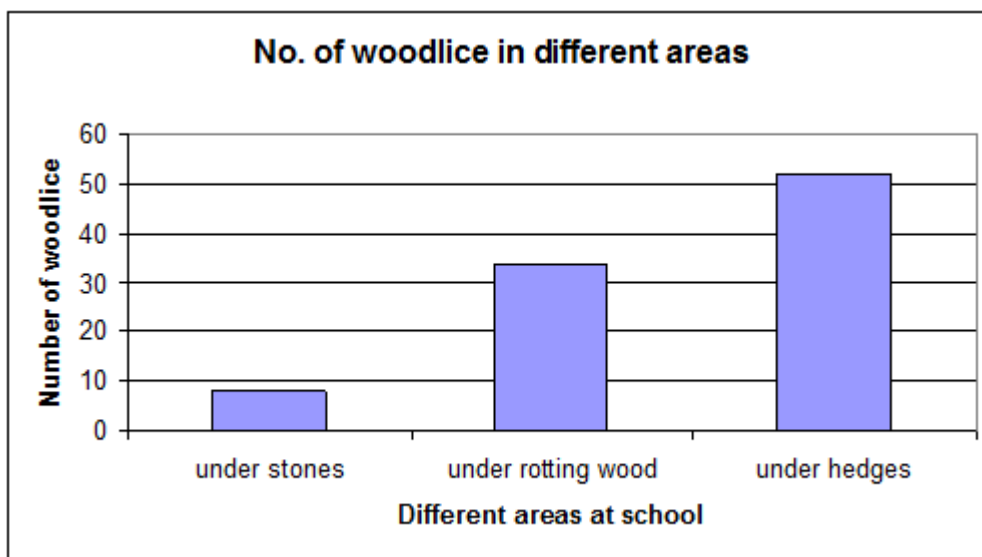
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(2 marks)

**(Total 8 marks)**

10. A group of biology students investigated the habitat of woodlice. They observed woodlice under stones, rotting wood and hedges (bushes) and counted the number of woodlice in these habitats. The bar chart below shows the results.



- a. Use the bar chart above to describe the trend in the variation of the number of woodlice in different habitats.

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(3 marks)



**DO NOT WRITE IN THIS SPACE**

b. List **TWO** characteristics common to all woodlice habitats.

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(2 marks)

c. Name one of the three habitats listed in the bar chart that is expected to provide the most damp environment. Give a reason for your choice.

Most damp habitat: \_\_\_\_\_

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

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(2 marks)

d. The Pygmy White-toothed Shrew (*Suncus etruscus*) is a predator of woodlice.

i) Define the term *predator*.

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(2 marks)

ii) The Sicilian Shrew (*Crocedura sicula*) is another type of shrew found on the Maltese Islands. Is the Sicilian shrew closely related to the Pygmy White? Give **ONE** reason for your answer.

Answer: \_\_\_\_\_

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

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(2 marks)

**(Total 11 marks)**

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**END OF QUESTIONS**

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

**SECONDARY EDUCATION CERTIFICATE LEVEL**

**SEPTEMBER 2012 SESSION**

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SUBJECT: **Biology**  
 PAPER NUMBER: IIB  
 DATE: 6<sup>th</sup> September 2012  
 TIME: 4:00 p.m. to 6:00 p.m.

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

*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. In 2008 the total generation of waste in the 27 EU countries amounted to 2.62 billion tonnes. The following table shows the amount of construction waste generated by five European countries in 2008, as a percentage ratio of their respective surface area.

Country	Waste : surface area (%)
Germany	55
Italy	23
Belgium	49
Malta	333
United Kingdom	42

(Source: <http://epp.eu.eurostatec.europa>)

- a. On the graph paper provided, draw a bar chart to show the percentage ratio of waste to surface area for each country listed in the table above. (6 marks)
- b. The following poster was designed for a campaign aimed to reduce waste production. List **TWO** ways how waste can be reduced in a school. (4 marks)



- c. List **TWO** benefits of recycling waste. (4 marks)
- d. List **TWO** materials from construction and demolition debris that can be recycled or reused. (2 marks)

