

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

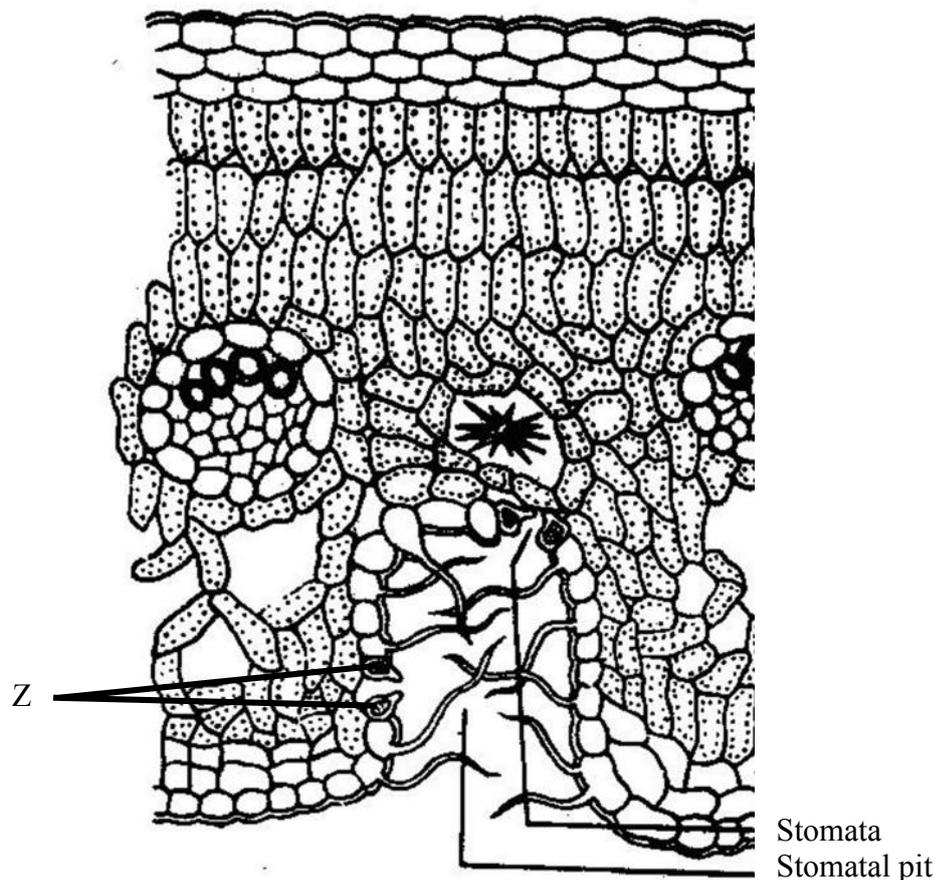
SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2014 SESSION

SUBJECT:	Biology
PAPER NUMBER:	I
DATE:	20 th May 2014
TIME:	4:00 p.m. to 6:00 p.m.

ANSWER ALL QUESTIONS IN THIS PAPER IN THE SPACES PROVIDED.

1. The following diagram shows a cross-section through a leaf *Nerium odorum*.



(http://learning.uonbi.ac.ke/courses/SBT204/scormPackages/path_2/nerium.JPG)

a. On the diagram label the following structures:

- i) an epidermal cell;
- ii) a palisade cell;
- iii) a spongy mesophyll cell;
- iv) a vascular bundle;
- v) the waxy cuticle.

(5 marks)

b. Name the cells labelled Z.

(1 mark)

c. Explain why stomata:

i) tend to be open during the day;

(1 mark)

ii) and close during the night.

(1 mark)

d. *Nerium odorum* lives in very dry environments. Give TWO structural features, visible in the diagram that support this statement.

(2 marks)

(Total 10 marks)

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

The discovery of new mammals is a rare event. The olinguito is the newest member of the family *Prycyonidae*. Indeed the olinguito is distinct from the other species within the genus, known as olingo. A new study published recently has established through DNA and other anatomical evidence that the olinguito *Bassaricyon neblina* is a distinct species. Olingos have reddish brown fur and live in the fast disappearing high forest of Ecuador and Columbia.

(www.opsci.com/science/article/2013-08)

a. From the passage write:

i) the scientific name of the olinguito;

(1 mark)

ii) the name of the molecule that carries genetic information;

(1 mark)

iii) ONE characteristic feature of mammals.

(1 mark)

b. Use information in the passage to explain why this newly discovered mammal is considered at critical risk of extinction.

(1 mark)

c. The olinguito is a carnivore.

i) Explain why canines in a carnivore are sharp and pointed.

(1 mark)

ii) Name the TWO types of teeth used to crush food on **each** side of the mouth in a herbivore.

(2 marks)

iii) Compare the movement of the jaw in a carnivore with that of a herbivore.

(2 marks)

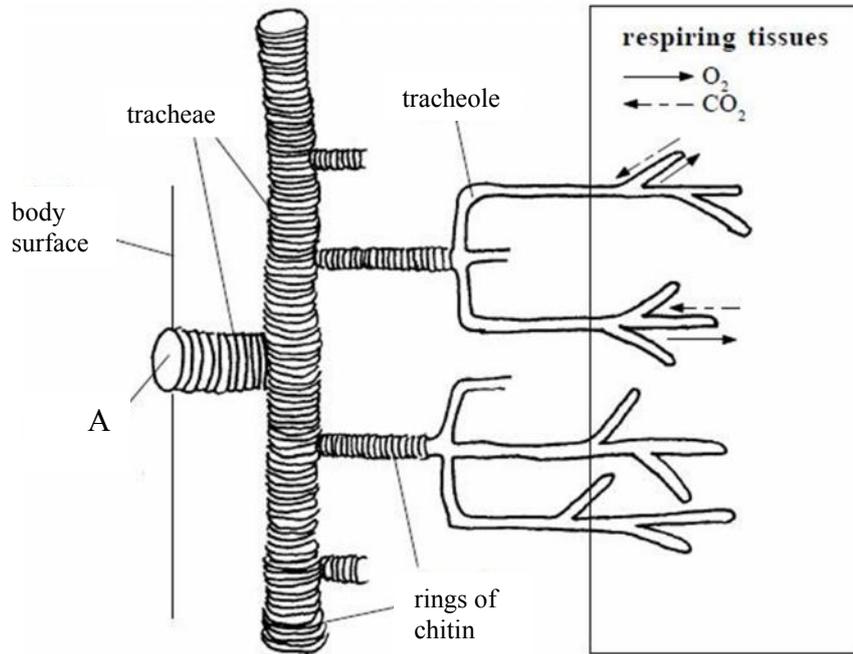
d. Explain why carnivores do not need cellulose-digesting bacteria in their stomach.

(1 mark)

(Total: 10 marks)

Please turn the page.

3. The diagram below shows a cross section through part of a tracheal system in an insect.



(http://3.bp.blogspot.com/_hhUdKwzDmA4/TIPHcZJAMyI/AAAAAAAAArg/KxrwHwJJeRs/s1600/Tracheal+system.jpg)

- a. i) Name the part labelled A. _____ (1 mark)
- ii) The insect may keep the part labelled A closed when air is not flowing through the tracheal system. Give the advantage of this observation.

