

MSCE '03 - '13

BIOLOGY

PAST PAPERS

QUESTIONS

SOLUTIONS

&

ANALYSIS

Introduction

National examinations in Malawi, **JCE and MSCE, are tough.** Students as well as teachers must cover syllabi of many subjects that contain a large number of topics. On the other hand, **to let students have fun of Math and Science** is one of missions for us, **Japan Overseas Cooperation Volunteers.** However, we have been facing **challenges** that we can't secure the time to carry out the mission because of the coverage of the syllabi.

“How can we cover the syllabi efficiently?”

“How can students learn effectively?”

In order to conquer the challenges, we have produced this series, **“JCE/MSCE Past Papers: Questions, Solutions & Analysis”.**

FEATURES:

- * **Questions and Answers in JCE / MSCE from 2003 to 2012**
- * **Classified by topic, for learning / teaching effectively**
- * **Graphs that show which topic is most often asked**
- * **Actual exams of 2013 as achievement tests**

We wish that students can learn effectively and that teachers can teach efficiently when these are used correctly. **But don't forget! To enjoy Maths and Science is more important than just to get high marks.** Learning with joy and wonder will finally lead you to the bright future.

JICA Math & Science Teachers' Committee

*There are no solutions of MSCE BIO paper2 and P/S paper2 because those answers depend on environments, conditions and materials.

* Actual exams of 2013 have only questions.

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~MSCE: Biology~

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Questions: Bio 1

(2003~2012)

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|-----------------------------|-------------------|
| 1. Photosynthesis | 9. Excretion |
| 2. Transportation in plants | 10. Coordination |
| 3. Tropism | 11. Human disease |
| 4. Digestive system | 12. Immunity |
| 5. Circulatory system | 13. Genetics |
| 6. Respiratory system | 14. Evolution |
| 7. Locomotion | 15. Population |
| 8. Reproduction | 16. Ecosystem |

Solutions: Bio 1

(2003~2012)

- | | |
|-----------------------------|---------------------|
| 1. Photosynthesis | 3. Tropism |
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- | | |
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| 5. Circulatory system | 11. Human disease |
| 6. Respiratory system | 12. Immunity |
| 7. Locomotion | 13. Genetics |
| 8. Reproduction | 14. Evolution |
| 9. Excretion | 15. Population |
| 10. Coordination | 16. Ecosystem |

Questions: Bio 2

(2003~2012 *Only questions)

- | | |
|------|------|
| 2003 | 2008 |
| 2004 | 2009 |
| 2005 | 2010 |
| 2006 | 2011 |
| 2007 | 2012 |

2013 MSCE Bio 1 Questions

(*Only questions)

2013 MSCE Bio 2 Questions

(*Only questions)

Acknowledgements

How to use

****Analysis / Preparation****

There is a graph made by analysing past-questions from 2003 to 2012.

You will know which topic you should learn / teach intensively. And you will also find **FUNDAMENTAL** but **IMPORTANT TIPS** to get higher marks.

****Questions / Solutions****

Questions and solutions are classified and re-ordered by each topic. Therefore, **you can learn specific topics, or topics that you are weak in, selectively. Think deeply on your own before you check the answer!**

****Questions of MSCE BIO, P/S paper2**** (Only MSCE BIO, P/S books)

Questions are sorted by year. Although there are no solutions because those answers depend on schools and their conditions, **you can grasp the trend.** Similar questions repeatedly appear.

****Actual exams of 2013****

These questions aren't re-ordered. You can try this exam to check your current level as an achievement test. You must **follow fixed time length** when you try.

Preparation

We analysed questions from 2003 to 2012 and made this graph. This graph shows the average of marks of each topic. It means **it also shows which topic is most often asked**. In this case, the length of “Photosynthesis” is longest: **MOST ASKED TOPIC**. The length of “Coordination” is shortest: **LEAST ASKED TOPIC**.

MOST ASKED TOPICS IN MSCE BIOLOGY (paper1):

1. *Photosynthesis*
2. *Ecosystem*
3. *Reproduction*
4. *Human disease*
5. *Circulatory system*

Even apart from daily learning, we can still make marks better. **How you write exams is also important.**

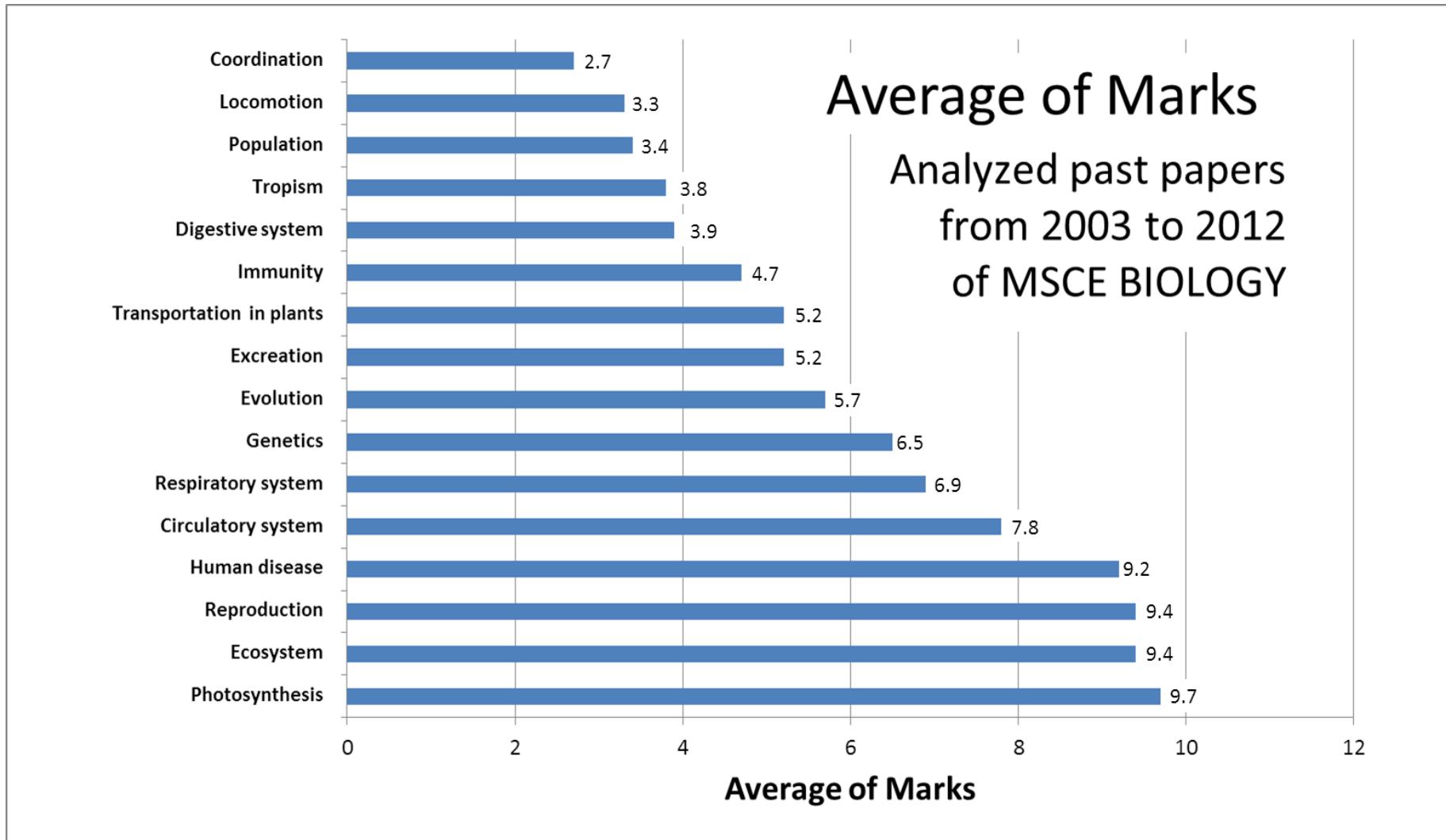
TIPS FOR GETTING HIGHER MARKS:

1. *Write your name correctly*
2. *Write your answers clearly and neatly*
3. *Try to solve all questions*
(Time designation is also important)
4. *Don't leave blanks, write something*
(Even if you don't know the answer, at least, you can mark one choice in multiple questions!)

IN ESSAY QUESTIONS:

5. *Don't itemise and number the sentences, write them in an essay form.*
6. *you don't have to rewrite “the question” in your answer essay.*

Analysis: MSCE BIOLOGY



Q M S C E : B I 01 QUESTIONS

1 Photosynthesis

Section A

2012-2.

Figure 1 shows part of a leaf. Use it to answer the questions that follow.

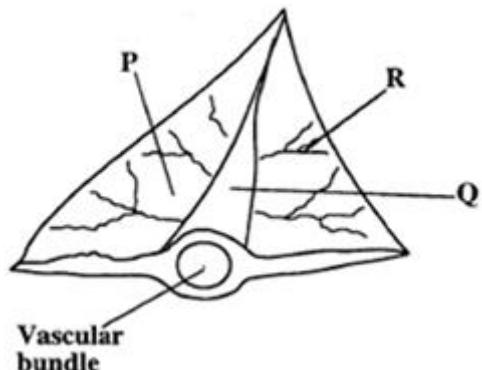


Figure 1

a. Name the part marked **Q**. (1 mark)

b. Explain the functions of **P** and **R** in relation to photosynthesis. (4 marks)

2011-2.

Figure 1 shows part of a chemical equation of a biological process. Use it to answer the questions that follow.

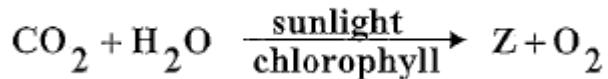


Figure 1

a. Write down the chemical formula of the substance represented by **Z**. (1 mark)

b. Explain one use of the substance marked **Z** to a plant. (3 marks)

c. Explain how the process in **Figure 1** prevents global warming. (2 marks)

2010-1.

Figure 1 shows some structures of a leaf as seen under an electron microscope. Use it to answer the questions that follow.

a. Name the parts marked **X** and **Y**. (2 marks)

b. Explain how magnesium is important for the function of part marked **Z**. (3 marks)

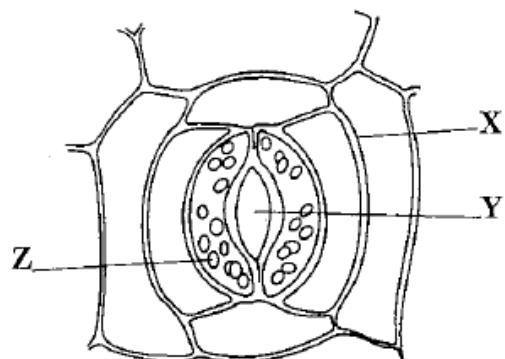


Figure 1

2009-6.

Figure 5 represents a process taking place in a plant. Use it to answer the questions that follow.

a. Name the process marked **K** and **L**.
(2 marks)

b. Name the process by which substance
N gets into the leaf. (1 mark)

c. Mention **one** adaptation of a leaf that
enables it to get substance **N**.
(1 mark)

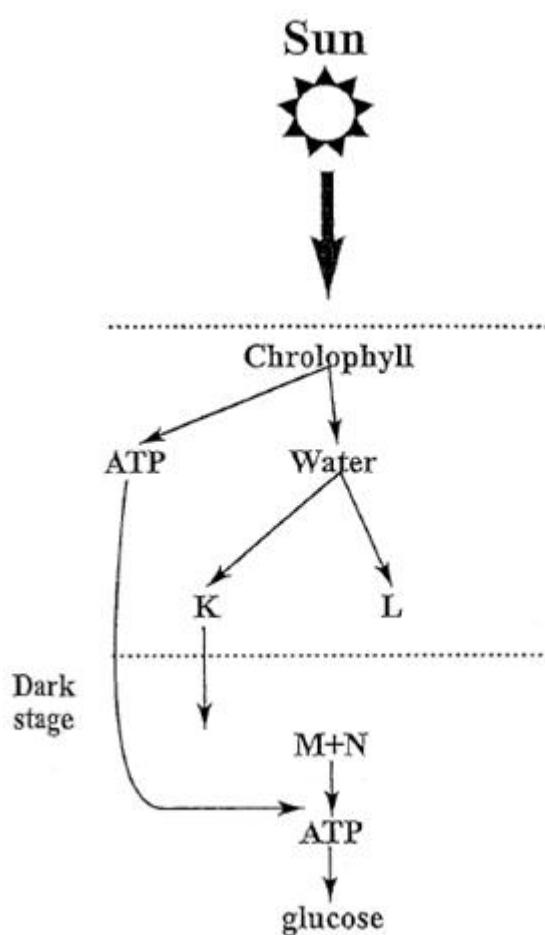


Figure 5

2007-1.

a. Name any one chemical reaction that takes place during light stage of photosynthesis. (1 mark)

b. **Figure 1** is a diagram of a plant cell as seen through a light microscope. Use it to answer the
questions that follow.

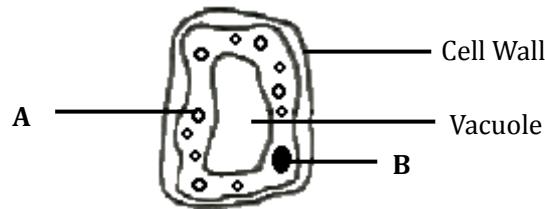


Figure 1

(i) Give the function of each of the following marked parts:

A (1 mark)

B (1 mark)

(ii) What is the name of the cell? (1 mark)

c. State **one** way in which photosynthesis is important. (1 mark)

2006-1.

Figure 1 is a diagram representing gas exchange between a leaf and the atmosphere. Use it to answer the questions that follow.



Figure 1

- What process in the leaf leads to this gas exchange shown in **Figure 1**? (1 mark)
- List **two** characteristics of a leaf that enable gas exchange shown in **Figure 1**. (2 marks)
- What is the function of the midrib? (1 mark)

2005-2.

- What role does the following play in photosynthesis?
 - Chlorophyll (1 mark)
 - Xylem (1 mark)
- How do plants make proteins? (1 mark)

2004-3.

- Why would a plant fail to carry out photosynthesis if it lacked magnesium? (1 mark)

2003-1.

- State **one** product of the following stages of photosynthesis.
 - Light stage (1 mark)
 - Dark stage (1 mark)
- How does a green plant reduce carbon dioxide concentration in the atmosphere? (1 mark)

Section B

2011-5.

Figure 3 is a diagram representing a cross section of a leaf. Use it to answer the questions that follow.

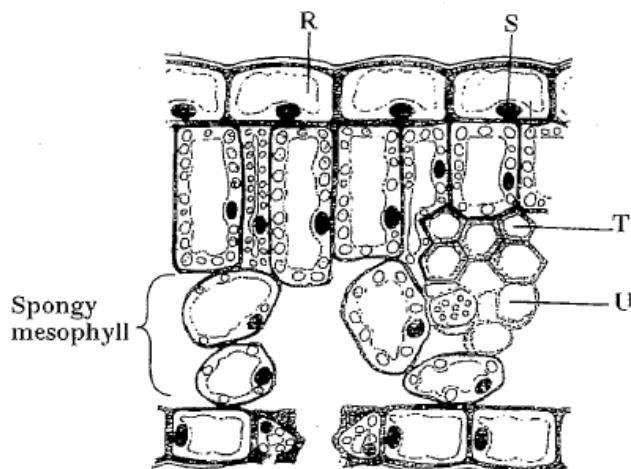


Figure 3

- Name the parts marked **R** and **S**. (2 marks)
- Which tissue is the main site for photosynthesis in the leaf? (1 mark)
 - Give a reason for your answer to 5.b.(i). (1 mark)
- State **two** structural differences between the parts marked **T** and **U**. (2 marks)
- Explain how a steady flow of carbon dioxide is maintained between the atmosphere and mesophyll cells in a leaf during day time. (3 marks)

2003-8.

Figure 3 is a diagram showing the changes in carbon dioxide concentration in air in a forest, over a 24 hour period. Use it to answer the questions that follow.

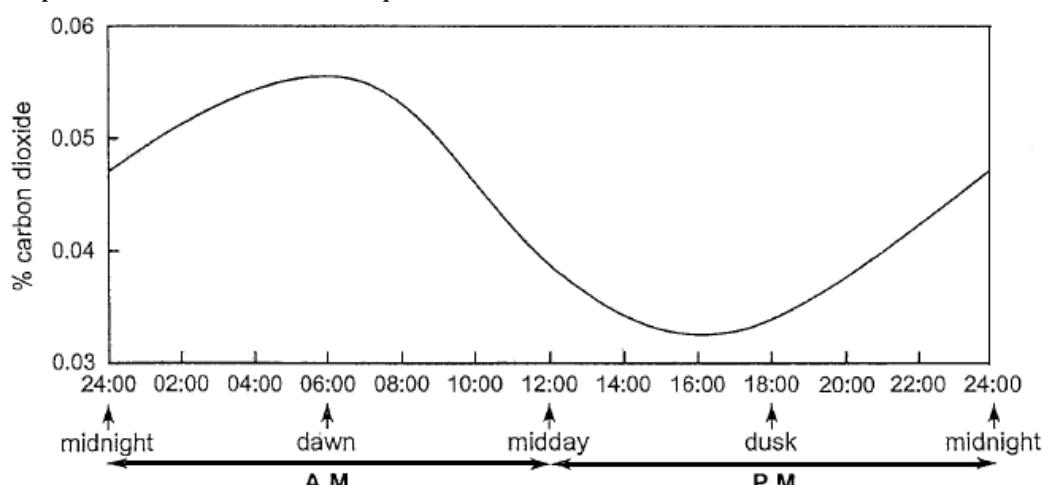


Figure 3

- Describe briefly how the concentration of carbon dioxide changed during the 24 hour period. (3 marks)
- Explain the carbon dioxide concentration change in 8.a. above. (3 marks)

Section C

2008-16.

Describe an experiment that could be carried out to show that fresh green leaves contain three types of pigments. Your answer should include procedure, results and conclusion in an essay form.

(10 marks)

2004-16.

Explain **five** ways in which glucose is used by the plant after photosynthesis. (10 marks)

2 Transportation in plants

Section A

2012-4.

Figure 3 shows a plant tissue obtained from a stem. Use it to answer the questions that follow.

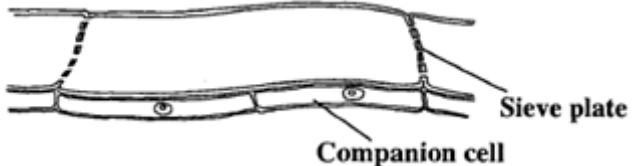


Figure 3

a.

- (i) Identify the tissue. (1 mark)
 - (ii) Give **two** reasons to support your answer in a.(i). (2 marks)
- b. Explain **two** adaptations of the tissue to its function. (4 marks)

2004-3.

a.

- (ii) By what process does a nitrate ion move into a root hair cell when its concentration is higher in the root hair cell than in the soil? (1 mark)
- b. In what way is diffusion similar to osmosis? (1 mark)

2003-2.

Figure 1 is a diagram of two plant cells in contact. The cells are of different cell sap concentrations. Use it to answer questions that follow.

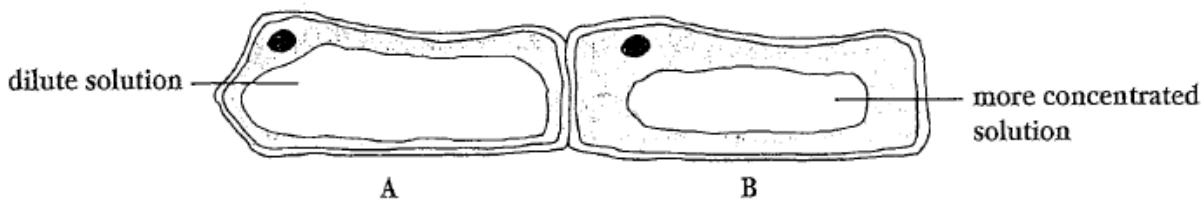


Figure 1

a.

- (i) Which one of the cells A or B has a higher osmotic potential? (1 mark)
 - (ii) Give a reason for your answer in a.(i) above. (1 mark)
- b. Draw an arrow in the diagram itself to show the direction of water movement between the two cells. (1 mark)

Section B

2011-12.

Figure 9 shows an experimental set up in a laboratory. Use it to answer the questions that follow.

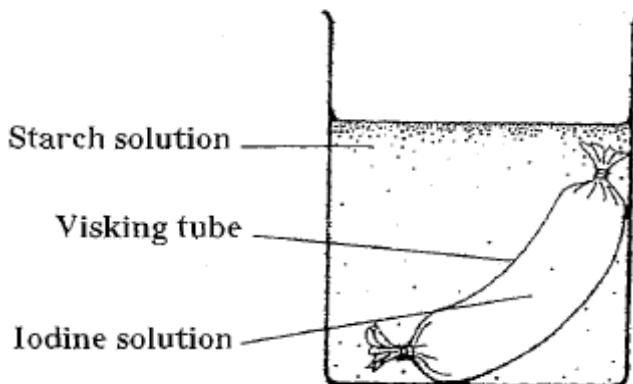


Figure 9

- What type of membrane is the visking tubing? (1 mark)
- (i) What result would be obtained after some time? (2 marks)
- (ii) Explain your answer to **12.b.(i)**. (3 marks)

2010-12.

Figure 10 shows a potometer with a leafy shoot. Use it to answer the questions that follow:

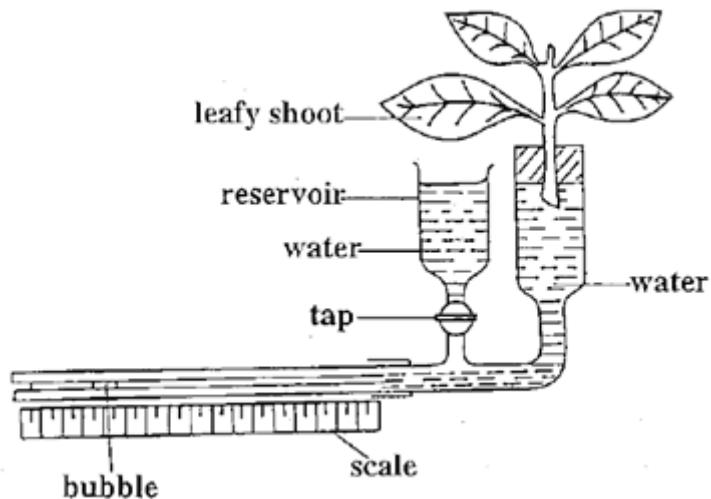


Figure 10

- What effect would each of the following have on the movement of the bubble?
 - Increased temperature of the surrounding air (1 mark)
 - Increased humidity of the surrounding air (1 mark)
- Explain how one can measure rate of transpiration in the leafy shoot using the bubble. (3 marks)

2008-10.

Figure 7 shows a cross-section of a stem from a fresh young bean plant that was dipped in coloured water. Use it to answer the questions that follow.

- a. Name the parts marked **X** and **Y**.

X (1 mark)

Y (1 mark)

b.

(i) Which tissue could take up the coloured water? (1 mark)

(ii) Give a reason for your answer to **10.b.(i).** (1 mark)

c. Explain the function of **Z** to the stem. (2 marks)

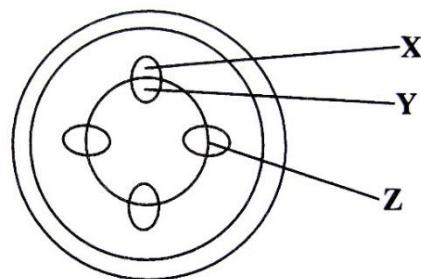


Figure 7

2008-11.

Figure 8 is a bar chart showing the relative amounts of different minerals in pond water and cell sap of green alga. Use it to answer the questions that follow.

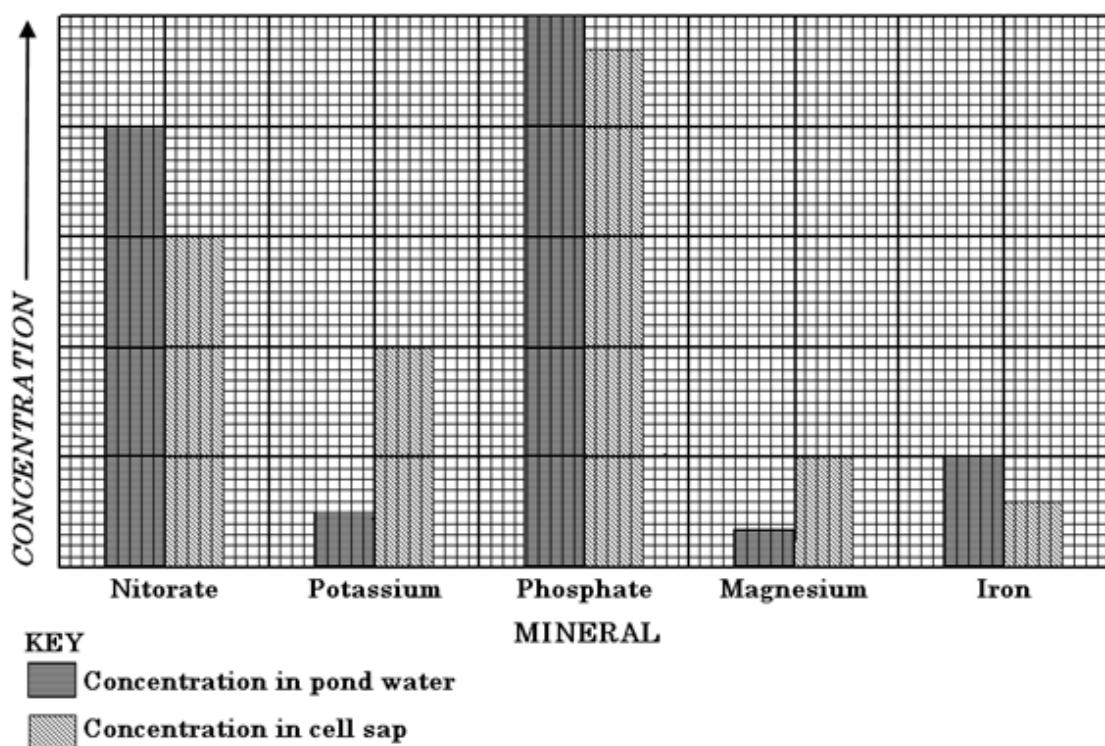


Figure 8

a.

(i) Name any **two** minerals that would enter the alga cell sap by active transport. (2 marks)

(ii) Give a reason for your answer to **11.a.(i).** (2 marks)

b.

(i) What would happen to the concentration of minerals in cell sap and pond water if alga were killed? (1 mark)

(ii) Explain your answer in **11.b.(i).** (2 marks)

2004-13.

Figure 7 is a diagram showing an experiment on osmosis. Use it to answer the questions that follow.

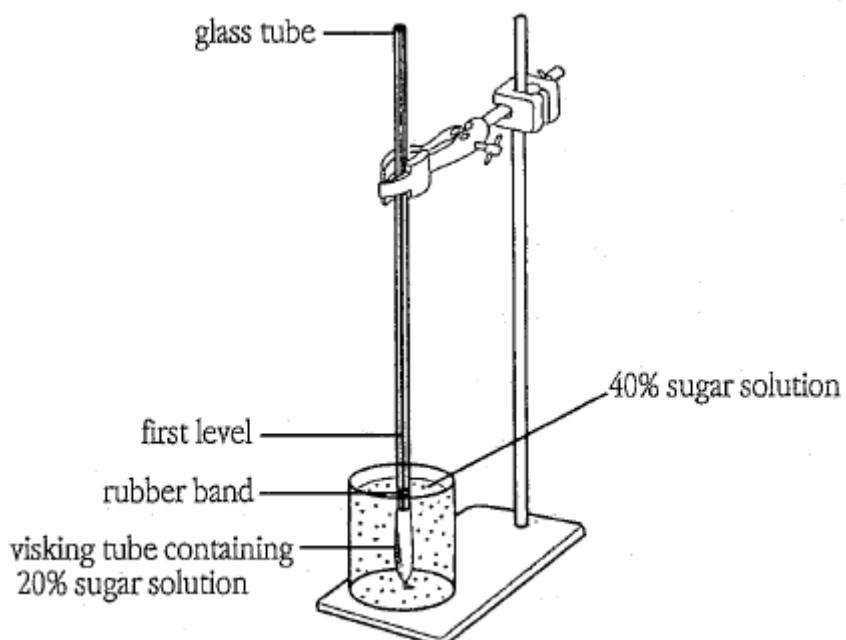


Figure 7

a.

(i) What change would occur to the level of sugar solution in the glass tubing after some time?

(1 mark)

(ii) Explain your answer to **13.a.(i)**. (2 marks)

b. What type of membrane is the visking tubing? (1 mark)

Section C

2011-16.

Describe an experiment that could be carried out to show that light intensity affects rate of transpiration in leafy shoots. Your essay should include procedure, expected results and conclusion. (10 marks)

2009-17.

Describe an experiment that could be conducted to show that germinating bean seeds contain an enzyme that digests starch. Your answer should include procedure, expected results and conclusions. (10 marks)

2005-16.

Describe an experiment you would do to show that transpiration from leaves affects uptake of water. Your answer should be in an essay form. (10 marks)

3 Tropism

Section A

2005-1.

- What are “auxins”? (1 mark)
- How does high auxin concentration affect growth of the following parts of the plant?
 - Shoots (1 mark)
 - Roots (1 mark)

Section B

2009-14.

Figure 11 shows three seedlings X, Y and Z placed in a box painted black and with a hole on one side. The seedlings were treated differently. Use it to answer the questions that follow.

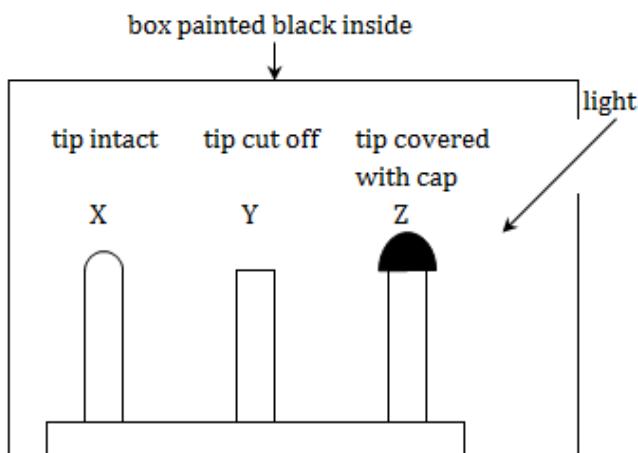
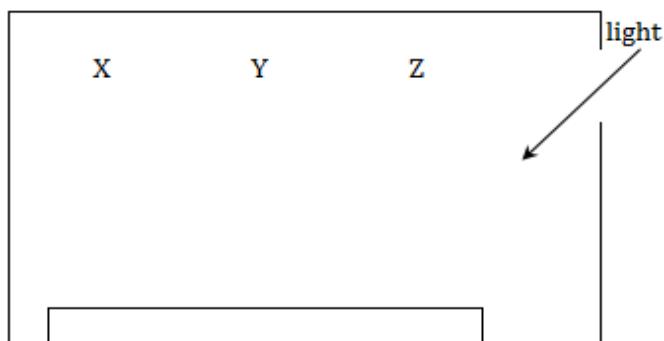


Figure 11

- Why was the box painted black inside? (1 mark)
- In the box provided below, draw the seedlings to show the results at the end of the experiment.
(3 marks)



- Explain the results in seedling Y. (2 marks)

2005-7.

Figure 3 shows diagrams A and B. Diagram A shows the results of what happened when a shoot was illuminated from one side for 48 hours. Diagram B shows cells P and Q which were taken from parts of the shoot in diagram A.

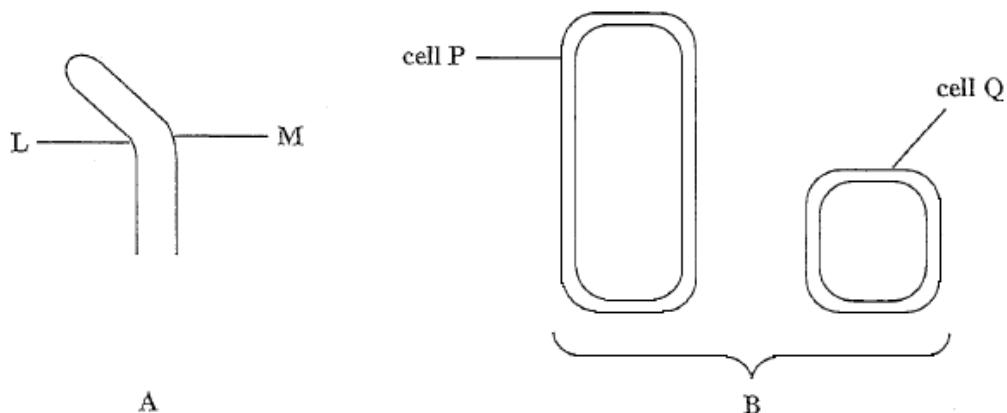


Figure 3

a. Which side of the shoot in diagram A was illuminated? (1 mark)

b.

(i) Which cell was taken from the part marked M. (1 mark)

(ii) Explain your answer to b.(i). (2 marks)

2003-14.

Figure 6 shows response in a potted plant which was placed horizontally. Use it to answer the questions that follow.

a. What was the stimulus in this experiment? (1 mark)

b.

