Index Number:_____ SEC04/1.16m

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

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2016 SESSION

SUBJECT:	**Biology**
PAPER NUMBER:	I
DATE:	5th May 2016
TIME:	4:00 p.m. to 6:05 p.m.

ANSWER ALL QUESTIONS IN THIS PAPER IN THE SPACES PROVIDED.

1. Give the biological term that best describes each statement below:

a.	The release of an egg from the ovary:	
b.	The release of fluid on the skin surface to bring about a cooling effect:	
c.	The muscular contractions that push food along the alimentary canal:	
d.	The movement of substances against a concentration gradient, using ATP:	
e.	The involuntary response to a stimulus:	
f.	The transfer of pollen from the anther to the stigma of the **same** flower:	
g.	The conversion of nitrites and nitrates in the soil into atmospheric nitrogen gas:	
h.	Blood vessels widen causing more blood to flow and loss of heat through the skin:	
i.	The maintenance of a constant internal environment:	
j.	The filling of lungs with air when ribs move upwards and outwards:	

(1 mark each)

(Total: 10 marks)

2. The figure below shows cuboidal cells making up the lining of a kidney tubule.

a. Assuming that the cuboidal cell is a perfect cube and the height of one side is 0.001 mm, calculate the surface area to volume ratio (S.A.:V) of one cell. Express your answer in ratio form. Show your working.

S.A. =

V: =

Ans: SA:V =_____

(4 marks)

b. State whether the SA:V ratio of another cuboidal cell with a shorter height would be larger or smaller than that of the cell mentioned in part a of this question.

_____

(1 mark)

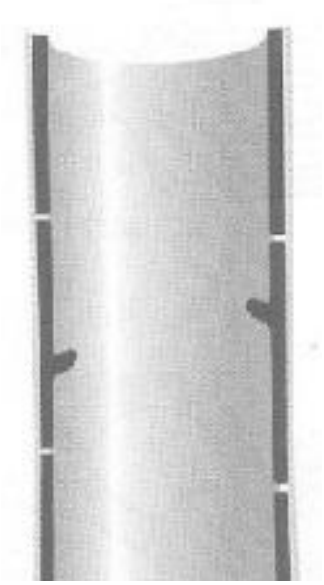
c. Cells in multicellular organisms show division of labour. Define the term *division of labour.*

_____

_____

(2 marks)

d. The diagram below shows a section through a xylem vessel.



Xylem vessels are responsible for the transport of water and mineral ions in vascular plants. List TWO structural characteristics that make them adapted to perform this function.

Characteristic 1: _____

_____

Characteristic 2: _____

_____

(2 marks)

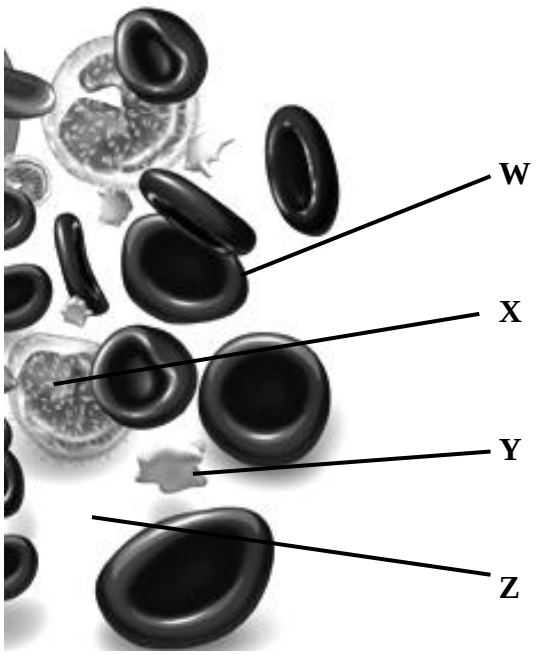
e. Besides transport of water and mineral ions, give another function of xylem vessels in vascular plants.

_____

(1 mark)

(Total: 10 marks)

3. Blood is a mixture of cells and cell fragments suspended in a fluid. The diagram shows the main components of blood.



(http://images4.fanpop.com/image/photos/22400000/Blood-human-blood-22466864-449-326.jpg)

a. Name the blood components labelled **W**, **X**, **Y** and **Z** on the diagram shown above.

W: _____ **X**: _____

Y: _____ **Z**: _____

(2 marks)

b. Describe ONE structural characteristic of a red blood cell and explain how it is related to its function.

_____

_____

_____

(3 marks)

c. Explain why people who have just donated blood may feel a bit tired.

_____

_____

_____

(2 marks)

d. People with a disorder called thrombocytopenia do not have enough platelets. Describe ONE symptom of this disorder and give a reason for your answer.

Symptom: _____

_____

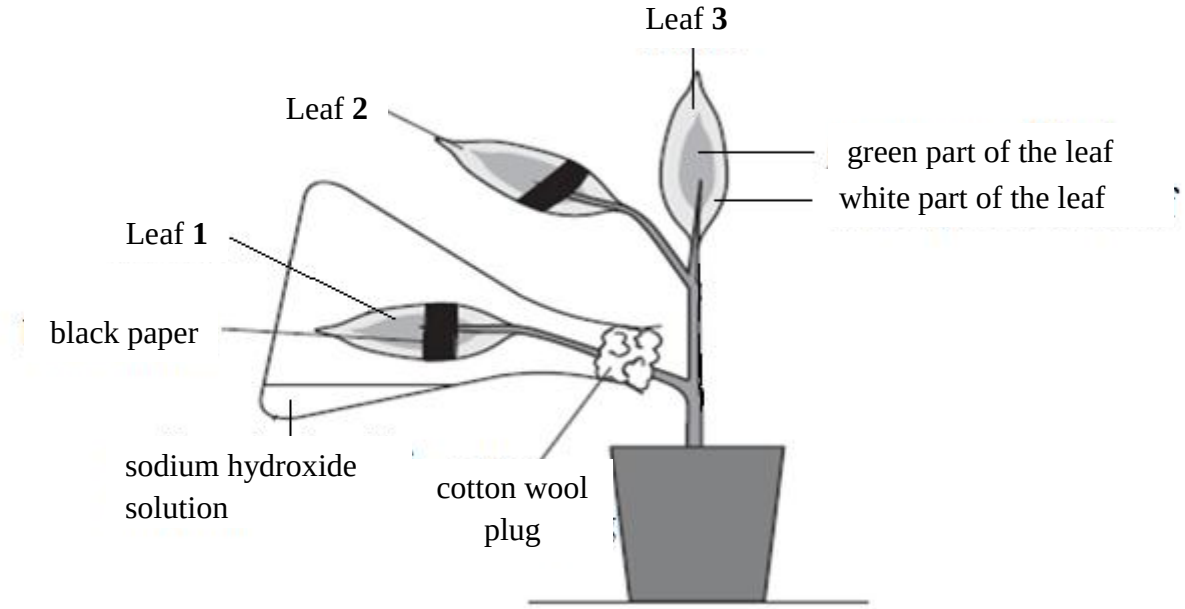
Reason: _____

_____

(3 marks)

(Total 10 marks)

4. Biology students carried out an experiment using a plant with variegated leaves. The setup is shown in the diagram below. The plant was de-starched for 24 hours. A strip of black paper was attached to the upper and lower surfaces of both leaves **1** and **2**. Leaf **1** was then sealed in a flask containing sodium hydroxide solution. Leaf **3** was not treated in any way. The plant was left in the light for 24 hours. Then, a test for starch was carried out on each of leaves 1, 2 and 3.



a. State how the plant was de-starched.