(2 marks)

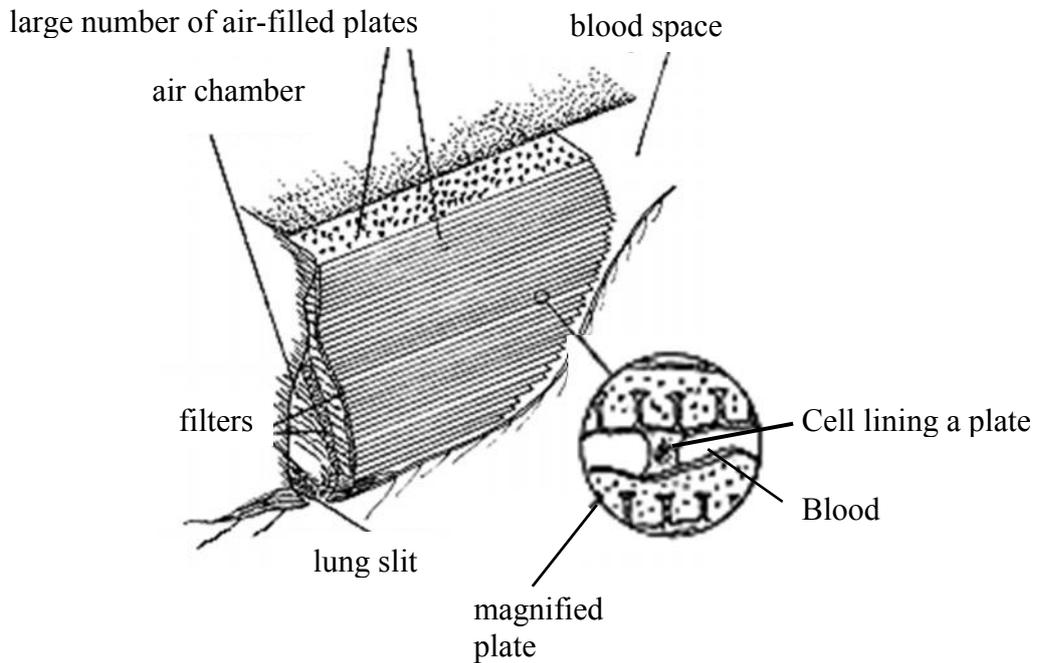
b. Explain why rings of chitin are present in the wall of the tracheae.

(2 marks)

c. The repeated branching of trachea into tracheoles increases the rate of uptake of oxygen. Explain why.

(2 marks)

- d. The diagram shows a section through book lungs. These are the gas exchange surfaces in spiders and scorpions.



(<http://www.burkemuseum.org/spidermyth/images/lung250.gif>)

Give THREE characteristics that make book lungs efficient gas exchange surfaces.

(3 marks)
(Total: 10 marks)

Please turn the page.

4. Fruit flies have grey bodies or black bodies. Grey body colour (G) is dominant to black body colour (g). The following table shows three different genetic diagrams A, B and C.

Genetic diagram letter:	A
Parents	GG x gg
Gametes	G G g g
F1 generation	Gg Gg Gg Gg

Genetic diagram letter:	B
Parents	Gg x gg
Gametes	G g g g
F1 generation	Gg Gg gg gg

Genetic diagram letter:	C
Parents	GG x Gg
Gametes	G G G g
F1 generation	GG Gg GG Gg

- a. Write the letter at the top of each genetic diagram that represents the breeding between:

i) two grey body fruit flies _____

ii) a pure breeding grey fly with a pure breeding black fly. _____

(2 marks)

- b. Compare the body colour of the phenotype of the F1 generation for genetic diagrams A and B.

(2 marks)

- c. Two grey body fruit flies were bred together and 25 % of the offspring were black bodied fruit flies. In the table provided, draw a genetic diagram to explain this observation.

Parents:	Grey body fruit fly		Grey body fruit fly	
Genotype of parents				
Gametes:				
F1 generation:				

(4 marks)

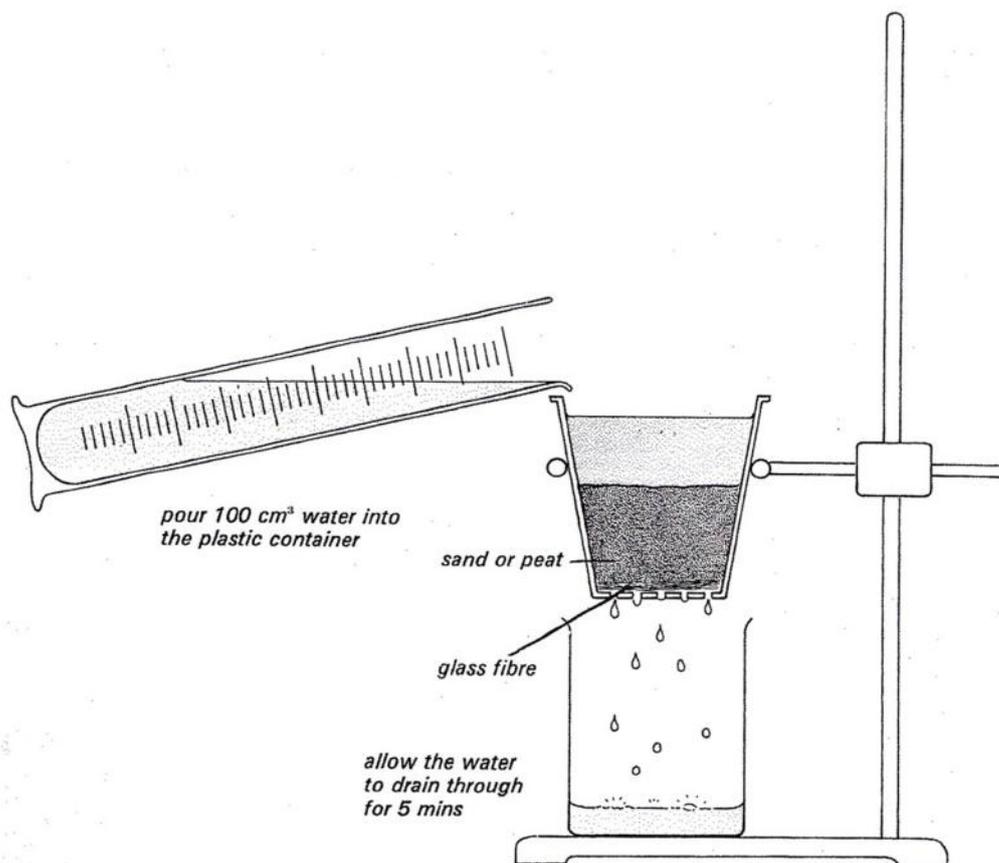
- d. Fruit flies can have long wings (**F**) or short wings (**f**). Long wing condition is dominant to the short wing condition. Write the TWO possible genotypes for a fruit fly with long wings.

(2 marks)

(Total: 10 marks)

Please turn the page.

5. The diagram below shows the apparatus used in an investigation on the retention of water by soil. In the first part of the investigation, 100cm^3 of sand is placed in a plastic container perforated at the base and containing a disc of glass fibre to stop the sand from falling through. The apparatus was weighed. 100cm^3 of water is poured into the sand and the apparatus is allowed to stand for 5 minutes. After 5 minutes the container containing the wet sand is weighed. The experiment is repeated with 100cm^3 peat.



The results obtained are shown in the table below:

	1st weight (<i>dry sample</i>) /g	2nd weight (<i>wet sample</i>) /g	Increase in weight (water retained) /g
100cm^3 sand	50	60	10
100cm^3 peat	50	80	30

- a. i) Explain why equal volumes of water were poured into both types of soil.

(1 mark)

-
- ii) Identify the type of soil that retains more water. Give a reason for selecting this type of soil.

Type of soil: _____

Reason: _____

(3 marks)

- b. Predict whether the weight would increase more if the experiment was repeated but instead of using 100cm^3 of peat alone a mixture containing 70cm^3 peat and 30cm^3 clay was used. Give a reason for your answer.

Prediction: _____

Reason: _____

(3 marks)

- c. Describe how plant growth is affected by clay soil. Give a reason for your answer.

(3 marks)

(Total 10 marks)

Please turn the page.

6. A biology student wrote the classification table for three different organisms (X, Y and Z) as shown in the table below:

	X	Y	Z
Kingdom	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata
Class	Reptilia*	Reptilia*	Mammalia**
Order	Testudines	Squamata	Soricomorpha
Family	Cheloniodea	Lacertidae	Soricidae
Genus	<i>Caretta</i>	<i>Podarcis</i>	<i>Crocidura</i>
species	<i>caretta</i>	<i>filfolensis</i>	<i>sicula</i>

(* Class Reptilia includes reptiles, **Class Mammalia includes mammals.)

- a. Write ONE structural characteristic common to all three species in the table above.

(1 mark)

- b. Write ONE structural characteristic common to organisms X and Y only.

(1 mark)

- c. Write the letters of the organism that mainly control their body temperature through their behaviour.

(2 marks)

- d. Organism Z (*Crocidura sicula*) is an endotherm and has a very small size. Explain the disadvantage caused by its small size in relation to heat loss.

(2 marks)

- e. Organism Z feeds mainly on earthworms.