- e. A landfill site is a site for the disposal of waste materials by burial. A newspaper journalist wrote:

*'Landfills and the surrounding areas are often heavily polluted.  
Landfills can attract pests such as rats, mosquitoes, cockroaches and seagulls.'*

- i) List **TWO** air pollutants that might be generated in a landfill area. (2 marks)
  - ii) List **TWO** other possible disadvantages of landfills to the inhabitants of the area. (4 marks)
- f. The practice of turning kitchen and garden waste into compost can be considered as a beneficial waste minimisation method.
- i) List **ONE** advantage of compost use by a gardener. (2 marks)
  - ii) A student wrote that compost is organic matter that has been decomposed aerobically or anaerobically. Distinguish between the terms *aerobically* and *anaerobically*. (1 mark)
- (Total: 25 marks)**

2. a. Both the nervous system and the endocrine system co-ordinate the functions of the mammalian body. List **THREE** differences between the two systems. You may present your answer in the form of a table. (6 marks)

- b. There is an increased tendency for developing diabetes in the Maltese population. Diabetics suffer from excess glucose in their blood.

- i) Name the endocrine gland which controls the blood glucose levels. (1 mark)
- ii) List the hormone produced by this gland which converts glucose to glycogen. (1 mark)
- iii) Explain why it is healthier to eat a high fibre cereal breakfast rather than a doughnut. (4 marks)

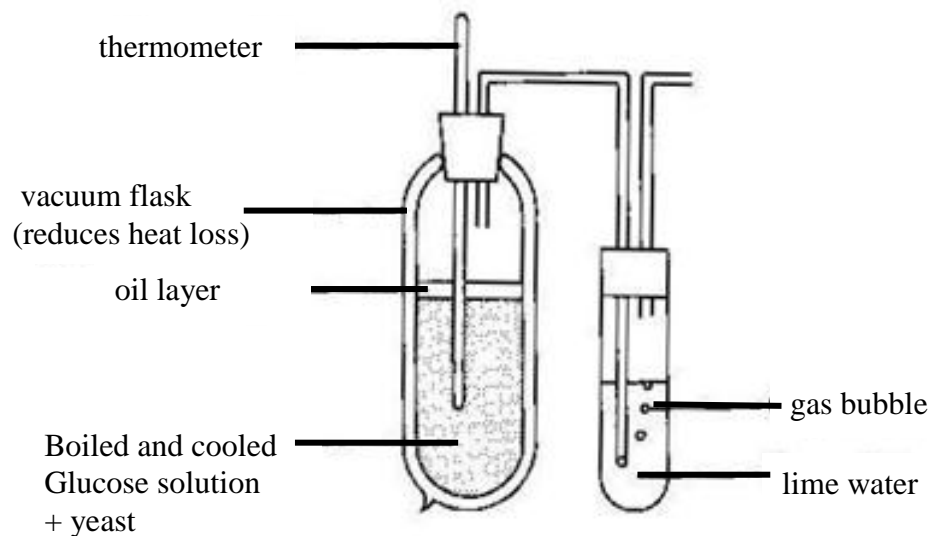
- c. Spinal muscular atrophy (SMA) is a genetic disease that attacks motor neurons of the spinal cord.

- i) Draw a large diagram of a motor neurone and label **three** features. (3 marks)
- ii) On your diagram show the direction in which a nerve impulse would normally travel. (1 mark)
- iii) Describe the pathway taken by a nerve impulse along a reflex arc. Start from a named stimulus and describe in detail the pathway until a response is produced. (5 marks)

- d. i) Plants also respond to stimuli. Explain why plants grow towards a unilateral source of light. (3 marks)