_____

(1 mark)

b. After the experiment, each leaf was tested for starch. Describe the method used to decolourise the leaf.

_____

(2 marks)

c. Name the chemical used to test each leaf for starch.

_____

(1 mark)

d. State the role of the sodium hydroxide solution used in the experiment.

_____

(1 mark)

e. Leaf 3 was left untreated. Explain why this was important.

_____

_____

(2 marks)

f. On the diagrams below, label clearly how each leaf would appear after the test for starch.

Leaf 1

Leaf 2

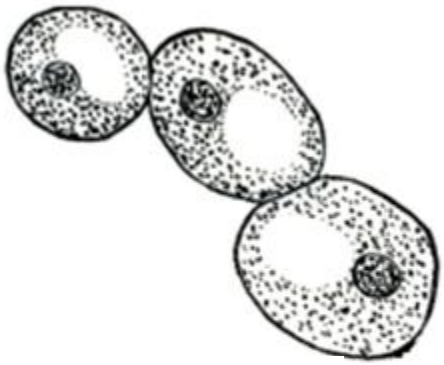
Leaf 3

(3 marks)

(Total: 10 marks)

5. Different organisms reproduce either sexually or asexually.

Pin mould



Yeast

Diagrams are not to scale

a. The diagram above shows pin mould and yeast. Both these organisms can reproduce asexually. Compare the mode of reproduction of the two organisms.

_____

_____

(2 marks)

b. *Euglena* is a plant-like protist. During asexual reproduction, it forms two daughter cells. State ONE advantage and ONE disadvantage for this mode of reproduction.

_____

_____

(2 marks)

c. Fill in the table below about sexual reproduction in animals and plants.

Feature	Sexual reproduction in animals	Sexual reproduction in plants
Male gametes	Sperm cell	
Site of fertilisation		

(3 marks)

d. Name ONE method how plants can reproduce asexually.

_____

(1 mark)

e. Explain how the number and size of male gametes in animals and plants is different from that of the female.

_____

_____

(2 marks)

(Total: 10 marks)

6.

a. The photograph below shows a female pig and its young piglets. List TWO visible characteristics in the photograph that show that the pig is a mammal.

Characteristic 1: _____

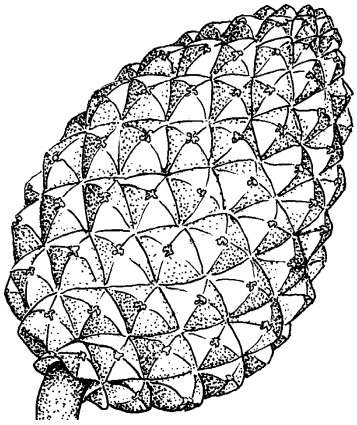
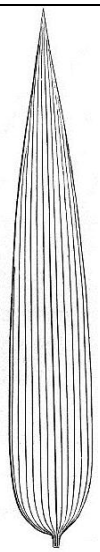
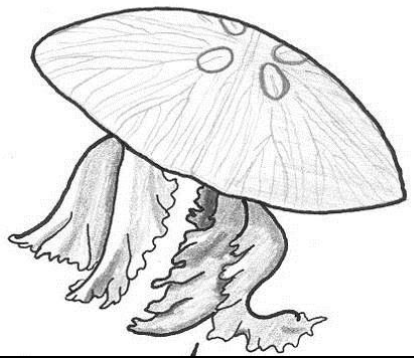
_____

Characteristic 2: _____

_____

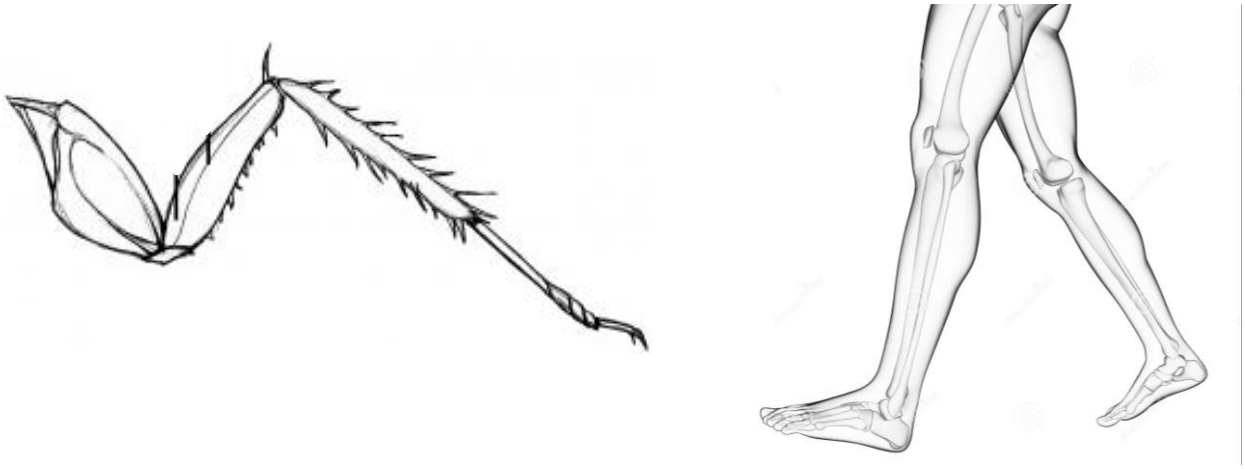
(2 marks)

b. The table shows diagrams of characteristic features of organisms. It also lists the name of the characteristic, the name of the kingdom and the phylum to which the organism belongs. Fill in the missing information in the table.

Diagram of feature	Characteristic shown in diagram	Name of Kingdom	Name of Phylum
		Plant	
		Plant	
		Animal	

(6 marks)

c. The figures show the skeleton of a leg of an insect and the leg of a human.



Leg of an insect

Leg of a human

(Note: Figures are not to scale)

Muscles in the leg of an insect are attached to the inside of the skeleton, whilst muscles in the leg of a human are attached on the outside of the skeleton. What allows the two organisms to have this arrangement?