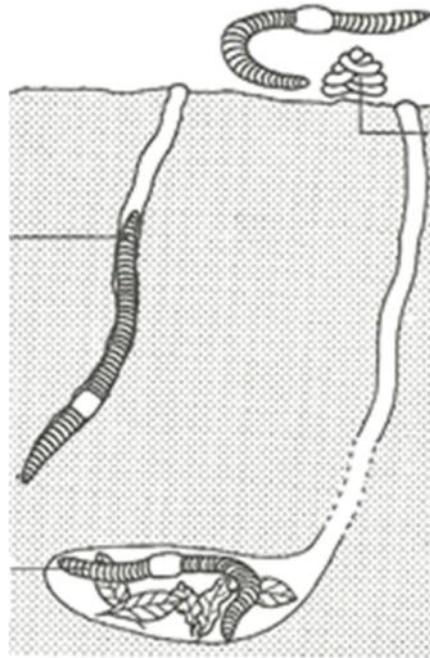
- i) Name the phylum to which earthworms belong.

(1 mark)

- ii) Describe ONE distinctive structural feature of earthworms.

(1 mark)

f. The diagram shows the activity of an earthworm in soil.



worm ejects cast of material eaten deep down in soil (thus turning it)

Describe the beneficial aspect of this activity.

(2 marks)

g. Earthworms may have internal parasites including Protozoa, Platyhelminthes and Nematodes.

i) Some free-living Protozoa have chlorophyll. Explain the importance of this observation.

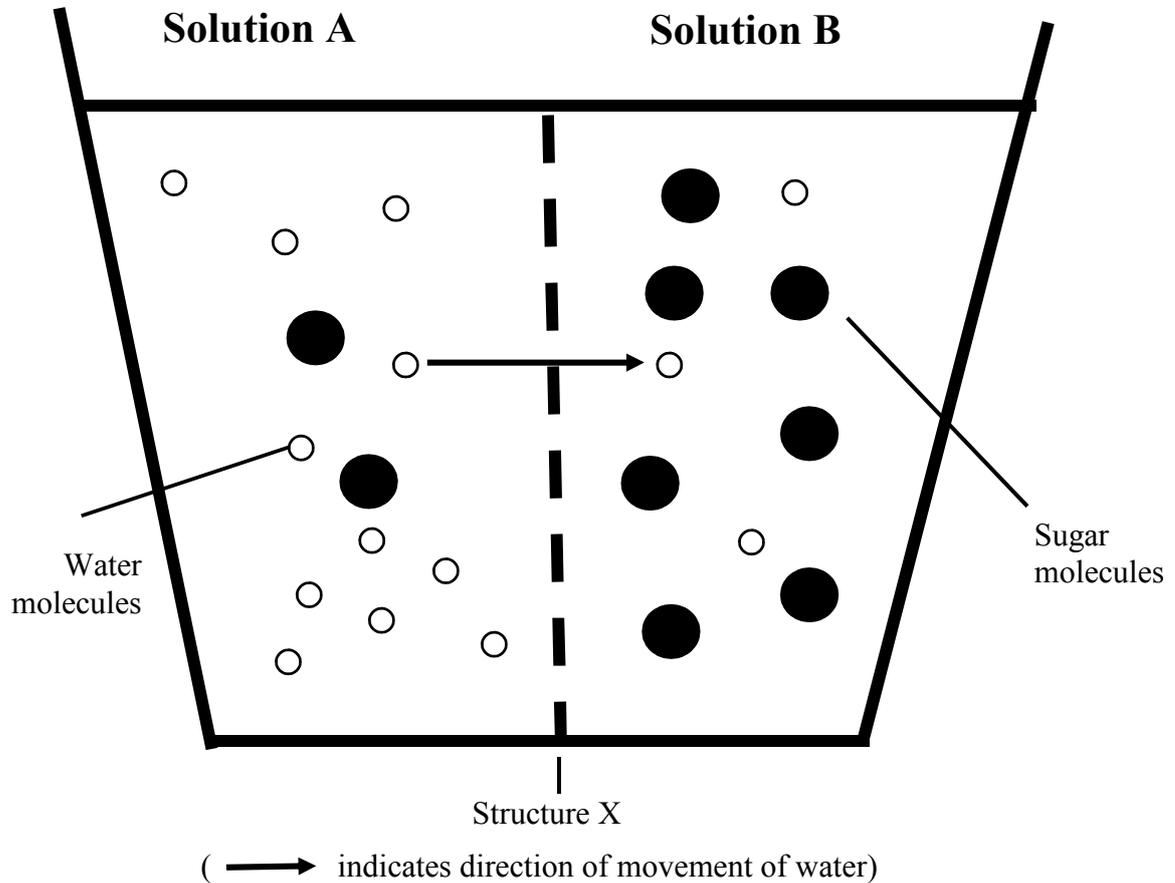
(2 marks)

ii) Compare the body structure of Platyhelminthes and Nematodes.

(2 marks)

(Total: 14 marks)

7. A student prepared the following sketch showing a biological process. The diagram shows the movement of water between two sugar solutions, A and B, that have different concentrations of sugar. The two solutions are separated by structure X.



- a. Name the process shown in the sketch: _____ (1 mark)
- b. i) Structure X was identified as a 'fully permeable membrane'. Explain why this is incorrect.
- _____ (1 mark)
- ii) Write the correct term to describe structure X.
- _____ (1 mark)
- c. In an experiment potato cylinders were placed in different concentrations of sugar solution. Three cylinders were placed in each sugar solution for 1 hour. The original mass of each cylinder was recorded at the beginning of the experiment, and the final mass of each cylinder was recorded at the end of the experiment.

The table below gives the results obtained.

% Sugar concentration	Original mass (g)	Final mass (g)	Difference in mass (g)	% mass change	Average % mass change
0	3.0	4.0	1.0	33	34.3
	3.0	4.1	1.1	37	
	3.3	4.2	1.1	33	
10	3.0	3.5	0.5	17	X
	3.2	3.6	0.4	13	
	2.9	3.3	0.4	14	
30	3.0	3.0	0	0	0.0
	2.9	2.9	0	0	
	3.2	3.2	0	0	
70	3.1	2.2	-0.9	-29	-29.6
	3.3	2.4	-0.9	-27	
	3.0	2.0	-1.0	-33	

- i) Calculate the Average % mass change (X) obtained in 10% sugar concentration. Show your working.

(3 marks)

- ii) Describe the result observed when the potato cylinders were placed in 70% sugar concentration.

(1 mark)

- iii) From the results, determine the concentration of sugar inside the potato cylinders. Give a reason for your answer.

Concentration: _____

Reason: _____

(3 marks)

(Total 10 marks)

8. The following statement was adapted from an article on cancer cells.

“A tumour (cancerous growth) starts as a single cell which acquires mutations and divides uncontrollably.”

a. i) Name the process of cell division taking place in human cells except for reproductive cells.

(1 mark)

ii) Give TWO reasons why cell division is important in multicellular organisms.

(2 marks)

b. i) Name the structures within the nucleus where mutations occur.

(1 mark)

ii) Define the term *mutation*.