- ii) Name this plant response. (1 mark)
- (Total: 25 marks)**

3. The diagram below shows an apparatus used to observe anaerobic respiration (fermentation) in yeast.



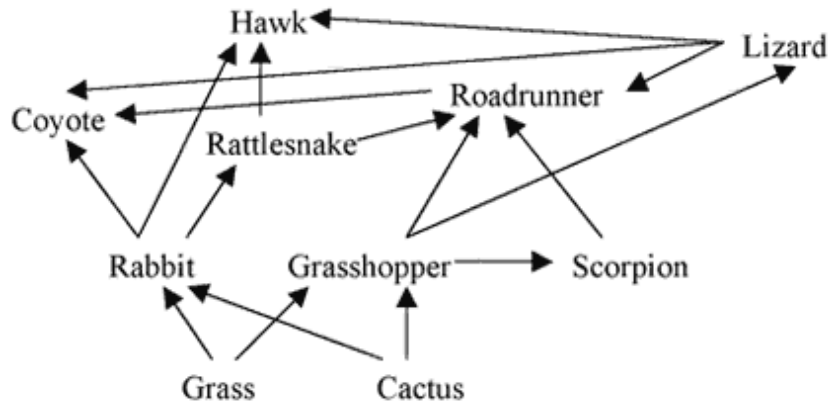
- a. Define *respiration*. (2 marks)
- b. Name the gas being produced by the reaction. (1 mark)
- c. State the use of the following in the experiment:
- i) the oil layer; (2 marks)
  - ii) the lime water; (2 marks)
  - iii) the vacuum flask. (2 marks)
- d. Give **ONE** reason why the glucose solution was:
- i) boiled; (1 mark)
  - ii) cooled before adding the yeast. (1 mark)
- e. Yeast is a fungus.
- i) Give **ONE** characteristic of fungi. (2 marks)
  - ii) Name the type of asexual reproduction performed by yeast cells. (1 mark)
  - iii) Give **ONE** disadvantage of asexual reproduction. (2 marks)
- f. In another experiment a Biology student compared the rates of fermentation of glucose and sucrose solutions using yeast. The student set up the apparatus above using water instead of limewater. The time to produce 10 gas bubbles was recorded. The experimental apparatus was first set up with glucose and then repeated with sucrose.
- i) What other apparatus would the students need to obtain their results? (1 mark)
  - ii) Identify the solution that would give a faster rate of reaction and give **ONE** reason for your answer. (4 marks)
- g. After heavy exercise, human muscle produces lactic acid and builds up an oxygen debt.
- i) Explain the term *oxygen debt*. (2 marks)
  - ii) List **ONE** effect of lactic acid production in muscle. (2 marks)

**(Total: 25 marks)**

4. a. The life cycle of a mung bean plant starts from the seed. For the seed to germinate it needs water.
- Explain the importance of water in germination. (2 marks)
  - List **TWO** other environmental factors that will affect germination. (2 marks)
  - Mung beans exhibit epigeal germination. Distinguish between *epigeal* and *hypogeal germination*. (4 marks)
- b. Bean seedlings are attached with horizontal plumules to two clinostats. One clinostat is set rotating while the other is kept stationary. The results of this investigation were observed after 24 hours.
- Name the type of plant response studied in this investigation. (2 marks)
  - Describe the changes, if any, observed in the seedlings attached to the rotating clinostat and to the stationary clinostat. (4 marks)
- c. When the bean seedlings form their first leaves, the plants start to photosynthesize.
- Give a word equation that summarizes the process of photosynthesis. (3 marks)
  - Name the pigment needed to absorb sunlight energy. (1 mark)
  - Magnesium is necessary for the formation of the pigment needed to absorb sunlight energy. Explain what happens to the plant if this mineral is lacking in the surrounding soil. (2 marks)
  - How is this mineral transported from the soil to the cells where the pigment is produced? (2 marks)
- d. Explain why farmers try to raise the carbon dioxide concentration in green houses. (3 marks)
- (Total: 25 marks)**
5. Autosomal dominant polycystic kidney disease (ADPKD) is a genetic disease that predominantly affects the kidneys but may affect other organs including the liver, pancreas, brain and arterial blood vessels.
- a. List **ONE** function of the:
- liver in humans; (2 marks)
  - arterial blood vessels (arteries). (2 marks)
- b. Name the:
- largest part of the brain; (1 mark)
  - master gland in the brain; (1 mark)
  - part of the brain that controls heart beat and blood pressure. (1 mark)
- c. The kidneys play an important role in homeostasis. Explain this homeostatic role played by the kidneys. (3 marks)
- d. Define the term *dominant* as used in the introduction of this question. (2 marks)
- e. A father affected by ADPKD and a normal healthy mother had two daughters, one was affected with the disorder while the other was normal.  
Work out a genetic diagram to explain this pattern of inheritance. Use **D** to represent a person with ADPKD and **d** to represent a normal person. (6 marks)