(i) Describe the response in B. (1 mark)

(ii) Explain how the response in b.(i)

above was brought about. (3 marks)

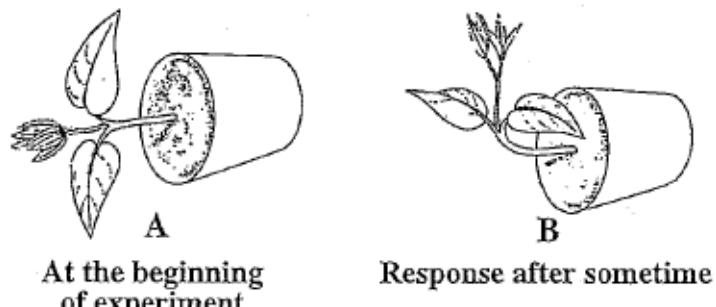


Figure 6

Section C

2006-16.

Design an experiment that you would conduct to find out the region that responds to stimulus of gravity in bean seedlings. Your answer should be in an essay form. (10 marks)

2004-18.

Describe an experiment that you would use to find out the effect of unequal distribution of light on a growing shoot. In your answer include method, expected results and conclusion. (10 marks)

4 Digestive system

Section A

2009-3.

Figure 2 shows the optimum pH for three enzymes **G**, **H** and **I**. Use it to answer the questions that follow.

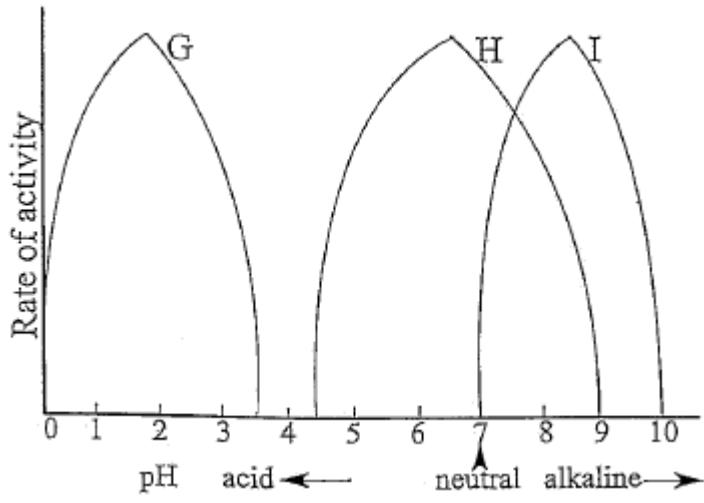


Figure 2

- Which enzyme is most likely to be secreted by the stomach? (1 mark)
- What would happen to activity of enzyme **H** at pH 2? (1 mark)
- What conclusion can be drawn from the results shown by the graphs? (1 mark)

2008-5.

Figure 4 shows a setup of an experiment to investigate properties of enzymes. Use it to answer the questions that follow.

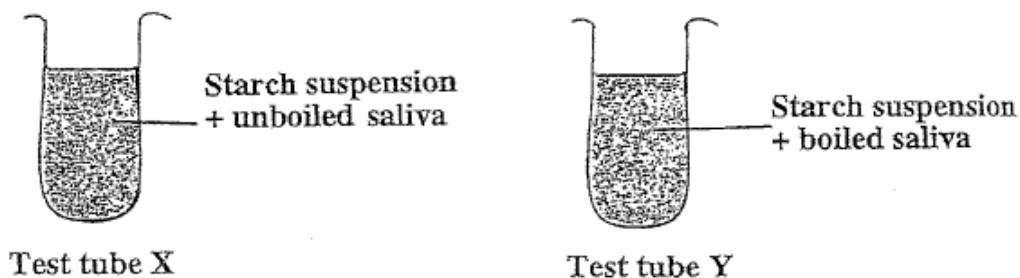


Figure 4

- What property of enzymes is being investigated in the experiment? (1 mark)
- If after 10 minutes the contents of both test tubes were tested for starch, what colour would be seen in the two test tubes?

Tube X (1 mark)

Tube Y (1 mark)

2005-3.

Figure 1 is a diagram showing part of the human digestive system. Use it to answer the questions that follow.

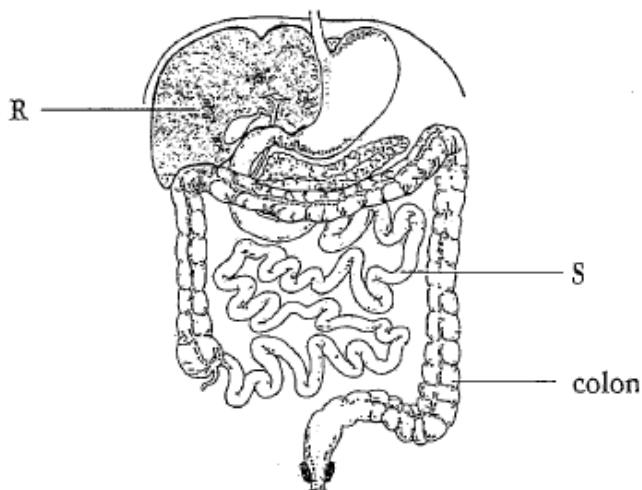


Figure 1

- Name the parts marked **R** and **S**. (2 marks)
- Explain how part **R** ensures a steady supply of glucose to the body. (2 marks)

2003-3.

- Give **two** differences between disaccharides and polysaccharides. (2 marks)
- Give **one** example of a polysaccharide. (1 mark)

Section B

2012-13.

- State any **two** adaptations of a villus for food absorption. (2 marks)
- If the liver failed to produce bile, what **two** effects could this have on digestion? (2 marks)
- Explain why the level of insulin increases in the blood soon after a meal of carbohydrates. (2 marks)

2011-6.

Figure 4 shows structure of a food substance. Use it to answer the questions that follow.

- Name the food substance. (1 mark)
- Explain how the food substance is produced. (2 marks)
- Mention **two** enzymes that could digest the food substance in humans. (2 marks)

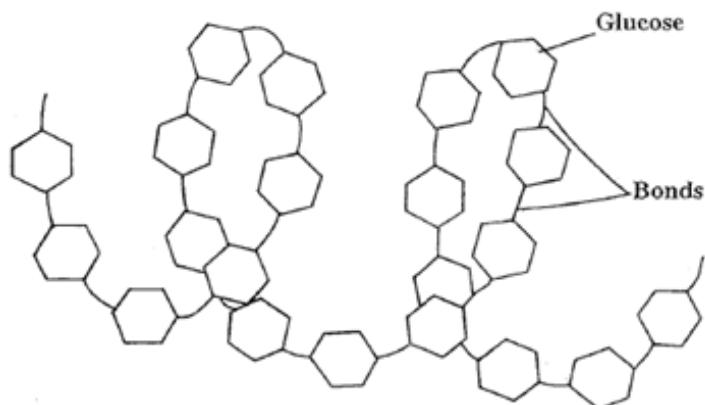


Figure 4

2006-7.

Figure 4 is a diagram of a longitudinal section of a villus. Use it to answer the questions that follow.

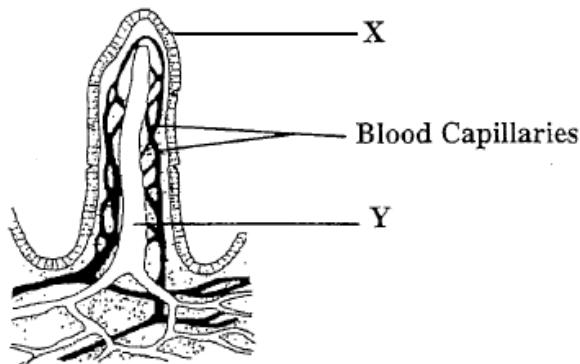


Figure 4

- Name the parts labelled X and Y. (2 marks)
- State one end-product of digestion which is transported by the part labelled Y. (1 mark)
- Explain one adaptation of the villus which enables it to perform its functions efficiently. (2 marks)

2003-9.

Table 2 shows results of an experiment on the effect of temperature on enzyme activity. Use it to answer the questions that follow.

Table 2

Temperature (°C)	Rate of reaction (mg / hour)
0	0
10	9
21	28
30	41
37	51
50	40
55	0

- Plot a graph on rate of reaction against temperature. (3 marks)
- Describe the effect of temperature on enzyme activity between 20°C and 50°C. (2 marks)
- Briefly explain the cause of the change in the rate of enzyme activity after 37°C. (2 marks)
- What is the optimum temperature of the enzyme used in this experiment? (1 mark)

Section C

2007-12.

Describe **five** problems associated with human digestive system and state how each problem can be controlled. Your answer should be in an essay form. (10 marks)

5 Circulatory system

Section A

2011-1.

- Define "lymph". (1 mark)
- State any **one** difference between lymph and plasma. (1 mark)
- Explain how inspirational movement of the chest wall helps in the flow of lymph. (3 marks)

2008-1.

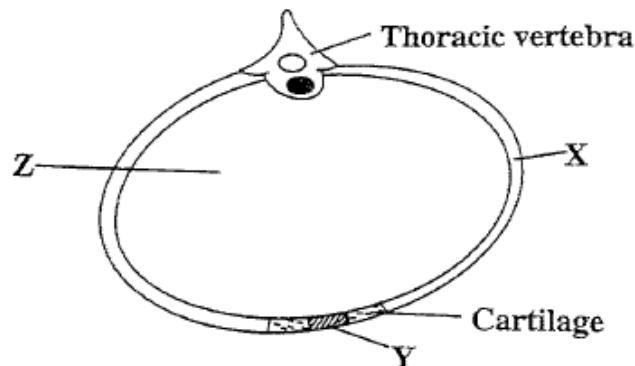
An athlete involved in a cross-country competition, was running at a speed of 2 metres per second. As she passed through a forest, she met a leopard and her speed immediately rose to 6 metres per second.

- Name the hormone that caused the change in speed. (1 mark)
- Explain how the hormone led to the change in speed in 1.a. (3 marks)

2008-2.

Figure 1 shows a cross-section of the thorax. Use it to answer the questions that follow.

- Name the parts marked X and Y. (2 marks)
- State any **one** vital organ found in the cavity marked Z. (1 mark)
- Give any **one** region within the cavity marked Z where lymph is found. (1 mark)



2008-6.

Figure 5 shows stages of a process marked K, L and M carried out by a type of blood cells. Use it to answer the questions that follow:

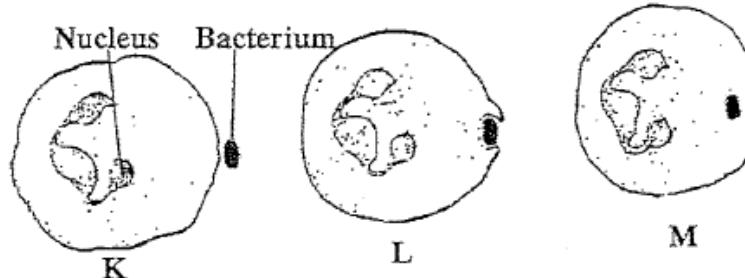


Figure 5

- Name the process. (1 mark)
- Where does this process take place in the body? (1 mark)
- What could happen to the bacterium at Stage M of the process? (1 mark)

2006-3.

Figure 2 is a photograph showing blood cells.

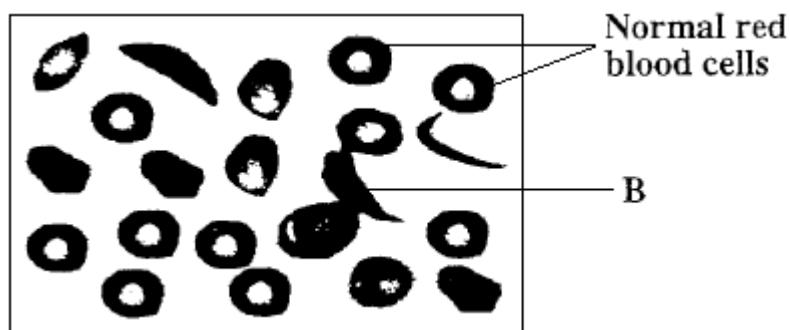


Figure 2

a.

(i) Name the condition of the cell marked **B**. (1 mark)

(ii) How are red blood cells with this condition affected? (1 mark)

b. What is the cause of the condition of the cell marked **B**? (1 mark)

c. Name the disease to which a person with the blood sample shown in **Figure 2** is resistant. (1 mark)

Section B

2012-12.

Figure 7 is a diagram of the human heart. Use it to answer questions that follow.

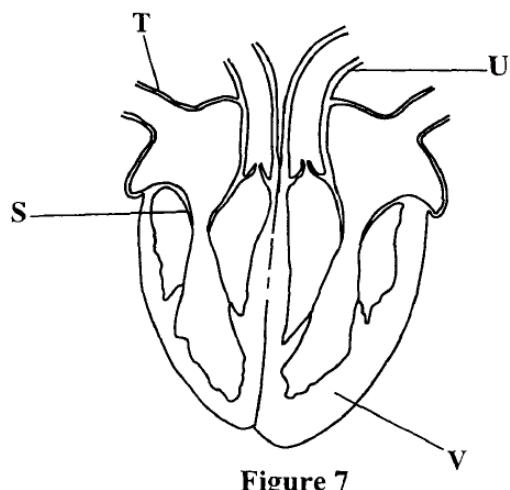


Figure 7

a. Name the part marked **S**. (1 mark)

b. Give **two** differences between the blood flowing through vessels **T** and **U**. (2 marks)

c. Explain how part **V** helps to create systolic pressure. (3 marks)

2012-14.

Figure 8 shows capillary bed. Use it to answer questions that follow.

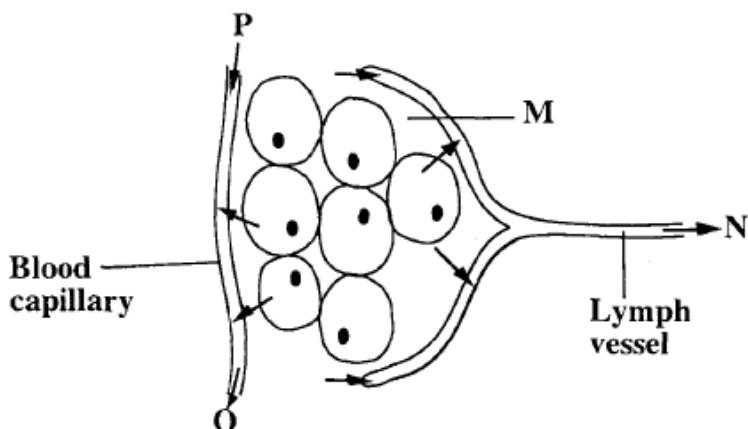


Figure 8

a.

- Name the fluid found in **M**. (1 mark)
- Name any **two** substances found in **M** that are used by the body. (2 marks)

b. Name **two** adaptations for each of the following to their functions:

- Blood capillaries (2 marks)
- Lymph vessels (2 marks)

c. Which letter represents the arterial end of the capillary bed? (1 mark)

2011-7.

Figure 5 shows cross sections of blood vessels **M** and **N**. Use it to answer the questions that follow.

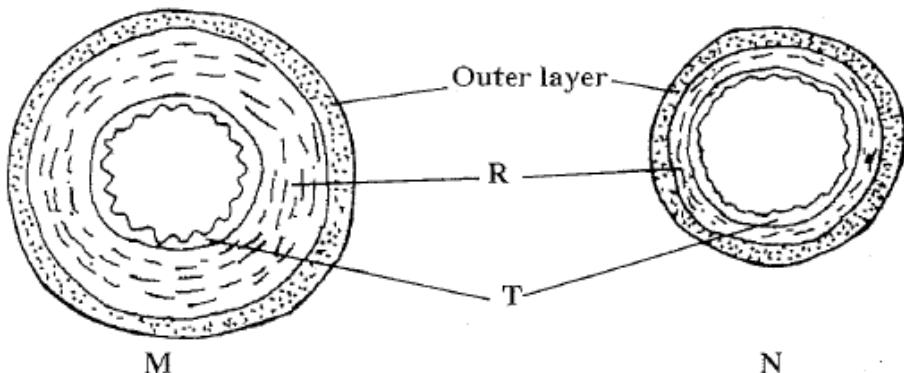


Figure 5

a. Name the parts marked **R** and **T**.

R (1 mark)

T (1 mark)

b. List any **two** structural differences between vessels **M** and **N**. (2 marks)

c. Explain any **one** way in which blood is transported in vessel **N**. (3 marks)

2010-7.

Table 1 shows parts of blood for three people **F**, **G** and **H**. Use it to answer the questions that follow.

Table 1

PART OF BLOOD (mm ³)	F	G	H
Red blood cells	7,500,000	5,500,000	2,000,000
White blood cells	5,000	6,000	5,000
Platelets	250,000	255,000	5,000

a.

(i) Which person is most likely to suffer from anaemia? (1 mark)

(ii) Give a reason for your answer to **7.a.(ii)**. (1 mark)

b. Calculate the ratio of white blood cells to platelets in the blood of person **F**. Show your working.

(2 marks)

2007-10.

Figure 7 shows cross-sections of blood vessels in the human circulatory system. Use it to answer the questions that follow.

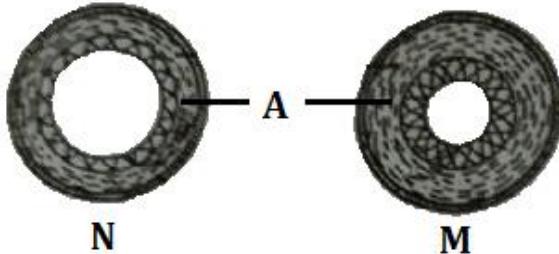


Figure 7

a. Name the tissue labelled **A**. (1 mark)

b.

(i) Which section represents an artery? (1 mark)

(ii) Give **two** reasons for your answer to **10.b.(i)**. (2 marks)

c. Explain why the rate of heart beat can be measured by pulse rate. (3 marks)

2006-6.

Figure 3 is a diagram showing a vessel of the circulatory system. Use it to answer the guess that follows.

a. Identify the structure marked **Q**. (1 mark)

b. Name **two** vessels in the human body which have the structure labelled **Q**. (2 marks)

c. On the diagram shown in **Figure 3** put an arrow which indicates the direction of flow. (1 mark)

d. Describe what is likely to happen if structure **Q** were damaged. (1 mark)

e. What enables blood to move along this vessel? (1 mark)

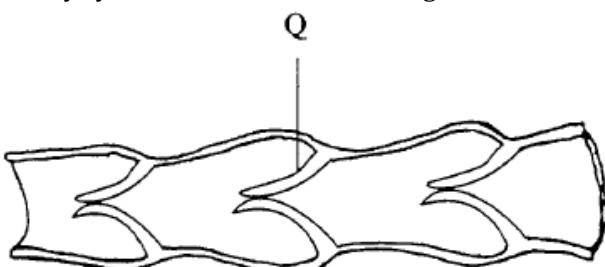


Figure 3

2005-10.

Figure 5 shows a cross section of the heart and its associated blood vessels.

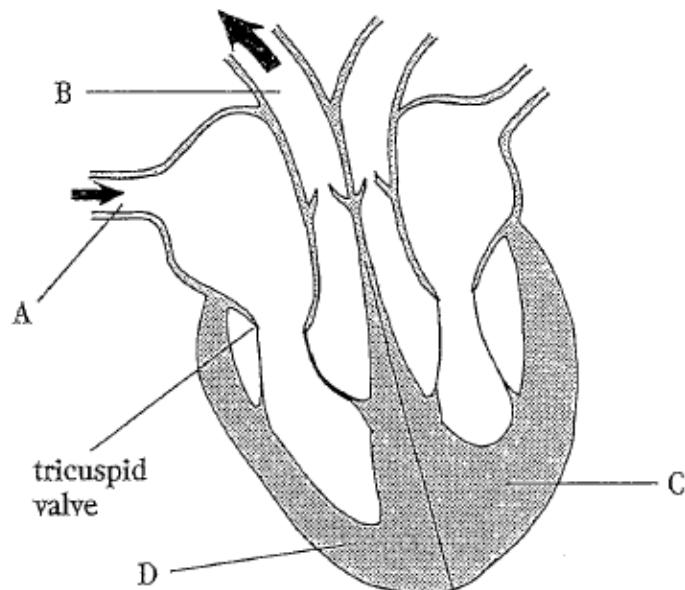


Figure 5

a. Name the parts marked **A** and **B**. (2 marks)

b.

(i) What is the structural difference between the walls of the parts marked **C** and **D**? (1 mark)

(ii) Give a reason for the difference stated in **b.(i)**. (1 mark)

2005-12.

To determine the blood group of a donor, a drop of blood was added to plates containing anti-A serum and anti-B serum respectively. **Figure 7** shows results of the test.

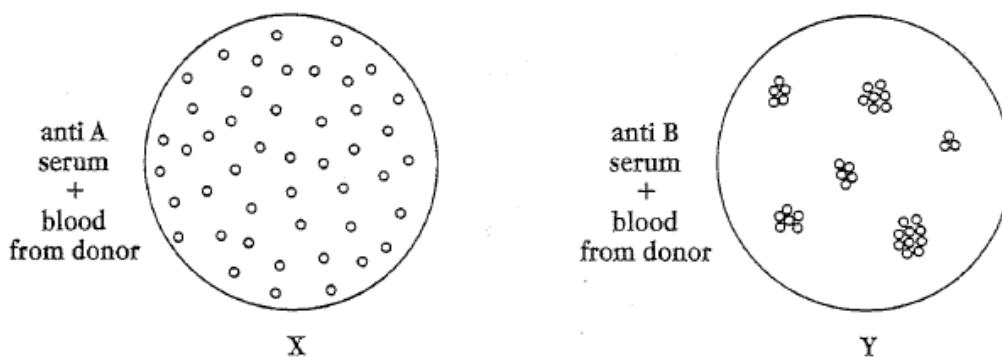


Figure 7

a. What is "serum"? (1 mark)

b.

(i) State the result shown in (1) X (2) Y. (1 mark)

(ii) What was the blood group of the donor? (1 mark)

(iii) Give a reason to support your answer in **b.(ii)**. (2 marks)

c. Why is it necessary to test the blood group of the donor before transfusion? (2 marks)

2003-10.

Figure 4 is a diagram representing blood as seen under a microscope. Use it to answer the questions that follow.

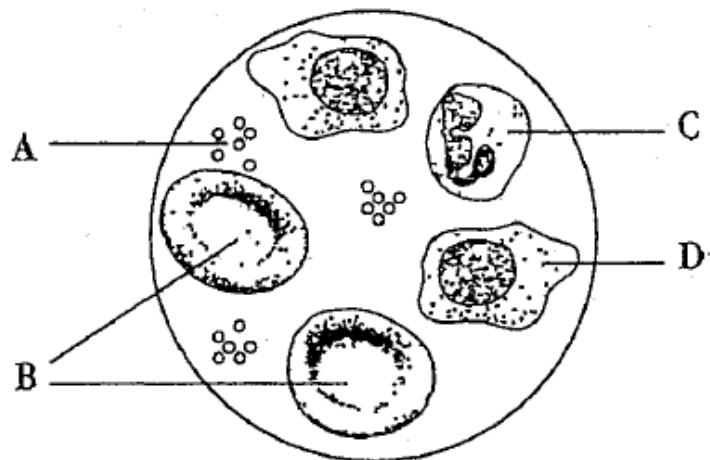


Figure 4

a. Use the letters to give the parts of blood responsible for the following:

(i) Transport of oxygen

(ii) Making antibodies

(iii) Blood clotting

(3 marks)

b. Explain **two** ways in which the structures that transport oxygen are adapted for their function.

(2 marks)

c. How do **C** and **D** differ in the way they function? (2 marks)

Section C

2005-15.

Write an essay stating **five** components of human blood and explain their functions. (10 marks)

6 Respiratory system

Section A

2010-2.

Figure 2 shows the respiratory structure of an insect. Use it answer the questions that follow.

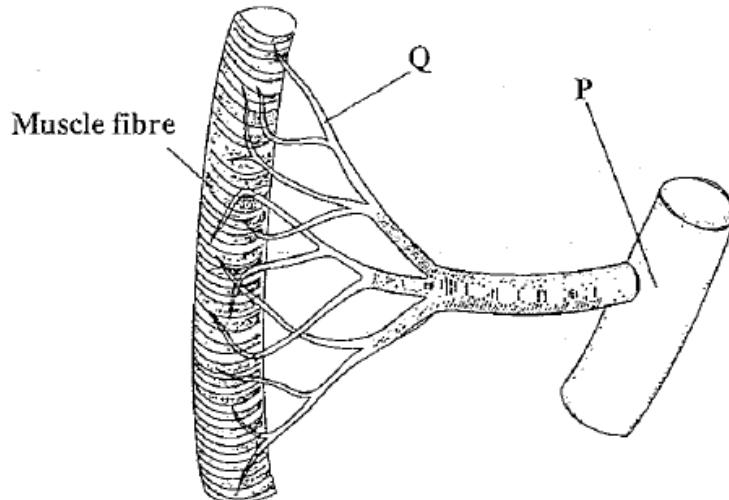


Figure 2

- Name the part marked P. (1 mark)
- State **one** adaptation of the part marked Q to its function. (1 mark)
- Explain how oxygen moves from part marked Q to the muscle fiber. (2 marks)

2009-2.

Figure 1 shows part of the lining of the trachea. Use it to answer the questions that follow.

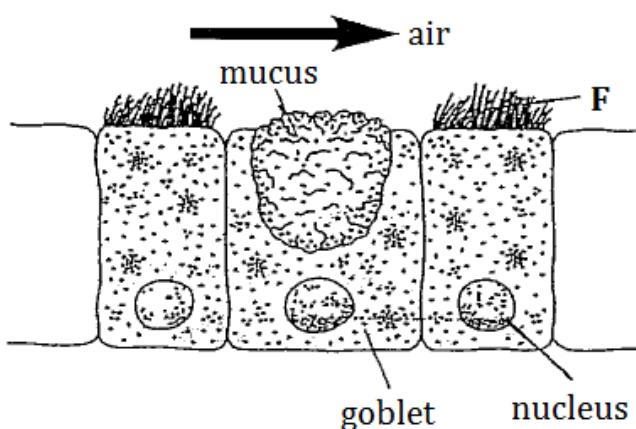


Figure 1

- Name the part marked F. (1 mark)
- What is the function of each of the following?
 - Mucus released by the goblet cell (1 mark)
 - Pleural fluid (1 mark)
- Explain how the trachea is kept open during breathing. (2 marks)

Section B

2012-10.

- Mention any **two** effects of smoking on human health. (2 marks)
- State any **two** effects of exercise on breathing. (2 marks)
- Mention any **two** adaptations of alveoli to their function. (2 marks)

2011-13.

Figure 10 is a graph showing the population of the bacteria and amount of oxygen in a stream after sewage is discharged into it. Use it to answer the questions that follow.

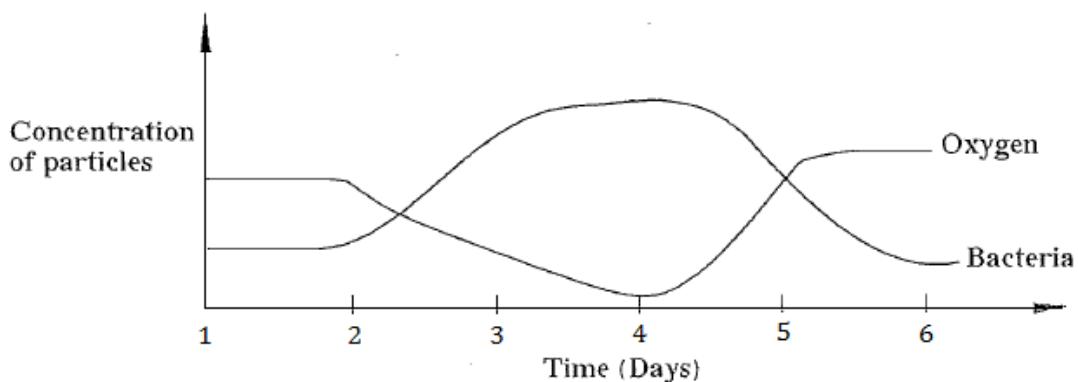


Figure 10

a. When was sewage discharged into the stream? (1 mark)

b.

(i) What happened to the amount of oxygen between day 2 and day 4? (1 mark)

(ii) Explain your answer given in **13.b.(i)**. (2 marks)

[2009-12]

Figure 10 is a diagram of an alveolus surrounded by a blood capillary. Use it to answer the questions that follow.

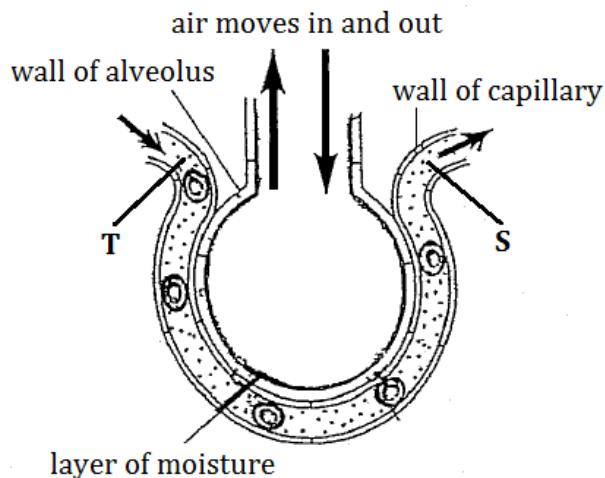


Figure 10

2009-12.

- a. To which chamber of the heart does blood flow from point **S**? (1 mark)
- b. Explain why there is a difference in the amounts of oxygen in the blood between points **T** and **S**.
(2 marks)
- c. Explain the role of the thin layer of moisture in the alveolus. (2 marks)

2007-7.

Figure 5 shows volume of air in the lungs of a child at rest to the start of an exercise. Use it to answer the questions that follow.

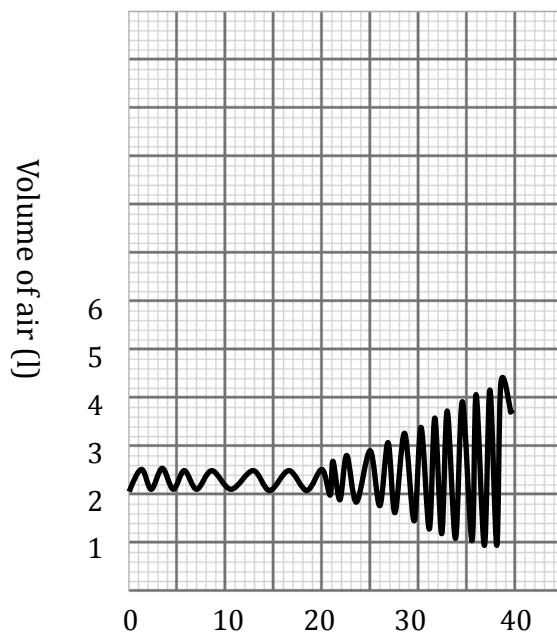


Figure 5

- a. At what time does the child start the exercise? (1 mark)
- b. What is the maximum volume of air inspired during the exercise? (1 mark)
- c. Calculate the number of breaths per minute. (4 marks)
 - (i) At rest
 - (ii) After exercise
- d. Explain why there is an increased breathing rate between 20 – 40 seconds? (2 marks)

2005-9.

Figure 4 is a diagram showing a summary of the process of respiration. Use it to answer the questions that follow.

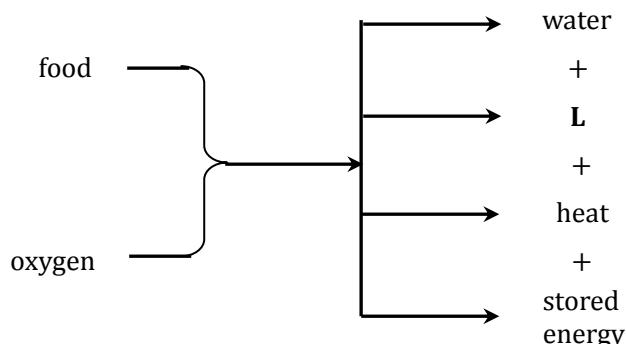


Figure 4

- a. Name the product represented by the letter **L**. (1 mark)
- b.
 - (i) What type of respiration is shown in **Figure 4**? (1 mark)
 - (ii) Give a reason for your answer to **b.(i)**. (1 mark)
- c. State any **two** ways in which the stored energy may be used. (2 marks)

Section C

2011-15.

During winter, a framer decided to light a charcoal burner to warm calves in a modern cattle khola. Before the charcoal completely got burnt, it was taken into the khola which had its windows closed. The following morning the calves were found dead. In an essay form, explain the steps that led to the death of the calves. (10 marks)

2010-17.

Describe an experiment that could be carried out to investigate the effect of exercise on breathing rate in human beings. Your essay should include procedure, expected results and conclusion. (10 marks)

2006-15.

Describe the breathing mechanism in human beings. Your answer should be in an essay form. (10 marks)

2004-17.

Explain the mechanism of breathing in fish. (10 marks)

7 Locomotion

Section A

2005-4.

What is the advantage of the following in locomotion?