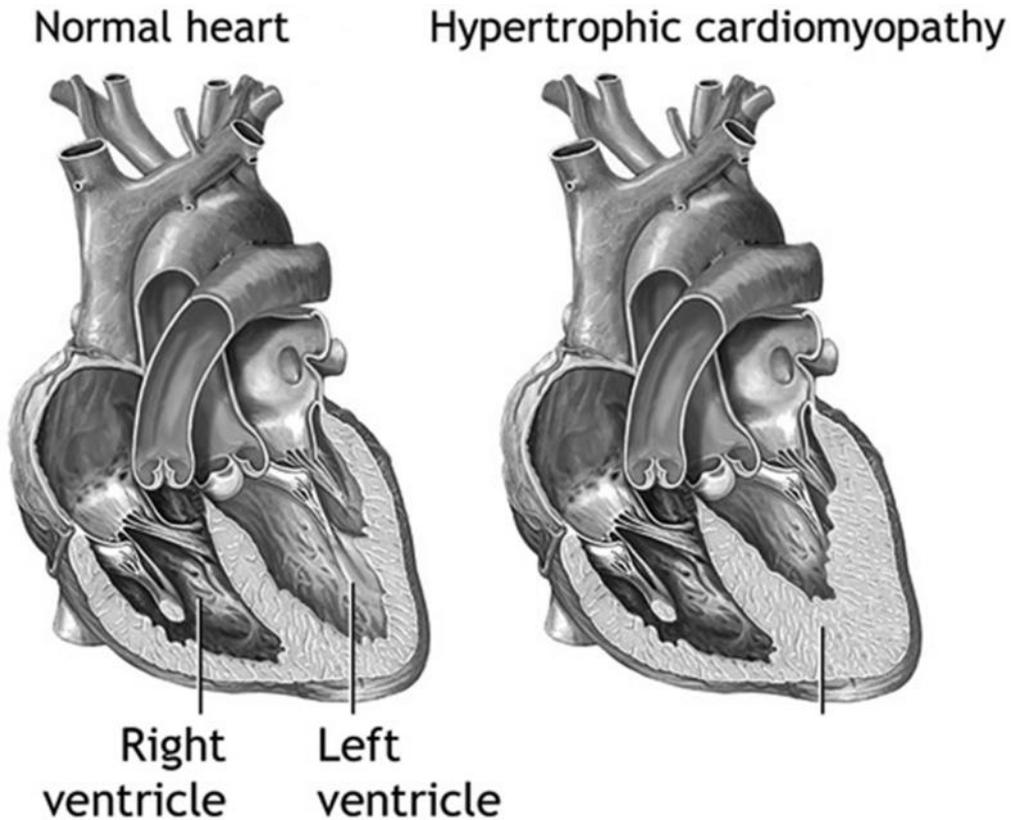
(2 marks)

c. Cancer cells tend to multiply at a faster rate than normal cells. Suggest how this may affect the cancer site.

(2 marks)

(Total 8 marks)

9. Hypertrophic cardiomyopathy (HCM) is a heart condition found in young children. The diagram shows a normal heart (left) and a heart suffering from HCM (right).



a. i) From the diagram list TWO structural changes in the heart that appears to be affected as a result of HCM.

(2 marks)

ii) Describe how these structural changes affect the flow of blood out of the heart.

(2 marks)

Please turn the page.

b. Name:

- i) a main vein that supplies blood to the right atrium;

(1 mark)

- ii) the blood vessel that supplies blood to the lungs.

(1 mark)

c. A heart attack is caused by blockage of the coronary arteries. This is caused by fat deposits in the coronary artery.

- i) Describe how blockage affects blood flow.

(1 mark)

- ii) Explain why persons with this condition find difficulty to participate in physical exercise.

(1 mark)

(Total 8 marks)

10. a. Read the following description of feeding relationships in a marine environment.

Autotrophic algae are eaten by limpets. Starfish and octopus feed on limpets and mussels. Zooplankton feed on autotrophic phytoplankton. Fish feed on both phytoplankton and zooplankton. Mussels feed on phytoplankton. Seagulls eat fish. Sharks eat fish, starfish and octopus.

In the space provided, use the information in the paragraph to construct a food web showing the feeding relationships in the marine environment.

(4 marks)

- b. From the description name:

i) ONE secondary consumer _____

ii) ONE organism in the 4th trophic level: _____

(2 marks)

iii) Phytoplankton produce a toxin as they metabolize. This is a small amount which does not harm the organism. Fish and mussels have been found to have large amounts of this toxin in their body. Explain this observation.

(2 marks)

- c. i) Dead marine organisms fall to the bottom of the sea where they decompose. Name the type of bacteria which perform decomposition.

(1 mark)

- ii) These organisms release nitrogen or ammonium ions. State ONE reason why nitrogen is important to organisms.

(1 mark)

(Total: 10 marks)

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UNIVERSITY OF MALTA, MSIDA**SECONDARY EDUCATION CERTIFICATE LEVEL****MAY 2014 SESSION**

SUBJECT:	Biology
PAPER NUMBER:	IIA
DATE:	21 st May 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 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.

Wine is produced when yeast, a type of fungus acts on the sugar extracted from grapes. The sugar is converted into alcohol. Different wines are produced by the action of different yeasts on different species of grape vine.

Other types of fungi cause diseases on grape vine. These include downy mildew, powdery mildew and *Botrytis*. Downy mildew is mainly observed on leaves as white brown hyphae growing on the lower surface of the leaf, powdery mildew forms characteristic white floury patches on leaves. *Botrytis* forms an ash grey cover on grapes, causing the fruit to decay and shrivel once infected.

A recent study on the effect of fungal diseases on grape vine showed that the varieties that produce red grapes were significantly less affected by powdery mildew and *Botrytis* than those varieties that produce white grapes. This may be due to the fact that red grapes have a thicker berry wall than the white grapes, preventing the hyphae of the fungus from passing through. Red grapes also contain a mixture of substances (called phenolics) that slow down the growth of hyphae of these fungal parasites.

Bacteria may also cause disease in grape vines. Phenolics were extracted from different parts of grape vine waste formed during the production of wine, namely stems, skins and seeds. The effect of the extract on four different species of bacteria was then investigated. Results showed bacteria grew slower in the extracts obtained from the red grape vines. The seed extracts were most effective in slowing and preventing growth of bacteria, whilst the stem extracts were the least effective. This might be due to the presence of a large amount of sugars in the stem extracts.

(Adapted from Lia F., *Comparison of phytochemical extracts from different grape cultivars for potential antimicrobial activity*;
in Biology Symposium Abstracts 2012, UOM)

- a. Name the process by which yeast produces wine from grapes and write a word **OR** chemical equation to summarize the process. (3 marks)

- b. i) Give ONE reason why the presence of downy mildew or powdery mildew on the lower surface of leaves will slow down the process of photosynthesis. (2 marks)
- ii) Give ONE reason why *Botrytis* causes grapes to decay and shrivel. (2 marks)
- c. Explain why downy mildew, powdery mildew and *Botrytis* are described as ‘parasites’. (2 marks)
- d. Give ONE structural difference between:
- i) a bacterial cell and a fungal cell; (1 mark)
- ii) a palisade cell in the vine leaf and a cell of downy mildew. (1 mark)
- e. Name the tissue in the stem where a lot of sugar is present. Give a reason for your answer. (2 marks)
- (Total 13 marks)**

2. The following table shows the fertility rate (live births per woman) for Malta and Italy from 1980 to 2010 at ten-year intervals.

Year	Malta (total fertility rate)	Italy (total fertility rate)
1980	1.99	1.64
1990	2.04	1.33
2000	1.70	1.26
2010	1.38	1.41

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

- a. On the graph paper (use the 2mm grid scale) provided draw **ONE** bar chart showing the variations in total fertility rates in both Malta and Italy over the years shown in the table. The bars for each year must be drawn side by side. (6 marks)
- b. Compare the total fertility rate in Malta and Italy from 1980 to 2010. (2 marks)
- c. Fertility medication enhances reproductive fertility. In females fertility medication is used to stimulate follicle development of the ovary. Name TWO female hormones that will be increased by the administration of fertility drugs. (2 marks)
- d. The reproductive cycle in a human female occurs over 28 days. The process of ovulation occurs during the cycle.
- i) Define the term *ovulation*. (1 mark)
- ii) On which days of the cycle, is ovulation likely to occur? (1 mark)
- (Total 12 marks)**

Section B: Answer any THREE questions from this section.