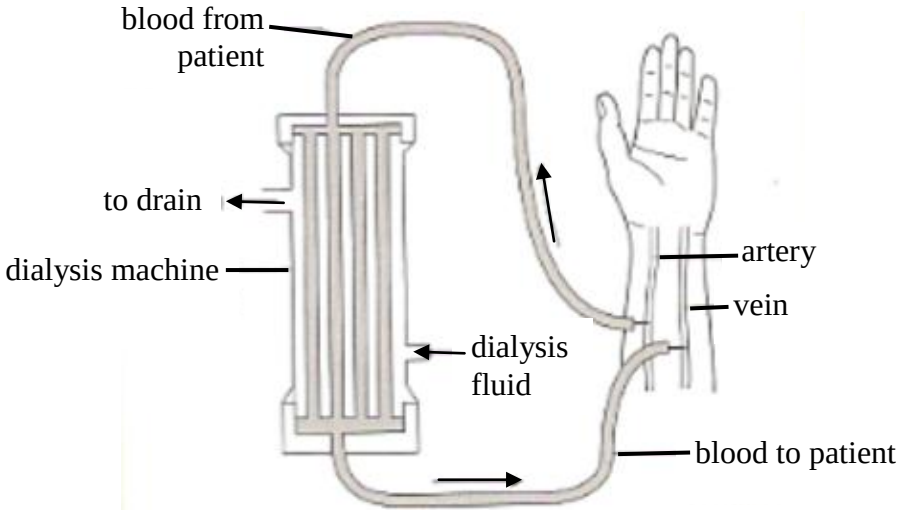
_____

_____

(2 marks)

(Total: 10 marks)

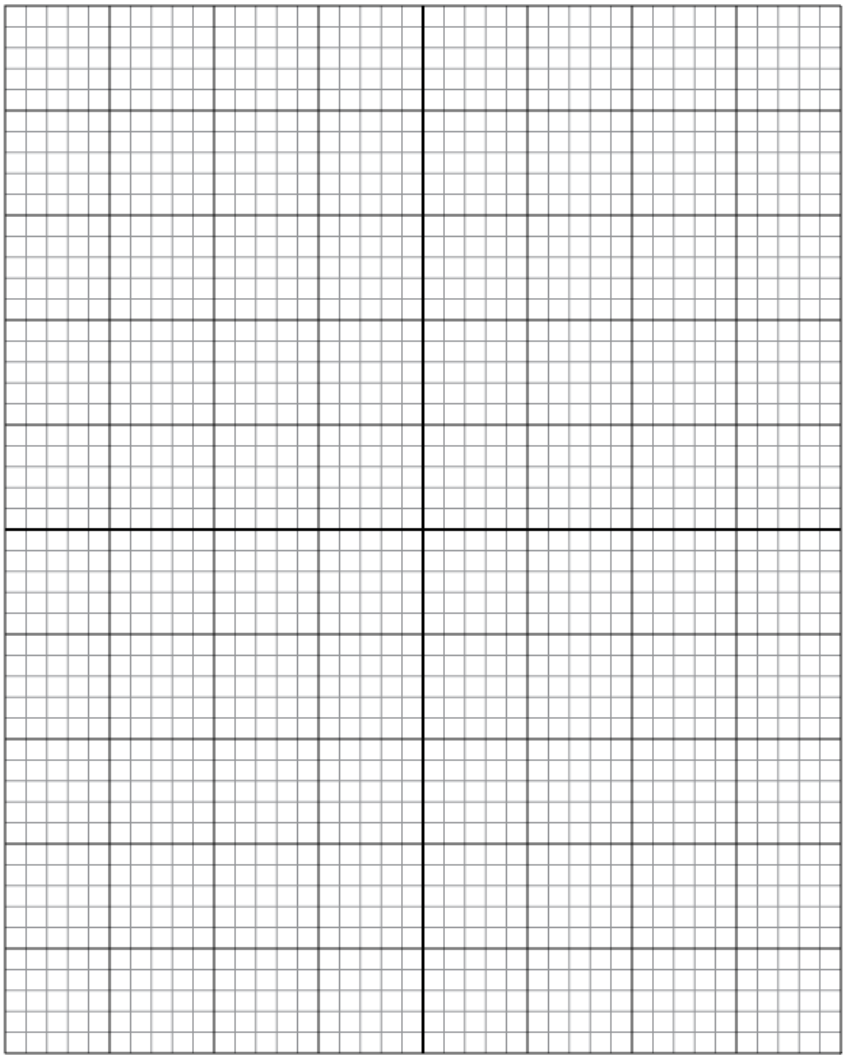
7. A dialysis machine is used by patients who have malfunctioning kidneys. The machine performs the same function that the kidneys do. The diagram shows how blood flows through a dialysis machine.



a. The table shows the different concentrations of amino acids, urea, glucose and salts in the blood artery leading to the dialysis machine and the blood in the vein leaving the dialysis machine.

Blood component	**Concentration /g per 100ml**	
	Blood in artery	**Blood in vein**
Amino acids	0.05	0.05
Urea	0.035	0.015
Glucose	0.10	0.10

Draw a bar chart to show the concentration of amino acids, urea and glucose in the blood entering the kidney and the blood leaving the kidney.



(5 marks)

b. Give ONE similarity in the composition of the blood in the artery and in the vein.

(1 mark)

c. Describe and explain the difference between urea concentration in the artery and in the vein.

(2 marks)

d. Describe how the liver and the kidneys act together to excrete excess protein.

(2 marks)
(Total 10 marks)

8. In Malta, fish consumption is much lower than recommended. Thus, in February, 2015, an 'Eat Fresh Fish' campaign was launched to raise awareness about the nutritional value of fish and increase the fish consumption on the Maltese islands.

a. Fish provide high quality protein and are rich in minerals and vitamin D.

i) State TWO reasons why proteins are important in the diet.

(2 marks)

ii) Describe a biochemical test that tests for the presence of proteins in a sample of fish flesh.

(2 marks)

iii) State the importance of Vitamin D in the diet.

_____

_____

(1 mark)

iv) Name a deficiency disease that results from lack of vitamin D in the diet.

_____

(1 mark)

b. Fish oils in fatty fish such as salmon and tuna are the richest source of a type of fat that is vital to normal brain development in unborn babies and infants. Without adequate amounts of these fatty acids, normal brain development does not take place.

Besides carbon, state the TWO elements present in both proteins and fats.

_____

(1 mark)

c. Fish farming tuna is an important industry in the Maltese islands. Describe TWO ways how fish farming can affect the natural marine ecosystem.