- a. Overlapping of scales in fish. (1 mark)
- b. Hollow bones in birds. (1 mark)

2004-2.

a. Name a locomotory structure in

- (i) bird (1 mark)
- (ii) fish (1 mark)

b. State **two** adaptations for locomotion common to both birds and fish. (2 marks)

Section B

2010-11.

Figure 9 shows a bird in flight. Use it to answer the questions that follow:

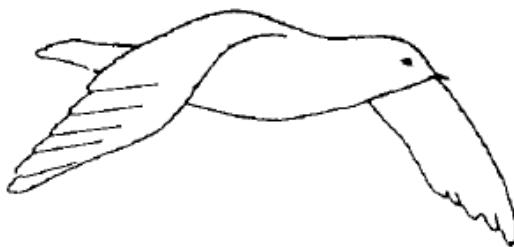


Figure 9

a.

- (i) Identify the stroke shown by the bird. (1 mark)
 - (ii) Explain how the stroke named in **11.a.(i)** occurs. (2 marks)
- b. Explain how the shape of the wing helps to generate lift in the bird. (2 marks)

2008-9.

Flight in birds involves an upward beat and a downward beat of the wings.

- a. Which one of the two is a recovery stroke? (1 mark)
- b. Explain the significance of each of the following during downward beat of the wing:
 - (i) spreading of the wing (3 marks)
 - (ii) overlapping of wing feathers (3 marks)

2006-13.

Figure 10 is a diagram showing antagonistic muscles of the arm.

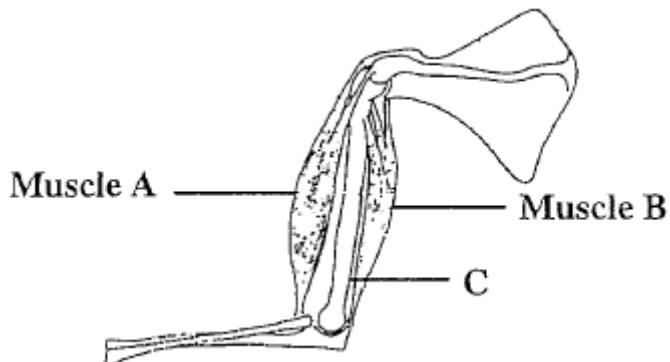


Figure 10

a.

(i) What is the name of muscle **A**? (1 mark)

(ii) Name the part marked **C**. (1 mark)

b. How does contraction of muscle **B** affect the arm? (1 mark)

c. State **two** physical changes that occur in muscle **A** when contracted. (2 marks)

2004-8.

Figure 4 is a diagram showing the wing of a bat labelled **A** and the front leg of a rabbit labelled **B**. Use it to answer the questions that follow.

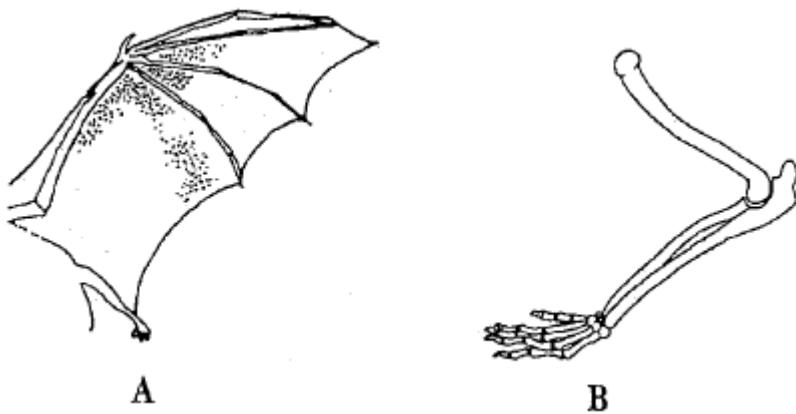


Figure 4

a. Give **two** structural differences between wing **A** and leg **B**. (2 marks)

Section C

2007-14.

Describe **five** ways in which a bird is adapted to overcoming gravity and the effect of drag in flight.

Your answer should be in an essay form. (10 marks)

8 Reproduction

Section A

2012-3.

Figure 2 shows a stage during meiosis. Use it to answer questions that follow.

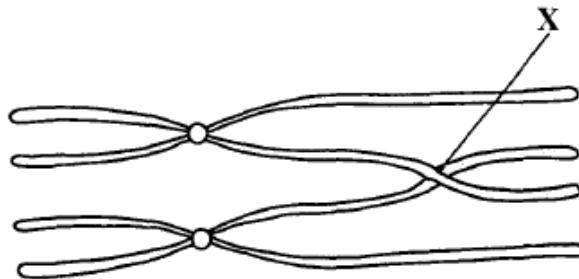


Figure 2

- Name the process taking place at part X. (1 mark)
- Name any **one** organ in the human body in which process X takes place. (1 mark)
- Explain the importance of the process taking place at X. (2 marks)

2010-5.

Figure 5 shows processes in human reproduction. Use it to answer the questions that follow:

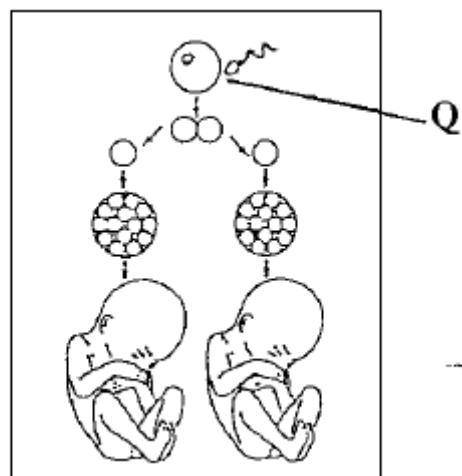


Figure 5

- Name the process represented by letter Q. (1 mark)
- What type of twins are produced in **Figure 5**? (1 mark)
 - Give a reason for your answer in 5.b.(i). (1 mark)

2009-4.

Figure 3 shows a cell undergoing mitotic division. Use it to answer questions that follow.

a.

- (i) Identify the stage. (1 mark)
 - (ii) Give a reason for your answer to **4.a.(i).** (1 mark)
- b. What is the role of J? (1 mark)

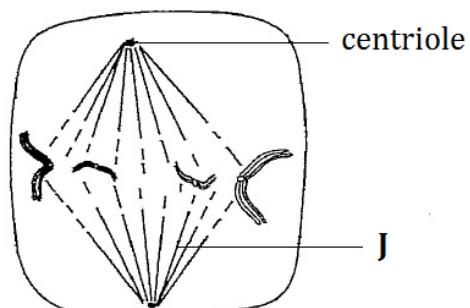


Figure 3

2008-4.

Figure 3 shows an animal cell at an early stage of division. Use it to answer the questions that follow.

a. What term is used to describe the number of chromosomes in the cell? (1 mark)

b. If the cell divided by meiosis:

- (i) How many daughter cells would be formed at the end of the first meiotic division? (1 mark)
- (ii) How many chromatids would each daughter cell contains at the end of Telophase II? (1 mark)

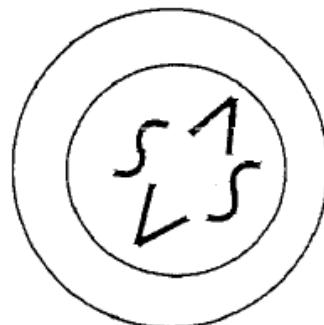


Figure 3

2007-2.

Figure 2 is a diagram of a sperm cell. Use it to answer the questions that follow.

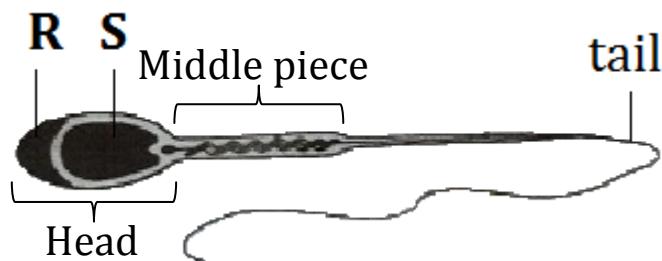


Figure 2

a.

- (i) What is contained in the part marked S? (1 mark)
 - (ii) What is the function of enzymes produced by the part marked R? (1 mark)
- b. How does the middle piece assist the sperm cell in movement? (2 marks)

Section B

2012-9.

Figure 6 is a diagram of male reproductive system. Use it to answer questions that follow.

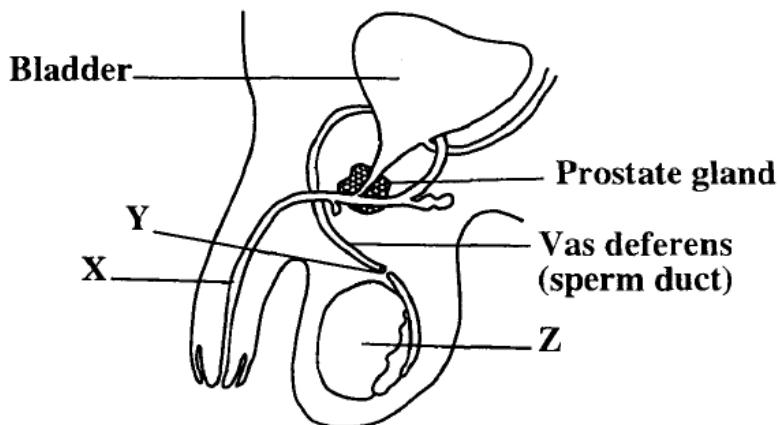


Figure 6

- Name the parts marked X and Z. (2 marks)
- Mention the contraceptive method shown at Y. (1 mark)
- Mention any **two** advantages of using this contraceptive method. (2 marks)

2011-8.

Figure 6 shows levels of some hormones during the menstrual cycle. Use it to answer the questions that follow.

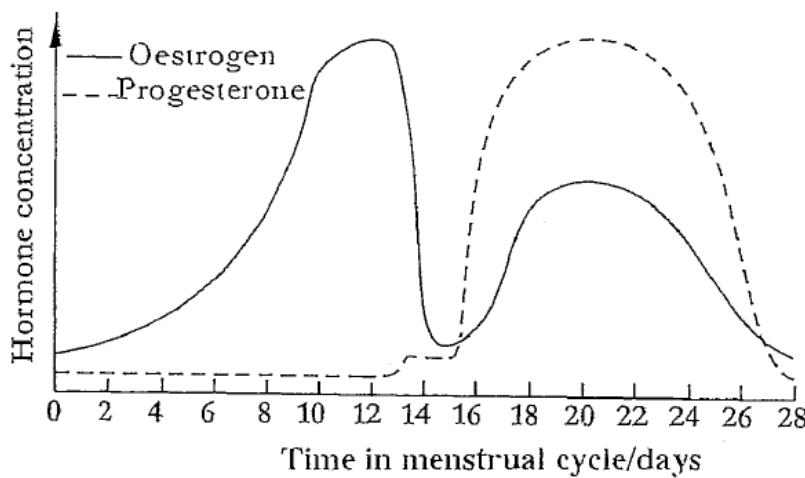


Figure 6

- (i) During which period is fertilisation more likely to occur? (1 mark)
(ii) Give a reason for your answer to 8.a.(i). (1 mark)
- State any **two** things that may happen to the wall of the uterus between days 5 and 10. (2 marks)
- Explain why the level of progesterone increases from day 16 to 20. (3 marks)

2010-9.

Figure 7 is a diagram showing blood supply between an embryo and the placenta. Use it to answer the questions that follow.

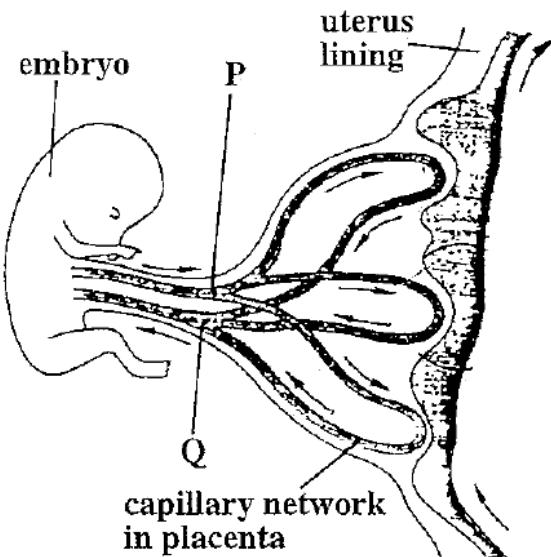


Figure 7

- Name the blood vessels marked **P** and **Q**. (2 marks)
- Mention any **two** substances transported by blood vessel marked **P**. (2 marks)
- Name **one** organ that starts to function immediately a child is born. (1 mark)
- Explain **one** adaptation of the placenta to its function. (2 marks)

2009-8.

Figure 7 shows the development of an ovum in the ovary of a woman. Use it to answer the questions that follow.

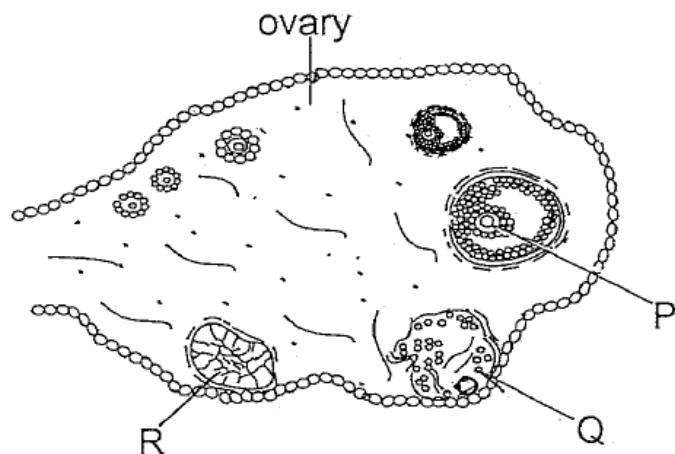


Figure 7

- Name the parts marked **P** and **R**. (2 marks)
- Name the process taking place at **Q**. (1 mark)
- c.
 - What hormone is produced by the part marked **R**? (1 mark)
 - Explain the role of the hormone in **8.c.(i)** in women. (2 marks)

2006-9.

Figure 6 is a diagram showing part of the male reproductive system. Use it to answer the question that follow.

- Name the parts labelled **A** and **B**. (2 marks)
- Name the hormone produced by the testis. (1 mark)
- Explain why a contraceptive method which involves cutting of part labelled **A** is more effective. (2 marks)

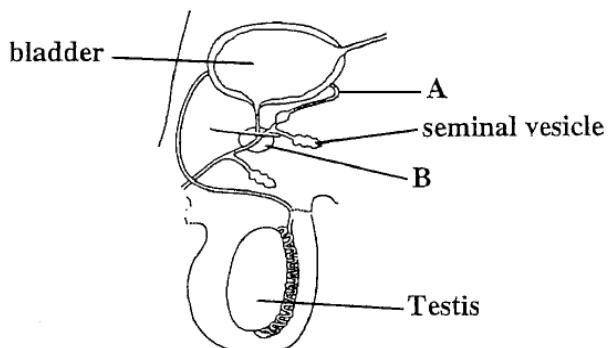


Figure 6

2005-11.

Figure 6 shows a developing human foetus inside the womb.

- Name the parts marked **B** and **C**. (2 marks)
- State **two** roles played by the part marked **A** during the development of the foetus. (2 marks)

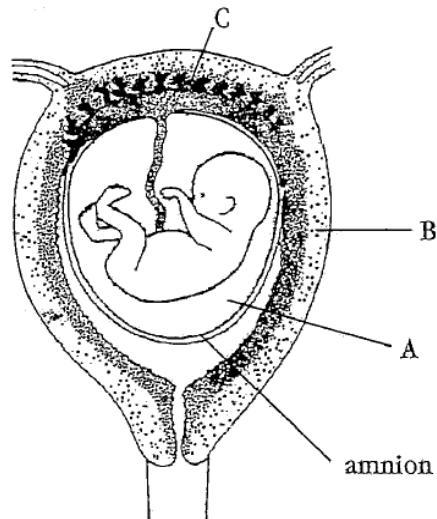


Figure 6

2005-13.

Data below are the birth masses of 12 babies in kg. Use it to answer the questions that follow.

3.1	3.4	3.0
2.5	2.5	3.5
3.0	2.6	2.0
3.5	3.4	3.5

- Calculate the average birth mass. (3 marks)

b.

- Using the above information, complete the table below. (1 mark)

Birth mass (kg)	2.0-2.4	2.5-2.9	3.0-3.4	3.5-3.9
Number of Babies				

- Using the table in b.(i), draw a histogram to compare the mass and number of babies of each range. (4 marks)

c. What is the modal birth mass range? (1 mark)

d. What type of variation is birth mass? (1 mark)

2004-14.

Figure 8 is a diagram showing a human embryo at different stages of development. Use it to answer the questions that follow.

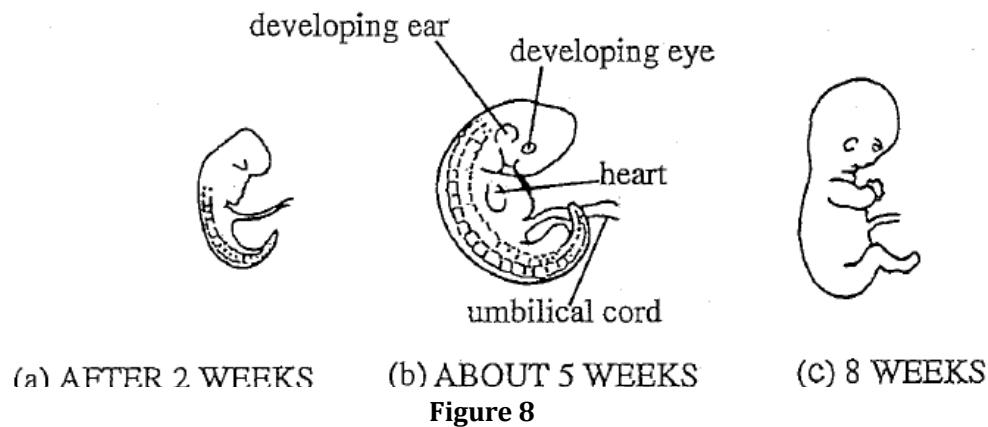


Figure 8

- a. How old is the embryo by the time a circulatory system develops? (1 mark)
- b.
 - (i) Apart from the head and tail, name the structure which is present in all the three stages shown in **Figure 8**. (1 mark)
 - (ii) Explain **two** ways in which the structure named in **14.b.(i)** is important to the embryo. (2 marks)
- c. What type of cell division contributes to the increase in size of the embryo? (1 mark)

Section C

2012-15.

Explain any **five** ways in which breast feeding is important. (10 marks)

2009-15.

State any **five** contraceptive methods and explain how each one works. Your answer should be in an essay form. (10 marks)

2003-16.

A married couple wants to choose a contraceptive method in order not to bear children for a period of four years. Suppose you are a health worker, state **five** contraceptive methods that the couple can use, explaining how each method work in preventing conception. (10 marks)

9 Excretion

Section A

2003-4.

- Define "deamination" (1 mark)
- State one substance that is excreted in each of the following excretory organs.
 - lungs (1 mark)
 - kidneys (1 mark)

Section B

2012-11.

- (i) Name the main nitrogenous waste excreted by kidneys. (1 mark)
(ii) Describe how the nitrogenous waste mentioned in 11.a.(i) is formed. (3 marks)
- Name **two** substances found in blood plasma that are not found in the urine of a healthy person.
(2 marks)

2010-8

Figure 6 is a graph showing urine output in a person after drinking 1 litre of water. Use it to answer the questions that follow:

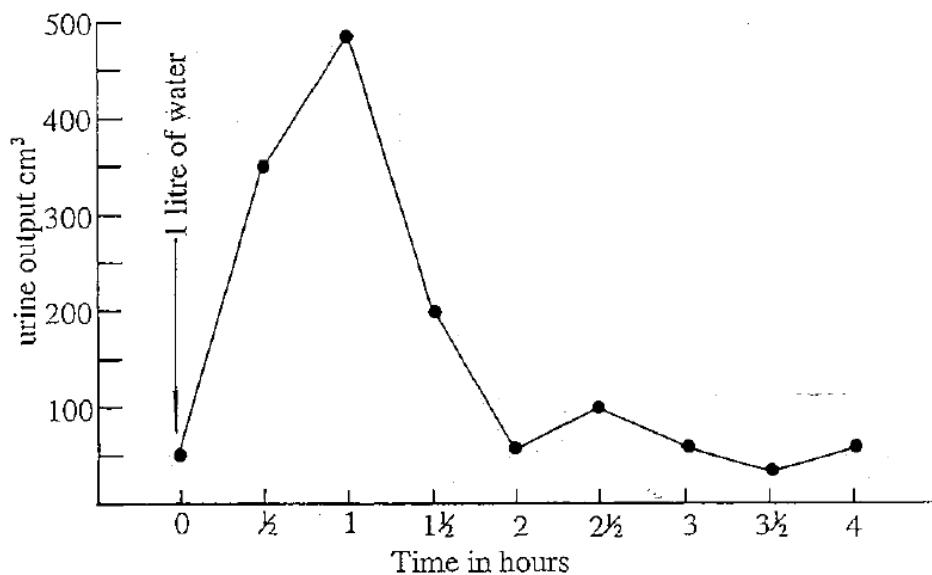


Figure 6

2010-8.

- What was the maximum amount of urine produced? (1 mark)
- What effect did drinking of the water have on urine output during the first hour of the investigation? (1 mark)
- Explain how Anti-Diuretic Hormone (ADH) affected results of urine output between 1 hour and 2 hours. (3 marks)

2009-7

Figure 6 shows a dialysis machine. Use it to answer the questions that follow.

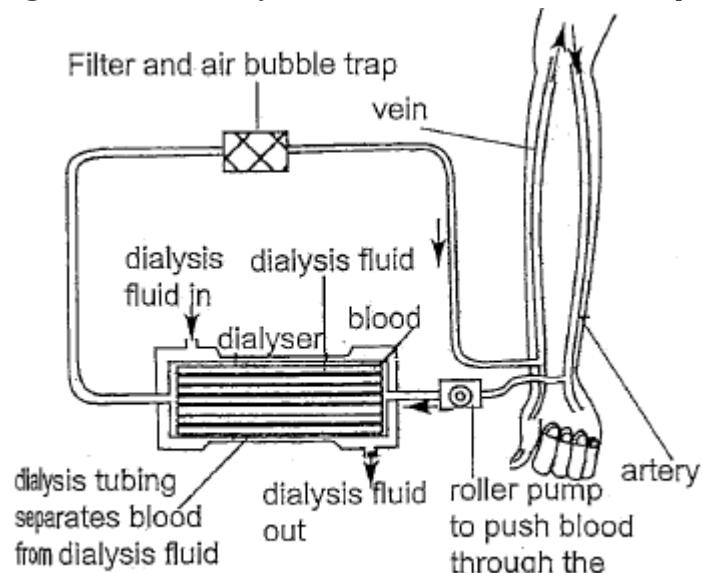


Figure 6

2009-7

- Explain why patient's blood and the dialysis fluid move to opposite directions in the dialyser.
(2 marks)
- Why are there many smaller channels in the dialyser rather than one large one? (2 marks)
- Explain why it is dangerous for an air bubble to get into the patient's blood while on the dialysis machine. (2 marks)

2007-9

Figure 6 is a section of the kidney. Use it to answer the questions that follow.

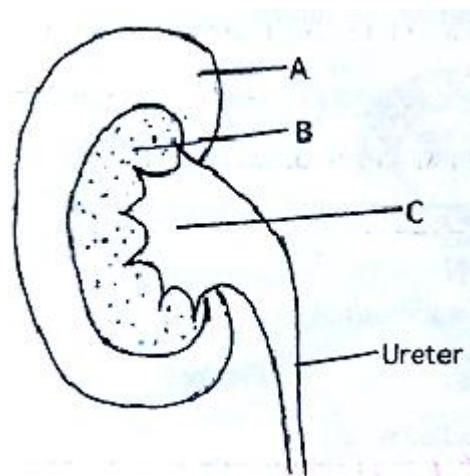


Figure 6

2007-9.

a. Name one structure of the nephron found in each of the following parts of the kidney.

(i) A (1 mark)

(ii) B (1 mark)

b. What is the function of the part labelled C? (1 mark)

c.

(i) What is the effect of an intake of salt solution on urine production? (1 mark)

(ii) Explain how the effect in 9.c.(i) is brought about. (3 marks)

2006-11

Figure 8 is a diagram showing part of a nephron. Use it to answer the questions that follow.

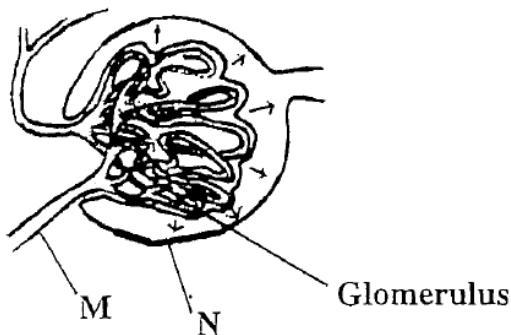


Figure 8

2006-11.

a. Name the parts marked M and N. (2 marks)

b. (i) Mention the process represented by the arrows. (1 mark)

(ii) Describe one adaptation of the figure to the process mentioned in b.(i). (2 marks)

c. Give one example of active transport which occurs in the nephron. (1 mark)

2005-8

Table 1 shows the composition of human blood and urine. Use it to answer the questions that follow.

Table 1

Substance	Blood (%)	Urine (%)
Water	90	96
Protein	9	0
Glucose	0.1	0
Urea	0.03	2
Uric acid	0.003	0.05
Creatinine	0.001	0.1
Chloride	0.37	0.6
Sodium	0.35	0.35 → 0.6
Potassium	0.02	0.15

2005-8.

a.

- Give one substance which is present in blood but is completely absent in urine. (1 mark)
 - Apart from urea and water, mention two substances which are more concentrated in urine than in blood. (1 mark)
- b. Which hormone regulates water concentration in the blood? (1mark)
- c. Why is urea excreted in large quantities? (3 marks)

2004-15.

A dialysis machine is an artificial kidney which is used when a person has kidney failure.

- How is the loss of glucose and other important substances from the blood prevented when a patient is on the dialysis machine? (2 marks)
- State **one** similarity between the dialysis tube and the tubule of the nephron. (2 marks)
- Name **two** substances which diffuse out of the dialysis tube when it is in operation. (2 marks)

Section C**2010- 15.**

Describe how urine is formed in the kidneys of the human body. Write your answer in an essay form. (10 marks)

10 Coordination

Section A

2011-4

Figure 2 shows a cross section of the spinal cord. Use it to answer the questions that follow.

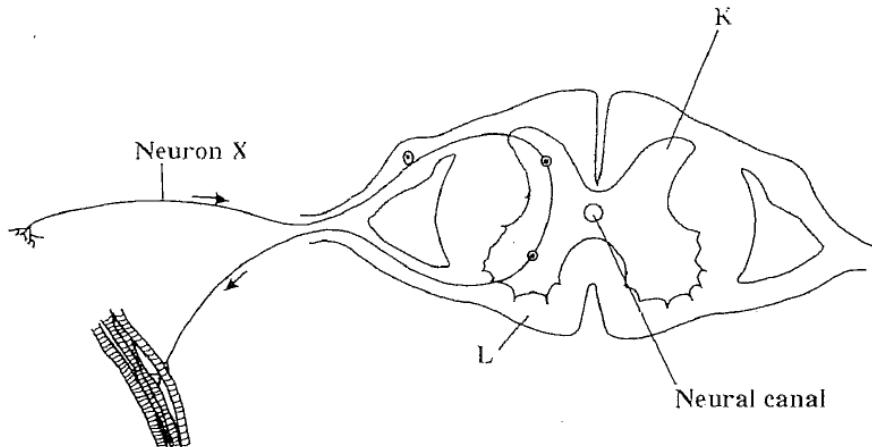


Figure 2

- Name the part marked **K**. (1 mark)
- Mention one disease that attacks neurone **X**. (1 mark)
- Give one function of the fluid found in the neural canal. (1 mark)

2007-3

- Define a "conditioned reflex action". (1 mark)
- Mention the three main steps involved in conditioning organism. (3 marks)

Step 1:

Step 2:

Step 3

- What is the difference between "a conditioned reflex" and "a single reflex action"? (1 mark)

2006-4

Table 1 shows results of an experiment where a person was blindfolded and asked to locate the direction of sound produced by a clock placed at different distances.

Table 1

DIRECTION OF SOUND	DISTANCE FROM EARS (cm)			
	60	80	100	120
Up	✓	✓	X	✓
Down	✓	X	✓	X
Left	✓	✓	X	X
Right	✓	✓	✓	X

Key: ✓ = correctly located sound direction
 X = incorrectly located sound direction

- What two variables were kept constant in this experiment? (2 marks)
- What was the aim of the experiment? (1 mark)
- What conclusion can be drawn from the results shown in **Table 1**? (1 mark)

2004-4

Figure 1 is a diagram showing a transverse section of the spinal cord. Use it to answer the questions that follow.

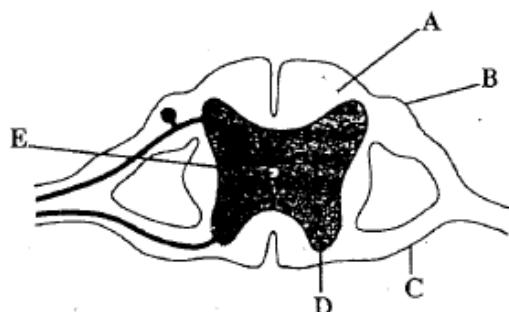


Figure 1

- Name the parts labelled **B** and **C**. (2 marks)
- State the structural difference between parts labelled **A** and **D**. (1 mark)
- What is the function of the substance found in the part labelled **E**? (1 mark)

Section B

2011-10

Figure 7 is a diagram showing a synapse between two nerve cells. Use it to answer the questions that follow.

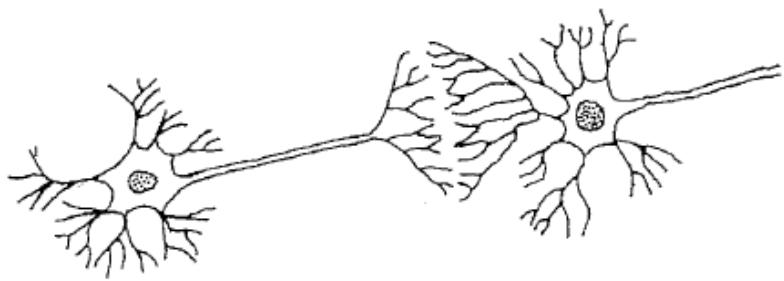


Figure 7

2011-10

- Use an arrow to indicate the direction of the nerve impulse in the diagram. (1mark)
- State any one function of the synapse to the work of neurons. (1mark)
- Explain one effect of smoking Indian hemp to the nervous system. (2 marks)

2010-10

Figure 8 is a diagram of a nerve cell. Use it to answer the questions that follow:

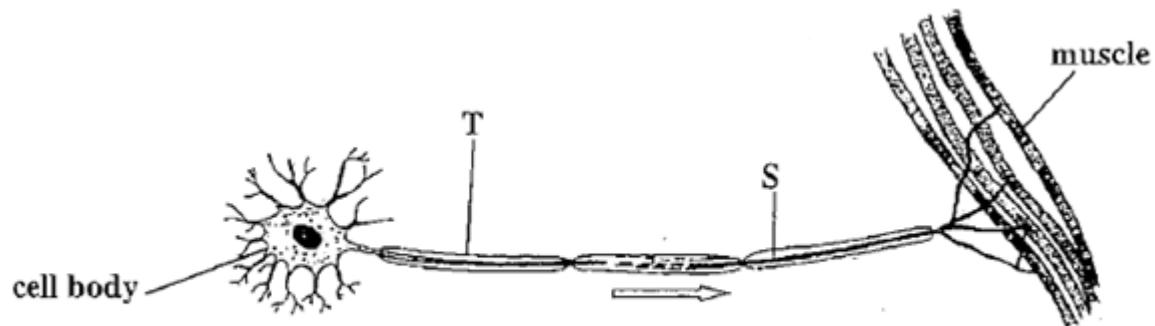


Figure 8

- Name the parts marked T and S. (2 marks)
- Name the type of nerve cell shown in **Figure 8**. (1 mark)
- Explain what could happen if the cell body was damaged. (2 marks)
- Explain any one adaptation that enables the nerve cell to conduct impulses at high speed. (2 marks)

11 Human disease

Section A

2012-1

- State any **two** ways in which vectors transmit diseases. (2 marks)
- Mention any **two** signs of athletes foot. (2 marks)

2011-3

At a certain school students developed rash on the skin and high fever. A doctor diagnosed them positive for a diarrhoeal disease.

- (i) Name the disease. (1 mark)
(ii) What is the causative agent of the disease? (1 mark)
(iii) Mention any **two** ways in which the disease could have been transmitted. (2 marks)
- Explain what happens during incubation period of a disease. (2 marks)

2010-4

Figure 4 shows a mode of transmission of some diseases. Use it to answer the questions that follow.