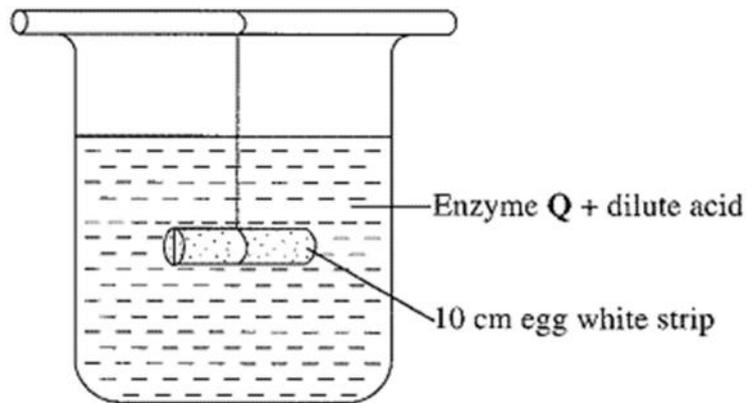
3. Complex organisms have evolved nervous and hormonal co-ordination and control.
- a. Distinguish between hormonal and nervous co-ordinating systems. (2 marks)
- b. A knee jerk reflex is a medical test performed by doctors to see if the peripheral nerves are working properly.
- Name the part of the nervous system involved in the knee jerk reflex. (1 mark)
 - The doctor hits the knee cap just below the knee. List the neurone being stimulated and describe the neural pathway until a response occurs. (4 marks)
 - Give one reason why reflexes are important. (2 marks)
- c. Animal hormones are messengers that co-ordinate chemical activities.
- Insulin is a hormone important in controlling the glucose level in blood. Name the site of insulin secretion, a target organ of insulin and describe its action. (4 marks)
 - Blood glucose levels are kept stable by feedback action. Explain. (4 marks)
- d. Auxins are considered to be plant hormones that control phototropism. In an investigation on the effect of auxins on phototropism in a coleoptile, the following results were obtained.

Coleoptile	Treatment of coleoptile at the beginning of the experiment	Observation of growth pattern in coleoptile after 24 hours
A	No treatment	Growth observed
B	Tip of coleoptile removed	No growth observed
C	Tip of coleoptile cut off and placed on a permeable agar block and placed on top of the coleoptile whose tip had been removed.	Growth observed
D	Tip of coleoptile cut and an impermeable metal disc inserted between the tip and the coleoptile	No growth observed

- From the results obtained from coleoptiles A and B, list the site of production of the plant hormone. (2 marks)
- From the results obtained from coleoptiles C and D, give ONE property of auxins and explain where growth occurs. (2 marks)
- Describe the growth pattern of coleoptile A if it is exposed to light from one side. Give a reason to support your answer. (2 marks)
- In a second investigation, tin foil was used to cover the sides of coleoptile A just below the tip. The tip was left uncovered. Coleoptile A was then placed directly under a light source. Using your knowledge, describe and explain the growth pattern of the coleoptile. (2 marks)

(Total: 25 marks)

4. The diagram shows an experiment set-up to investigate the effect of pH on enzyme activity. Enzyme Q is found inside the mammalian digestive system.



50cm³ of enzyme were placed in the beaker together with 10cm³ of dilute acid. A 10cm egg white strip was suspended in the beaker as shown in the diagram above. The set up was allowed to stand for 24 hours and the decrease in length of the egg white strip was determined. The experiment was repeated at different pH values. When the experiment was repeated with 50cm³ of boiled enzyme Q together with 10cm³ of dilute acid, the length of the egg white strip did not decrease.

The following table summarizes the results obtained:

pH	Decrease in length of egg white strip (mm)
1	7
2	9
3	6
4	3
5	1
6	0

(<http://biosmks9.blogspot.com/>)

- a. Explain why the length of the egg white strip decreased during the experiment. (2 marks)
- b. Explain why:
 - i) the length of the egg white strip must be kept constant in all the pH values. (2 marks)
 - ii) the egg white strip was suspended with string in the enzyme instead of being dropped at the bottom of the beaker. (2 marks)
- c. i) A student wrote that ‘The experiment can be improved by placing the beakers in a water bath kept at a temperature of 37°C.’ Give TWO reasons to support this statement. (2 marks)
 - ii) Another student wrote that ‘The experiment can be improved by measuring the mass of the egg white strip before and after the experiment instead of measuring its length.’ Give ONE reason to support this answer. (2 marks)

- d. i) Determine the optimum pH of enzyme Q. Give a reason for your answer. (3 marks)
 ii) Explain why there is no decrease in length of the egg white strip when the experiment is repeated with boiled enzyme. (2 marks)
- e. A student repeated the experiment replacing enzyme Q with another enzyme X. Explain why no decrease in the length of the egg white strip was recorded in pH values from 1 to 6. (2 marks)
- f. Explain how this experiment shows that the decrease in the length of the egg white strip is due to the action of the enzyme and not the action of the acid. (2 marks)
- g. Enzyme Q was identified as pepsin. Give ONE reason to support this statement. (2 marks)
- h. i) Egg white is rich in proteins. Name the four elements that are present in all proteins. (2 marks)
 ii) Describe a food test that may be performed to show that a suspension of egg white contains protein. (2 marks)
- (Total: 25 marks)**

5. The following table lists a number of organisms that are found in different habitats in the Maltese Islands. The table includes the kingdom, the major group and the scientific name of each organism. The common Maltese and English names are included in the last two columns.

Kingdom	Major Group	Scientific name	Common Maltese name	Common English name
Protist	Alga	<i>Ulva laetivirens</i>	Hass il-baħar	Sea lettuce
Plant	Pteridophyte	<i>Adiantum capillus-veneris</i>	Tursin il-bir	Maidenhair fern
Plant	Conifer	<i>Pinus halepensis</i>	Sigra taż-Żnuber	Aleppo pine
Plant	Angiosperm	<i>Quercus ilex</i>	Sigra tal-Ballut	Evergreen oak
Plant	Angiosperm	<i>Arum italicum</i>	Garni tal-Pipi	Italian lords and ladies
Animal	Mollusc	<i>Cantareus asperus</i>	Għakrux raġel	Edible snail
Animal	Arthropod	<i>Periplaneta americana</i>	Wirdiena ħamra	American cockroach
Animal	Arthropod	<i>Pholcus phalangioides</i>	Brimba tad-Djar	Daddy longlegs

With reference to the table answer the questions that follow.

- a. Give TWO advantages of listing the scientific name of each living organism listed in the table. (2 marks)
- b. The Sea lettuce, *Ulva laetivirens* is a multicellular green alga. Give TWO common **structural** features its cells share with the other plants mentioned in the table. (2 marks)
- c. i) Give ONE reason why the *Adiantum capillus-veneris* is found growing only in humid environments, whilst the other plants listed grow in environments that are not as humid. (2 marks)
 ii) Explain why all the plants listed in the table can reach larger sizes than bryophytes. (2 marks)
- d. i) Name the reproductive structures formed in *Pinus halepensis* and in *Quercus ilex* respectively. (2 marks)
 ii) Describe how the seed formed in *Pinus halepensis* is different from that formed in *Quercus ilex*. (2 marks)

- e. *Quercus ilex* is a dicot whilst *Arum italicum* is a monocot.
- i) Draw TWO diagrams to show how the external structure of a leaf and the pattern of veins differs in a typical dicot and a typical monocot. Label your diagrams clearly. (4 marks)
 - ii) Give ONE similarity and ONE difference one would expect to observe in the seed of a monocot and the seed of a dicot. (3 marks)
- f. i) Give TWO common characteristics of *Periplaneta americana* and *Pholcus phalangoides*. (2 marks)
- ii) *Periplaneta americana* is an insect whilst *Pholcus phalangoides* is a spider. Give TWO structural features that distinguish the two organisms. (2 marks)
 - iii) List TWO distinguishing structural features that show that *Cantareus asperus* is a mollusc. (2 marks)
- (Total: 25 marks)**
6. The Mediterranean Sea is an important shipping route from Europe to Asia. Large oil tankers and cargo ships pass close to the Maltese Islands, on a regular basis.
- a. Oil spillage from ships is a major source of marine pollution. List TWO ways how such incidents affect the marine environment and the organisms that live in. (4 marks)
 - b. Following an oil spill, surviving seabirds released back in the wild after cleaning have difficulty breeding.
 - i) Give ONE short-term consequence of this effect. (1 mark)
 - ii) Give TWO long-term consequences of this effect. (2 marks)
 - iii) Name ONE other type of marine pollution and describe how this pollution is caused. (3 marks)
 - c. Recent studies on the composition of air at Giordan Lighthouse in Gozo show that the passage of ships increases air pollution. In an article related to these studies a journalist defined the Mediterranean Sea as a “pollution superhighway”. Using your biological knowledge, explain this term regarding air pollution. (2 marks)
 - d. This study revealed that ozone in the lower levels of the atmosphere is one of the unexpected air pollutants. In the stratosphere (more than 10km above the earth’s surface), ozone has an important useful function.
 - i) Describe the function of the ozone layer in the stratosphere. (2 marks)
 - ii) Name ONE substance that results in thinning of the ozone layer. (1 mark)
 - iii) List TWO effects of a reduced layer of ozone. (2 marks)
 - e. Building debris is sometimes illegally dumped on garigue (xagħri) ecosystems.
 - i) Give TWO characteristics of the garigue ecosystem. (2 marks)
 - ii) Give TWO reasons why the illegal dumping of building debris harms this ecosystem. (4 marks)
 - f. Areas of garigue are being reclaimed for the purpose of agriculture or recreation. Give a biological reason to show:
 - i) a beneficial effect of this reclamation; (1 mark)
 - ii) an adverse effect of this reclamation. (1 mark)
- (Total: 25 marks)**