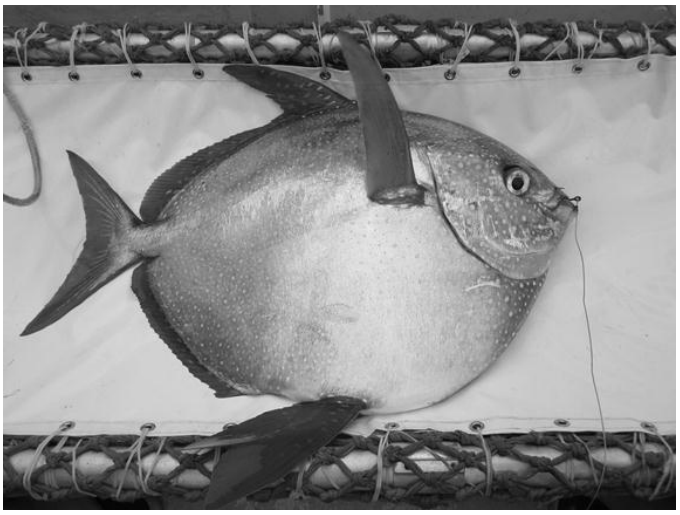
_____

_____

_____

(2 marks)

d. The photo below shows a Moonfish. The journal *Science* reported that the Moonfish is the first known endothermic fish.



(Source: http://www.livescience.com/50836-warm-blooded-moonfish-photos.html)

i) Define the term *endotherm*.

(1 mark)

ii) State TWO structural characteristics common to all fish.

(2 marks)

(Total: 12 marks)

9. Environmental groups have opposed the construction of new buildings in the natural environment of Malta.

A statement issued by S-Cubed, the Science Students' Society at University claimed that:

"The construction of new buildings will lead to loss of habitats…The effect of the loss of one species cannot be predicted accurately, since losing one species will probably have 'knock-on effects' leading to other organisms that are dependent on it also being lost. Apart from direct habitat loss, this proposed development will also cause noise pollution and air pollution."

a. Define the term *habitat*.

(1 mark)

b. i) Suggest ONE way how the loss of one species may lead to the loss of other organisms.

(2 marks)

ii) Suggest ONE way how the proposed construction of new buildings may lead to air pollution.

(2 marks)

c. During the UN Climate Change Conference (COP21) almost 200 countries agreed to hold the increase in average global temperatures to well below 2^{o}C and to pursue efforts to limit the temperature increase to 1.5^{o}C by 2100.

i) Describe how average global temperatures have been rising over the past years.

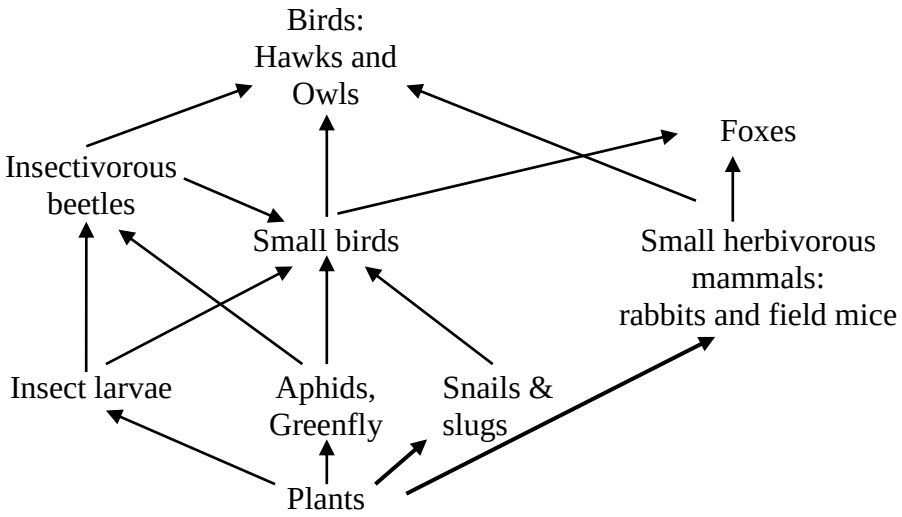
(3 marks)

ii) Suggest TWO ways how the increase in global temperatures may be limited to well below 2^{o}C.

(2 marks)

(Total: 10 marks)

10. The diagram below shows a food web for a tree in oak woodland.



a. Name the producer in this food web.

(1 mark)

b. Name ONE secondary consumer in this food web.

_____

(1 mark)

c. Using the food web above draw a food chain showing how energy flows from producers to foxes. The chain must include 4 trophic levels.

(2 marks)

d. Explain why the number of insectivorous beetles might decrease if all the small birds leave the woodland.

_____

_____

_____

(2 marks)

e. A group of students observed, identified and counted animals in a woodland area. The amount of each type of animal seen is shown in table A below.

Table A

Animal	Amount of animals seen	Animal	Amount of animals seen
Aphid	42	Owls	0
Field mice	0	Rabbits	2
Greenfly	44	Slugs	8
Hawk	1	Small Birds	25
Insect larvae	12	Snails	5

Use the information in the food web and Table A to calculate the total amount of animals at the second trophic level. (Show your working)

(2 marks)
(Total: 8 marks)

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

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2016 SESSION

SUBJECT:	**Biology**
PAPER NUMBER:	IIA
DATE:	6th May 2016
TIME:	4:00 p.m. to 6:05 p.m.

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

Bryophyte communities in the Maltese Islands

Bryophytes are the second largest group in the Plant Kingdom, comprising between 15,000 and 25,000 species. Around 126 species are found in the Maltese islands. This group contains very small plants which are commonly referred to as mosses, liverworts and hornworts. Bryophytes form important miniature ecosystems by providing habitats and nesting sites for other small organisms. They mark an important step in the evolution of plants as they were the first group of plants to move out of an aquatic environment and start growing on a terrestrial one. Due to this change, plants eventually evolved and developed different ways how to prevent and decrease water loss.

Bryophytes do not have lignified tissues; they lack proper roots, proper stems and proper leaves. The leaf-like structures making up the bryophyte are not covered with a waxy cuticle. Bryophytes exchange substances with the environment over their whole body surface. This property makes them highly susceptible to changes in their environmental conditions. Consequently the distribution of different species of bryophytes often indicates different types of micro-habitats.

A biologist (Dunlop S., 2015) investigated the effect of abiotic factors on local communities of bryophytes. These communities were found growing on limestone boulders (large rocks) resting on large areas of soil. The study was performed in 20 different sites chosen across the Maltese Islands.

Results showed that the variety of bryophyte species in a particular site was similar on boulders and on the soil. A similar result was obtained when different sites were compared. Yet, the study showed that the number of different species of bryophytes increased on boulders with larger surface area. Factors that affected availability of light and the level of moisture also affected the number of different species in a bryophyte community.