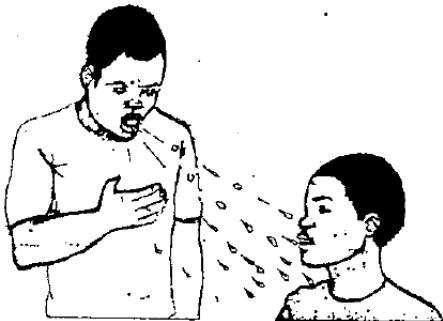


Figure 4

- Identify the mode of transmission. (1 mark)
- Name any **two** diseases that can be transmitted by the mode shown in **Figure 4**. (2 marks)
- Explain **one** way of preventing transmission of diseases through the mode shown in the **Figure 4**. (2 marks)

2009-1.

- (i) Give any **one** way of contracting HIV besides sexual intercourse. (1 mark)
(ii) What sort of precautions would prevent the spreading of the virus in the method you have given in a.(i). (1 mark)
- State any **two** practices that an HIV and AIDS patient can follow to live longer. (2 marks)

2008-3

Figure 2 shows the head of a child with a skin infection. Use it to answer the questions that follow.



Figure 2

- a. Name the infection. (1 mark)
- b. Mention the causative agent of the infection. (1 mark)
- c. Give **one** way of preventing spread of the infection. (1 mark)

2006-5.

- a. Cancerous cells carry out many cellular functions as normal cells. What characteristics distinguish them from normal cells? (1 mark)
- b. Why is cancer not contagious? (1 mark)
- c. Explain **two** ways of reducing the risk of developing cancer. (2 marks)

2004-5

Figure 2 is showing a lymph node which has a tumour beginning to develop. Use it to answer the questions that follow:

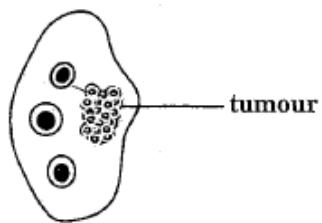


Figure 2

- a. Name the type of disease shown in **Figure 2**. (1 mark)
- b. State **two** ways in which the cells of the tumour might affect cells surrounding it. (2 marks)
- c. Suggest any **two** factors that would increase the risk of developing the disease named in 5.a. (2 marks)

2003-5

In an experiment, five petri dishes with nutrient agar were sterilized and then exposed to air in the laboratory for 30 minutes, after which they were placed in areas of different temperatures. **Table 1** shows the result of the experiment after 2 days.

Table 1

Dish	Temperature	Number of colonies of Bacteria
1	Freezer (below 0°C)	0
2	Refrigerator (3-5°C)	5
3	Room temperature (20-25°C)	15
4	In an incubator (37°C)	30
5	In an oven (130°C)	0

- What was the aim of the experiment? (1 mark)
- At what temperature did the bacteria grow most rapidly? (1 mark)

Section B

2011-9

- What causes sleeping sickness? (1 mark)
- Explain any **two** ways of preventing transmission of sleeping sickness. (4 marks)

2010-6

- Define "passive immunity". (1 mark)
- Explain how each of the following helps the body to defend itself against infection.
 - platelets (2 marks)
 - stomach (2 marks)

2008-12

Figure 9 shows legs of a person with a skin disease. Use it to answer the questions that follow.

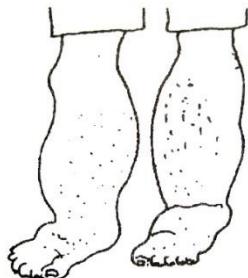


Figure 9

- a. Name the disease. (1 mark)
- b. To which group of organisms does the causative agent of this disease belong? (1 mark)
- c. Describe the life cycle of the causative agent of the disease. (4 marks)
- d. Give any **two** ways of preventing the disease. (2 marks)

2007-6

Figure 4 is a diagram of an experiment that was used to find the energy value of cashew nuts. The result obtained was 1800kg per 100g of cashew nuts. Use it to answer the questions that follow.

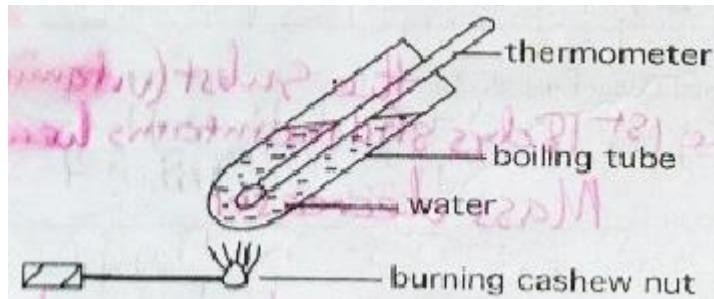


Figure 4

- a. If the exact energy value for the cashew nut is 2500kg per 100g,
 - (i) Give **two** reasons why a lower result was obtained. (2 marks)
 - (ii) What **two** things can be done to improve the accuracy of the result? (2 marks)
- b. If this method was used to find out energy value of beans, state **two** experimental conditions that must be kept constant in order to make a fair comparison of energy values of cashew nuts and beans. (2 marks)

2006-14.

- a. How does each of the following methods work in preventing malaria?
 - (i) spraying a layer of oil on stagnant water (2 marks)
 - (ii) Breeding fish in slow running water (2 marks)
- b. Why does a malarial patient become anaemic? (2 marks)

2003-12

The Ministry of Health conducted a research to study malaria causes in four randomly selected districts **M**, **N**, **O** and **P** in Malawi. The study was done in some health centers for three months and the results were presented in a bar graph as in **Figure 5**.

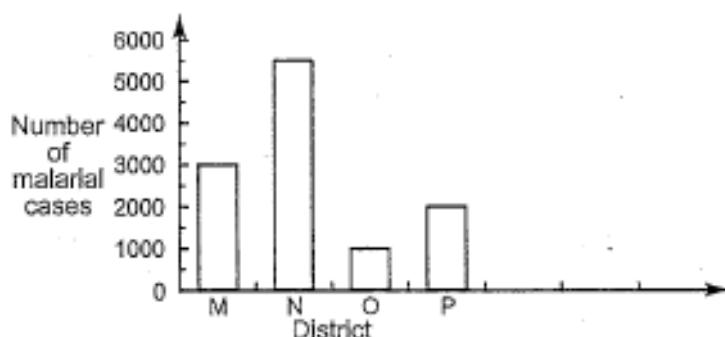


Figure 5

- Which district had the highest number of cases of malarial infection? (1 mark)
- How many cases were registered during the whole research period? Show your working. (2 marks)
- Suggest **two** reasons why it is not correct to conclude that these were the only malarial patients in the studied districts. (2 marks)
- Mention any **two** signs of malaria. (2 marks)

Section C

2010-16.

Suppose you are a medical doctor and you have a patient who requires blood transfusion. Explain any **five** factors that you would consider before carrying out a blood transfusion. Your answer should be in an essay form. (10 marks)

2008-14.

Suppose you are a Health Assistant in a community where there is high prevalence of malaria, what advice would you give to the community on prevention of malaria. Explain any **five** points in an essay form. (10 marks)

2005-17.

Suppose there is an outbreak of diarrhoea on a boarding school. Describe how you would establish the cause of the outbreak. Your answer should be in an essay form. (10 marks)

12 Immunity

Section A

2006-2.

- Name the agglutinating proteins in plasma of a person with blood group O. (2 marks)
- Explain why a person with blood group O is a universal donor. (2 marks)

2005-5.

- What is the function of helper T-cells in the body? (1 mark)
- Explain the effect of HIV on helper T-cells in the body. (2 marks)

Section B

2011-14

Table 2 shows the number of children that were infected by tuberculosis after being exposed to two different treatments. Use it to answer the questions that follow.

Table 2

Treatment	Number of Children	Number of Infected Children
vaccinated	500	20
unvaccinated	500	350

- Calculate the percentage of vaccinated children that were not infected. Show your working. (3 marks)
- Explain how the vaccine protected some children from tuberculosis. (2 marks)

2010-6.

- How does the “Human Immunodeficiency Virus” (HIV) weaken immunity of the human body? (2 marks)

2009-10

Figure 8 is a graph showing the response of antibodies in the human body at different times. Use it to answer the questions that follow.

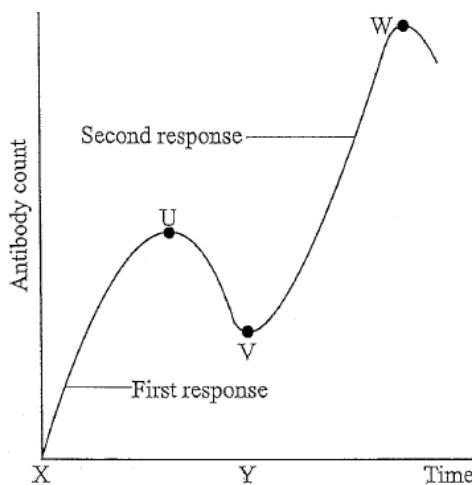


Figure 8

- Why does the level of antibodies decrease between points **U** and **V**? (1 mark)
- State what happens in the human body at points **X** and **Y**. (1 mark)
- Why is there a rapid change in response between points **V** and **W**? (2 marks)

2007-8.

Explain the role of each of the following in body's defence.

- phagocytes (3 marks)
- antibodies (2 marks)
- killer T-cells (2 marks)

2004-6.

- State **two** factors which must be considered before a blood transfusion is done. (2 marks)
- Describe how an individual could acquire natural active immunity. (3 marks)

2003-11.

- Define a "vaccine". (2 marks)
- Children under five years of age are vaccinated against diseases like tetanus and tuberculosis.
 - Explain how vaccination protects children against infection. (3 marks)
 - Why can a vaccine for tetanus not be used against tuberculosis? (1 mark)

Section C

2003-17.

Describe **five** barriers which the body used to prevent entry of disease causing organisms into it. Explain how each barrier works. (10 marks)

13 Genetics

Section A

2009-5

Figure 4 shows a bar graph of human blood groups. Use it to answer the questions that follow.

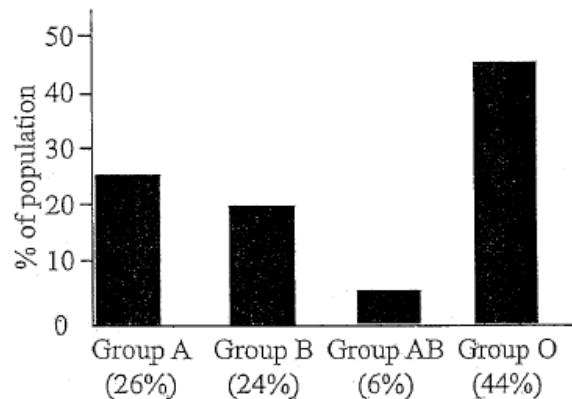


Figure 4

- (i) What type of variation is shown by blood groups in the bar graph? (1 mark)
(ii) Give a reason for your answer to 5.a.(i). (1 mark)
- In a population of 200 people, what would be the number of people with blood group O?
Show your working. (3 marks)

2003-7

Figure 2 is a diagram, of two adult dogs labeled **L** and **K** of the same age and produced from a common ancestor by artificial selection.



Figure 2

- Write down **two** variations that you can see between dogs **L** and **K**. (2 marks)
- Suggest the cause of the variations between the two dogs. (1 mark)

Section B

2012-5.

A man with blood group A was married to a woman with blood group B. Their first born son was of blood group O while their second born son was of blood group AB.

- Give the genotypes of the two parents. (2 marks)
- Explain how the genotype of the second born son came about. (3 marks)

2012-6.

When a grey cock was mate with a grey hen, grey and white chicks were produced.

- Using G for grey colour and g for White colour draw a generic diagram to determine the genotype of the offspring. (3 marks)
- Give the genotypic ratio of the chicks. (2 marks)
- If the parents produced 12 chicks, how many were white? Show your working. (2 marks)

2011-11

Figure 8 shows occurrence of light and dark varieties of peppered moth in an industrial area before and after industrial revolution in England. Use it to answer the questions that follow.

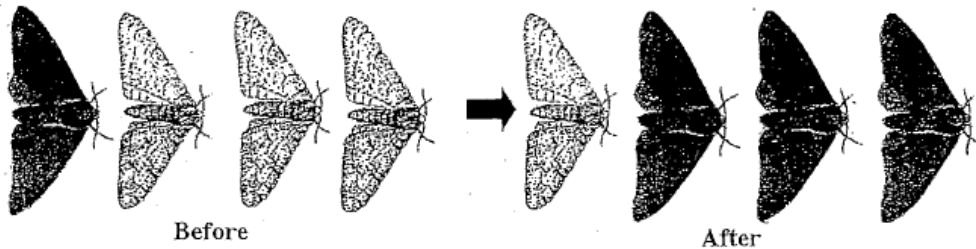


Figure 8

- Table 1** shows a cross between a pure breeding red cow and pure breeding white bull. Use it to answer the questions that follow.

Parents		red		
		RR		
white	rr	Gametes	R	R
		r	Rr	
		r	Rr	Rr

P } offsprings

Table 1

- Complete the table by filling the genotype of the offspring marked P. (1 mark)
- What term is used to describe the genotype of the offspring? (1 mark)
- If R and r are codominant, determine the phenotype of the offspring. (1 mark)

2009-11

Figure 9 shows two parent animals with their offspring. Use it to answer the questions that follow.



Figure 9

- What is the phenotypic ratio of the offspring? (1 mark)
- If the allele **B** for black fur, is dominant over the allele **b** for white fur, what would be the possible genotypes of parents? (2 marks)
 - Black parent
 - White parent

2008-13

Figure 10 shows a family tree in which there is inheritance of a recessive gene that causes haemophilia. Males with a single recessive gene suffer from the disease while females are carriers of the gene. Use it to answer the questions that follow.

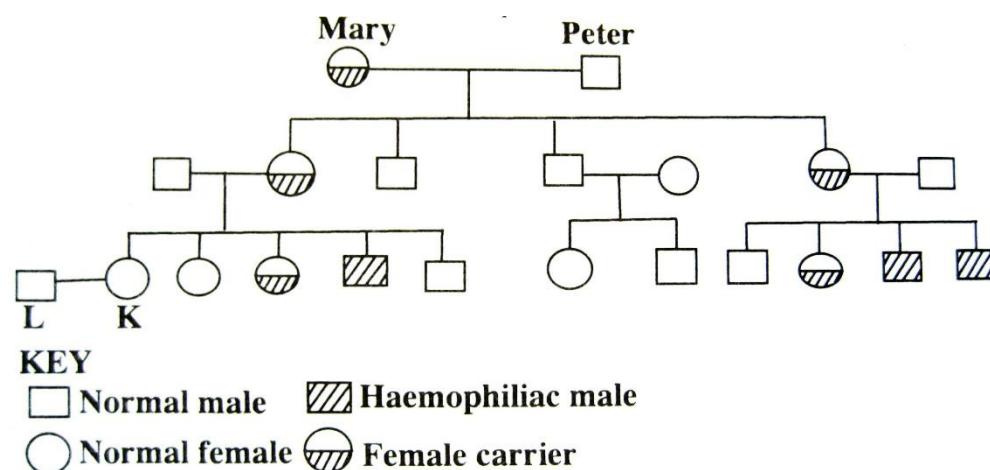


Figure 10

- How many individuals with a single recessive gene are there in three generations? (1 mark)
- How many of Peter's grandsons have haemophilia? (1 mark)
- What type of children with regard to haemophilia would L and K produce? (1 mark)
- State any **two** disorders in a haemophiliac person. (2 marks)
- Name the chromosome where the gene for haemophilia is located. (1 mark)
- How does the gene for haemophilia arise in a population? (2 marks)

2007-11.

In a certain plant species, the leaves may be pure green, pure white or variegated (white and green patches). When two plants with variegated leaves were crossed, a total of 84 offsprings were produced of which 21 were green, 42 were variegated and the remaining 21 died soon after germination.

(i) Using **G** - to represent allele for green colour

H - to represent allele for white colour

Draw a genetic diagram of the cross between two plants with variegated leaves. Indicate genotypes of parents and offsprings. (4 marks)

(ii) State the genotype and phenotype of offsprings that died soon after germination. (2 marks)

Genotype

Phenotype

(iii) a. Explain why these offsprings died. (2 marks)

b. What term is used to describe the behaviour of allele **G** and **H** in the cross? (1 mark)

2006-8.

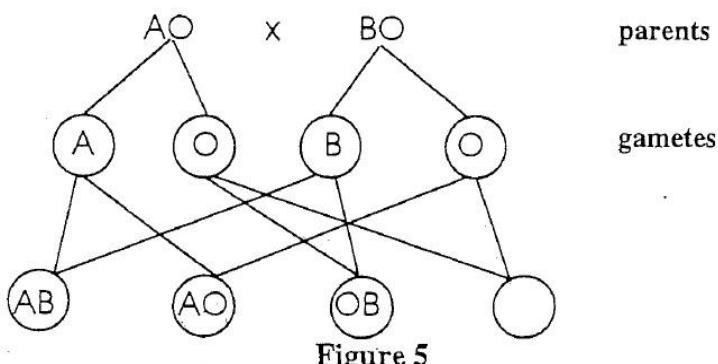
a. Give **two** examples of sex-linked characteristics. (2 marks)

b. Complete **Table 2** by indicating the categories of the given genotypes. (2 marks)

Table 2

GENOTYPE	CATEGORY
Gg	
GG	Homozygous dominant
gg	

c. **Figure 5** shows a cross diagram between a woman of blood group A married to a man of blood group B.



(i) Complete the cross-diagram by filling in the genotype of the remaining offspring. (1 mark)

(ii) What is the total number of blood groups of the offspring? (1 mark)

2005-14.

In mice a gene for coat colour has two alleles. There is dominant allele, **G**, for grey colour and a recessive allele, **g**, for white colour.

- a. Complete the table below using the information provided. (3 marks)

Colour of mice	Genotype of mouse
Grey (homozygous)	
Grey (Heterozygous)	
White (Homozygous)	

b.

- (i) Using a genetic diagram show the results of a cross between a grey heterozygous and a white homozygous mouse. (3 marks)
- (ii) State the phenotypes in F1 generation. (2 marks)
- (iii) If the mice produced 24 off springs, how many mice would be white? Show your working. (2 marks)

2004-10.

A scientist crossed a red flowered plant with a white flowered plant, all the F1 generation had pink flower.

- a. Explain how the F1 plant had produced pink flowers. (1 mark)
- b. Using **R** to represent gene for red colour and **r** to represent gene for white colour, write down genotype of
- (i) red flowered plants (1 mark)
 - (ii) F1 plants (1 mark)
- c. State one advantage of cross pollination in plants. (1 mark)

2004-11.

Dwarfism is a human characteristic in which a person is abnormally short.

Gene **T** for tallness is dominant over gene **t** for shortness.

If a man and a woman who are both heterozygous for this trait marry

a. (3 marks)

- (i) draw a cross diagram to show how this family would produce a dwarf.
- (ii) indicate genotype of parents, gametes and offspring.

b. Write down the ratio of the genotype and the phenotype of the offspring.

- (i) genotypic ratio (1 mark)
- (ii) phenotypic ration (1 mark)

14 Evolution

Section B

2012-7

Figure 4 shows one of the examples of natural selection in action. Use it to answer questions that follow.

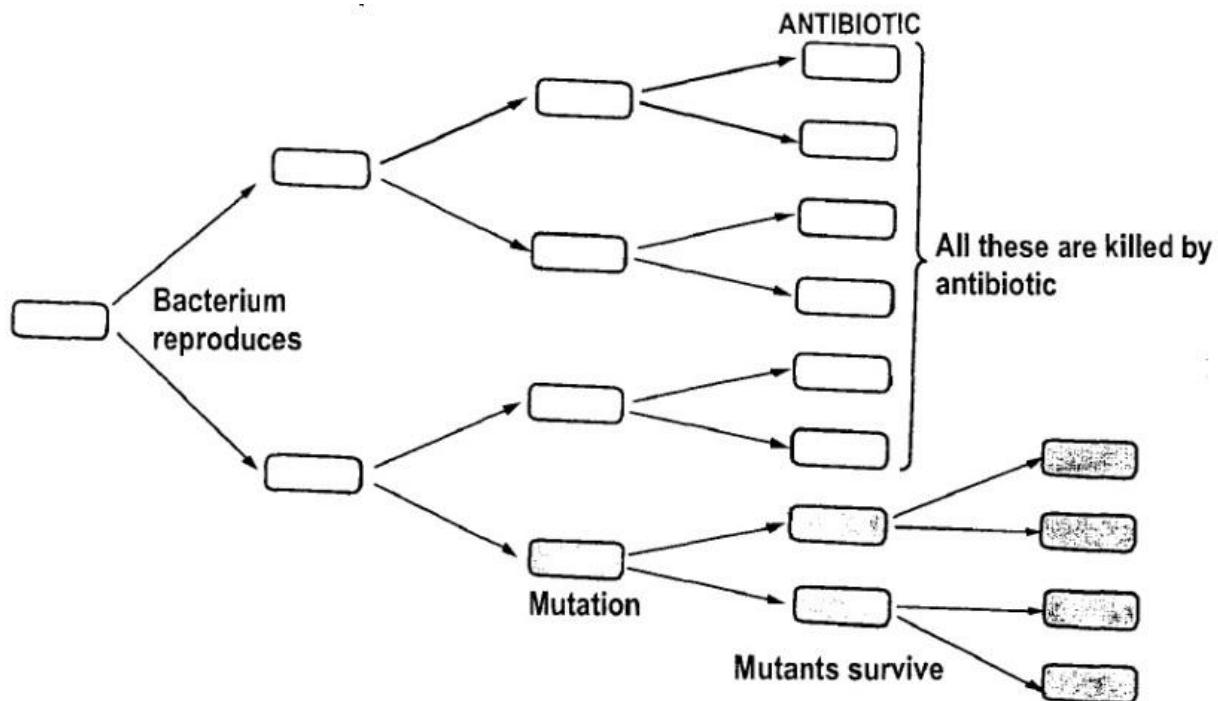


Figure 4

a.

- Name the example of natural selection shown. (1 mark)
- Describe what led to the survival of some of the bacteria while the others got killed. (2 marks)

b. What will happen to the antibiotic after sometime? (1 mark)

2011-11

Figure 8 shows occurrence of light and dark varieties of peppered moth in an industrial area before and after industrial revolution in England. Use it to answer the questions that follow.

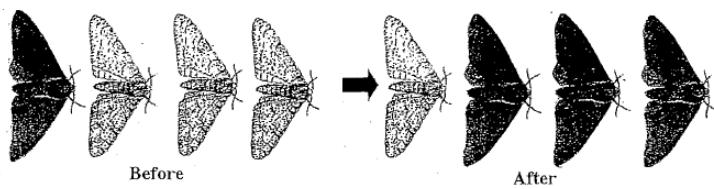


Figure 8

a. (i) In the table provided,

state **two** differences in the population of moths before and after industrial revolution. (2 marks)

Before	After

(ii) Explain how the population of dark peppered moth could have arisen before industrial revolution. (3 marks)

2010-14

Figure 12 is an evolutionary tree of an organism. Use it to answer the questions that follow:

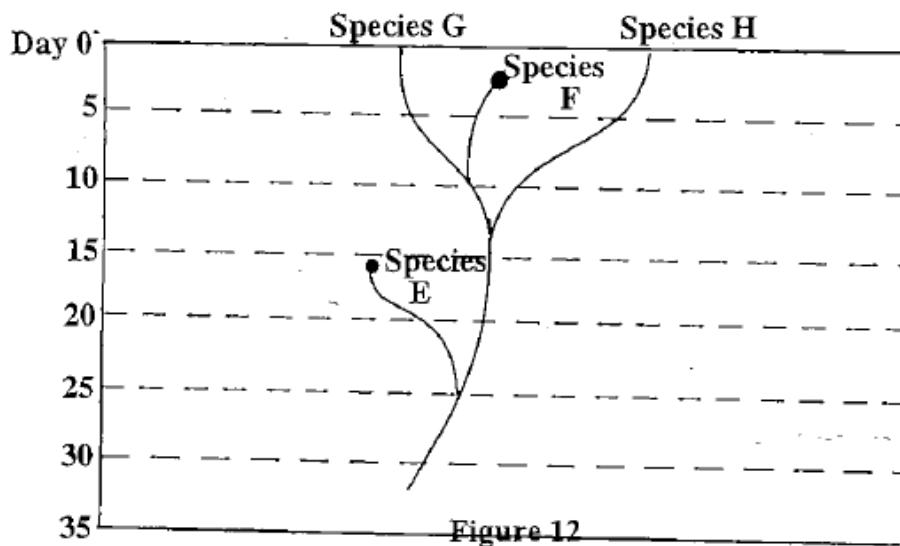


Figure 12

a. Name **two** species that have become extinct. (2 marks)

b. At what time did species E evolve? (1 mark)

c. Explain how fossil records can be used to show that the species in the diagram have a common ancestor. (3 marks)

2009-9

Table 1 shows results of an investigation on mechanism where equal numbers of red and white ground beetles were put on red clay in a mesh cage. Insect-eating birds were then introduced in the cage. Use it to answer questions that follow.

Table 1

Types of beetles	Number of beetles before experiment	Number of beetles after experiment
Red ground beetles	500	475
White ground beetles	500	123

- How many red ground beetles were eaten by the birds? (3 marks)
- Calculate the percentage of white beetles that survived. (3 marks)
- Explain the results of this investigation. (2 marks)

2009-11

Figure 9 shows two parent animals with their offspring. Use it to answer the questions that follow.



Figure 9

- If these animals fed at night, explain how natural selection would operate on the recessive allele in an environment where wild cats are predators. (3 marks)

2008-8

- What is "evolution"? (1 mark)
- Explain how each of the following helps to support the theory of evolution:
 - comparative anatomy (2 marks)
 - embryology (2 marks)
- How does meiosis cause variation among offsprings? (2 marks)

2006-10

Figure 7 is a diagram showing some of the varieties of cichlid fish (mbuna) found in Lake Malawi.

Use it to answer the questions that follow.

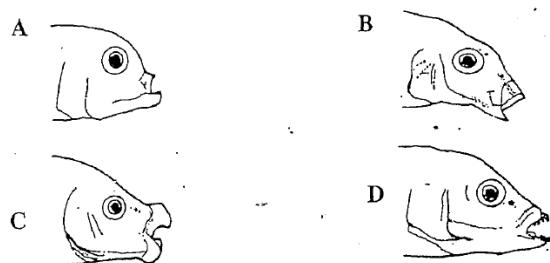


Figure 7

a.

(i) Which cichlid fish is adapted for carnivorous feeding habits? (1 mark)

(ii) Explain your answer to a.(i). (2 marks)

b. Explain briefly how the four varieties of the cichlid fish may have arisen from a common ancestor. (3 marks)

2004-8

Figure 4 is a diagram showing the wing of a bat labelled and the front leg of a rabbit labelled **B**. Use it to answer the questions that follow.



Figure 4

b. (i) What type of evidence of evolution is shown in **Figure 4**? (1 mark)

(ii) Give a reason for your answer to 8.a.(i). (2 marks)

2003-13.

In Malawi, during the 1980s, DDT was a common pesticide that was used to kill weevils. This pesticide began to appear. In the 1990s, a new pesticide had to be introduced because the majority of weevils could not be killed by DDT.

a. How could weevils become resistant to DDT? (1 mark)

b. Explain how natural selection would help the population of weevils to become resistant to DDT.

(4 marks)

15 Population

Section C

2012-16.

Explain how one can estimate the population of fish in a pond. Your answer should be in an essay form. (10 marks)

2006-17.

Describe **five** problems which result from rapid growth of human population and how they could be controlled. Your answer should be in an essay form. (10 marks)

16 Ecosystem

Section A

2010-3

Figure 3 shows the carbon cycle. Use it to answer the questions that follow:

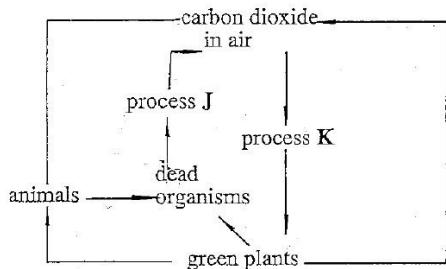


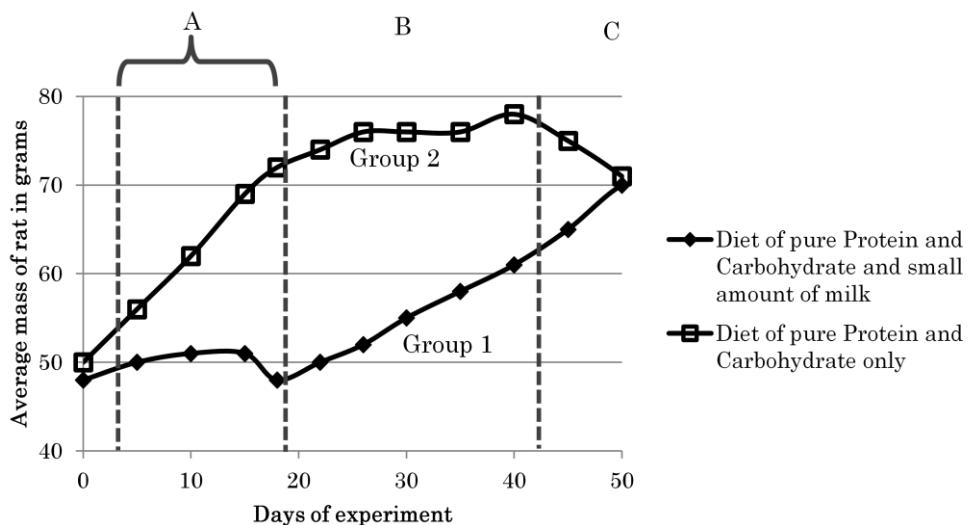
Figure 3

a. Name the processes **J** and **K**. (2 marks)

b. Mention one environmental problem that is caused by increased amounts of carbon in dioxide in the atmosphere. (1 mark)

2007-4

Figure 3 is a graph showing results of an experiment on the diet of two groups of rats. The graph is divided into three regions **A**, **B** and **C**. Use it to answer the questions that follow.



a. Describe what happened to the mass of group 2 rats in regions **B** and **C**.

(i) Region **B** (1 mark)

Explain your observation: (1 mark)

(ii) Region **C** (1 mark)

Explain your observation: (1 mark)

b. Mention any **two** variables that were kept constant during the experiment. (2 mark)

2005-6

Figure 2 is a diagram showing a food web in an aquatic ecosystem. Use it to answer the questions that follow.

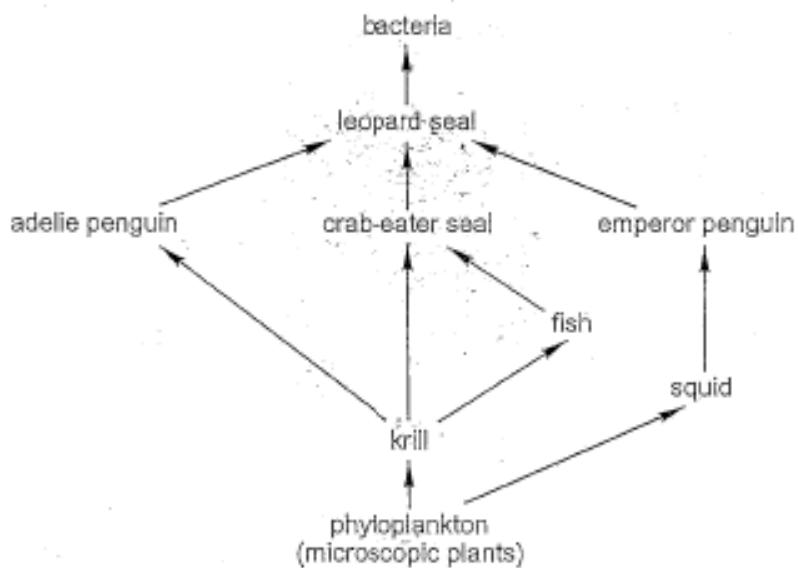


Figure 2

a. Name one organism which represents a:

- (i) Herbivore (1 mark)
- (ii) Decomposer (1 mark)

b. From the food web draw one food chain of six organisms. (2 marks)

c. Why would bacteria not belong to a specific feeding level? (1 mark)

2004-1.

a. Define the following terms:

- (i) "ecosystem" (1 mark)
- (ii) "community" (1 mark)

b. Suppose a particular ecosystem has 2 shrubs, 100 caterpillars and 3 birds, construct a pyramid of:

- (i) number (1 mark)
- (ii) biomass (1 mark)

2003-6.

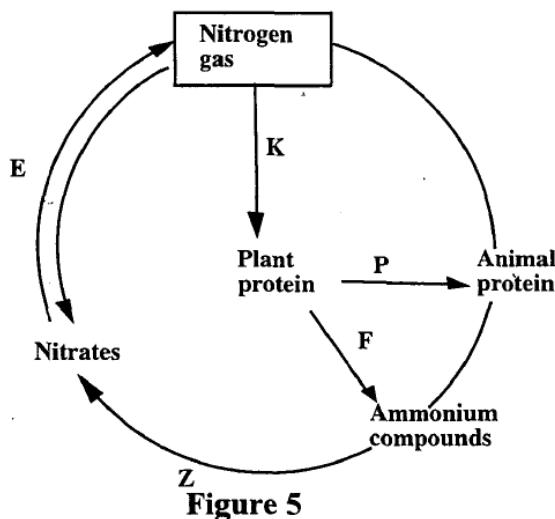
a. Mention **one** abiotic factor that affects plant growth. (1 mark)

b. Give **two** ways in which the activities of man can affect an aquatic ecosystem. (2 marks)

Section B

2012-8

Figure 5 shows one of the nutrient cycles in nature. Use it to answer the questions that follow.