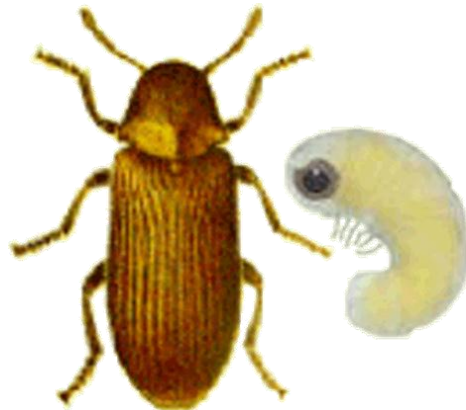
- f. Two affected parents had a normal child. However the genetic counsellor explained to the parents that they still have a high percentage chance of having an affected second child. Work out a genetic diagram to find out the percentage chance of having a child suffering from ADPKD. (5 marks)
- g. A student wrote that *scurvy and rickets* are also genetic diseases. Explain why this statement is incorrect. (2 marks)
- (Total: 25 marks)**

6. The following diagram shows a foodweb in the desert biome.

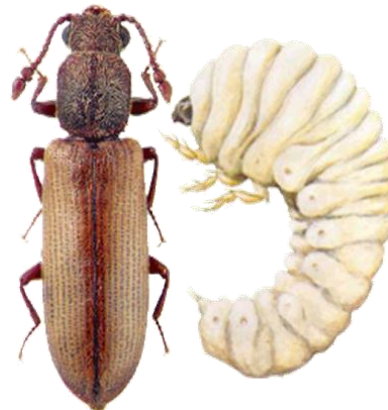


- a. From the diagram name:
- i) **two** reptiles; (2 marks)
  - ii) **two** secondary consumers; (2 marks)
  - iii) **two** primary consumers. (2 marks)
- b. Describe **TWO** adaptations of plants that enable them to survive in a desert environment (2 marks)
- c. Describe **TWO** adaptations of animals that allow them to survive in deserts. (4 marks)
- d. Describe **ONE** adaptation of the dentition in rabbits to a diet consisting mainly of plant material. (2 marks)
- e. Distinguish between *producers* and *consumers*. (4 marks)
- f. Use the food web to build a food chain involving **five** trophic levels. (5 marks)
- g. Hawks are bird species commonly found in desert biomes. Explain why some of the largest feathers are attached to the wing. (2 marks)
- (Total 25 marks)**

7. a. Define the term *homeostasis*. (2 marks)
- b. Distinguish between an *endotherm* and an *ectotherm*. (4 marks)
- c. Give **ONE** biological reason for the following observations:
- i) At the end of the game, the basketball players returned to the dressing rooms sweating heavily. (2 marks)
  - ii) Katrina was very pale when she boarded the bus after waiting for fifteen minutes for a bus on a cold day in January. (2 marks)
  - iii) The uniform of workers in a bakery typically includes a **light white** shirt. (2 marks)
  - iv) John noticed that his pet hamster ate more food during the cold winter months rather than the warm summer months. (3 marks)
- d. Explain why it is important to keep a constant volume of blood in the circulatory system. (2 marks)
- e. The nephron plays an important role in osmoregulation in humans. The following are the main parts of the nephron:  
Bowman's capsule, proximal convoluted tubule; Loop of Henle; distal convoluted tubule and collecting duct.
- i) Draw a labelled diagram to show the structure of the nephron. Label the main parts clearly. (4 marks)
  - ii) Give the function of the Bowman's capsule and the Loop of Henle. (4 marks)
- (Total: 25 marks)**
8. Woodworm is a collective name for several different species of insects that bore in wood. These parasitic insects cause a lot of damage to the environment and are a real threat to wood. They feed totally on wood substance. The figure shows 2 species of woodworm.



*Anobium punctatum*



*Brunneus lyctus*