(Adapted from Dunlop S., *Species richness and metacommunity dynamics in bryophytes;* in Biology Symposium Abstracts 2015, UOM)

a. Define the term *bryophyte community*. (2 marks)
b. Give ONE common characteristic that bryophytes share with all other species in the plant kingdom. (1 mark)

c. Although bryophytes do not have proper roots, they have rhizoids that resemble roots. What is the function of these structures? (1 mark)

d. Give ONE advantage and ONE disadvantage of bryophytes not having a waxy cuticle. (2 marks)

e. 'Bryophytes do not have lignified tissues'. Explain how this affects the size of the bryophyte plant and give a reason for your answer. (2 marks)

f. What is the advantage of including a large number of sites in this study rather than a few sites? (2 marks)

g. Explain why the number of bryophyte species:
   i) increased on boulders with a larger surface area; (1 mark)
   ii) was affected by the availability of light; (1 mark)
   iii) was affected by the level of moisture. (1 mark)

(Total: 13 marks)

2. An investigation was carried out to find the mass of fats digested by the enzyme lipase. The experiment was repeated at different pH levels and each time, the mass of fats remaining undigested after 24 hours was recorded. The results are shown in the table below.

pH	**Mass of fat undigested after 24 hours / g**
2	10
4	10
6	9.4
8	5
10	6.6
12	9.8
14	10

a. On the graph paper provided (use the 2 mm grid scale), draw a graph to show the relationship between mass of fat undigested after 24 hours and pH. Join the points of the graph with straight lines. (6 marks)

b. From the graph, determine:
   i) the optimum pH for lipase to work;
   ii) the mass of undigested fat at pH 7. (1,1 mark)

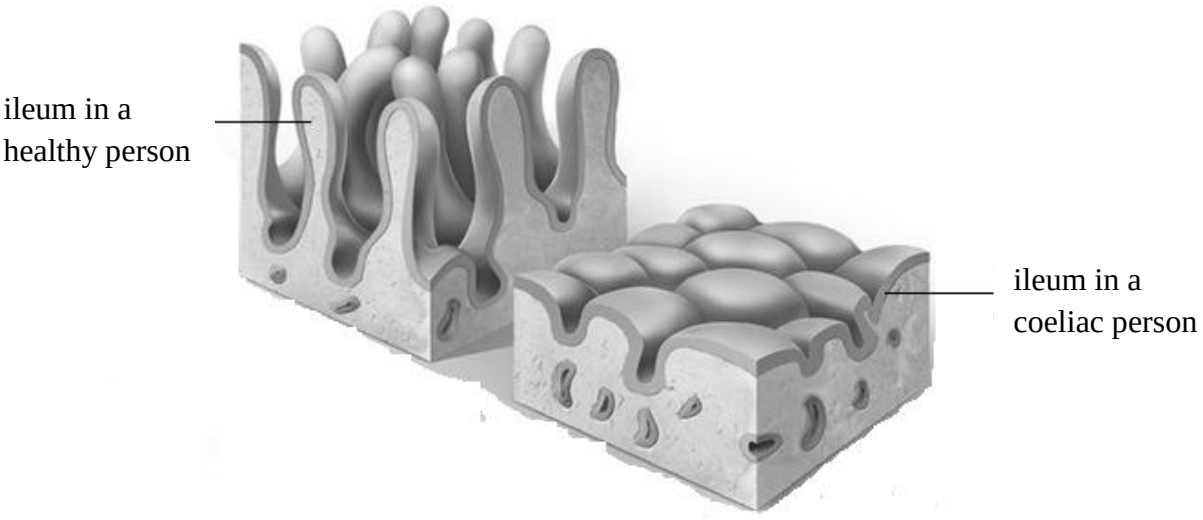
c. List TWO variables that were kept constant during these experiments, to ensure accurate results. (2 marks)

d. Gall stones are pieces of solid material that form in the gall bladder and bile duct. Explain why patients suffering from gall stones are advised to reduce the fat intake in their diet. (2 marks)

(Total: 12 marks)

Section B: Answer any THREE questions from this section.

3. Coeliac disease is caused by a reaction of the cells lining the small intestine to the presence of gluten. The lining becomes inflamed such that the surface of the ileum becomes smooth, as shown in the diagram below.



a. Explain how coeliac disease affects the normal functioning of the ileum. (2 marks)

b. The inside of the ileum of a healthy person is lined with villi. State THREE ways how villi are adapted to perform their function efficiently. (3 marks)

c. Draw a well labelled diagram to show the internal structure of the villus. (5 marks)

d. Undigested food passes into the large intestine. State the function of the following parts of the large intestine.
   i) colon;
   ii) rectum;
   iii) anus. (3 marks)

e. The caecum and appendix in rabbits and horses are highly enlarged. Explain their role in digestion. (2 marks)

f. Ruminants are frequently observed 'chewing the cud'. Describe how their digestive system is adapted to break down cellulose effectively. (4 marks)

g. An animal's dentition is adapted to its diet. Discuss this statement with reference to ruminant herbivores. (4 marks)

h. Tapeworms are endoparasites that live in the small intestine of humans. State TWO adaptations which allow the tapeworm to survive. (2 marks)

(Total: 25 marks)

4. Give biological explanations to the following statements.

a. The seaweed *Caulerpa taxifolia* lives in tropical oceans but is now also found in the Mediterranean Sea, where it grows at twice the rate of local seaweeds. At first, chlorine was used to kill it but now the introduction of tropical sea slugs (herbivorous molluscs) is being considered since the seaweed is part of their natural diet. (5 marks)

b. Agriculture and animal husbandry are important in supplying humans with food, however they also have harmful effects on the environment. (5 marks)

c. Chemical insecticides are used to kill as many insect pests as possible. However their use may also have unwanted effects. (4 marks)

d. Biology students were provided with a group of specimens labelled as worms. On close examination they separated the worms in 3 groups: Flatworms, Roundworms and Annelids. (5 marks)

e. Snails and millipedes have different appearances and are classified in a different phylum. Yet, although spiders, millipedes, crabs and beetles have different appearances they are all classified in the same phylum. (6 marks)

(Total: 25 marks)

5. Students carried out an experiment to investigate osmosis in chicken eggs. Each egg was left overnight in a large beaker of concentrated hydrochloric acid to dissolve the shell. Each egg was then rinsed and gently dried with a paper towel. The mass of each egg was recorded. Each egg was then placed in each of solutions A, B and C and left for 24 hours. After, each egg was dried gently and the mass was recorded again.

Solution **A**	Solution **B**	Solution **C**
Distilled water	60% salt solution	10% salt solution

a. Give one reason why the:
   i) shell was removed before the experiment;
   ii) eggs were dried before weighing. (1,1 mark)