- Name the processes taking place at **F**, **Z** and **P**. (3 marks)
- Explain how the process at **K** takes place. (3 marks)
- Under what conditions does the process at **E** take place? (1 mark)

2010-13

Figure 11 is a diagram showing recycling of materials in an ecosystem. Use it to answer the questions that follow.

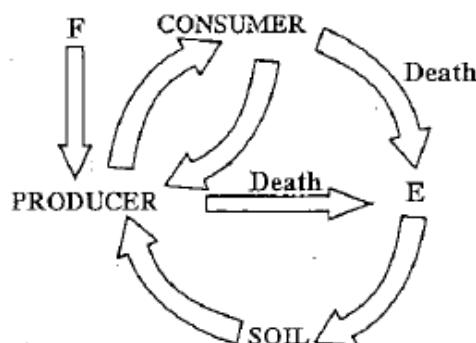


Figure 11

- What does **F** represent? (1 mark)
- Explain how the producer benefits from the activities of organisms represented by letter **E**. (3 marks)

2009-13

Table 2 shows results of an analysis of water in a stream and the organisms present in it. The stream was sprayed annually with an insecticide to kill larvae of mosquitoes. Use it to answer the questions that follow.

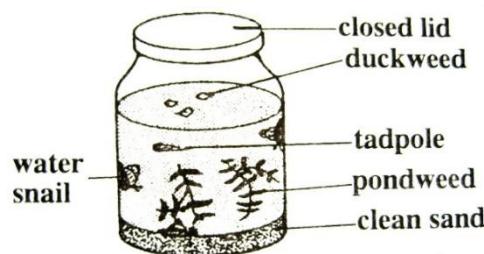
Table 2

Analysis	Concentration of pesticide
Stream water	2
Water plants	500
Fish type A	27,000
Fish type B	115,000
Fish eagles	160,000

- a. Write down a food chain that includes all the organisms shown in the table. (3 marks)
- b. Why is the insecticide concentration in the fish eagles higher than in the water plants? (2 marks)

2008-7

Figure 6 shows a closed aquarium which was set up in the sun by a group of students. Use it to answer the questions that follow.

**Figure 6**

- a. Besides feeding relationship, explain how the pond weeds and snails depend on each other in the aquarium. (4 marks)
- b. If the following morning students observed that tadpoles and water snails had died explain the cause of death. (3 marks)

2007-5.

Student caught 64 grasshoppers in a school garden of area $32m^2$ and marked them with nail varnish. They released them into the same garden. After two hours the students captures 60 grasshoppers in the same area of which 12 had marks of nail varnish.

- a. Name the sampling technique used by the students. (1 mark)
- b. Calculate the total number of grasshoppers for this area. (3 marks)
- c. Calculate the population density of the grasshoppers. (2 marks)

2006-12

Figure 9 is a diagram showing one of the relationships that exists among organisms in any ecosystem. Use it to answer the questions that follow.

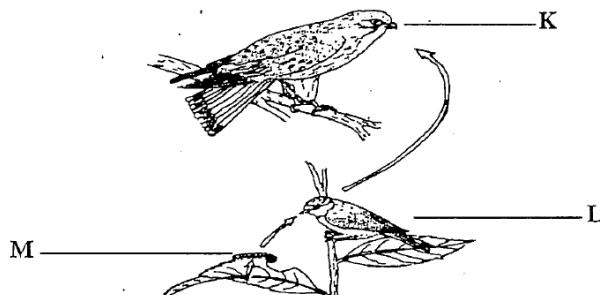


Figure 9

a.

- (i) Name the type of relationship shown in **Figure 9**. (1mark)
 - (ii) State **two** adaptations of organism **K** to survive in this relationship. (2 marks)
- b. Explain briefly how organism **K** would be affected if the population of organism **M** was red. (2marks)
- c. Apart from pesticide application, mention one way of reducing population of organism **M**. (1 mark)

2004-7

Figure 3 is a diagram showing recycling of materials in an ecosystem; Use it to answer the questions that follow.

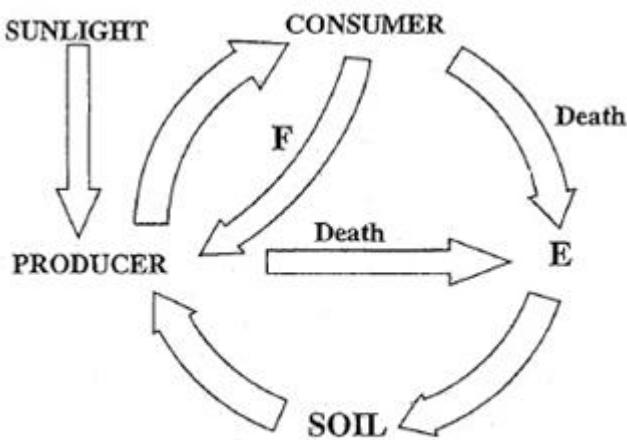


Figure 3

- a. What do the letters **E** and **F** represent? (2 marks)
- b. Explain how the consumer be affected if **E** was absent in the cycle. (3 marks)
- c. How would a worm using the soil as a habitat benefit the producer? (3 marks)

2004-9

Figure 5 is a photograph of plant known as cactus. Use it to answer the questions that follow.



Figure 5

a.

- (i) Suggest a possible environment where the plant in **Figure 5** would grow. (1 mark)
- (ii) State **one** adaptation shown in the photograph which would assist the plant to survive in its habitat. (1 mark)
- (iii) Explain how the adaptation in 9.a.(ii) would help the plant to survive in its habitat. (1 mark)

2004-12

Figure 6 shows cross-sections through stems **6A** and **6B** of two plant species. Use it to answer the questions that follow.



Figure 6A

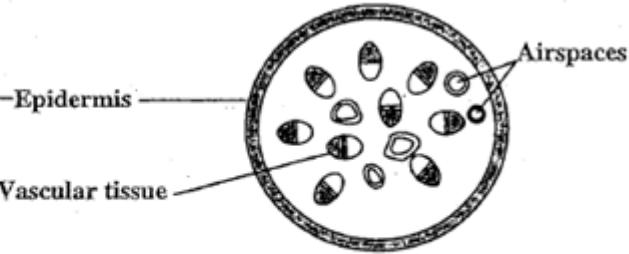


Figure 6B

a. State **two** structural differences between **Figure 6A** and **6B**. (2 marks)

b.

- (i) Which cross-section belongs to an aquatic plant? (1 mark)
- (ii) Explain your answer to 12.b.(i). (2 marks)

2003-15

Figure 7 is a graph showing the effect of untreated sewage on concentration of oxygen in a stream. Use it to answer the question that follow.

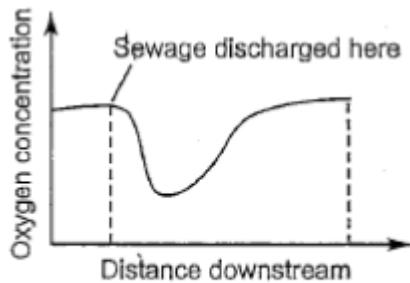


Figure 7

- Describe the effect of untreated sewage on oxygen concentration from the point of sewage discharge as distance increases down stream. (2 marks)
- Explain why there is a change in oxygen concentration from the point where sewage is discharged into the stream. (2 marks)
- Suppose there were fish in the stream, what effect would untreated sewage have on the population of fish? Explain your answer.

Effect (1 mark)

Explanation (1 mark)

Section C

2009-16.

Suppose you are an environmental officer in an area where people are not aware of the causes of environmental degradation. Explain any **five** causes and effects of environmental degradation you would include in your advice to people in the area. Your answer should be in an essay form. (10 marks)

2008-15.

Discuss the energy flow in a tropical woodland. Your answer should be in essay form. (10 marks)

2007-13.

Describe how the population of a plant in an open field can be estimated. Write your answer in an essay form. (10 marks)

2003-18.

Design an experiment that would be used to estimate the density of grasshoppers in a school garden. (10 marks)

SMSCE:B101
SOLUTIONS

1 Photosynthesis

Section A

2012-2.

- a. Midrib
- b. **P** has large surface area to expose as much of it possible to sunlight and air for photosynthesis.
R is branched to provide good water supply to mesophyll cell for photosynthesis.

2011-2.

- a. $C_6H_{12}O_6$
- b. **Z** is used for respiration to release energy.
Z is changed into proteins for growth.
Z is changed into lipids for cell wall formation.
- c. The process absorbs carbon dioxide from the atmosphere/thereby reducing its concentration in the atmosphere.

2010-1.

- a. **X**: Epidermal cell
Y: Stoma
- b. It is used to form chlorophyll which traps sunlight energy for photosynthesis.

2009-6.

- a. **K**: Oxygen
L: Hydrogen
- b. Diffusion
- c. It has stomata on its surface.

2007-1.

- a. Photolysis
- b.
- (i) **A**: Chloroplast, (traps light for photosynthesis).
B: Nucleus
- (ii) Plant cell
- c. It provides oxygen to the environment.
It provides food in form of starch.
It reduces CO_2 in the atmosphere thereby preventing global warming.

2006-1.

- a. Respiration
- b. Has stomata for enter and go out gases.
 - Thin lamina to facilitate faster diffusion of gases.
- c. Transporting mineral salts as well as water to photosynthesizing leaves.

2005-2.

- a.
- (i) Chlorophyll absorbs light energy.
- (ii) Xylem brings water to leaves which is a raw materials for photosynthesis.
- b. By combining glucose and nitrogen.

2004-3.

- a.
- (i) Because magnesium is necessary for production of chlorophyll molecules.

2003-1.

- a.
- (i) Oxygen
- (ii) Glucose
- b. By absorbing carbon dioxide which diffuses into leaves of plants to use for photosynthesis.

Section B

2011-5.

- a. **R:** Vacuole
- S:** Nucleus
- b.
- (i) Palisade mesophyll
- (ii) Having a lot of chloroplasts. Cells are close to upper epidermis.
- c. **T** is pentagonal in shape while **U** is round. **T** has thick walls while **U** has thin walls.
- d. Carbon dioxide is used up in the process of photosynthesis in the mesophyll cells so its concentration decreases in the cells hence carbon dioxide diffuses into the leaf to mesophyll cells.

2003-8.

- a. CO₂ concentration is the highest at dawn. It is decreasing from dawn to dusk. At dusk, the concentration is the lowest. And it is increasing from dusk to dawn.
- b. At dawn when sunlight intensity is low, the rate of photosynthesis is low so carbon dioxide which is a raw material for the process does not diffuse much into the leaf. On the other hand, between midday and dusk, the rate of photosynthesis is high since sunlight intensity has increased, so this result in more diffusion of carbon dioxide into the leaf.

Section C**2008-16.**

Collect fresh green leaves and grind them. Squeeze the ground leaves to obtain an extract.

Cut a strip of filter paper. Put a drop of the extract on the strip about 4cm from the edge.

Dip the edge of the filter paper with the drop of the extract in alcohol in a beaker about 2cm from the spot of the extract.

The alcohol rises up the strips to the spot of the extract dissolve as the alcohol passes through the spot the pigments move up with the alcohol at different rates.

This leads to the separation of the pigments into three different coloured spots.

The three different coloured spots indicate the leaves have three different types of pigments.

2004-16.

1. Glucose is used by other cells in plant where it can be used for respiration.
2. Can be stored for future use in storage organs, e.g. roots.
3. Can be converted into cellulose to make new cell walls.
4. Can be converted into fats and oils.
5. Can be combined with nitrogen and other minerals to make amino acid and proteins.

2 Transportation in plants

Section A

2012-4.

a.

- (i) Phloem
- (ii) It has sieve plate. It has companion cell.

b. pores in sieve plate allow sugars to pass from one cell to the other. Companion cell carries out some life processes of the phloem.

2004-3.

a.

- (ii) Osmosis

b. Both processes involve movement substance from areas of high concentration to area of low concentration.

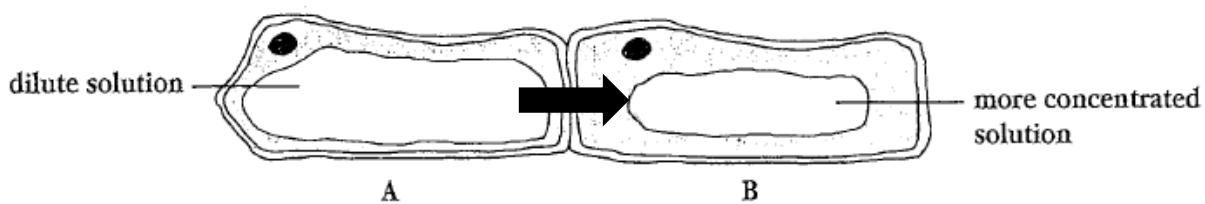
2003-2.

a.

- (i) A

(ii) Because A has more dilute solution, so it has more water molecules than a more concentrated solution that has fewer water molecules.

b.



Section B

2011-12.

a. Semi-permeable membrane

b.

- (i) Blue black colour in starch solution. Brown colour inside the visking tube.
- (ii) Iodine molecules will diffuse out of the visking tube to starch solution but starch molecule will not enter the tube because their molecules are big.

2010-12.

- a.
- (i) Increased temperature will make the bubble move faster towards the shoot.
 - (ii) Increased humidity would make the bubble either move slowly towards the shoot or remain stationary.
- b. To measure distance moved by the bubble for a given period of time. Then divide distance moved by time taken.

2008-10.

- a. X: Phloem tube
Y: Xylem vessel
- b.
- (i) Y: Xylem vessel
 - (ii) Xylem vessels carry water up from the roots.
- c. Z is called cambium. The cambium is a region of active cell division, where new xylem and phloem are formed.

2008-11.

- a.
- (i) Potassium, Magnesium
 - (ii) Concentration of potassium and magnesium in cell sap is higher than it in pond water, so these minerals enter the cell sap against concentration gradient by active transport.
- b.
- (i) The concentration of minerals in cell sap and pond water would be equal.
 - (ii) If alga were killed, alga cannot absorb ions by active transport. As a result, minerals move by diffusion to decrease the concentration gradient.

2004-13.

- a.
- (i) It will decrease.
 - (ii) Because water will move by osmosis from visking tubing to container with 40% sugar solution.
- b. Selectively permeable membrane.

Section C

2011-16

PROCEDURE

1. Fill two similar photometers with equal volume of water.
2. Record the level of meniscus.
3. Insert one leafy shoot in both potometers.
4. Smear Vaseline on areas between the shoot and the cork.
5. Observe changes in the level of meniscus in both potometers.

RESULTS

Distance covered by meniscus in the photometer placed in sunlight would be more than in photometer placed in darkness.

CONCLUSION

Increase in light intensity increases rate of transpiration.

2009-17

Prepare soaked bean seeds during about 4 days in water and the agar petri dish which contains starch.

Cut the beans in half and put them on the agar petri dish so as that the section of beans faces on the surface of agar.

Maintain these sets under 30°C during 24 hours.

Remove the beans from the agar after 24 hours.

Drop the iodine solution on the surface of the agar.

Remove the excess iodine solution from the surface of the agar and wash the surface of the agar.

Observe colour change on the surface of the agar. If experiment is well done, the parts the beans are put on the surface of the agar does not change, the colour is iodine/brown colour and another parts turn to blue black colour.

We can conclude the enzymes are secreted from the beans and it digests starch in the agar.

2005-16.

Prepare a shoot and fix it on a potometer. Fill the potometer with water of known volume.

Leave the plant on the ground where air is circulating and where there is enough there light.

As water transpires from the aerial surface of the shoot, it draws it from the potometer tube.

The photometer will measure the amount of water taken up the plant as result of transpiration.

This then shows that transpiration affects water uptake in plant.

3 Tropism

Section A

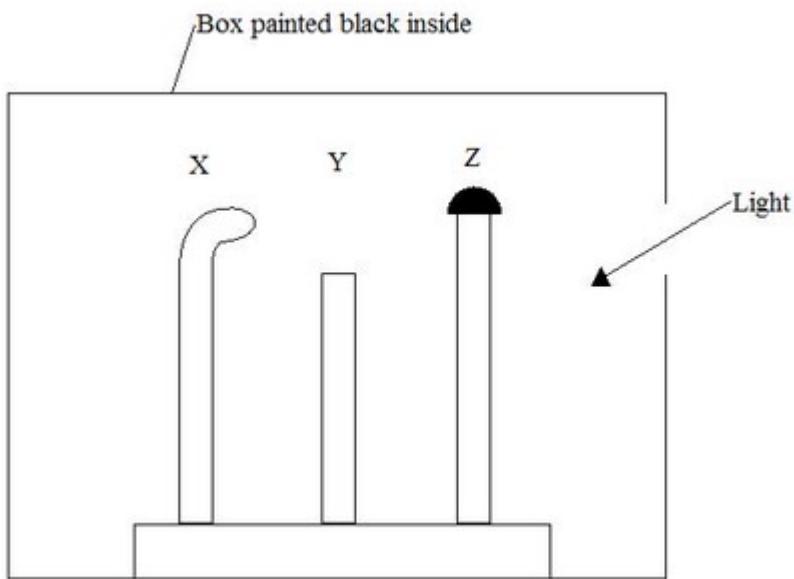
2005-1.

- a. Plant hormone which may affect rates of growing in roots and shoots.
- b.
- (i) By growing faster.
- (ii) By growing slowly.

Section B

2009-14.

- a. Because black colour prevents the reflection of light inside the box.
- b.



- c. In seedling Y the growth does not occur because tip which produces auxins that promote and regulate plant growth was cut off.

2005-7.

- a. L
- b.
- (i) Cell P
- (ii) Because cells in region M are elongated.

2003-14.

a. Gravity

b.

- (i) The potted plant shows negative geotropism where it grows away from the pull of the earth gravity.
- (ii) Owing to gravity, auxin concentrates more on the lower side of the shoot as a result this has a higher concentration of auxin than the upper side. This influences cell elongation on the lower side as compared to the upper side, so the plant bends upwards.

Section C**2006-16.**

Prepare pre-germinated beans seedling with straight plumules and radicle, 2 petri dishes, pins, moist cotton.

Pin 2-3 bean seedlings on the cotton in each petri-dish. In one petri-dish, the seedlings are in horizontal position. In another one, the seedlings are in vertical position. Make sure there is space between them.

Leave the sets on horizontal bench, and observe after 2 days.

We will observe that plumules grow upwards, while radicles grow downwards.

2004-18.

In this as a methods, one would need 2 potted plants(seedlings) of similar stages of growth, one of which placed in cardboard box with a window cut in one side allow light to penetrate from one direction. The other should be places on a clinostat. This expose the plant to light on both. This is control.

After a few days, the two plant should be removed from the boxes and compared. The results would show that the stem of plant with one-sided-illumination bend towards the light. The one in the clinostat does not bend.

This gives a conclusion that the young shoot has responded to one-sided lighting by growing towards it. This tendency is called phototropism.

4 Digestive system

Section A

2009-3.

- a. Enzyme G
- b. It would lose its activity. (It would be denatured.)
- c. Optimum pH of each enzyme is different.

2008-5.

- a. Enzymes are denatured by heat.

b. **Tube X:** brown.

Tube Y: blue-black.

2005-3.

a. **R:** Liver

S: Small intestines

- b. By regulating and recovering excess glucose stored by the liver.

2003-3.

a

Disaccharides	Polysaccharides
i. Sweet taste	No sweet taste
ii. White crystalline solids	Not crystalline
iii. Soluble in water	Insoluble in water

b. Starch, glycogen, cellulose

Section B

2012-13.

- a. Thin epithelium to diffusion of food faster.
Dense network of blood capillaries to ensure continuous blood flow.
- b. Large drops of fats are not broken down.
Stomach acid is not neutralized for another enzyme.
- c. To reduce of glucose level to conversion of glucose to glycogen.

2011-6.

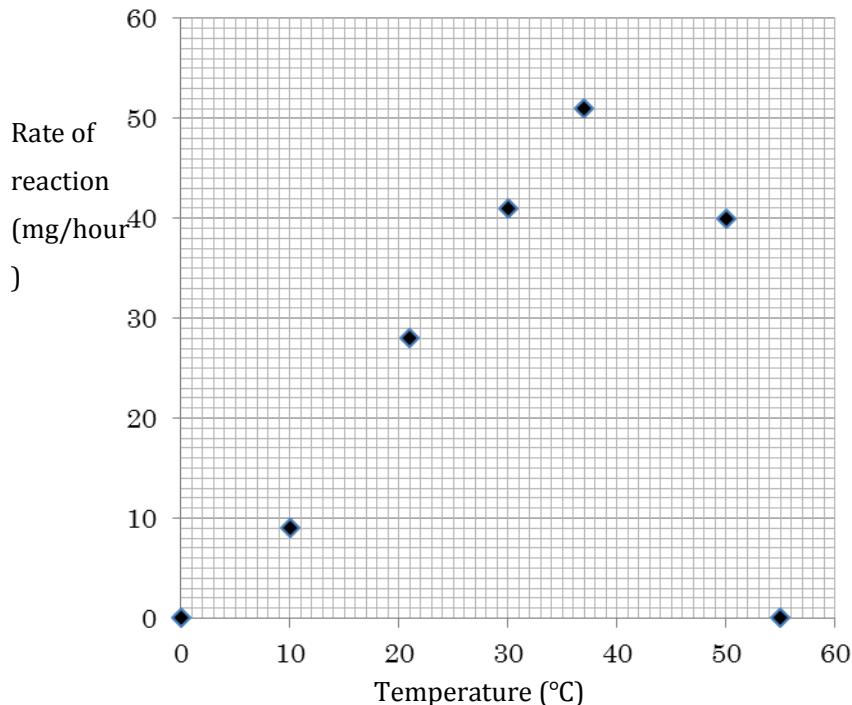
- a. Starch
- b. The food substance is produced by combining several glucose molecules which release water molecules.
- c. Salivary amylase. Pancreatic amylase.

2006-7.

- a. X: Epithelium
Y: Lacteal
- b. Fatty acids, glycerol.
- c. Villus has thin epithelial cells that allow soluble substances to pass easily.
Epithelial cells on villus have numerous mitochondria that provide energy for the uptake of digested food by active transport.
Villi are provide a large surface area for the absorption of the product of digestion.

2003-9.

a.



- b. As the temperature increases, the rate of reaction increase too up a point where any more temperature increase does not result in increase in the rate reaction. At that point, enzyme activity is denatured and reaction begins to decrease.
- c. Since the enzyme is denatured due to high temperatures, the rate of reaction decrease considerably.
- d. 37°C

Section C

2007-12.

The first problem associated with the human digestive system is constipation. Constipation is a situation where stools become too hard to be expelled from the body. It can be controlled from the body. It can be controlled by drinking enough water after meals and by doing physical exercises. It can also be controlled by using drugs such as laxatives.

Another problem is heartburn. This is a burning sensation in the oesophagus. It is caused by acidic stomach when the contents surge or increase and move upwards into the oesophagus. It can be controlled by taking anti-acid medications.

Stomach ulcer is another problem of the human digestive system. It may be caused when a person constantly has too much acid in his or her stomach so that the gastric juice begins to eat into the lining of the stomach, causing ulcers. Ulcers can be avoided by leading a worry-free life and a life not burdened by too much work.

Indigestion is another problem and is caused by eating food too quickly and not chewing it enough. It can be controlled by ensuring that one eats the food slowly, adequately chewing it before swallowing.

The fifth problem is appendicitis. This is an inflammation of the appendix. This can be cured by removing the appendix in an operation.

5 Circulatory system

Section A

2011-1.

- a. Lymph is tissue fluid drained into the lymphatic system.
- b. Lymph does not contain large protein molecules nor red blood cells while plasma contains large protein molecules and red blood cells.
- c. The volume of chest cavity increases/pressure in the chest cavity decreases/ and this draws the lymph towards the chest cavity.

2008-1.

- a. Adrenaline
- b. It caused more supply of glucose and oxygen to muscles. This increased respiration rate which resulted in more energy released for running.

2008-2.

- a. X: Rib
Y: Sternum
- b. The heart / the lungs
- c. Pericardial cavity / pleural cavity

2008-6.

- a. Phagocytosis
- b. The site of infection in the blood vessel.
- c. The bacterium is digested.

2006-3.

- a.
 - (i) Sickle-shaped
 - (ii) They have an abnormal shape like a sickle and contain little haemoglobin.
- b. Genetic/ mutation
- c. Malaria

Section B

2012-12.

- a. Tricuspid
- b.
- (i) **U** has more O₂ than **T**.
- (ii) **T** has more CO₂ than **U**.
- c. Contract of thick muscles of **V** to the greater force exerted on blood.

2012-14.

- a.
- (i) Tissue fluid
- (ii) Oxygen, water, glucose, fatty acid, amino acid
- b.
- (i) They are very thin walls which consist of a single layer of flattened cells.
Having narrow lumens which create high blood pressure to push plasma.
- (ii) Having valves to prevent back flow of lymph.
The wall of lymph vessel are permeable than capillaries to drain wastes.
- c. **P**

2011-7.

- a. **R**: Elastic muscle fiber (or tunica media)
T: Endothelium (or tunica intima)
- b. **M** has thick elastic muscle fiber while **N** has thin elastic muscle fiber.
M has a narrow lumen while **N** has wide lumen.
- c. The contraction of skeletal muscles squeeze vessel **N** and force blood forward.

2010-7.

- a.
- (i) Person **H**
- (ii) Because has lowest content of red blood cells.
- b. Ratio of white blood cells to platelet in person **F** is 5,000 : 250,000 = 1 : 50

2007-10.

- a. Tunica media, fiber layer/ fibrous tissue
- b.
- (i) **M**
- (ii) Arteries have narrow lumen. Fiber layer in arteries is thicker than that in any other blood vessel.
- c. Because the pulse rate corresponds to the beating action of the heart as the heart pumps blood through arteries.

2006-6.

- a. Valve
- b. Veins and lymph vessel/lacteal
- c. ← Arrow shows direction of the flow of blood.
- d. Blood would flow backwards without reaching the heart.
- e. Muscle contraction

2005-10.

- a. **A:** Pulmonary artery
- B:** Vena cave
- b.
 - (i) Walls marked **C** are thicker than those marked **D**.
 - (ii) Because they have to pump blood with much force to all parts of the body.

2005-12.

- a. The liquid part of the blood which fibrinogen has been removed.
- b.
 - (i) **X:** Compatible blood
 - Y:** Agglutination of blood
 - (ii) Group B
 - (iii) Because anti-B antibodies agglutinate against the b antigens on the red blood cells.
- c. Avoid agglutination of blood cells.

2003-10.

- a.
 - (i) **B**
 - (ii) **D**
 - (iii) **A**
- b.
 - (i) Their shape which is biconcave offers a wide area to collect and release oxygen more efficiently.
 - (ii) Has haemoglobin that has a high affinity for oxygen.
- c. Cell **D** produces antibodies to fight against infections which cell **C** engulfs bacteria and destroys them.

Section C

2005-15.

Plasma is one of the components of the human blood. Plasma is the liquid part of blood. It contains glucose, amino acid, salts, hormones and blood protein. It also contains antibodies that fight against infections.

Another component of human blood is white blood cells. There are several types of white blood cells in the body. Phagocytes engulf bacteria and lymphocytes produce antibodies.

Red blood cells form another component of the human blood. Red blood cells determine blood group of individuals since they have antigens. Red blood cells contain hemoglobin which transports oxygen throughout the body to tissues.

Another component of the human blood comprises the platelets. Platelets prevent entry of germs into the body by forming clots.

6 Respiratory system

Section A

2010-2.

- a. Trachea
- b. It is thin walled.
- c. There is high concentration of oxygen in part marked **Q** than in the muscle fiber hence oxygen diffuses into the muscle fiber.

2009-2.

- a. Cilia
- b.
 - (i) It traps dust particles in the air.
 - (ii) It lubricates the surfaces in the regions of contract between the lungs and thorax.
- c. The rings of cartilage help to keep trachea open during breathing.

Section B

2012-10.

- a. Causing lung cancer
 - Damaging the brain.
- b. Increase rate of breathing. Increase heart beat
- c. Very thin wall to diffuse gases effectively
 - Surrounded by a network of blood capillaries to exchange gases which in blood easily.

2011-13.

- a. day2
- b.
 - (i) The amount of oxygen is decreased between day2 and day 4.
 - (ii) The population of bacteria is increasing thereby using more oxygen for respiration.

2009-12.

- a. Left atrium
- b. Blood flows from point **T** to **S**. During this blood flow blood receives oxygen from alveolus.
 - So point **S** has more oxygen than point **T**.
- c. Oxygen dissolves in this thin layer of moisture for easy diffusion across the wall of the alveolus.

2007-7.

a. After 20 seconds

b. 4.2liters

c.

(i) 5 seconds take 2 breaths

$$60 \text{ seconds will take } 2 \times \frac{60}{5} \text{ breaths} = 24 \text{ breaths}$$

(ii) 5 seconds take 4 breaths

$$60 \text{ seconds will take } 4 \times \frac{60}{5} \text{ breaths} = 48 \text{ breaths}$$

d. Because the body muscles require more oxygen to release more energy during respiration for exercising.

2005-9.

a. Carbon dioxide

b.

(i) Aerobic respiration

(ii) Because oxygen is used.

c. For growth.

For chemical reactions.

For physical activities.

Section C**2011-15.**

Partially burnt charcoal used up oxygen in the khola and gave off carbon monoxide. The calves breathed in the carbon monoxide which combined with haemoglobin hence reduction in the amount of oxygen transported. This lowered respiration in cells which resulted in less energy produced. Then brain cells stopped working.

2010-17.

Let a person breath while at rest for one minute (specified period of time) then record number of breaths made. Let the same person carry out a vigorous activity for some time then immediately after exercise record number of breaths made in one minute (specified time). Compare number of breaths made before and after exercise. Number of breaths (or breathing rate) made before exercise is lower than after exercise. Therefore exercise increase rate of breathing.

2006-15.

Basically, the breathing mechanism in a human being is viewed from two angles. The first part is inspiration. During inspiration also called inhalation, external intercostal muscles contract. This makes the intercostal muscles relax. The ribs move upwards and outwards and the diaphragm muscles on the edges contract. The diaphragm flattens, making the volume of thorax increase. Air pressure decreases in the thorax and this makes air rush into the lungs.

Another part is expiration. During expiration or exhalation, the external intercostal muscles relax and the intercostal muscles contract. The diaphragm domes upwards, making the volume of thorax when compared to that of the atmosphere. This forces the air out of the lungs.

2004-17.

For inhalation, a fish opens its mouth (buccal cavity). This increases the volume of the mouth and decreases the water pressure in the buccal cavity (mouth).

Water flows into the mouth from outside because internal water pressure is lower than external water pressure.

Operculum muscles bulge. This increases volume of the mouth and decreases pressure in the gill region. Water flows over the gills.

For exhalation, a fish closes mouth while muscle raises the floor of mouth. This decreases volume of, and increases the water pressure now exceeds external water pressure. Water is forced out of operculum. As water flows past gill filament oxygen diffuses out of the water into blood, and carbon dioxide diffuse out of the blood into the water.

7 Locomotion

Section A

2005-4.

- a. Provides a slimy surface that reduces friction.
- b. It is light and makes buoyancy in air while in flight.

2004-2.

- a.
 - (i) Feathers
 - (ii) Fins
- b. Both have streamlined body shape.

Both have powerful muscles that act on skeleton to produce movement.

Section B

2010-11.

- a.
 - (i) Down stroke
 - (ii) Depressor muscles contract and elevator muscles relax.
- b. Has aerofoil shape which creates higher pressure below the wing than on upper part.

2008-9.

- a. Upward beat
- b.
 - (i) Spreading of the wing provides the large surface area. This creates a large air pressure under the surface of the wing.
 - (ii) Feathers enable birds to trap a lot of air. It raises air resistance below the wings and produces up thrust on the wings.

2006-13.

- a.
 - (i) Biceps / Flexor muscle
 - (ii) Humerus
- b. The aim will stretch.
- c. It bulges out. It shortens.

2004-8.

a. Differences in shape of the bones especially humerus.

Radius and ulna in rabbit are separate while in bad are fused.

Section C**2007-14.**

If birds were not adapted to overcoming gravity, they would not fly up and not fly at all. Besides, if their bodies were not so adapted the birds would not overcome the effect of drag which are reduced speed and lack of balance. Birds overcome these problems because they have strong but light bones. This makes them lighter. Birds also have large and powerful flight or pectoral muscles that provide the power to flap wings in flight. Their bodies are also streamlined to reduce air resistance.

They contain air sacs that make them lighter beside the feathers that provide aerofoil needed to generate lift when the wings.

8 Reproduction

Section A

2012-3.

- a. Crossing over
- b. Ovary or testis
- c. Giving variation resulting from exchange of genetic material in strand.

2010-5.

- a. Fertilization
- b.
 - (i) Identical twins
 - (ii) They originated from a single ovum or single zygote.

2009-4.

- a.
 - (i) Metaphase
 - (ii) Because the pairs of chromatid line up on equator of cell.
- b. It contracts and pulls chromatids for separating and moving to opposite poles of the cell.

2008-4.

- a. Diploid (number)
- b.
 - (i) 2 daughter cells
 - (ii) 2 chromatids

2007-2.