7. Point out the mistake in **each** statement and write down an explanation of what the correct statement should say:
- a. The glomerular filtrate passes through the walls of the Bowman's capsule and into the proximal convoluted tubule. As it passes along the tubule, the composition of the filtrate does not change. (4 marks)
 - b. Metabolic wastes do not leave the body. (5 marks)
 - c. Salivary amylase stops acting in the stomach, but starts again in the duodenum. (4 marks)
 - d. Transpiration is faster on a humid cool day. (4 marks)
 - e. The small intestine is short and straight to allow fast passage of food. (4 marks)
 - f. Bread mould is a common autotrophic plant. (4 marks)
- (Total: 25 marks)**
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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2014 SESSION

SUBJECT:	Biology
PAPER NUMBER:	IIB
DATE:	21 st May 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 1 of this paper you need the graph paper in the booklet.

Answer any FOUR questions.

1. The following table shows the fertility rate (live births per woman) for Malta from 1980 to 2010 at ten-year intervals.

Year	Malta (total fertility rate)
1980	1.99
1990	2.04
2000	1.70
2010	1.38

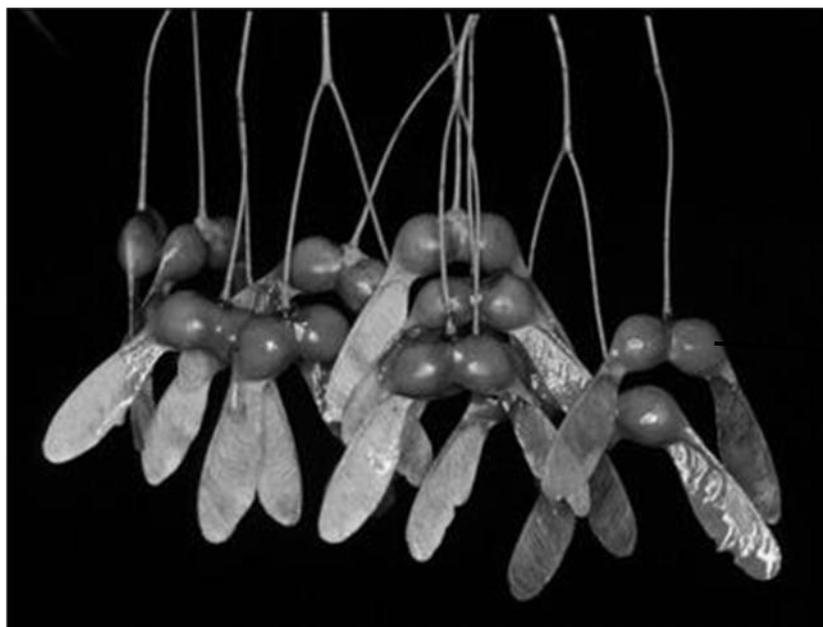
(Source: <http://epp.eurostat.ec.europa.eu>)

- On the graph paper provided (use the 2mm scale) draw a bar chart showing the total fertility rates in Malta from 1980 to 2010. (6 marks)
- Calculate the average total fertility rate for Malta between 1980 and 2010. (2 marks)
- Describe the general trend of the total fertility rate in Malta from 1980 to 2010. (2 marks)
- Fertility medication enhances reproductive fertility. In females fertility medication is used to stimulate follicle development of the ovary.
 - Name the gland that releases hormones that control the activity of the ovary. (1 mark)
 - Name the hormone that stimulates the release of a mature ovum from the ovary. (1 mark)
 - Compare the number of chromosomes in an ovum with those of a zygote. (2 marks)
- The ovary in a flowering plant contains the ovules. When a pollen grain lands on the stigma of a flower, a pollen tube grows down towards the ovary through the style.
 - What does the ovule change into once the egg cell is fertilised? (2 marks)
 - Draw a diagram of the structure of a typical insect-pollinated flower to show the position of the stigma, style, ovary and ovule. (5 marks)
- The following diagrams show the fruits of the maple and the goose grass. **Describe** the appearances of **each** and **explain** the biological importance of the structures. (4 marks)



Fruit of the
goose grass

<http://en.wikipedia.org/wiki/File:Galium.aparine.jpg>



Fruit of the
maple

http://site.tapmytrees.com/images/sugar_maple_fruit.jpg

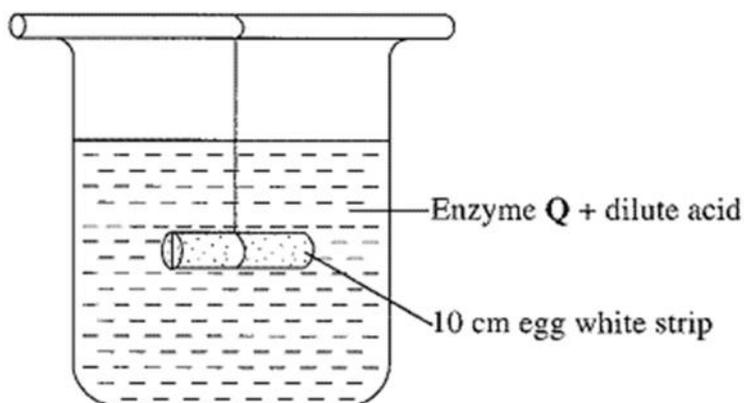
(Total 25 marks)

2. Re-write the statements below to correct the mistake and give a biological explanation for your answer.

- a. The small intestine is short and straight to allow fast passage of food. (4 marks)
- b. The intestines of a goat and a dog of similar size are equal in length. (4 marks)
- c. Salivary amylase breaks down starch to glucose in the mouth and the stomach. (4 marks)
- d. Transpiration is slower in low humidity and high light intensity. (5 marks)
- e. Both shoots and roots are negatively geotropic. (4 marks)
- f. Bread mould is a common autotrophic plant. (4 marks)

(Total: 25 marks)

3. The diagram shows an experiment set-up to investigate the effect of pH on enzyme activity. Enzyme Q is found inside the mammalian digestive system.



50cm³ of enzyme were placed in the beaker together with 10cm³ of dilute acid. A 10cm egg white strip was suspended in the beaker as shown in the diagram above. The set up was allowed to stand for 24 hours and the decrease in length of the egg white strip was determined. The experiment was repeated at different pH values. When the experiment was repeated with 50cm³ of boiled enzyme Q together with 10cm³ of dilute acid, the length of the egg white strip did not decrease.