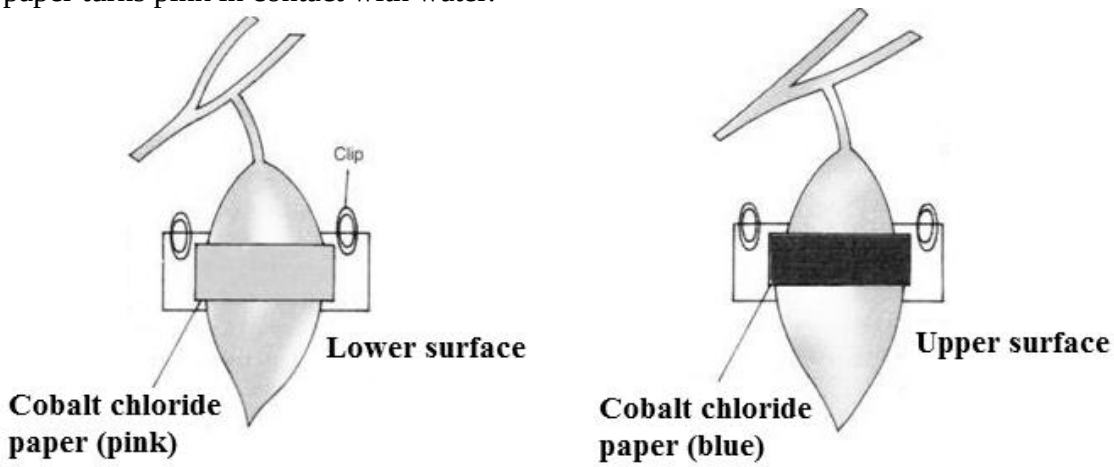
b. Students observed that the mass of the egg placed in solution A increased, the egg placed in solution B decreased but there was no change in the egg placed in solution C. Give a biological explanation for each result. (6 marks)

c. The biology teacher explained that the rate of osmosis varies depending on the size of the egg used. Explain. (2 marks)

d. Students repeated the same experiment using red onion epidermis. After 3 hours, they observed the cells placed in solutions A and B under the light microscope. The red onion epidermis cells placed in each solution showed changes. Compare the observations. (2 marks)

e. Draw a labelled diagram to show how cells placed in solution B appeared under the light microscope. (5 marks)

f. During an experiment to investigate transpiration using Privet leaves, cobalt chloride paper was put on both upper and lower surfaces of a leaf, as shown in the diagram. Cobalt chloride paper turns pink in contact with water.



State TWO conclusions that students may draw from this experiment. (2, 2 marks)

g. State TWO ways how plants living in dry regions are adapted to prevent water loss. For each adaptation, explain how it helps in preventing water loss. (2, 2 marks)

(Total: 25 marks)

6. Hunger in humans is controlled by two protein hormones called ghrelin and leptin. Ghrelin promotes the feeling of hunger, whilst leptin inhibits this feeling and instead promotes the feeling of fullness after eating. Both hormones are produced from several cells including cells in the stomach. They affect the hypothalamus.

a. i) Define the term *hormone*. (2 marks)
ii) State where the hypothalamus is found in the human body and give ONE function that it performs. (2 marks)
iii) Describe how the two hormones produced in the stomach may reach the hypothalamus. (2 marks)
iv) Explain why the balance of ghrelin and leptin is important in humans. (2 marks)
v) Insulin and glucagon are also two protein hormones. Describe how insulin and glucagon control the level of glucose in blood. (7 marks)

b. Congenital leptin deficiency is an autosomal recessive genetic disorder caused by mutations in the LEP gene which codes for the production of leptin.
   i) Define the term *mutation* as used in the statement above. (2 marks)
   ii) How is an autosomal disorder different from a sex-linked genetic disorder? (2 marks)
   iii) Briefly describe the role of the LEP gene in the production of leptin. (2 marks)
   iv) Congenital leptin deficiency leads to obesity. List ONE harmful effect of obesity on human health. (2 marks)

c. Familial partial lipodystrophy (FPL) is a condition where the body starts losing its fat deposit. One type of FPL is an inherited autosomal dominant trait, whilst another type of FPL is an inherited autosomal recessive trait.
   Distinguish between an autosomal dominant trait and an autosomal recessive trait. (2 marks)

(Total: 25 marks)

7. Viruses, bacteria and yeast cells are important in the biotechnology industry.

a. i) Give TWO reasons why viruses are classified as a separate group from bacteria. (2 marks)
   ii) Bacteria are prokaryotic cells whilst yeast cells are eukaryotic. State TWO similarities and ONE difference between all prokaryotic and eukaryotic cells. (3 marks)

b. *Saccharomyces cerevisiae* and *Candida stellata* are both examples of yeast species.
   i) State the name of the scientific naming system used to identify each yeast species and suggest ONE advantage for using this system in classification. (3 marks)
   ii) Name the kingdom that all the yeast species belong to. List ONE structural similarity and TWO structural differences between yeast cells and palisade cells in plants. (4 marks)
   iii) List ONE structural similarity and ONE structural difference between yeast cells and animal cells. (2 marks)

c. Anaerobic respiration in yeast cells is important in the production of several products including bread and butter.
   Write a word equation summarizing the process of anaerobic respiration in yeast cells. (2 marks)

d. Give ONE reason for each of the following steps involved in bread baking.
   i) Thorough mixing of ingredients in the first step;
   ii) The resulting dough is allowed to stand for 3 hours at 27^{o}C. (2, 2 marks)

e. Genetically modified bacteria have been used to synthesize human insulin. Describe how bacteria are genetically modified. (You may present you answer in the form of a flow-chart.) (5 marks)

(Total: 25 marks)

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

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2016 SESSION

SUBJECT:	**Biology**
PAPER NUMBER:	IIB
DATE:	6th May 2016
TIME:	4:00 p.m. to 6:05 p.m.

Write your answers on the booklet provided. Write down the number of the questions you answer, on the front page of your answer booklet.
Please note that for question 1 of this paper you need the graph paper in the booklet.

Answer any FOUR questions.

1. An investigation was carried out to find the mass of fats digested by the enzyme lipase. The experiment was repeated at different pH levels and each time, the mass of fats remaining undigested after 24 hours was recorded. The results are shown in the table below.

pH	Mass of fat undigested after 24 hours / g
2	10
4	10
6	9.4
8	5
10	6.6
12	9.8
14	10

a. On the graph paper provided (use the 2mm grid scale), draw a graph to show the relationship between mass of fat undigested after 24 hours and pH. Join the points of the graph with straight lines. (6 marks)

b. From the graph, state:
i) the optimum pH for lipase to work;
ii) the mass of undigested fat at pH 7. (2,2 marks)

c. Name a chemical produced in the human digestive system that provides an optimum pH for lipase to function. (2 marks)

d. Give TWO reasons why the temperature was kept constant throughout the experiment. (2 marks)

e. The breakdown of fats in the digestive system is helped by the action of bile. Explain the importance of bile. (3 marks)

f. The liver produces bile. State TWO other functions of the liver. (2, 2 marks)

g. Gall stones are pieces of solid material that form in the gall bladder and bile duct. Patients suffering from gall stones are advised to reduce the fat intake in their diet. Explain. (2 marks)

h. Name the blood vessel that carries blood rich in nutrients from the ileum to the liver. (2 marks)

(Total: 25 marks)

2. Bryophytes are the second largest group in the Plant Kingdom. There are between 15,000 and 25,000 species in all. Around 126 bryophyte species have been found in the Maltese islands. This group contains very small plants which are commonly referred to as mosses.

a. Define the term *species*. (2 marks)

b. i) Give ONE common characteristic that bryophytes share with all other plant species. (2 marks)

ii) Name TWO other plant phyla besides bryophytes. (2 marks)