- a.
 - (i) Genetic material (Nucleus)
 - (ii) Dissolves surface on the ovum to allow sperm to penetrate it for fertilization.
- b. Contains mitochondria that release energy used in sperm movement.

Section B

2012-9.

- a. **X:** Urethra
- Z:** Testis
- b. Vasectomy
- c. Passing sperm is stopped completely. Permanent. No side effect.

2011-8.

- a.
- (i) day 12 to 16
- (ii) Ovulation has occurred or the egg is in the fallopian tube.
- b. Thickening of the uterine wall. Vascularisation of uterine wall.
- c. Corpus luteum produces progesterone which maintains the thickness of the uterine wall in preparation for implantation.

2010-9.

- a. **P:** Umbilical artery
- Q:** Umbilical vein
- b.
- (i) Carbon dioxide
- (ii) Urea
- c. Lungs
- d. Has dense network of blood vessels for efficient transport of substance.

2009-8.

- a. **P:** Ovum
- R:** Corpus luteum
- b. Ovulation
- c.
- (i) Progesterone
- (ii) It keeps the uterus lining thick and with a dense network of blood vessels.

2006-9.

- a. **A:** Vas deferens or sperm duct
- B:** Prostate gland
- b. Testosterone
- c. Because of cutting the sperm duct, sperm cannot reach the penis.

2005-11.

a.

(i) **B:** Uterus

(ii) **C:** Placenta

b. It acts as a shock absorber, protecting the developing foetus against mechanical injury.

It supports the foetus and allows it to move freely during growth.

2005-13.

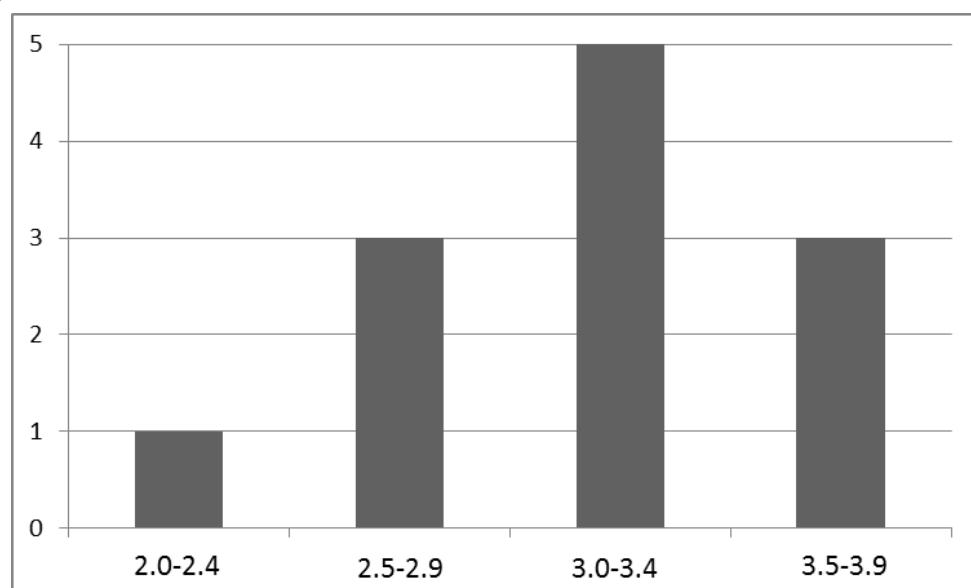
a. $3 = (3.1+2.5+3.0+3.5+3.4+2.5+2.6+3.4+3.0+3.5+2.0+3.5)/12$

b.

(i)

Birth mass(kg)	2.0-2.4	2.5-2.9	3.0-3.4	3.5-3.9
No. of babies	1	3	5	3

(ii)



c. 3.0-3.4

d. Continuous variation

2004-14

a. About 5 weeks

b.

(i) Umbilical cord

(ii) It allows antibodies diffuse from the mother's blood into the embryonic blood capillaries.

It allows metabolic waste, e.g. urea to diffuse from the embryonic blood capillaries into the mother's bloodstream.

It allows dissolved food substances such as glucose to diffuse from the mother's blood into that of embryo.

c. Mitosis

Section C

2012-15.

Fist milk of breast feeding called colostrum which is rich in proteins, vitamins and antibodies which help the baby fight early infections before its own immunity system develops.

Breast milk is cheap and is available the instant it is needed.

Breast milk is digested more quickly and more easily than bottled milk. If unhygienically handled, bottled milk may cause frequent constipation in babies.

Breast milk is at the right temperature, i.e. the normal body temperature for the baby.

Breast feeding provides emotional and psychological benefits to both mother and baby.

2009-15.

There are several contraceptive methods. Typical contraceptive methods are following ways;

1. The rhythm method: the rhythm method prevents pregnancy by avoiding sexual intercourse during the period when ovulation is most likely to occur.
2. Use of the condom: the condom is used to cover the penis and collect the semen in order to prevent pregnancy.
3. Taking contraceptive pills: contraceptive pills contain female sex hormones that prevent ovulation.
4. Use of the intra-uterine device (IUD): the IUD is inserted into the uterus. It prevents the implantation of an egg in the uterus.
5. The vasectomy: the sperm ducts are tied and cut by the surgical operation. This prevents sperm from reaching the penis, so no sperm are discharged.

*Another contraceptive methods:

The tubal ligation is the sterilization operation for women. Both the oviducts are cut and tied back. This prevents the sperm in the uterus from reaching the egg.

The diaphragm is inserted into the top of the vagina and placed over the cervix. It prevents sperm from getting into the uterus.

The spermicides are placed high into the vagina before intercourse and chemicals that can be used to kill the sperm.

2003-16.

I would advise the couple to choose from a number of contraceptive methods. The first would be use of contraceptive pills. These are pills that contain estrogen and progesterone-like hormones. The hormones prevent ovulation.

Another method would be the use of a diaphragm. A diaphragm is a dome-shaped rubber cap with an elastic rim increased onto the top of the vagina and placed over the cervix, preventing sperms from entry into uterus.

The couple would also benefit if I presented to them the use of a condom as a contraceptive method. A condom is a thin rubber tube which is used to cover the erect penis before intercourse.

Sperms are collected at the end of the sheath so are prevented from entering the uterus. I would also present to them the rhythm method. This is also known as safe-period method. This method is based on the fact that in every menstrual cycle, there is a fertile period when ovulation is likely, so avoiding sexual intercourse during this period prevents pregnancy.

The fifth method I would present to them would be withdrawing the penis from the vagina before the organism so as to prevent depending the sperms into the uterus. I would however emphasise that this is a very risky method because it can be too late to withdraw the penis.

9 Excretion

Section A

2003-4

- a. The process that removes amino groups from the amino acid.
- b. (i) Carbon dioxide
 - (ii) Nitrogenous compounds e.g. urea

Section B

2012-11.

- a. (i) Urea
 - (ii) Excess amino acids are deaminated by the liver. Deamination is the removal of amino groups from amino acid molecules by the liver. The amino group is changed to urea and sent to the kidneys.
- b. Glucose, Protein

2010-8.

- a. 485cm³
- b. Urine output increased
- c. ADH made kidney to reabsorb more water hence reducing urine output.

2009-7.

- a. Because they produce concentration gradient in the dialyser for efficient diffusion of waste matters.
- b. Because they provide a large surface area to increase the rate of diffusion.
- c. Because if an air bubble enters the patient's blood vessels, it blocks and prevents the blood flow.
As a result, it leads to the death of the patient.

2007-9.

- a. (i) A: medulla
 - (ii) B: Collecting duct, t
- b. Contains the Bowman's capsule where ultra-filtration occurs.
- c. (i) Less urine is produced
 - (ii) When blood is concentrated with salt, hypothalamus stimulates pituitary glands to secrete into blood anti-diuretic hormone. When this hormone reaches the kidney, it causes tubules to absorb more water from the glomerular filtrate back into the blood and this causes little urine production.

2006-11.

- a. M: Renal artery N: Bowman's capsule
- b. (i) Ultra-filtration
 - (ii) Blood capillaries in the Bowman's capsule have very small diameter, so the high blood pressure forces substances out of semipermeable hence allows some substances to pass and not others.
- c. Reabsorption of glucose from the tubule into the bloodstream.

2005-8.

- a. (i) Glucose, Protein
 - (ii) Uric acid, Creatinine, Chloride, Sodium, Potassium
- b. Anti-diuretic Hormone
- c. Because it contains ammonia which is not needed and harmful to the body.

2004-15.

- a. Dialysis fluid and blood plasma are similar in composition so important substances do not diffuse out of the blood.
- b. Each has a selectively permeable membrane that allows only smaller particles to pass through.
- c. (i) Urea
 - (ii) water

Section C**2010-15.**

There is filtration in the glomerulus due to high pressure which results in smaller substances leaking out into the bowman's capsule or renal tubules.

Then selective re-absorption of useful substances occurs from the renal tubules into the blood capillaries either by active transport or diffusion or osmosis(for water) leaving behind substances in the renal tubules called urine.

10 Coordination

Section A

2011-4.

- a. Grey matter
- b. Leprosy
- c. To protect spinal cord from the external force.

2007-3.

- a. It is a reflex action that is acquired through experience.
- b. -Presentation of original stimulus and related response made.
 - Substitute stimulus is presented together with the original stimulus.
 - Substitute response is now presented alone.
- c. Conditioned reflex is acquired from experience with a stimulus that was originally ineffective in producing the observed response while simple reflex action is an automatic response to stimulation.

2006-4.

- a. Time taken for the person to hear the sound.
Intensity of the sound from the clock.
- b. To find out the out the distance of sound from the cars increases,
it became difficult to locate the source of the sound location is effective by using two cars.
- c. In general, as the distance of sound from the ears increases, it becomes difficult to locate the source of the sound, and sound location is effective by using two ears.

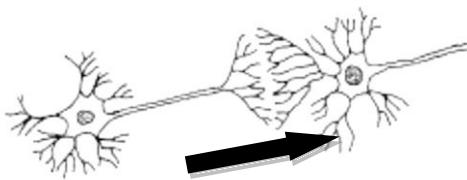
2004-4.

- a. A-White matter B-Ganglion
- b. A consists of nerve fibers white D consists of cell bodies.
- c. Over-exposure to radiations. Smoking, viral infection.

Section B

2011-10.

a.



- b. To ensure that impulses travel one direction or to help filter weak or unwanted stimuli.
- c. It affects the cerebrum thereby affecting decision making of an individual.

2010-10.

- a. T: Myelin sheath S: Axon
- b. Motor neurone
- c. Impulses would not be transmitted to effectors or muscle hence no response.
- d. Has myelin sheath which insulates the neurone

11 Human diseases

Section A

2012-1.

- a. Carrying germs which introduce human body through bite.
Burrowing under the skin of human and lay eggs. e.g. flea cause the jigger.
- b. Itching in between toes. Splitting skin between toes.

2011-3.

- a. (i) Typhoid
(ii) Salmonellosis (bacteria)
(iii) Drinking contaminated water.
Eating contaminated food.
- b. Germs multiply in the body but there are no symptoms in the host.

2010-4.

- a. Droplet infection
- b. Tuberculosis, Common cold
- c. Covering the mouth or nose when coughing or sneezing to prevent germs(drops) getting into the air or to others.

2009-1.

- a. (i) Sharing injection needles with an infected person.
Receiving infected blood during a blood transfusion
Mother-to-child transmission.
(ii) Avoiding to share injection needles.
- b. They have to take the drug ARV that can slow down the illness.
They have to keep the healthy daily life.

2008-3.

- a. Ringworm
- b. fungu
- c. To ensure personal cleanliness. / To avoid contact with infected person or personal objects.
To dry the skin to remove moisture./To wash the skin with soap, etc. (Write any one.)

2006-5

- a. They carry out cell division uncontrollably.
- b. Because it is genetic.
- c. Avoiding exposure to ultraviolet rays (radiation).

Avoid smoking as this induces mutation of chromosomes.

Avoid drinking alcohol.

Protect yourself from strong sunlight.

Reduce stress

2004-5.

- a. cancer
- b. The cell of the tumour takes nutrition from surrounding cells. The cell of the tumour cause other cells to malfunction.
- c. Smoking

Drinking excess alcohol

2003-5.

- a. To find out the effect of temperature on bacterial growth.
- b. 37°C

Section B**2011-9.**

- a. Trypanosome
- b. Using insecticides to kill the tsetseflies.

Appling repellants to the skin to avoid being bitten by tsetseflies.

2010-6.

- a. It is body defense against infection through already made antibodies or through introduction of antibodies.
- b. (i) Platelets form blood clots or scab which prevent entry of germs.
(ii) Stomach produces hydrochloric acid which kills germs.

2008-12.

- a. elephantiasis
- b. filarial worms
- c. The tiny larvae of this worm are transmitted by mosquitoes.

The mosquito bites a person and the filarial worms are injected into the victim's blood stream.

After that, these worms grow in the lymph vessels and lay eggs.

If other mosquito bites an infected person, it sucks this worm.

- d. Always wear long trousers and long sleeved shirts at dusk and dawn and sleep under mosquito nets to prevent you from mosquito bites.

2007-6.

- a. (i) Because some of the energy has been dissipated into the air.

Also some of the energy has been used to heat the water.

- (ii) The boiling tube should not be inclined at that angle, it should be upright.

The distance between burning cashew nut and the boiling tube should be reduced.

- b. Size of both cashew nut and bean seed should be the same.

Time taken to burn the seeds should be kept constant.

Amount of water being heated is constant Size of test tube is the same.

2006-14.

- a. (i) Oil prevents oxygen from reaching the mosquito larvae. So, they will be died.

(ii) Fish eats mosquito larvae and eggs.

- b. Because malaria parasites destroy red blood cells.

2003-12.

- a. N

- b. M=3000

N=5500

O=1000

P=2000

Total 11500

- c. Others might have got the infection but did not show malarial signs so were not included in the survey.

The number of malarial cases represented only the sample of the whole district.

- d. High fever, shivering and chills followed by sweating.

Aches and pain, anaemia, enlargement of liver and spleen.

Section C

2010-16.

This was also an essay question and the expected five points should have included the following:

- Checking the blood groups of donor and recipient to avoid agglutination
- Consider the rhesus factor to avoid any reactions or still birth or miscarriages in subsequent pregnancies.
- Testing blood for HIV to avoid infecting the recipient
- Checking haemoglobin content of the donor to avoid death of donor due insufficient oxygen supply.
- Check for syphilis in donor to avoid infecting recipient.
- Consider blood pressure of donor to avoid death of donor due to low blood pressure.
- Check for hepatitis in donor to avoid infecting the recipient.
- Consider age of the donor, i.e. should not be too old or too young to avoid death of donor as replacement of blood may be too slow.
- Check for malarial parasites to avoid infecting the recipient.

2008-14.

- First point is killing the adult mosquitoes directly to spray rooms and houses with insecticides.
- Second point is killing the mosquitoes at the larvae, eggs and pupa stages to drain all stagnant water.
All empty receptacles such as tins, bottles and broken pots should be removed or turned upside down.
- Third point is taking the breeding places from mosquitoes to cut down all the tall grasses around homes to prevent mosquitoes from finding breeding places.
- Fourth point is decrease in number of mosquitoes. Where mosquitoes breed in a slow running stream, the use of fish or ducks to eat the mosquito larvae and pupa is applied.
- Fifth point is protecting yourself from mosquitoes. Always wear long trousers and long sleeved shirts at dusk and dawn when mosquitoes are likely to bite. And always sleep under mosquito net.

2005-17.

To establish the cause of diarrheal disease, the following can be done:

I would find out about personal hygiene items of students because unhygienic condition result in breeding of various type of germs.

I would also find out about source of water used by the students whether it is from a hygienic source. If it is from boreholes, then I would advise that the boreholes should be re-located away from pit latrines.

Knowing whether the students had been vaccinated against diseases like cholera before would also be necessary.

Beside all these, I would find out the methods of waste disposal used at the school. Waste management is crucial since waste disposal areas are breeding grounds for microbes that cause diarrheal diseases.

12 Immunity

Section A

2006-2

- a. Antibodies a and b
- b. Because in blood plasma of a person with blood group O, there are no antigens so which trigger agglutination.

2005-5

- a. It produce chemicals which coordinate the activity of all cells in the immune system.
- b. HIV destroys the helper T-cell by inhibiting the producing of antibodies by the T-cell.

Section B

2011-14.

- a. Number of uninfected children= $500-20= 480$ children
 $\% \text{ of uninfected children} = 480 \div 500 \times 100\% = 96\%$
- b. It stimulate the production of antibodies which fought against bacteria.

2010-6.

- c. It destroys or kills white blood cells which defend the body against diseases.

2009-10.

- a. Because antibodies killed some antigen and then the level of antigens decreased.
- b. The body is memorizing information about the antigens.
- c. Because antibodies are produced in large amounts very quickly by the memory cells after reinfection by some antigen.

2007-8.

- a. Engulf and digest foreign particles, e.g. bacteria.
- b. By neutralising the (poisonous) toxins produced by bacteria.
By dissolving bacteria outer coats.
By agglutinating bacteria so that they cannot invade.
By adhering to the outer surface of bacteria and so making it easier phagocytes to ingest them.
- c. By dissolving digesting bacteria.

2004-6.

a. Hemoglobin level in blood.

Presence of HIV and AIDS.

Blood group

Rhesus factor

Hepatitis

Syphilis

b. An individual makes its own antibodies as a result of contact with the antigen from the disease.

Once it recovers, it can make some antibodies very quickly.

2003-11.

a. A preparation of killed disease bacteria or viruses or forms of these treated in such a way as to prevent their reproduction and when injected into bloodstream the organism undergoes a mild form of the disease and its cells manufacture an excess of antibodies.

b. (i) Vaccination helps the body produce antibodies that fight against infections. Vaccines which induce the production of antibodies and these antibodies remain in the body for a short time but the ability to produce them in future becomes greatly increased due to the vaccines greatly increased due to the vaccines, so any future invading viruses or bacteria are stopped at once.

(ii) Because vaccines are specific for the type of infections.

Section C**2003-17.**

The first barrier is the skin. This is a physical barrier which prevents entry of pathogens into the body. It does this by acting as a plastic hindrance or coverage so that pathogens cannot enter the bloodstream.

In case the skin is cut, the mechanism of blood clotting acts as another barrier. Blood clotting prevents the entry of germs into the bloodstream through cuts in the skin, apart from preventing further loss of blood.

Tears also act as a barrier. Tears are produced by tear glands. The tears contain enzymes which kill germs which may try to enter the bloodstream through the eyes.

13 Genetics

Section A

2009-5.

- a. (i) discontinuous variation
 - (ii) Because the graph does not give a general shape.
- b. 88%

2003-7.

- a. Size, colour
- b. Genetics(heredity), environment

Section B

2012-5.

- a. Man is AO. Woman is BO
- b. The son inherited allele A from father and allele B from mother have a new combination AB.
These are co-dominant alleles.

2012-6.

- a. Grey cock: Gg Grey hen: Gg

	G	g
G	GG	Gg
G	Gg	gg

The genotype of offspring are GG, Gg and gg.

- b. GG: Gg: gg=1:2:1
- c: $12 \times \frac{1}{4} = 3$ 3 white chicks

2011-11.

- b. (i) Rr
 - (ii) Heterozygous
 - (iii) Roan/red roan or patched red and white.

2009-11.

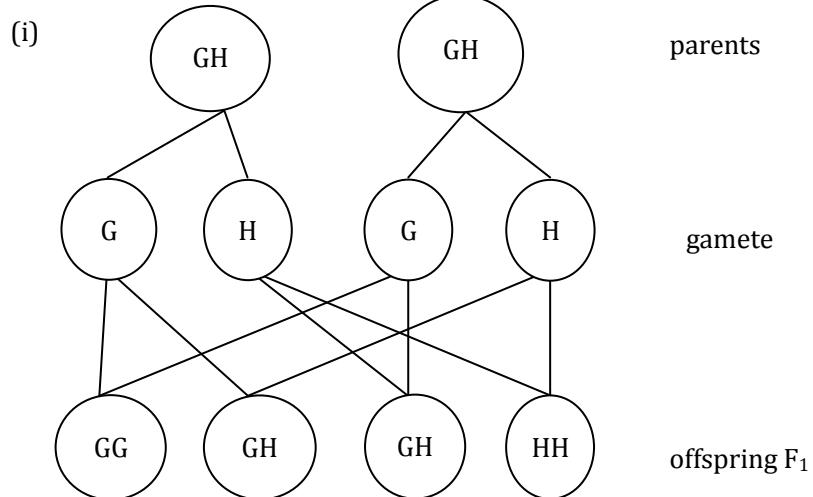
- a. The phenotype of offspring is white and black furs and their ratio is 1 to 1.
- b. (i) Black parent: Bb
 - (ii) White parent: bb

2008-13.

- a. eight
- b. three
- c. normal male, normal female
- d. Blood fails to clot properly./ blood lacks platelets./ blood lacks plasma proteins, and so on.
- e. X-chromosome
- f. Haemophilia arises by a gene mutation in the gene which controls the formation of the blood clotting mechanism.

2007-11.

a



(ii) Genotype: HH Phenotype: white

(iii) a. Because the offspring had lethal genes or undesirable traits that are dangerous to the individual organisms.

b. Additive character

2006-8.

- a. Haemophilia, Duchenne's muscular dystrophy, Hairy ears, Red-green colour blindness, Baldness
- b.

Genotype	Category
Gg	Heterozygous dominant
GG	Homozygous dominant
Gg	Homozygous recessive

c.

- (i) OO
- (ii) 4 (A, AB, B, O)

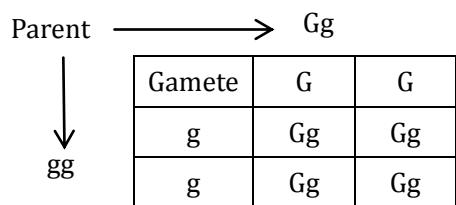
2005-14.

a.

Colour of mice	Genotype of mouse
Grey(Homozygous)	GG
Grey (Heterozygous)	Gg
White(Homozygous)	Gg

b.

(i)



(ii) Grey and white

(iii) Phenotype ratio=1:1

$$24 \times 1/2 = 12$$

12 mice white

2004-10.

a. Because the inheritance of genes was an intermediate process.

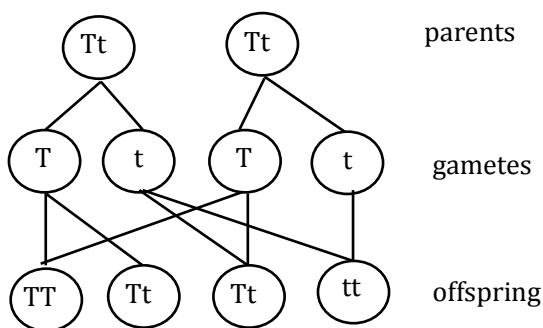
b. (i) RR

(ii) Rr

c. It facilitates production of hybrids with desirable characteristics.

2004-11.

a. (i)



a. (ii) As shown by the cross diagram.

b.

(i) 1:2:1

(ii) 3:1

14 Evolution

Section B

2012-7.

- a.(i) Drug resistance in germ
 - (ii) The bacteria has resistance gene by mutation.
- b. Population of the resistance bacteria become higher than before.

2011-11.

a.

(i)

Before	After
More light peppered moth	Less light peppered moth
Less dark peppered moth	More dark peppered moth

(ii). Through mutation which gave dark peppered moth an advantage over the light peppered moth because they were better camouflaged.

2010-14.

- a. Species E and F
- b. day25
- c. Structures of fossils for organisms that existed in the past should be compared with the current ones resemblances show relationships.

2009-9.

- a. 25 beetles
- b. 24.6%
- c. Red beetles were eaten less than white beetles because their red colour was useful for them to be difficult to be found by birds on red clay.

2009-11.

- c. The natural selection would decrease the recessive allele.

2008-8.

- a. A gradual change or formation of new organisms from already existing species.
- b.(i) By anatomy some parts of animals have same basic structure. This means these animals evolved from common ancestor.
 - (ii) Embryology proves that the early stage of embryological development are similar in animals have a close relationship.
- c. During that early stage of meiosis when homologous chromosomes pair up, these chromosomes exchange portions. This leads to variability in the gene combinations in the gametes. Fertilization of these gametes produces variation among offspring.

2006-10.

- a. (i) D
 - (ii) Because it has a pointed mouth and teeth.
- b. They have one pair of nostril and the different adaptation of the mouth to feeding behavior.

These are enough to suggest that they arise from a common ancestor or since they share a common ancestor. It means they used to depend on the same type of food.

Owing to a rise in population, the competition for food and space was high.

Some fish sought alternative forms of food, others migrated to new environments where their body morphological adapted to the new habitats.

2004-8.

- b. (i) Homologous structure
 - (ii) Because these structure have same design.

2003-13.

- a. Through adaptation where the weevils have acquired characteristics that help them survive DDT.
- b. Weevils that have developed an adaptation for surviving in a DDT accumulated environment are going to survive compared to those that are not well adapted, so these weevils will become resistant to DDT and able to reproduce more of resistant weevils.

15 Population

Section C

2012-16.

To estimate the population of fish in a pond, one would need the following materials: nets, nail vanish or indelible ink and paintbrush.

One would then use the following methods; First use nets to capture the fish from a pond. Then mark each fish caught with a spot of nail vanish or indelible ink. Small paintbrush should be used to apply dye or ink.

Next, count the number of fish marked. Then release the fish into a pond. This should take at least some time before another capturing exercise.

At this point, repeat the capturing exercise in which one should collect both marked and unmarked fish.

One should then count them and use this formula:

Population size=Number of fish in first catch \times Number of fish in second catch \div Number of fish recaptured

In the end or in the conclusion, one would find that the calculations give an estimate of the population of the fish in a pond.

2006-17

The first problem from rapid growth of human population is deforestation. This is the clearing of large areas of natural woodland and forests either for settlement or agriculture. Deforestation disturbs rainfall pattern, which eventually leads to desertification.

Another problem is overgrazing. When people have occupied almost all lands including where animals would be feeding, the animals are forced to graze on a small piece of land for a long time. This leads to soil erosion and therefore loss of fertility.

Scarcity of land forces people and companies to dump waste material some of which can be toxic into the environment. This pollution can lead to contamination and therefore diseases.

Overpopulation can lead to overcrowded and this can encourage spread of diseases such as tuberculosis. Diseases like HIV and AIDS easily spread in highly populated areas due to the high rate of interaction between individuals.

Rapid growth of human population causes pressure on social services like health service, education and welfare services.

16 Ecosystem

Section A

2010-3.

- a. J:Decomposition K: Photosynthesis
- b. Global warming

2007-4.

- a. (i) In region B, the rats are not rapidly growing or accumulating mass.

Because the rats lacked a diet with vitamins to make them grow healthy.

- (ii) In region C, the rats rapidly start to lose considerable weight.

Because the rats could have been attacked by diseases.

- b. Number of rats , Quantity of food given

2005-6

- a.(i) Squid or krill

(ii) Bacteria

- b. Phytoplankton→ Krill Fish→ Crab-eater seal→ Leopard seal→ Bacteria

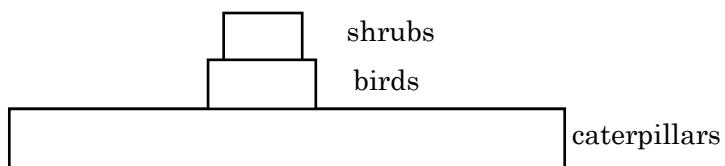
- c. Because they are organisms the break down dead organisms at any other tropic level.

2004-1

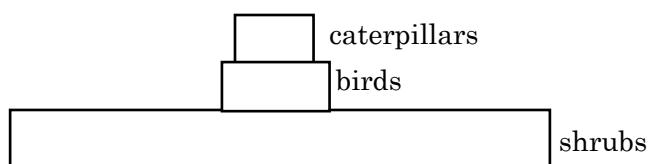
- a. (i) Refers to the natural unit that is composed of both living and non-living components of the environment.

(ii) Refers to an association of plants and animals that live together in the same habitat and affect each other.

- b. (i) numbers



- (ii) biomass



2003-6.

- a. Light, temperature, water, humidity, wind speed, topography, oxygen
 - b. 1. Water pollution through washing away of chemicals, e.g. fertilizer from cultivated fields
 - 2. Industrial accidents, for example, for example, spills in oceans cause pollution on the surface water.
- Oils spills besides cutting off oxygen supply, can also stick to feathers of water-living birds.

Section B**2012-8.**

- a. F: Decomposition P: Feeding Z: Nitrification
- b. Nitrogen gas is changed to ammonium compound while nitrogen fixation by bacteria in soil.
 - Then nitrifying bacteria change ammonium compound to nitrate while nitrification.
 - Nitrate absorbed by plant.
- c. Denitrification take place in the conditions which are groundwater, wetlands and poorly ventilated corners of the ocean.
 - Denitrification takes place under special conditions in both terrestrial and marine ecosystems.
 - In general, it occurs where oxygen, a more energetically favourable electron acceptor, is depleted, and bacteria respire nitrate as a substitute terminal electron acceptor.
 - Due to the high concentration of oxygen in our atmosphere, denitrification only takes place in environments where oxygen consumption exceeds the rate of oxygen supply, such as in some soils and groundwater, wetlands, poorly ventilated corners of the ocean, and in seafloor sediments.

2010-13.

- a. Sunlight
- b. Decomposes organic matter and releases mineral salts which are used by producer for growth or for protein formation or lipid formation or synthesis of vitamin.

2009-13.

- a. water plants → fish type A → fish type B → fish eagles
- b. Because in high tropic level's animals the insecticide is accumulated and then concentrated by eating another animals which contain insecticide in their body.

2008-7.

- a. Pondweeds produce oxygen by photosynthesis. Water snails use this oxygen for respiration.
Water snails produce carbon dioxide by respiration. Pondweeds use this carbon dioxide for photosynthesis.
- b. Because there was no oxygen to breath in the aquarium. During the night, pondweeds and duckweeds couldn't carry out photosynthesis and produce oxygen because of a lack of light.

2007-5.

- a. Capture, mark and recapture method.
- b. Using $P = (\text{No. of organism in first sample} \times \text{No. of organisms second sample}) \div \text{No. of marked organism recaptured}$

Where P = total no. of grasshoppers in the area

$$P=64 \times 60 \div 12$$

$$P= 320$$

- c. Density = No. of individuals ÷ Area
 $= 320 / 32 \text{m}^2$
 $= 10 / \text{m}^2$

2007-13.

First mark out, using pegs and strings a piece of ground of known area where a particular plant is in abundance.

Use a metre quadrat, collect data from at least a number of quadrats placed at random in the area you have marked out. Count number of individual plants in each quadrat.

Calculate the average density of the plant per m^2 .

Finding total population, then multiply the density figure by the number of square metre of the total area calculated at the beginning.

2006-12

- a.(i) Feeding relationship
(ii) Sharp eye sight. Sharp beak.
- b. Population of K will also decrease. Because population reduction of M will bring lack of food for L. So population of L will decrease. It means K will be not able to get food. As a result, population of K will decrease.
- c. By introducing more of organism L in the environment.

2004-7.

- a. E-Decomposers F-Carbon dioxide
 - b. Absence of decomposers result in shortage of mineral salts in the soil, making the soil infertile for growth of producers; the result of which is that the consumer has little food.
 - c. Worms make holes in soil and these holes help aerate the soil as a result enough oxygen is available to producers for respiration.
- Worms provide nutrients to the soil from their excreta.

2004-9.

- a. (i) Desert
- (ii) Spine
- (iii) Modified leaves that are in form of spine. Because less water will be evaporated from the leaves since reduced surface area.

2004-12.

- a. 6B has air spaces but not 6A.
6A has spirally arranged vascular tissue but 6B has not.
- b. (i) 6B
(ii) Because has air spaces to contain oxygen while in water.

2003-15.

- a. Untreated sewage causes failure of oxygen to dissolve into the water surface at point of discharge as a result oxygen concentration is low at that point. But as distance increases, from the point of sewage discharge, the concentration of the sewage becomes low, due to the fact that it becomes spread, so oxygen will dissolve into the water surface and combines with water molecules more, so oxygen concentration starts to increase.
- b. Because at the point of sewage discharge, the concentration of sewage becomes greater than the concentration of water containing oxygen, so oxygen does not dissolve into the water surface from the atmosphere.
- c. Effect: It would be decreased.
Explanation: Fish can not get enough oxygen,

Section C

2009-16.

Environmental degradation can be caused by next five causes.

1, Soil erosion.

When it rains, the rain washes soil off hilly slopes. Soil erosion results in the loss of topsoil. This is the most fertile soil as it contains the nutrients that plant need. When people cultivate the land, it also cause soil erosion. So we need to take measures against it such as reforestation.

2, Deforestation.

Deforestation is caused by the cutting down of trees for making the gardens, firewood and building the house. Deforestation can cause soil erosion, reduction of rainfall and changes in weather patterns. In order to prevent the deforestation, we need to change the source of energy and materials from trees to new ones.

3, Air pollution.

Air pollution is caused by an increase in harmful gases and fumes from fires, industry and vehicle exhausts. It is responsible for the greenhouse effect and for global warming. It may cause respiratory diseases. In order to prevent air pollution, we need to do the proper disposal of trashes and control the amounts of exhaust from vehicles and industries.

4, Water pollution.