The following table summarizes the results obtained:

pH	Decrease in length of egg white strip (mm)
1	7
2	9
3	6
4	3
5	1
6	0

(<http://biosmks9.blogspot.com/>)

- Explain why the length of the egg white strip decreased during the experiment. (3 marks)
- Explain why:
 - the length of the egg white strip must be kept constant in all the pH values. (2 marks)
 - the experiment was performed at a temperature of 37°C. (2 marks)
- Determine the optimum pH of enzyme Q. Give a reason for your answer. (3 marks)
- A student repeated the experiment replacing enzyme Q with another enzyme X. Explain why no decrease in the length of the egg white strip was recorded at any pH value. (4 marks)

- e. Explain why there is no decrease in the length of the egg white strip when the experiment was performed with boiled enzyme. (3 marks)
- f. Enzyme Q was identified as pepsin.
- i) In which organ is Q produced in the human body? (1 mark)
 - ii) Using the results in the table give ONE piece of evidence that enzyme Q is pepsin. (2 marks)
 - iii) Name another enzyme that acts on proteins in the small intestine. (1 mark)
- g. i) Egg white is rich in proteins. List the four elements that are present in all proteins. (2 marks)
- ii) Describe a food test that may be performed to show that a suspension of egg white contains protein. (2 marks)
- (Total 25 marks)**
- 4.a. Eutrophication is an effect of excess nutrients in water. A coastal ecosystem becomes enriched in dissolved nutrients that stimulate growth of algae and aquatic plants.
- i) Give ONE source of the excess nutrients bringing about eutrophication. (2 marks)
 - ii) Explain how the sudden growth of aquatic plants eventually reduces the amount of oxygen dissolved in water. (2 marks)
 - iii) Describe how the change in oxygen levels affects marine animals. (2 marks)
- b. Oil spills are a form of marine pollution. Seabirds get covered in oil and as a consequence the effect of air trapped between the feathers is reduced.
- i) Discuss the consequence of losing trapped air between feathers. (3 marks)
 - ii) Some birds covered in oil are rescued and cleaned. Many of these birds have difficulty breeding. Explain how a decrease in breeding affects food webs. (3 marks)
 - iii) List TWO other ecological effects resulting from oil spills, besides the effect on birds. (4 marks)
- c. Recent studies on the composition of air at Giordan lighthouse in Gozo show that the passage of ships from Europe to Asia increases air pollution.
- i) Name ONE air pollutant released from ships. (2 marks)
 - ii) An article related to these studies defined the Mediterranean Sea as a “pollution super highway”. Using your biological knowledge explain this term. (3 marks)
- d. i) Describe the function of the ozone layer in the atmosphere. (2 marks)
- ii) Give ONE effect of a reduced layer of ozone. (2 marks)
- (Total: 25 marks)**

5.a. Wine is produced when yeast, a type of fungus, acts on the sugar extracted from grapes. The sugar is converted into alcohol. Different wines are produced by the action of different yeasts on different species of grape vine.

- a. i) Name the process by which yeast produce wine from grapes. (1 mark)
- ii) Write a word equation to summarize the process. (3 marks)
- iii) Another biological process involving yeast is bread baking. Describe the role of yeast in this process. (2 marks)

b. Other types of fungi cause diseases on grape vine. These include downy mildew, powdery mildew and *Botrytis*. Downy mildew is mainly observed on leaves as white brown hyphae growing on the lower surface of the leaf, powdery mildew forms characteristic white floury patches on leaves. Thus they physically block the stomata. *Botrytis* forms an ash grey cover on grapes, causing the fruit to decay and shrivel once infected.

- i) Describe the appearance of a stoma. (2 marks)
- ii) Explain why the fungi blocking the stomata will slow down the process of photosynthesis. (2 marks)
- iii) Name the type of nutrition shown by *Botrytis*. Describe how this type of nutrition reduces grape production. (3 marks)

c. A study on the effect of diseases caused by these parasitic fungi on grape vine showed that the varieties that produce red grapes were affected less by powdery mildew and *Botrytis* than those varieties that produce white grapes. Red grapes have a thicker berry wall than white grapes. This prevents the hyphae of the fungus from passing through. Red grapes also contain a mixture of substances (called phenolics) that slow down the growth of hyphae of these fungal parasites.

Define the term *parasite*. (2 marks)

d. Bacteria may also cause disease in grape vines. Phenolics were extracted from different parts of grape vine waste formed during production of wine, namely stems, skins and seeds. The effect of the extract on four different species of bacteria was then investigated. Results showed bacteria grew slower in the extracts obtained from the red grape vines. The seed extracts were most effective in slowing and preventing growth of bacteria, whilst the stem extracts were the least effective. This might be due to the presence of a large amount of sugars in the stem extracts.

Give ONE structural difference between:

- i) a bacterial cell and a fungal cell; (2 marks)
 - ii) a palisade cell in the vine leaf and a cell of downy mildew. (2 marks)
- e. i) Name the tissue in the stem through which sugar is transported. Name two regions that receive this sugar. (3 marks)
- ii) Name the tissue in the stem responsible for transporting water and mineral ions from the root to the leaves. (1 mark)
- iii) Give TWO functions of water in a plant. (2 marks)

(Total 25 marks)

6. The following table lists a number of organisms that are found in different habitats in the Maltese Islands. The table includes the kingdom, the major group and the scientific name of each organism. The common Maltese and English names are included in the last two columns.

Kingdom	Major Group	Scientific name	Common Maltese name	Common English name
Protist	Alga	<i>Ulva laetivirens</i>	Hass il-baħar	Sea lettuce
Plant	Pteridophyte	<i>Adiantum capillus-veneris</i>	Tursin il-bir	Maidenhair fern
Plant	Conifer	<i>Pinus halepensis</i>	Sigra taż-Żnuber	Aleppo pine
Plant	Angiosperm	<i>Quercus ilex</i>	Sigra tal-Ballut	Evergreen oak
Plant	Angiosperm	<i>Arum italicum</i>	Garni tal-Pipi	Italian lords and ladies
Animal	Arthropod	<i>Periplaneta americana</i>	Wirdiena ħamra	American cockroach
Animal	Arthropod	<i>Pholcus phalangoides</i>	Brimba tad-Djar	Daddy longlegs

With reference to the table answer the questions that follow:

- Give ONE advantage of listing the scientific name rather than the local name of each living organism listed in the table. (2 marks)
- The Sea lettuce, *Ulva laetivirens* is a multicellular green alga. Give TWO common **structural** features its cells share with the other plants mentioned in the table. (2 marks)
- Give ONE reason why the *Adiantum capillus-veneris* is found growing only in humid environments, whilst the other plants listed grow in environments that are not as humid. (2 marks)
 - Explain why all the plants listed in the table can reach larger sizes than bryophytes. (3 marks)
- Name the reproductive structures formed in *Pinus halepensis* and in *Quercus ilex* respectively. (2 marks)
 - Describe how the seed formed in *Pinus halepensis* is different from that formed in *Quercus ilex*. (2 marks)
- Quercus ilex* is a dicot whilst *Arum italicum* is a monocot.

 - Draw TWO diagrams to show how the external structure of a leaf and the pattern of veins differs in a typical dicot and a typical monocot. Label your diagrams clearly. (6 marks)
 - Give ONE difference one would expect to observe in the seed of a monocot and the seed of a dicot. (2 marks)
- Give TWO common characteristics of *Periplaneta americana* and *Pholcus phalangoides*. (2 marks)
 - Periplaneta americana* is an insect whilst *Pholcus phalangoides* is a spider. Give TWO structural features that distinguish the two organisms. (2 marks)

(Total: 25 marks)

7. a. List TWO characteristics of nerve impulse transmission and action. (2 marks)
- b. i) Draw a labelled reflex arc. Include the following labels: grey matter, white matter, dorsal root ganglion; sensory neurone, motor neurone, relay neurone. (5 marks)
- ii) On the diagram drawn, include arrows showing the direction in which the impulses travel. (1 mark)
- iii) List ONE biological importance of a reflex action. (1 mark)
- c. The level of glucose in blood is kept constant by means of two hormones.
- i) Name the hormones and name the organ that produces them. (3 marks)
- ii) Describe the role each hormone plays in keeping the level of glucose in blood constant. (4 marks)
- d. In an investigation on the effect of plant hormones on phototropism in a coleoptile, the following results were obtained.