Bryophytes do not have lignified tissues; they lack proper roots, proper stems and proper leaves. The leaf-like structures making up the bryophyte plant are not covered with a waxy cuticle. Bryophytes exchange substances with the environment over their whole body surface.

c. Instead of proper roots, bryophytes have rhizoids. These are structures that resemble roots. State the function of these structures. (2 marks)

d. 'Bryophytes do not have lignified tissues'.

i) State the function of lignin in a cell wall. (2 marks)

ii) How does the absence of lignified tissues affect the size of the bryophyte plant? Give a reason for your answer. (1, 2 marks)

e. Give ONE advantage and ONE disadvantage why bryophytes do not have a waxy cuticle. (2, 2 marks)

A biologist investigated the effect of abiotic factors on local communities of bryophytes. These communities were found growing on limestone boulders (large rocks) resting on large areas of soil.

f. i) Define the term *bryophyte community*. (2 marks)

ii) Distinguish between biotic and abiotic factors. (2 marks)

Results showed that the variety of bryophyte species in a particular site was similar on boulders and on the soil. Yet, the study showed that the number of different species of bryophytes increased on boulders with larger surface area. Factors that affected the availability of light also affected the number of different species in a bryophyte community.

g. Explain why the number of bryophyte species:

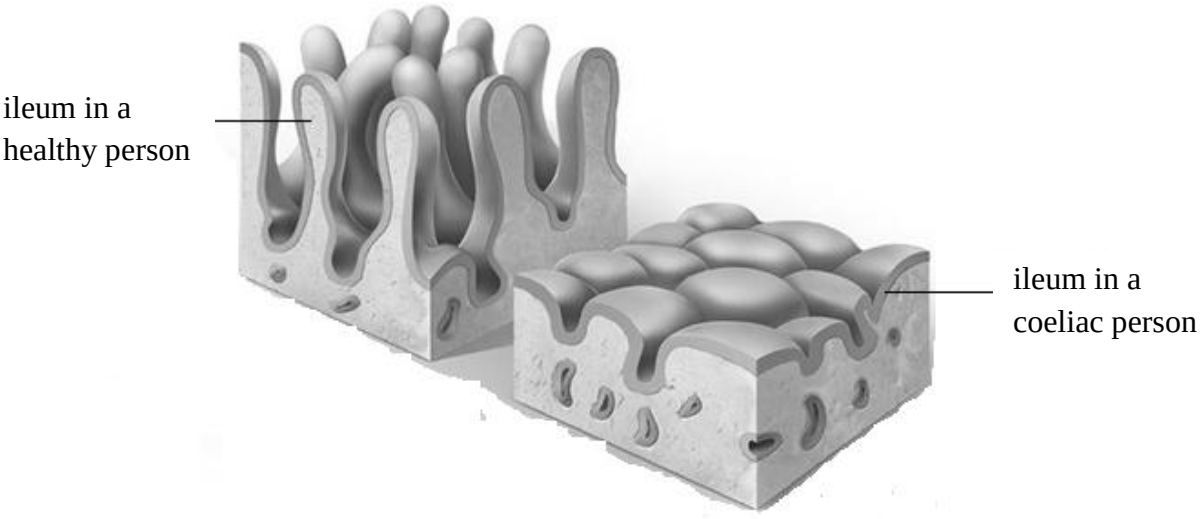
i) increased on boulders with a larger surface area; (2 marks)

ii) is affected by the availability of light. (2 marks)

(Adapted from Dunlop S., *Species richness and metacommunity dynamics in bryophytes;* in Biology Symposium Abstracts 2015, UOM)

(Total: 25 marks)

3. Coeliac disease is caused by a reaction of the cells lining the small intestine to the presence of gluten. The lining becomes inflamed such that the surface of the ileum becomes smooth, as shown in the diagram below.



a. Explain how coeliac disease affects the normal functioning of the ileum. (2 marks)

b. The ileum of a healthy person is lined by villi. State THREE ways how villi are adapted to perform their function efficiently. (6 marks)

c. Draw a well labelled diagram to show the internal structure of the villus. (6 marks)

d. Undigested food passes into the large intestine. State the function of the following parts of the large intestine.
   i) colon;
   ii) rectum;
   iii) anus. (3 marks)

e. The caecum and appendix in rabbits and horses are highly enlarged. Explain their role in digestion. (3 marks)

f. An animal's dentition is adapted to its diet. List THREE ways how the dentition of a herbivore is adapted to its diet. (3 marks)

g. Tapeworms are endoparasites that live in the small intestine of humans. State TWO adaptations that allow the tapeworm to survive in this habitat. (2 marks)

(Total: 25 marks)

4. Give biological explanations to the following statements.

a. The seaweed *Caulerpa taxifolia* has spread into the Mediterranean Sea. It grows faster than local seaweeds. Biologists will use a sea slug (a herbivore) to control the growth of *Caulerpa* instead of using chemicals to kill it. (6 marks)

b. Agriculture provides humans with food. However it also has harmful effects on the environment. (6 marks)

c. Biology students were provided with a group of specimens labelled as worms. On close examination they separated the worms in 3 groups: Flatworms, Roundworms and Annelids (6 marks)

d. Snails and millipedes have different appearances. Snails are classified as molluscs whilst millipedes are classified as arthropods. Yet, although spiders, millipedes, crabs and beetles have different appearances they are all classified as Arthropods. (7 marks)

(Total: 25 marks)

5. Students carried out an experiment to investigate osmosis in chicken eggs. Each egg was left overnight in a large beaker of concentrated hydrochloric acid to dissolve the shell. Each egg was then rinsed and gently dried with a paper towel. The mass of each egg was recorded. Each egg was then placed in each of solutions A, B and C and left for 24 hours. After, each egg was dried gently and the mass was recorded again.

Solution **A**	Solution **B**	Solution **C**
Distilled water	60% salt solution	10% salt solution

a. Give one reason why the:
   i) shell was removed before the experiment;
   ii) eggs were dried before weighing. (2, 2 marks)