Water pollution is caused when sewage or domestic and industrial wastes are released into streams and rivers. The release of untreated sewage into rivers can spread waterborne diseases such as cholera, dysentery and typhoid. We have some ways for preventing the water pollution. One of them is to dispose the urine and faeces properly.

5, Over-fishing.

The number of fish is declined by the over fishing in the lake. Over-fishing is partly due to changes in fishing patterns. Now fishermen catch too many fish including small and immature fish. This means that fish are caught faster than they can replace themselves through breeding. We have the closing season and return small and immature fish into the lake for keeping the number of fish.

2008-15.

The energy flow is started up by light energy from the sun. This light energy is absorbed by chlorophyll in green plants. In the chlorophyll light energy is converted into chemical energy. In tropical woodland, there are so many green plants. They absorb much light energy and it is converted into chemical energy.

Next energy flow is from plants to first consumers along food chains as plants are eaten by first consumers. In this step, energy moves to first consumers from plants. And then the first consumers are eaten by second consumers. So energy moves to second consumers from first consumers. But much of this chemical energy is lost at each step. So, a little energy is transferred to the next level. Some energy is lost as heat energy, as plants and animals respire. Some is unused when parts of plants and animals are left uneaten. Substances such as carbon and nitrogen are cycled in ecosystem. But the energy flow is one-way flow. The energy flow is started up by light energy. And then energy flows from one link to the next along food chains. And some energy is lost as respiration by living things.

2007-13.

First mark out, using pegs and strings a piece of ground of known area where a particular plant is in abundance.

Use a metre quadrat, collect data from at least a number of quadrats placed at random in the area you have marked out. Count number of individual plants in each quadrat.

Calculate the average density of the plant per m².

Finding total population, then multiply the density figure by the number of square metre of the total area calculated at the beginning.

2003-18.

To estimate the density of grasshoppers in the garden, one would need the following materials: nets, nail vanish or indelible ink and paintbrush.

One would then use the following methods; First use nets to capture the grasshoppers from the garden. Then mark each grasshopper caught with a spot of nail vanish or indelible ink. Small paintbrush should be used to apply dye or ink.

Nest, count the number of grasshoppers marked. Then release the animals into the garden. This should take at least some time before another capturing exercise.

At this point, repeat the capturing exercise in which one should collect both marked and unmarked grasshoppers. One should then count them and use this formula: Population size=Number of grasshoppers in first catch × Number of grasshoppers in second catch ÷ Number of grasshoppers recaptured

In the end or in the conclusion, one would find that the calculations give an estimate of the population of the grasshoppers in the garden.

Q M S C E : B I O 2 QUESTIONS

2003

1. **Table 1** shows the amount of energy in 100 g of each type of food. Use it to answer the questions that follow.

Food	Energy(kJ/100 g)
Potato	90
Peas	170
Boiled rice	120
Banana	330
Beef	200

- a. Draw a bar graph to show amount of energy against type of food.
- b.
- (i) Which food is the best for a man with very heavy work?
- (ii) Explain your answer in b.(i) above.
- c. Beef is not a carbohydrate, suggest why it has higher energy content than boiled rice.

2. **Figure 1** shows diagrams of some common animals of the vertebrate group. Use it to answer the questions that follow.

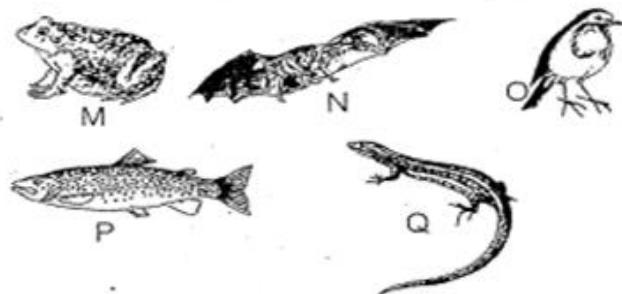


Figure 1

- a. Construct a simple dichotomous key that can be used to identify the above animals.
- b. To which groups of vertebrates do **N** and **Q** belong?
- c. State **one** way **M** and **Q** differ in their mode of reproduction.
- d. State one structural adaptation in **P** for its mode of locomotion.

3. You are provided with a wing feather of a bird labelled specimen **A**.

- a. Draw specimen **A** and any three parts.
- b.
- (i) Measure the long axis of your drawing in millimeter and record your finding.
- (ii) Calculate the magnification of your drawing. Show your working.
- c.
- (i) What is the main use of specimen **A** to a bird?
- (ii) State **two** ways in which specimen **A** is adapted to its function.

4. You are provided with the following materials:

- Specimen X.
- Salt solutions of the following concentration: 0%, 25% and 50%.
- Razor blade/scalpel or knife .
- Ruler.

(i) Using a scalpel or razor blade,

- peel the specimen
- cut three small pieces that are 2 cm long, 1 cm wide and 0.5 cm thick.

(ii) Place one piece in 0% salt solution, the other piece in 25% salt solution, and the third piece in 50% salt solution. Leave to stand for 10 minutes.

(iii) Remove the pieces.

- (1) Measure the length of each piece.
- (2) Try to bend each piece to test its flexibility.

a. Record your results in the following table:

Concentration of salt solution (%)	Length of Potato piece in cm	Flexibility
0		
25		
50		

(e) From the table, state the relationship between salt concentration and length of potato pieces.

(f) Explain the results observed in flexibility the potato pieces in 0% salt concentration and 50% salt solution.

2004

1. You are provided with a mango twig.

a.

(i) What type of leaf arrangement is displayed by the twig?

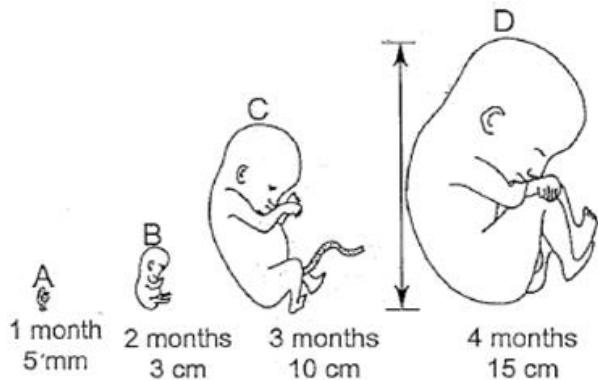
(ii)What is the advantage of this type of arrangement of the leaves on the twig?

b. Detach one leaf from the twig. Draw the leaf and label any three parts.

c. Calculate the magnification of your drawing. Show your working.

d. State three adaptations of the leaf for photosynthesis that can be seen in the specimen.

2. The Figure below is a diagram showing a human embryo at different stage of development in terms of stage and corresponding length. Use the information to answer the questions that follow.



a.

- (i) Measure the length of embryo **D** along the axis shown.
- (ii) Calculate the magnification of embryo **D**. Show your working.

b.

- (i) Plot a graph of length of embryo against age.
- (ii) From your graph, estimate the length of embryo at the age of $3\frac{1}{2}$ months.
- c. Apart from the umbilical cord, state the major difference between embryo **C** and **D**.

3. You are provided with the following specimens:

- 1 maize seed labelled specimen **A**
- Sorghum/millet seed labelled specimen **B**
- 1 bean seed labelled specimen **C**
- 1 groundnut seed labelled specimen **D**

a. Apart from colour, use one physical characteristic to put the seeds into two groups.

Write down the physical characteristic that you have used to put the seeds into two groups.

b. Using the letters **K**, **L**, **M**, and **N** to represent the seeds, construct a simple dichotomous key to that can be used to identify the seeds.

c. State one way in which groundnuts contribute to the nitrogen cycle.

4. The Table below shows results of an investigation on food tests on **A**, **B**, **C**, and **D**. Use it to answer the question that follow.

Food Food substance	A	B	C	D
Starch		—		
Fats		—		
Proteins		—		
Vitamin C			—	

Key:
 — : Absence
 ||| : Very little
 ||||| : High amounts

- a. Describe how the food were tested for proteins.
- b. One of the foods tested was an orange fruit. Which letter in the table could represent an orange?

c.

(i) Which food could result in scurvy if eaten as the only food?

(ii) Give a reason for your answer in 4.c.(i).

d.

(i) What health problem would arise if one's diet consisted of too much of food D?

(ii) Give a reason for your answer in 4.d.(i).

2005

1. You are provided with a small fish.

a.

(i) Draw the fish and label any **two** locomotory structures. (4 marks)

(ii) Calculate the magnification of your drawing. (2 marks)

b.

(i) Describe the shape of the fish. (1 mark)

(ii) What is the advantage of this shape to the fish? (1 mark)

c. How does drying preserve the fish? (1 mark)

d. State two nutrients that human beings get from fish. (2 marks)

2. The table below shows the effect of storage time on amount of vitamin C in potatoes. Use it to answer the questions that follow.

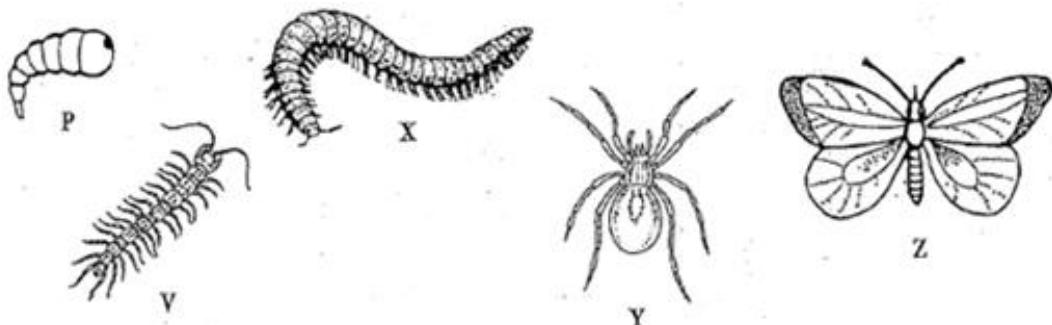
Storage Time (Months)	Amount of Vitamins (mg/100g)
0	30
2	20
4	15
6	10
8	8

a. Using the graph paper provided on Page 4, plot a graph of amount of vitamin C against time. (6 marks)

b. What is the effect of storage time on Vitamin C? (1 mark)

- c. How much vitamin C would be found in the potatoes at 10 months? (1 mark)
- d. What disease is prevented by vitamin C in human beings? (1 mark)
- e. Apart from potatoes, mention **two** other sources of vitamin C. (2 marks)
3. You are provided with specimens **A** and **B**.
- a.
- (i) Which one is a stem? (1 mark)
 - (ii) Give a reason answer to question 7.a. (i). (1 mark)
- b. Apart from shape, state any **two** structural differences between specimens **A** and **B**. (2 marks)
- c. State **one** similarity between the specimen **A** and **B**. (1 mark)
- d. How would you test specimen **B** for starch? (4 marks)

4. The figure shows five invertebrates and a dichotomous key. Use it to answer the questions that follow.



- | | |
|---------------------------|-----------|
| 1. Wings absent | See 2 |
| Wings present | butterfly |
| 2. Legs present | See 3 |
| Legs absent | Larvae |
| 3. More than 8 legs | See 4 |
| Eight legs present | Tick |
| 4. Long antennae | Centipede |
| Short antennae | Millipede |

a. Identify the vertebrate: (5 marks)

P _____ V _____
 X _____ Y _____
 Z _____

b. What two features are common to organisms labelled X and V? (2 marks)

c.

(i) Which of the organisms in a. is still in the developmental stages? (1 mark)

(ii) Which of the organisms in a. can transmit diseases to tamed animals? (1 mark)

2006

1. You are provided with a bean seed which was soaked in water.

a.

(i) Measure the longest axis of the bean seed and record its length in mm. (1 mark)

(ii) Suppose the bean seed was drawn to a magnification of x4, calculate the length of the diagram. (4 marks)

b. Using hands peel the seed and separate the cotyledons so that the embryo is seen attached to one cotyledon. Draw the cotyledon with the embryo and label any two parts. (3 marks)

c. Mention any **one** of food substances stored in the seed. (1 mark)

2. **Figure 1** shows blood cells seen under a microscope. Use it to answer the questions that follow.

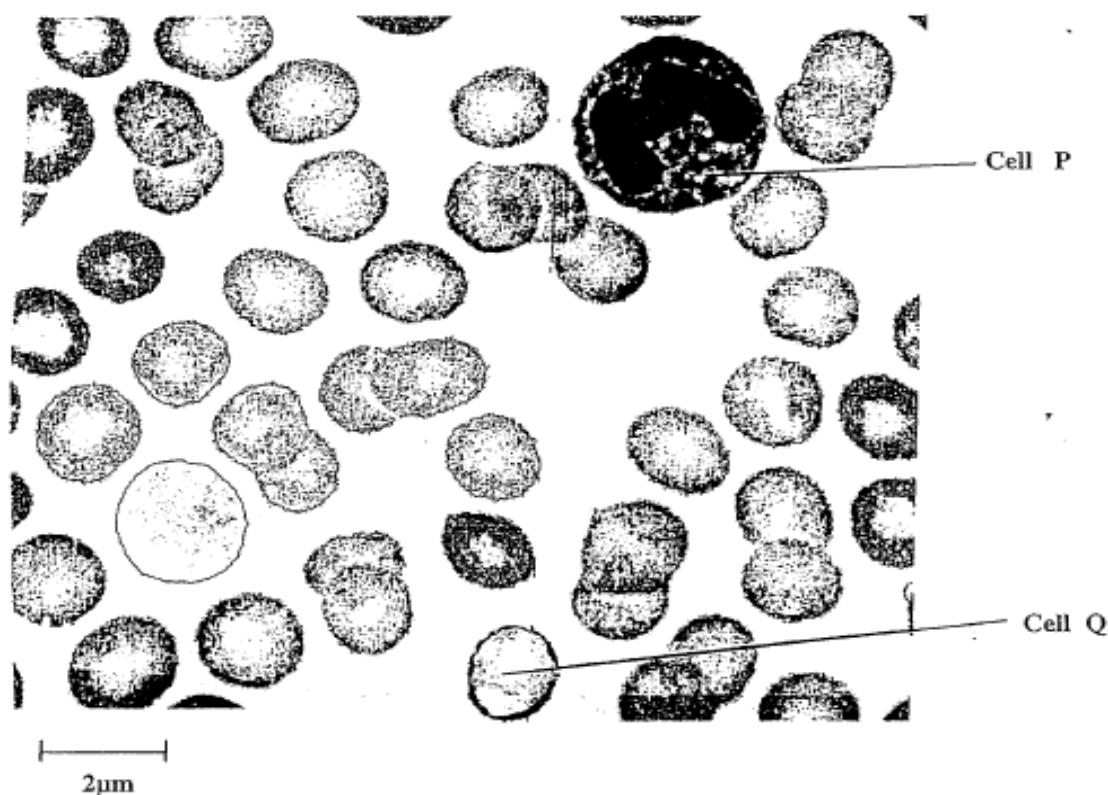


Figure 1

- a. Draw cell **P** and label any **two** parts. (3 marks)
- b.
- (i) Measure the longest axis of cell **P** in **Figure 1**. (1 mark)
 - (ii) Calculate the actual size of cell **P**. Show your working. (2 marks)
- c. Explain why cell **Q** is darker at the edges than in the middle. (1 mark)
- d. Explain how cell **Q** is adapted for its function. (2 marks)
- e. Give **one** structural difference between cell **P** and cell **Q**. (1 mark)

3. You are provided with the following:

- very dry groundnut seed labelled specimen **B**;
- very dry maize seed labelled specimen **C**;
- ruler which can measure in millimeters;
- a match box With 10 sticks;
- a paper clip.

a. Measure the longest axis of each specimen and record your results in millimeters in **Table 1**. (2 marks)

Table 1

SPECIMEN	LENGTH (mm)
B	
C	

b. Draw specimen **B** with a magnification of x5. (2 marks)

c.

(i) Pierce the paper clip into specimen B as shown in **Figure 2**.

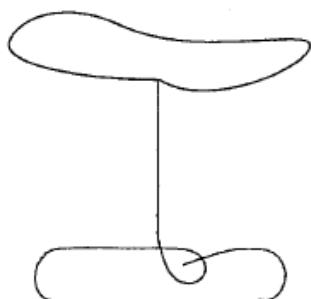


Figure 2

(ii) Light a match stick and use it to burn the specimen. Observe what happens.

(iii) Pierce the paper clip into the soft part of specimen **C** as shown in **Figure 2**.

(iv) Light a match stick and use it to burn the specimen. Observe what happens.

(v) Record your observations for specimens **B** and **C** in **Table 2**. (2 marks)

Table 2

SPECIMEN	OBSERVATION
B	
C	

d. Explain your observations in **Table 2**. (2 marks)

e. Describe how you can test specimen **C** for lipids. (2 marks)

4. **Figure 3** is a graph showing relative death rate from cancer against cigarettes taken per day in three countries marked **P**, **Q** and **R**.

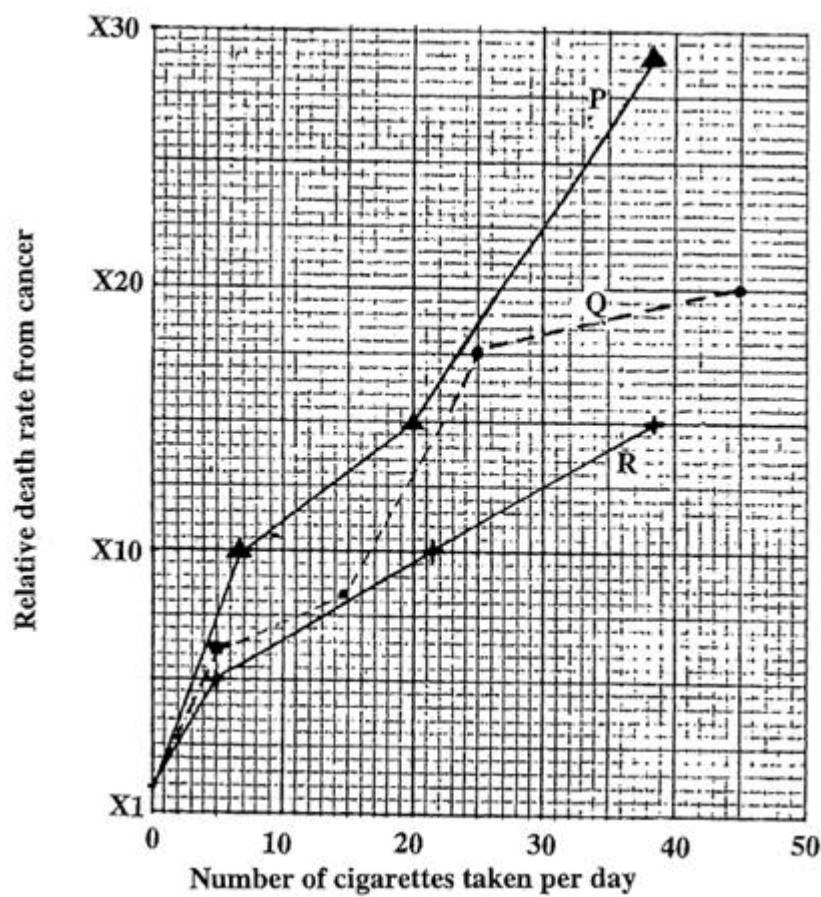


Figure 3

a. Which country has the lowest relative death rate from cancer? (1 mark)

b. Complete **Table 3** which has information for country Q. (2 marks)

Table 3

NUMBER OF CIGARETTES TAKEN PER DAY	RELATIVE DEATH RATE FROM CANCER
0	X1.0
5	
	X20.0

c. What is the relationship between cigarettes taken per day and relative death rate? (2 marks)

d.

(i) State **two** effects of cancerous cells in the body. (2 marks)

(ii) Give **two** reasons why some non-smokers suffer from cancer. (2 marks)

e. Which country would register highest death rate if the number of cigarettes taken per day exceeds 30? (1 mark)

2007

1. You are provided with a flight feather. Use it to answer the questions that follow.

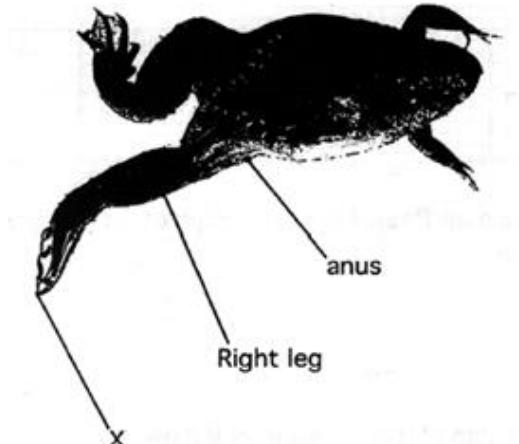
a.

(I) Draw the feather and label any **three** parts. (4 marks)

(ii) Calculate the magnification of your drawing. Show your working. (3 marks)

b. State **two** adaptations of the feather for flight. (2 marks)

2. The figure below is a diagram of a frog. Use it to answer the questions that follow.



- a. If the diagram was made from an actual length of 11cm from the tip of the head to the anus, calculate its magnification. Show your working. (4 marks)
- b. Using your answer in 2.a., calculate actual length of the right hind leg from the anus to point X. Show your working. (4 marks)
- c. What proportion of the body is the hind leg? Show your working. (3 marks)

3. The table below shows an increase in length of a grasshopper nymph over a period of time. Use it to answer the questions that follow.

Number of days	1	4	7	10	13	16
Length of nymph in (mm)	8	8	20	20	50	50

- a. Use the graph paper provided on Page 5 to plot of time of growth in days against length of the nymph. (6 marks)
- b. From the graph:
- (i) Find the increase in length of the nymph after 9 days. (1 mark)
 - (ii) Which period had the lowest increase in length apart from 0? (1 mark)
 - (iii) Describe the relationship between the period of growth and the length of the nymph. (2 marks)
- c. Explain why the grasshopper has this pattern of growth. (2 marks)

4. You are provided with the following fresh leaves:

- Specimen **A** (mango leaf)
- Specimen **B** (cassava leaf)
- Specimen **C** (grass leaf)
- Specimen **D** (Tridax procumbens leaf)
- Specimen **E** (cassia leaf)

- a. Use the specimens to construct a dichotomous key that can be used to identify them. (8 marks)

2008

1. You are provided with specimens **X** and **Y**.

- a. Draw specimen **Y** and label any three parts. (4 marks)
- b. Calculate the magnification of your drawing. (3 marks)
- c.

 - (i) Which one of the two specimens could withstand dry conditions? (1 mark)
 - (ii) Explain your answer to 1.c.(i). (2 marks)

- d. Give any one product of specimen **X**. (1 marks)

e. To which group of plants does the plant of specimen Y belong? (1 mark)

2. **Figure 1** shows an experimental set up to investigate the effect of light intensity on rate of gas production from a submerged pondweed. Results obtained were recorded in **Table 1**.

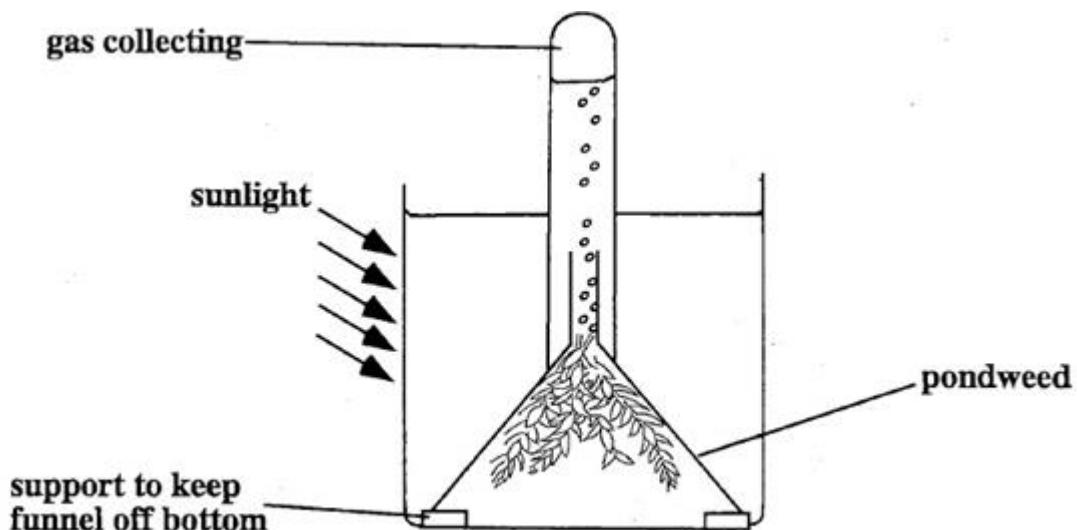


Figure 1

Table 1

LIGHT INTENSITY (CANDELAS)	NUMBER OF GAS BUBBLES/MIN
0	0
50	5
100	9
200	15
250	17
300	19
350	20
450	20

- On the graph paper, on Page 4, plot a graph of rate of gas production against light intensity. (5 marks)
- Name the gas produced by the pond weed. (1 mark)
- What is the optimum light intensity for gas production? (1 mark)
- Explain the gas production between 350 and 450 candelas. (2 marks)

3. You are provided with the following:

- Irish potato tuber
- Solutions in containers labelled **R**, **S** and **T**
- Razor blade or scalpel

Procedure:

- Cut eight equal-sized strips of irish potato, each measuring 3 mm long, 5 mm wide and 5 mm high.
- Put two strips into each of the containers labelled **R**, **S** and **T**.
- Leave for 10 minutes.

(i) After 10 minutes, measure and record the length of the strips **in Table 2**.

(ii) Calculate the average length of the potato strips and record. (6 marks)

SOLUTION	LENGTH OF STRIPS (mm)		AVERAGE LENGTH OF THE STRIP (mm)
R			
S			
T			

b.

(i) In which container did the strips decrease in length most? (1 mark)

(ii) Explain your answer to 3.b.(i). (2 marks)

c.

(i) Which solution had the highest water concentration? (1 mark)

(ii) Give a reason for your answer to 3.c.(i). (1 mark)

4. **Figure 2** shows diagrams of five animals. Use it to answer the questions that follow.

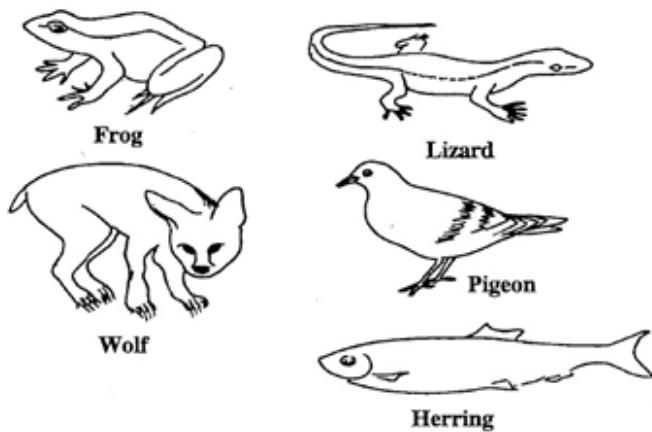


Figure 2

Using the diagrams in **Figure 2** construct a dichotomous key that can be used to identify the animals.

2009

1. You are provided with the following:

- 1 bean seed marked **G**
- 1 soaked maize seed marked **H**
- 1 razor blade or scalpel
- dilute iodine solution

a.

(i) Measure the longest axis of specimen **G** and record its length in millimetres. (1 mark)

(ii) Draw specimen **G** and label any **two** parts. (3 marks)

(iii) Calculate the magnification of your drawing. Show your Working. (3 marks)

b. Place specimen **H** flat on the bench and cut it down the middle lengthwise into two separate parts. Apply one or two drops of dilute iodine solution to one of the cut surfaces.

(i) Describe the results obtained. (2 marks)

(ii) What conclusions can you make from these results? (2 marks)

2. **Figure 1** shows diagrams of two cells, **X** and **Y**. Use it to answer the questions that follow.

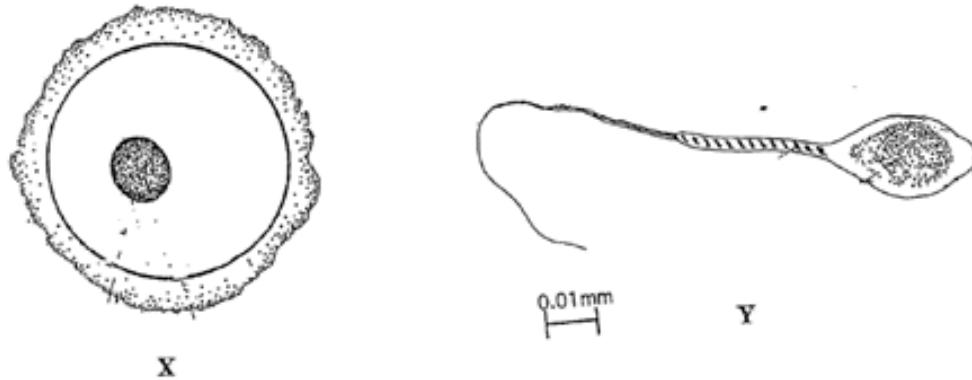


Figure 1

a. In the table provided, write down two structural differences between the two cells. (2 marks)

Cell X	Cell Y

b. State any **two** possible causes of genetic variation in the two cells. (2 marks)

c. Explain any **two** adaptations of cell Y to its function. (4 marks)

(i)

(ii)

d. Using the scale provided, calculate the actual length of cell Y. (4 marks)

3. The table below shows the constituents of edible portions of certain foods. Use it to answer the questions that follow.

Food	Protein(g)	Fat (g)	Carbohydrate (g)
Rice	10	4	70
Potatoes	8	6	15
Peanuts	30	48	8
Corn	10	5	67
Fish	23	3	-
Pork	15	42	-

Given that:

1 g of protein and 1 g of carbohydrate each gives 17 KJ of energy

1 g of fat gives 39 KJ of energy

a. Calculate the energy value of rice. (8 marks)

b. What is the advantage of eating peanuts over corn for growing children? (1 mark)

c.

(i) Which food is suitable for a person who would like to lose weight? (1 mark)

(ii) Give a reason for your answer to 3.c. (i). (1 mark)

4. **Figure 2** represents five different types of fish. Use the key provided to identify the fish.

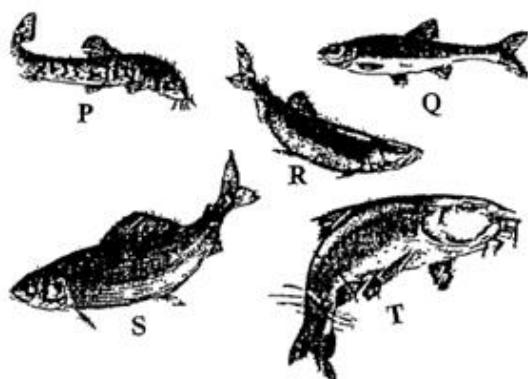


Figure 2

Key:

1. Tail fin undivided.....*Noemacheilus barbatulus*
Tail fin divided.....See 2
2. Tail fin evenly divided.....*xinus phoxinus*
Tail fin unevenly divided.....See 3
3. Has barbels (fleshy extensions) at corner of mouth.....*Barbus barbus*
Has no barbels at corner of mouth.....See 4
4. Has more prominent dorsal fins.....*Thymallus thymallus*
Has less prominent dorsal fins.....*Osmerus esperlanus*
 - a. Write down the name of the fish represented by each letter. (5 marks)
 - b. Name the structure used for gaseous exchange in organism T. (1 mark)

2010

1. You are provided with an onion bulb and a razor blade or scalpel or knife.
 - a. Make a longitudinal section of the onion bulb, draw and label any three parts. (4 marks)
 - b. Describe how you would test the specimen for the presence of reducing sugars. (6 marks)
2. **Figure 1** shows diagrams of two plants. Use it to answer the questions that follow:

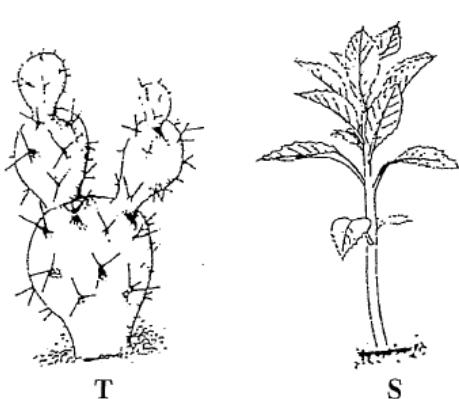


Figure 1

- a. Name any two structural differences between **T** and **S**. (2 marks)

Plant T	Plant S

b.

(i) Which plant is more likely to die in dry conditions? (1 mark)

(ii) Explain your answer to 2.b.(i). (2 marks)

c.

(i) To which group of plants does S belong? (1 mark)

(ii) Give a reason for your answer to 2.c.(i). (1 mark)

d. Why would goats find it difficult to feed on T? (1 mark)

e. Explain how plant marked T obtains its food. (2 marks)

3. The table below shows blood alcohol level (BAL) in a person over sometime during an experiment.

Use it to answer the questions that follow.