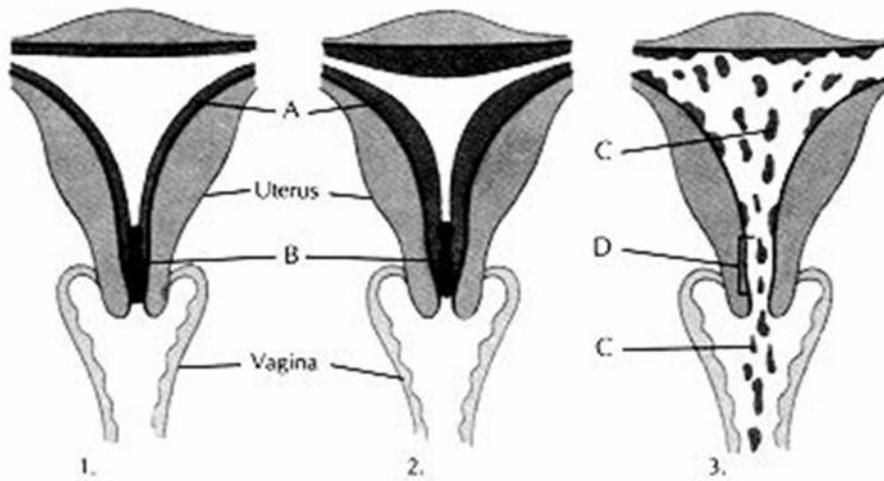
Coleoptile	Treatment of coleoptile at the beginning of the experiment	Observation of growth pattern in coleoptile after 24 hours
A	No treatment	Growth observed
B	Tip of coleoptile removed	No growth observed
C	Tip of coleoptile cut off and placed on a permeable agar block and placed on top of the coleoptile whose tip had been removed.	Growth observed
D	Tip of coleoptile cut and an impermeable metal disc inserted between the tip and the coleoptile	No growth observed

- i) From the results obtained from coleoptiles A and B, list the site of production of the plant hormone. (2 marks)
- ii) Explain why coleoptile C grows but coleoptile D does not. (3 marks)
- iii) Describe, using diagrams, the growth of a coleoptile if a light source is placed on one side of the coleoptile. (3 marks)
- iv) Mark on the diagram the region of the coleoptile where there is the highest amount of plant hormone (1 mark)

(Total: 25 marks)

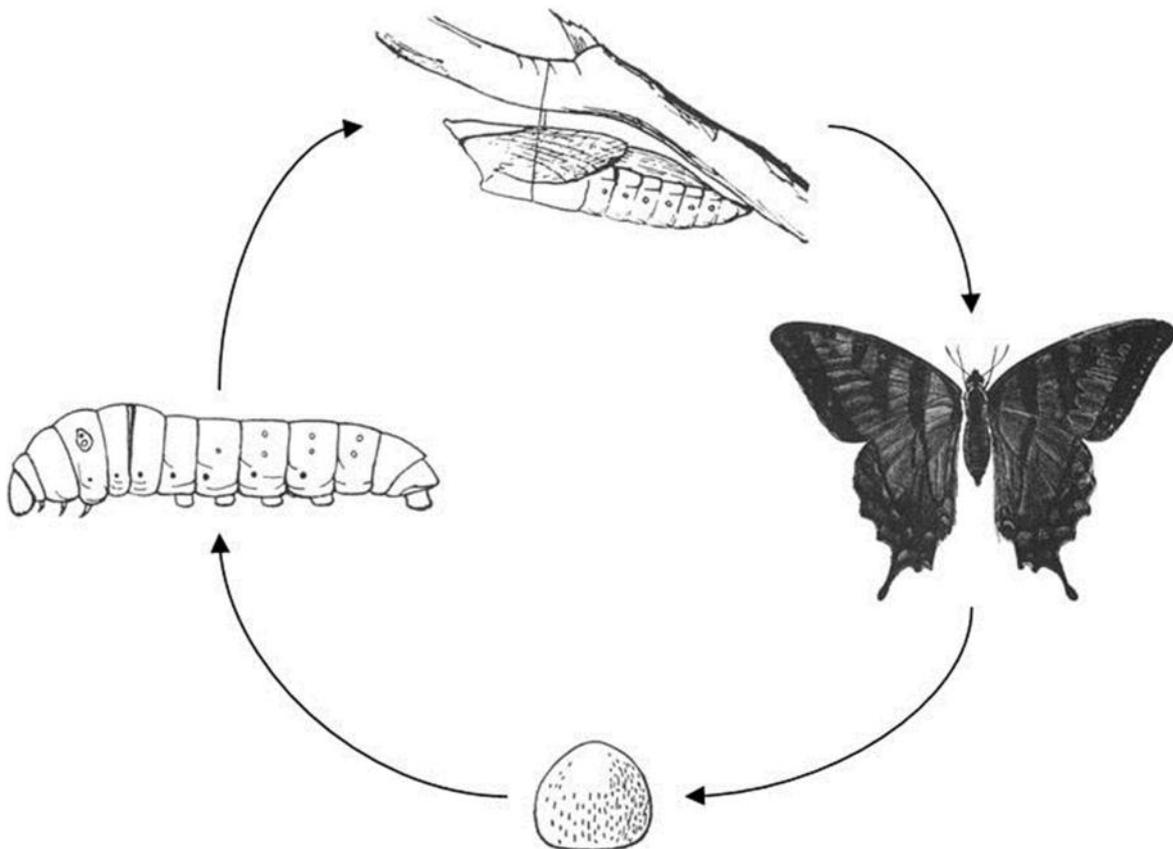
8. a. Name and describe the processes shown in pictures A, B and C.

Picture A



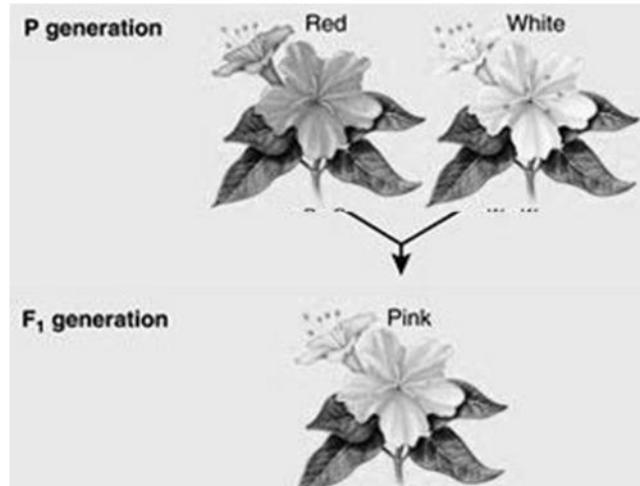
(http://www.sexarchive.info/ATLAS_EN/assets/images/ANAT5.jpg)
(5 marks)

Picture B



(<http://dragonflywoman.files.wordpress.com/2009/07>)
(5 marks)

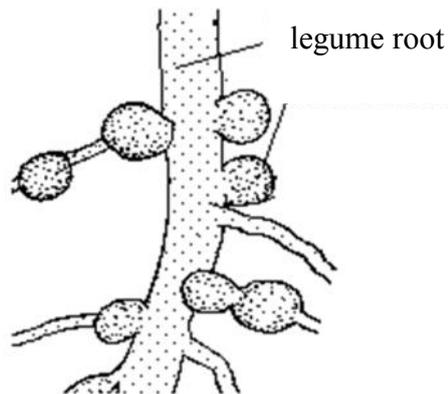
Picture C



(Adapted from <http://www.doctortee.com/dsu/tiftickjian/cse-img/genetics/mendel-ext/4-oclocks-fl.jpg>)
(5 marks)

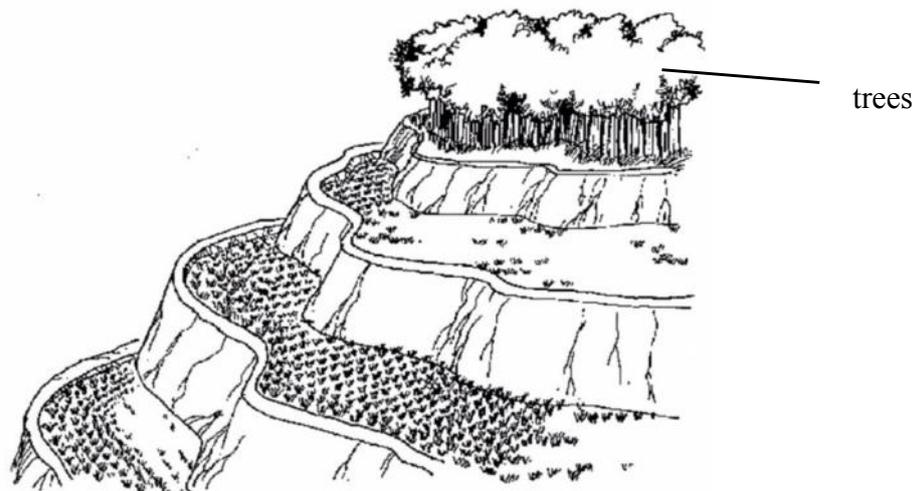
b. Give a biological explanation of the importance of the features shown in the following two diagrams

i)



(http://www.uq.edu.au/_School_Science_Lessons/9.72.GIF)
(5 marks)

ii)



(5 marks)
(Total: 25 marks)