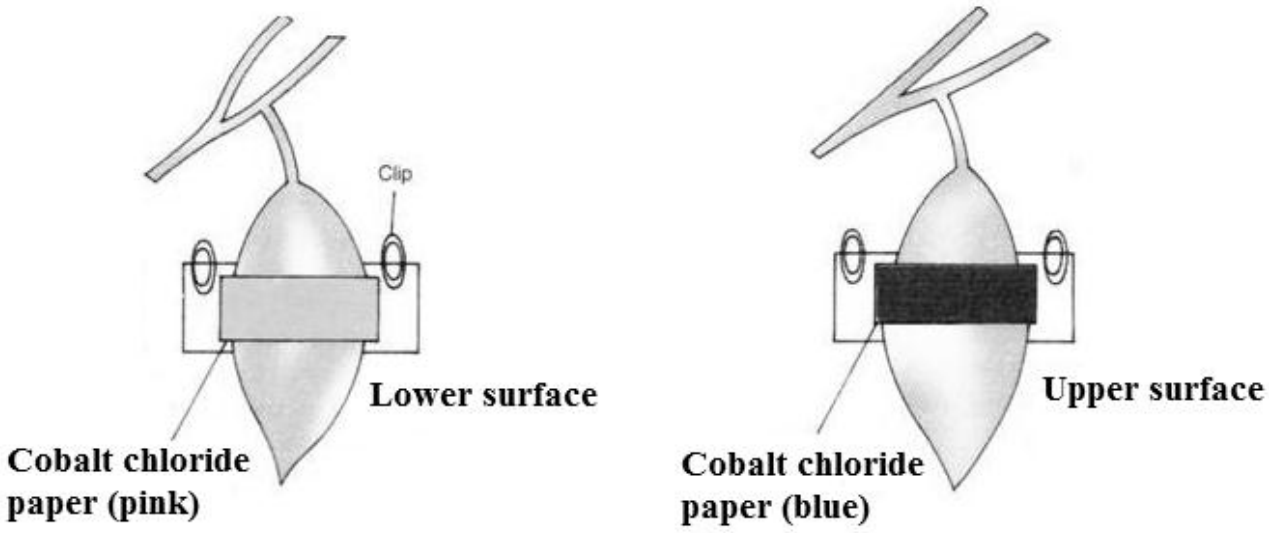
b. Students observed that the mass of the egg placed in solution A increased while the mass of the egg placed in solution B decreased. Give a biological explanation for each result. (4 marks)

c. Students put some red onion epidermis in Solution B for 3 hours. After 3 hours, changes in the cells were observed under the light microscope. The red onion cells showed changes.

i) Explain what happened to the red onion cells. (2 marks)

ii) Draw a labelled diagram to show how the cells appeared under the light microscope. (5 marks)

d. During an experiment to investigate transpiration using Privet leaves, cobalt chloride paper was put on both upper and lower surfaces of a leaf, as shown in the diagram. Cobalt chloride paper turns pink in contact with water.



State ONE conclusion the student draws from this experiment. (2 marks)

e. Non-woody plants easily wilt when they lack water. State ONE adaptation plants may have to prevent water loss. (2 marks)

f. i) Name the specialised cells in the plant needed to transport the products of photosynthesis. (2 marks)

ii) Write a word equation to summarize the process of photosynthesis. (2 marks)

iii) Explain why in a variegated leaf the rate of photosynthesis is higher in the green part of the leaf than in the white part of the leaf. (2 marks)

(Total: 25 marks)

Please turn the page.

6. Hunger in humans is controlled by two protein hormones called ghrelin and leptin. Ghrelin promotes the feeling of hunger, whilst leptin inhibits this feeling and instead promotes the feeling of fullness after eating. Both hormones are produced from several cells including cells in the stomach. They affect the hypothalamus.

a. Define the following terms:
   i) *protein;*
   ii) *hormone.* (2, 2 marks)

b. i) The hypothalamus forms part of an important organ in the human body. Name this organ. State ONE function of the hypothalamus. (1, 2 marks)
   ii) Describe how the two hormones produced in the stomach may reach the hypothalamus. (2 marks)
   iii) The balance of ghrelin and leptin allows humans to control the amount of food that they eat. State ONE function of food in humans. (2 marks)

c. Insulin and glucagon are also two protein hormones.
   i) What condition leads to the release of insulin in blood? State ONE way how insulin counteracts this condition. (1, 2 marks)
   ii) What condition leads to the release of glucagon in blood? State ONE way how glucagon counteracts this condition. (1, 2 marks)

d. Congenital leptin deficiency is an autosomal recessive genetic disorder caused by mutations in the LEP gene which codes for the production of leptin.
   i) Define the term *mutation* as used in the statement above. (2 marks)
   ii) How is an autosomal disorder different from a sex-linked genetic disorder? (2 marks)
   iii) Congenital leptin deficiency leads to obesity. List TWO harmful effects of obesity on human health. (4 marks)

(Total: 25 marks)

7. Viruses, bacteria and yeast cells are important in the biotechnology industry.

a. i) Give ONE reason why viruses are classified as a separate group from bacteria. (2 marks)

ii) Bacteria are prokaryotic cells whilst yeast cells are eukaryotic. State TWO similarities and ONE difference between all prokaryotic and eukaryotic cells. (4, 2 marks)

b. *Saccharomyces cerevisiae* and *Candida stellata* are both examples of yeast species.

i) Give ONE advantage for using the binomial (two-name) system to classify organisms. (2 marks)

ii) Name the kingdom that all the yeast species belong to. List TWO structural differences between yeast cells and palisade cells in plants. (5 marks)

iii) List ONE structural similarity and ONE structural difference between yeast cells and animal cells. (4 marks)

c. Anaerobic respiration in yeast cells is important in the production of several products including bread and butter.
Write a word equation summarizing the process of anaerobic respiration in yeast cells. (2 marks)

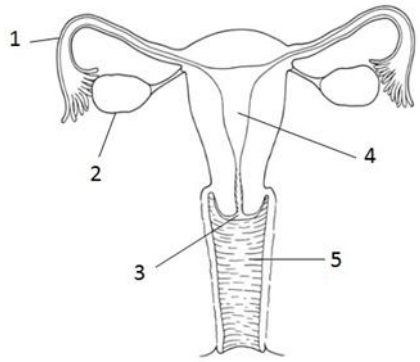
d. Genetically modified bacteria have been used to synthesize human insulin. Briefly describe how bacteria are genetically modified to synthesize insulin after the gene coding for insulin is extracted from the human cell. In your answer include the following terms: *plasmid*, *enzymes*, *recombinant plasmid.* (You may present your answer in the form of a paragraph or a flow chart.) (4 marks)

(Total: 25 marks)

Please turn the page.

8. This question is about sexual reproduction in humans and flowering plants.

The diagram shows part of a human female reproductive system.



a. Name parts labelled 1, 2, 3, 4 and 5. (1,1,1,1,1 marks)

b. Meiosis occurs in part labelled 2.
i) Define the term *meiosis*. (2 marks)
ii) Name the cell produced by meiosis in the human female. (1 mark)

c. Describe the following processes related to reproduction in humans:
i) ovulation;
ii) menstruation. (2, 2 marks)

d. Explain why a blocked part 1 (in the diagram above) prevents a woman from becoming pregnant. (1 mark)

e. Sketch a graph to show changes in the levels of progesterone and oestrogen during the first 14 days of a 28-day menstrual cycle. (4 marks)

f. Cigarette smoke contains carbon monoxide which, on being inhaled into the lungs, enters the bloodstream and combines with haemoglobin.

Use this information and your knowledge to explain why a pregnant woman must stop smoking during pregnancy. (4 marks)

g. The female reproductive system in a flowering plant is the carpel. State TWO differences between the process of fertilization in the human reproductive system and that in a flowering plant. (4 marks)

(Total 25 marks)