Time (hours)	BAL mg/100cm ³
0.0	0.0
0.5	70
1.0	120
1.5	140
2.0	115
3.0	75
4.0	50
5.0	40

a. Plot a graph of blood alcohol level (BAL) against time on the graph paper provided. (6 marks)

b. What was the blood alcohol level at 2.5 hours? (1 mark)

c. Explain why there was a decrease in the blood alcohol level from 1.5 hours to 5.0 hours. (2 marks)

d. Explain how a person who is driving a car under the influence of alcohol is likely to be involved in a road accident. (3 marks)

4. **Figure 2** shows diagrams of five different animals. Use it to answer the question that follows:

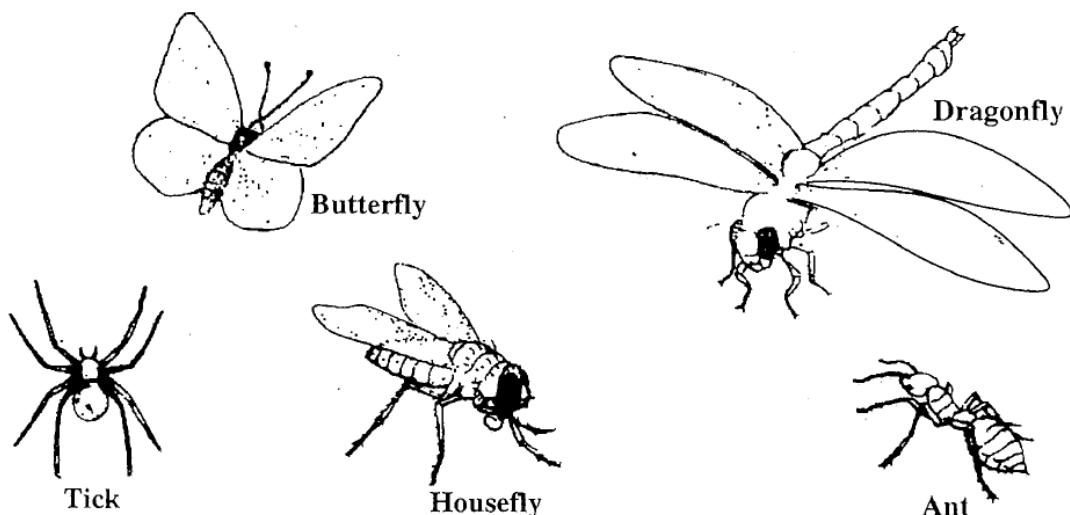


Figure 2

Construct a dichotomous key that can be used to identify the organisms. (8 marks)

2011

1. You are provided with the following:

- food solution marked specimen A
- iodine solution
- copper sulphate solution
- sodium hydroxide solution
- water in a beaker (container)
- two test tubes

a. Test the food specimen for starch. Complete the table provided by filling in Procedure, Results and Conclusion. (5 marks)

Food Test	Procedure	Results	Conclusion
Starch			

b. Test the food specimen for proteins. Complete the table provided by filling in Procedure, Results and Conclusion. (7 marks)

Food Test	Procedure	Results	Conclusion
Protein			

2. Students at a certain Secondly School estimated the population of tridax in their garden using a quadrat. **Table 1** shows data that was collected during the investigation. Use it to answer the questions that follow.

Table 1

Quadrat Throws	Number of Tridax
1	3
2	2
3	4
4	3
5	2
6	2
7	5

a. Calculate the average number of tridax per-quadrat. Show your working. (3 marks)

b. If the area of the school garden was 100cm^2 and the quadrat measured 50 cm by 50 cm, calculate the total population of tridax in the garden. (4 marks)

c. Explain why several quadrats were thrown in the investigation. (3 marks)

3. You are provided with 14 bean seeds.

a. Measure the length of each seed and record the results in millimetres in **Table 2** provided. Indicate the number of seeds under each length. (2 marks)

Table 2

Length (mm)	7	8	9	10	11	12
Number of beans						

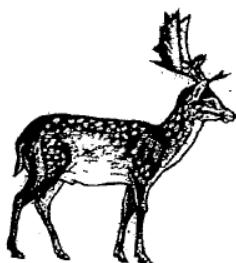
b. On the graph paper provided, plot a graph of number of beans against length. (6 marks)

c.

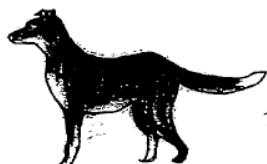
(i) What type of variation is shown by the plotted graph? (1 mark)

(ii) State **two** possible causes of this type of variation. (2 marks)

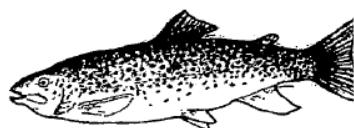
4. **Figure 1** shows some vertebrates. Use it to answer the questions that follow.



X



Y



Z

Figure 1

a.

(i) Which vertebrate would easily become extinct (wiped out) in an area where there are prolonged dry conditions? (1 mark)

(ii) Explain your answer to 4.a.(i). (3 marks)

b. Due to insufficient rainfall in desert areas, water is found in holes and some of which are small in size. Explain how natural selection would operate on vertebrate X in such an environment. (3 marks)

2012

1. You are provided with the following:

- a part of a stem marked X

- a razor blade or scalpel or knife

- a hand lens

- 30 cm ruler

Using a razor blade or scalpel or knife, cut a cross section through the middle of specimen X and observe with a hand lens.

a. Draw the cross section of specimen X and label any two parts. (3 marks)

b.

(i) Measure the longest axis of the cross section of specimen X and record your answer in millimetres (mm). (1 mark)

(ii) Calculate the magnification of your drawing. Show your working. (3 marks)

2. The Table below shows results of food tests V, X, Y and Z on samples of food from different regions of the alimentary canal of a mammal.

FOOD TEST	REAGENT	RESULTS
V	Biuret	Blue colour
X	Biuret	Purple colour
Y	Benedict's	Blue colour
Z	Iodine	Blue black colour

a.

(i) In which region did food test X take place? (1 mark)

(ii) Give a reason for your answer. (2 marks)

b. Name **two** regions where food test Z likely occurred? (2 marks)

c.

(i) Mention any two food substances that were present in the food that the mammal ate. (2 marks)

(ii) Explain your answer to 2.c.(i). (4 marks)

3. **Figure 1** shows blood cells X and Y. Use it to answer questions that follow.

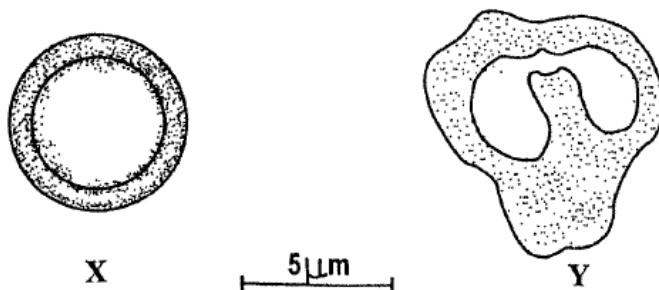


Figure 1

a. In the Table below, write down two structural differences between cell X and Y. (2 marks)

Cell X	Cell Y

- b. Measure the longest axis of cell **Y** in millimeters. (2 marks)
- c. Using the scale provided, calculate the actual size of cell **Y**. (3 marks)
- d. What is the function of cell **X** in the human body? (1 mark)
- e. Explain how cell **Y** performs its function. (2 marks)

4.

a. (i) What ecological method could be used to find the population of *Bidens pilosa* (chisoso) in a savanna woodland ecosystem? (1 mark)

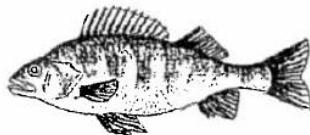
(ii) How are errors minimized when using the method mentioned in 4.a.(i)? (1 mark)

(iii) Explain how pollution of the soil could affect a savanna woodland ecosystem. (3 marks)

b. **Figure 2** shows some animals in an environment. Use it to answer the questions that follow.



F



G

Figure 2

- (i) What is the feeding behaviour of organism **F**? (1 mark)
- (ii) Give a reason for your answer to 4.b.(i). (1 mark)
- c. Give **two** observable adaptations of organism **G** to life in water. (2 marks)

2013 MSCE BIOLOGY 1 QUESTIONS

***ONLY QUESTIONS**

Section A (20 marks)Answer **all** questions in this section.

1. A child developed the following signs and symptoms: high fever, rash inside the mouth and a cough.

- a. (i) Name the disease that the child could be suffering from.

(1 mark)

- (ii) How is the disease transmitted?

(1 mark)

- b. Explain **one** way of preventing the disease in 1a(i).

(2 marks)

2. **Figure 1** shows an experiment that was set up to investigate the movement of water in plant tissues. Use it to answer the questions that follow.

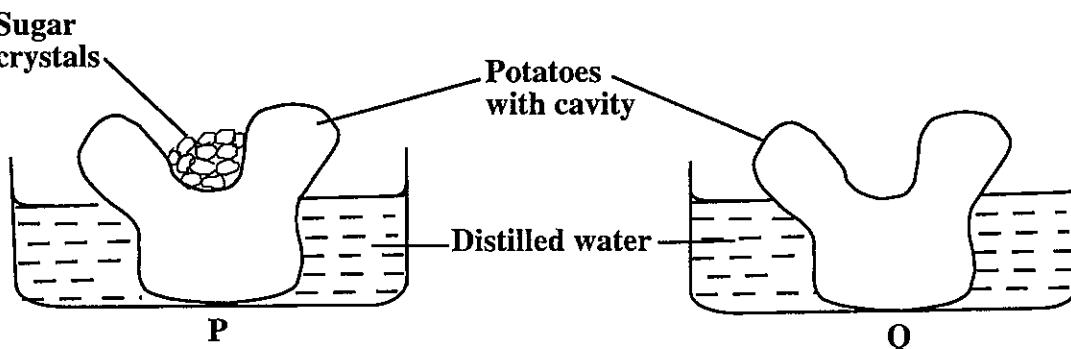


Figure 1

- a. (i) What would be observed in **P** after 1 hour?

(1 mark)

- (ii) Give a reason for your answer in 2a(i).

(2 marks)

Continued/...

2. (Continued)

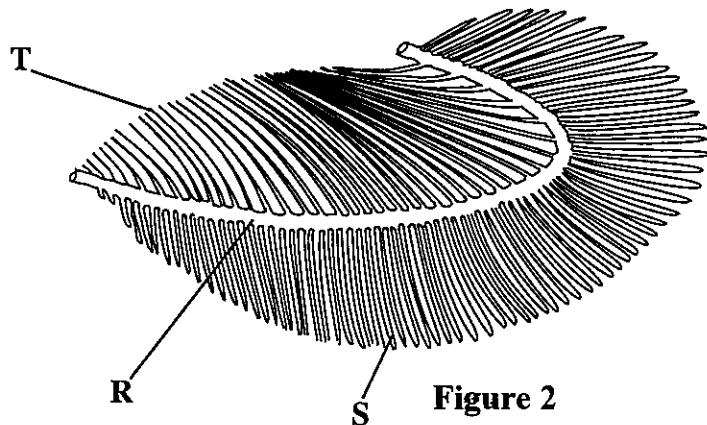
- b. Which set up is a control?

(1 mark)

- c. Name any **one** variable that was kept constant in the investigation.

(1 mark)

3. Figure 2 is a diagram of a fish gill. Use it to answer questions that follow.



- a. Name the part marked **T**.

(1 mark)

- b. What is the function of part marked **R**?

(1 mark)

- c. Give any **two** adaptations of part marked **S** to its function.

(2 marks)

4. Figure 3 shows the structure of a bone. Use it to answer the questions that follow.

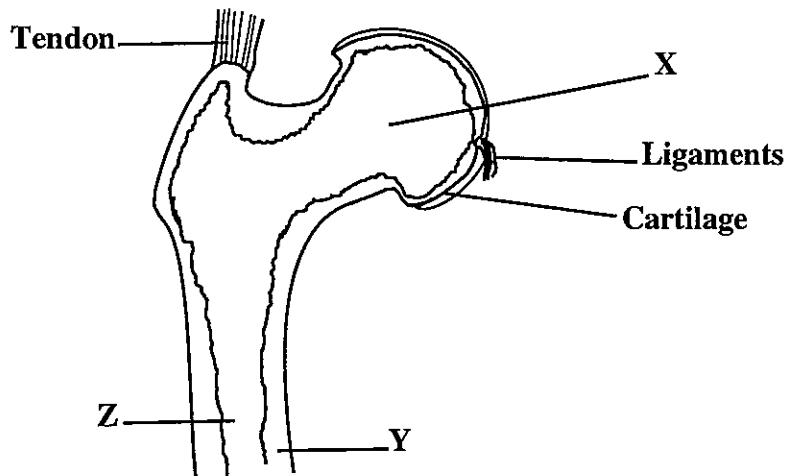


Figure 3

- a. Name the parts marked X and Y.

X: _____ (1 mark)

Y: _____ (1 mark)

- b. State the function of part marked Z.

_____ (1 mark)

5. Figure 4 shows a biological process taking place in the body of a person. Use it to answer the questions that follow.

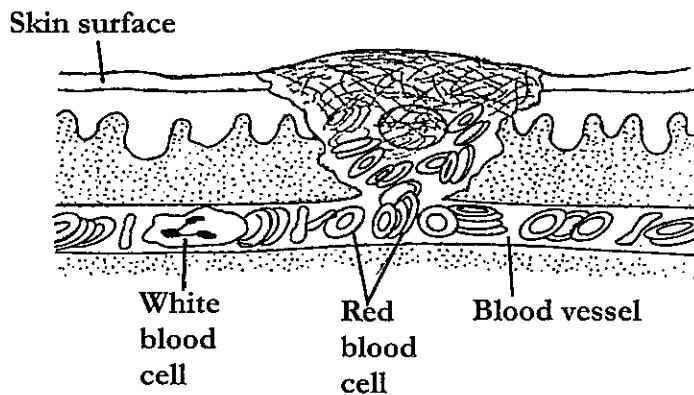


Figure 4

- a. Name the process.

_____ (1 mark)

Continued/...

5. (Continued)

- b. State any **one** enzyme which is involved in the process.

(1 mark)

- c. Give **two** ways in which the process is important to the human body.

(i) _____ (1 mark)

(ii) _____ (1 mark)

Section B (60 marks)

Answer **all** the questions in this section.

6. a. Define “transpiration stream”.

(1 mark)

- b. (i) State any **two** ways in which transpiration is important to plants.

(2 marks)

- (ii) Describe how the transpirational stream is caused.

(3 marks)

Continued/...

7. Figure 5 shows a structure found in a plant cell. Use it to answer the questions that follow.

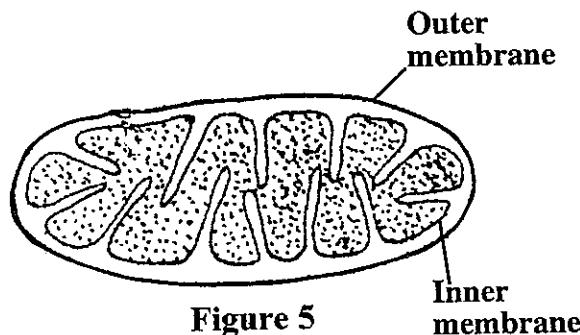


Figure 5

- a. Name the structure.

(1 mark)

- b. State any one substance produced by the structure.

(1 mark)

- c. Explain any two adaptations of the structure to its function.

(4 marks)

8. Figure 6 shows a summarised reaction which occurs in the human body. Use it to answer the questions that follow.

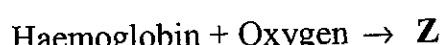


Figure 6

- a. (i) Name the compound represented by Z.

(1 mark)

- (ii) In which organ does the reaction take place?

(1 mark)

Continued/...

8. (Continued)

- b. State any two food nutrients that are required for the formation of haemoglobin.

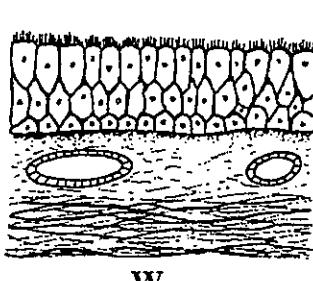
(2 marks)

- c. Describe the behaviour of chromosomes during mitosis and meiosis at the stated stages.

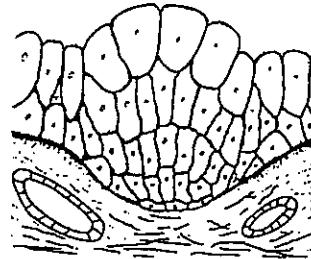
Stage	Chromosome behaviour during mitosis	Chromosome behaviour during meiosis
prophase		
metaphase		

(4 marks)

9. Figure 7 shows the normal lining of a lung in W and an infected lining in X. Use it to answer the questions that follow.



W



X

Figure 7

- a. Name the disease that causes the condition in X.

(1 mark)

- b. Explain how the disease is caused.

(2 marks)

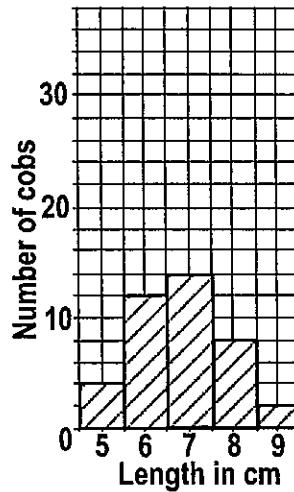
Continued/...

9. (Continued)

- c. State any **two** ways of preventing the disease.

(2 marks)

- 10.** **Figure 8** is a graph of number of maize cobs against their length. Use it to answer the questions that follow.

**Figure 8**

- a. What is the range of the lengths of the maize cobs?

(1 mark)

- b. Calculate the median length of the cobs. Show your working.

(4 marks)

Continued..

10. (Continued)

- c. Mention the type of variation shown by maize cob length.

(1 mark)

11. Figure 9 is a diagram of the human brain. Use it to answer the questions that follow.

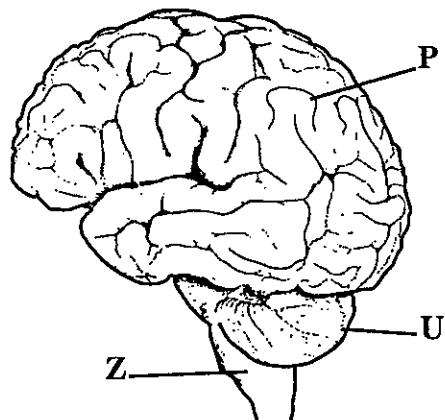


Figure 9

- a. State any **one** function of part marked **P**.

(1 mark)

- b. Why is part marked **P** highly folded?

(2 marks)

- c. State any **two** differences in structure between parts **Z** and **U**.

(2 marks)

- d. Explain why injury to part **Z** may cause death.

(2 marks)

Continued/...

12. Figure 10 shows part of a nephron. Use it to answer the questions that follow.

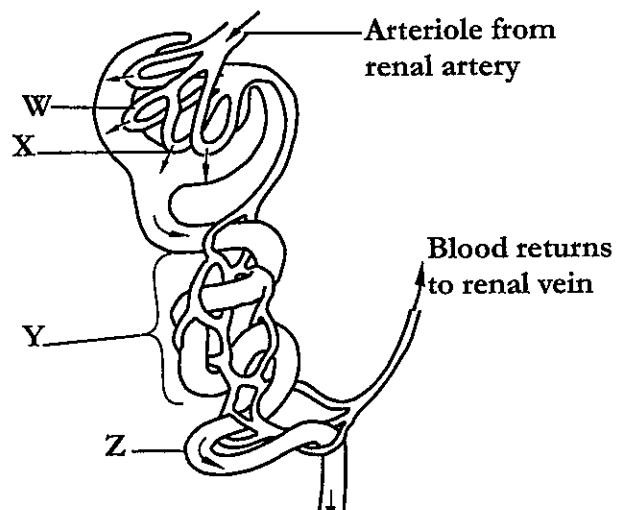


Figure 10

- a. Name the parts marked W and Z.

W: _____ (1 mark)

Z: _____ (1 mark)

- b. Name the process that occurs in region Y.

_____ (1 mark)

- c. State any two substances that become part of the fluid shown by arrow X.

(i) _____ (1 mark)

(ii) _____ (1 mark)

- d. Name the condition associated with presence of glucose in urine.

_____ (1 mark)

13. Table 1 shows average quantities of food substances taken by three students in their meals per day. Use it to answer the questions that follow.

Table 1

Food Substance	Student A	Student B	Student C
Carbohydrates	690 g	750 g	710 g
Proteins	76 g	70 g	81 g
Fats	40 g	55 g	47 g
Roughages	15 g	3 g	12 g
Vitamins	0.11 g	0.14 g	0.03 g
Water	1 700 ml	420 ml	1 300 ml

- a. (i) Which student is likely to suffer from constipation?

(1 mark)

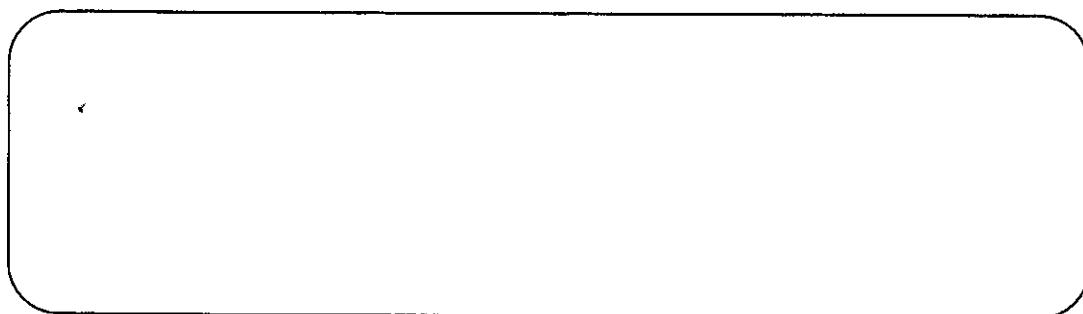
- (ii) Give a reason for your answer in 13a(i).

(2 marks)

- b. Mention two other problems of the digestive system apart from constipation.

(2 marks)

- c. If 1 g of carbohydrate gives 17 Kj of energy and 1 g of fat gives 39 Kj, calculate the energy gained by student C. Show your working.



(6 marks)

Continued/...

14. **Figure 11** is a diagram of a vector. Use it to answer the questions that follow.

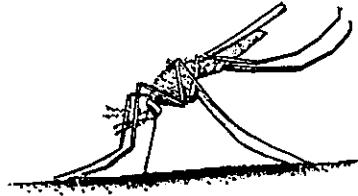


Figure 11

- a. Name the disease that is transmitted by this vector.

(1 mark)

- b. (i) How does the vector transmit the disease?

(2 marks)

- (ii) Explain any **one** way in which the disease in 14b(i) can be controlled.

(2 marks)

Section C (20 marks)

Essay Questions

Answer **all** questions in this section.

- 15.** Describe any **five** characteristics that enable fresh water plants to survive in their habitat. Your answer should be in an essay form.

(10 marks)

Continued/...

16. State any five vitamins and their respective functions. Your answer should be in an essay form.

Handwriting practice lines for cursive writing. The page contains 10 rows of horizontal lines, each consisting of a solid top line, a dashed midline, and a solid bottom line.

(10 marks)

END OF QUESTION PAPER

NB: This paper contains 14 pages.

**2013 MSCE
BIOLOGY 2
QUESTIONS**

***ONLY QUESTIONS**

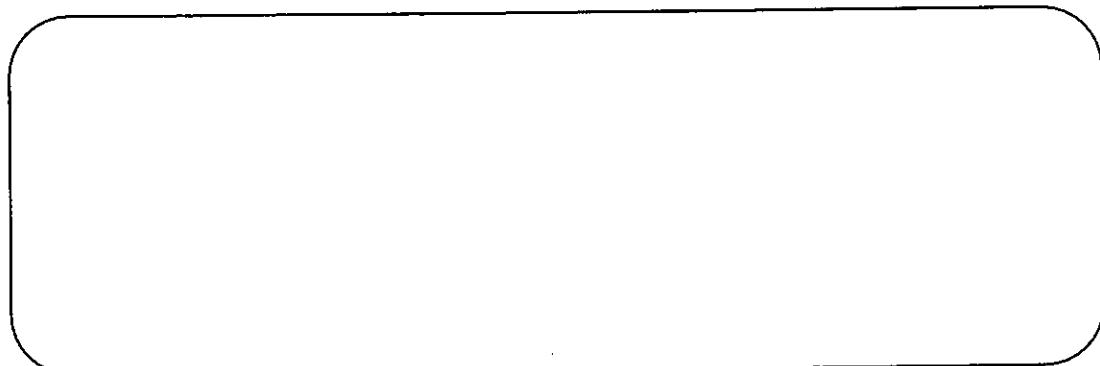
1. You are provided with the following:

- specimen P
- specimen Q
- a 30 cm ruler

a. Mention **one** functional difference between P and Q.

(1 mark)

b. Draw specimen P and label any **three** parts.

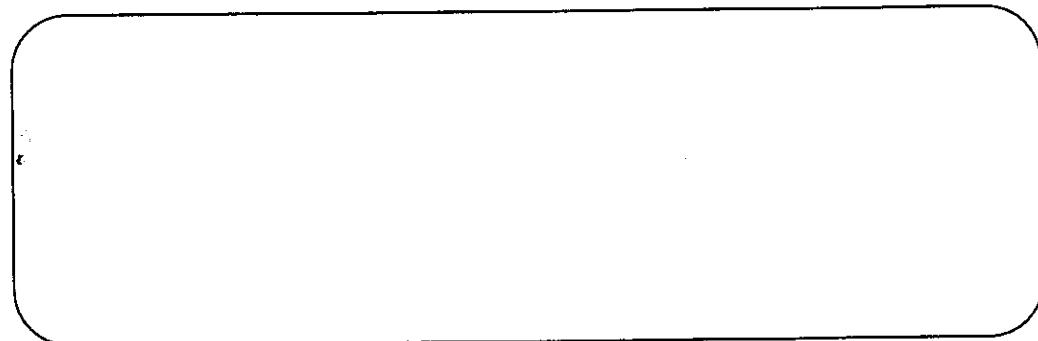


(4 marks)

c. Measure the length of specimen P. Give your answer in millimetres (mm).

(1 mark)

d. Calculate the magnification of your drawing.



(3 marks)

Continued/...

1. (Continued)

- e. Explain any **one** adaptation of specimen P to its function.

(2 marks)

2. The **Table** below shows results of an investigation on the effect of light intensity on the rate of photosynthesis in a water plant. The rate of photosynthesis is measured by the number of air bubbles produced per minute. Use it to answer the questions that follow.

Distance of lamp from Plant (cm)	Number of air bubbles per minute
0	29
10	28
20	27
30	24
40	20
50	12
60	6

- a. Using the graph paper provided on **Page 4**, plot a graph of number of air bubbles produced per minute against distance of lamp from the plant.

(6 marks)

- b. (i) What is the relationship between the number of air bubbles produced and the distance of the lamp from the plant?

(2 marks)

- (ii) From the graph, find the number of bubbles produced when the distance of the lamp from the plant is 35 cm.

(1 mark)

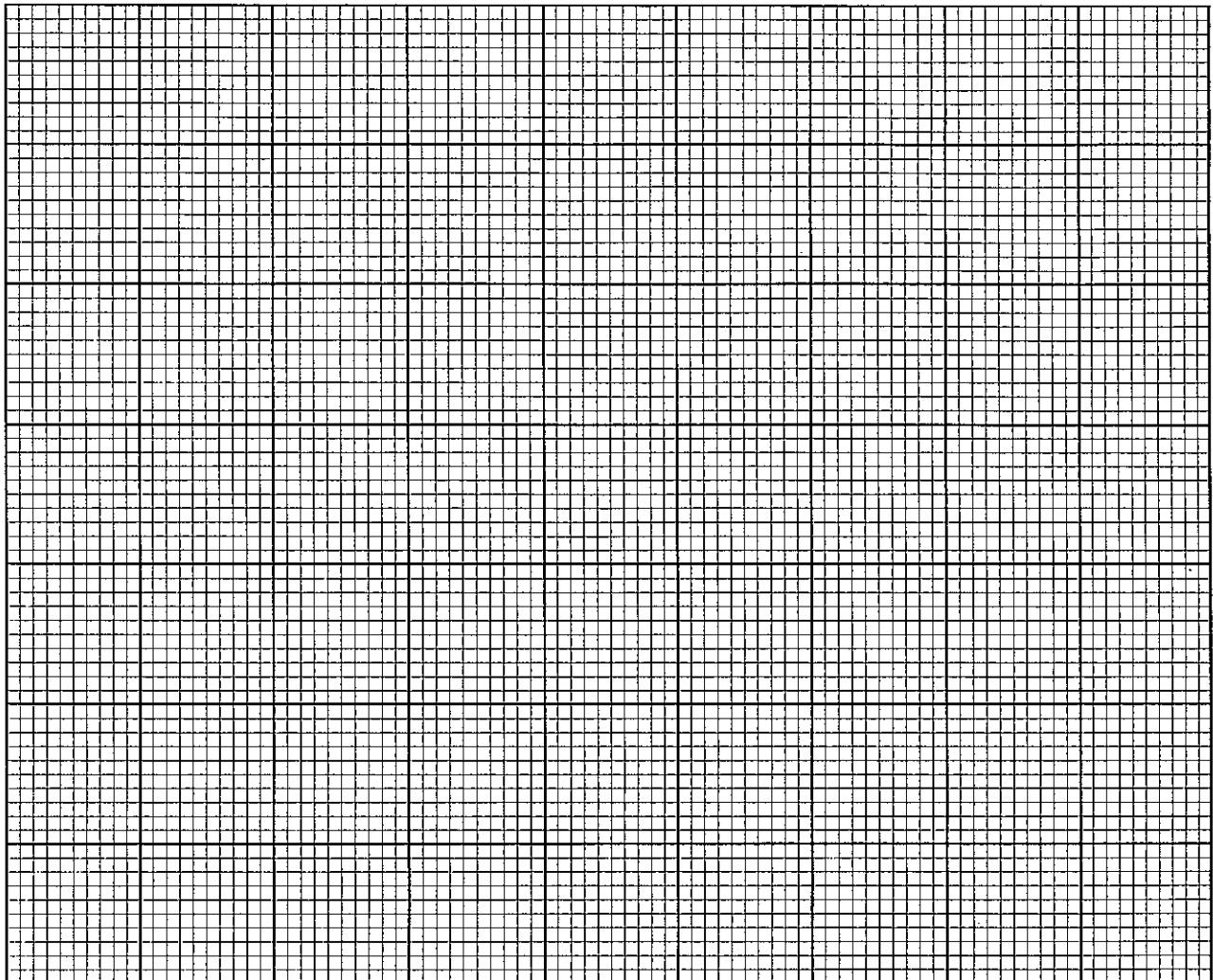
- c. What type of gas is contained in the air bubbles produced in the investigation?

(1 mark)

Continued/...

2013

EXAMINATION NO.: _____
Page 4 of 6 M022/II



Continued/...

3. You are provided with specimen X and Y.

- a. Give any one observable difference between the two specimen.

(1 mark)

- b. Describe the way in which specimen X can be tested for protein.

(6 marks)

- c. Mention any two food substances contained in Y?

(2 marks)

- d. What type of storage organ is Y?

(1 mark)

- e. Name the deficiency disease that results from lack of proteins in the body.

(1 mark)

Continued/...

4. Figure 2 shows diagrams of **five** different animals. Use it to answer the questions that follow.

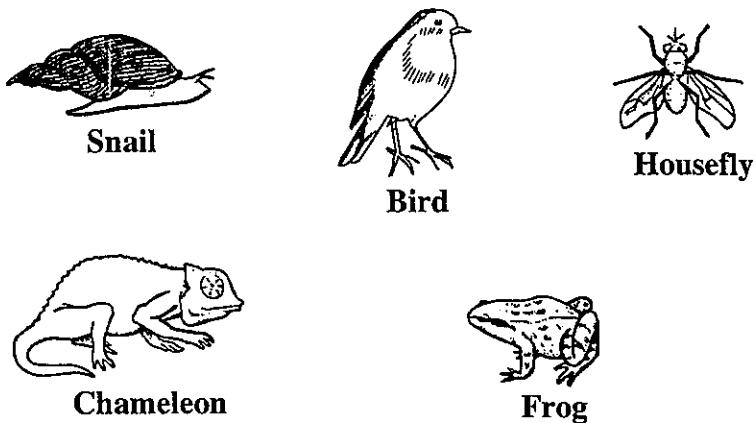


Figure 2

Construct a biological key that can be used to identify the animals.

A large, empty rectangular box with rounded corners, intended for the student to draw a biological key for identifying the animals shown in Figure 2.

(8 marks)

END OF QUESTION PAPER

NB: This paper contains 6 pages.

Acknowledgements

It was a long journey. This project was completed thanks to the united efforts of a large number of people. Our great thanks to MANEB for permitting our using past-papers, many schools for lending us past-papers, JICA Malawi Office for their great support, members of Japan Overseas Cooperation Volunteers and Secondary School teachers who worked together to achieve this common goal.

Finally we thank to you, students and teachers, who are using this book and who will make future of Malawi more fruitful and more colourful!

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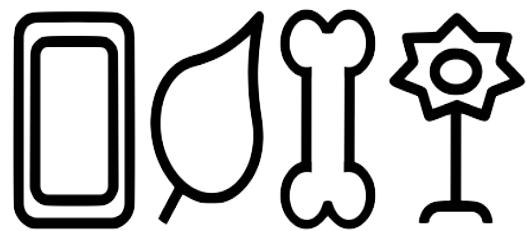
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