



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

CURRICULUM GRADE 10-12 DIRECTORATE

NCS (CAPS)

LEARNER SUPPORT DOCUMENT

GRADE 11



LIFE SCIENCES

JUST IN TIME

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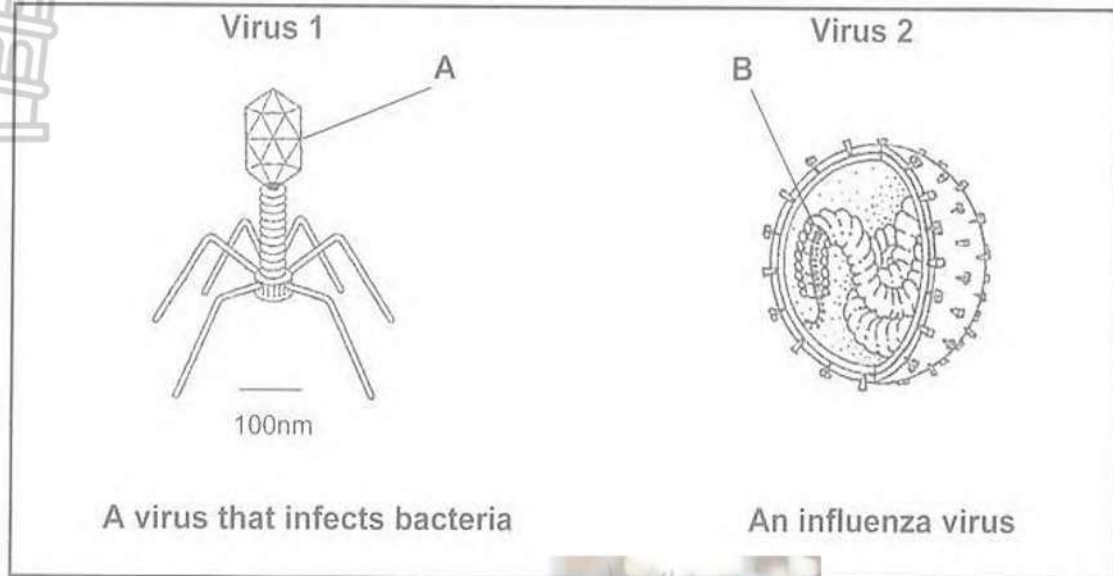
Topic: Biodiversity of Microorganisms

ACTIVITY 1

No.	Description	Biological Term
1.1.	A singled cell organism.	
1.2.	An organism that does not have a true nucleus.	
1.3.	Outer protein layer that encloses genetic material of a virus.	
1.4.	A virus that attacks bacteria.	
1.5.	A lack of cellular structure in an organism.	
1.6.	An organism that causes diseases.	
1.7.	Organism that has a trues nucleus	
1.8.	Organism that can be divided into two identical parts.	
1.9.	Grouping of organisms according to their similarities.	
1.10.	Micro-organisms that only reproduce inside a host.	
1.11	Whiplike structure used by bacteria for movement.	
1.12	The bacterium type which is spherical.	
1.13	Substances used to stimulate the production of antibodies.	
1.14	Mass of fungal threads.	
1.15	Acquired immunity obtained through injection	
1.16	A parasitic protozoan that causes malaria	
1.17	A relationship between two organisms where both benefit	
1.18	An inborn ability to produce antibodies	
		(18 X 1) (18)

ACTIVITY 2

2.1 The diagram below represents different viruses.



2.1.1 Identify parts A and B

(2)

2.1.2 State why viruses are acellular.

(1)

2.1.3 Explain how virus 1 may be used as biological control agent.

(3)

(6)

2.2 Corona virus, the world's greatest enemy.

Corona virus is also known to suppress the human immune system.

2.2.1 State TWO recommendations to prevent the spread of corona virus.

(2)

2.2.2 Give ONE reason why it is difficult to develop cure for corona virus.

(1)

Corona virus is known to suppress the human immune system.

2.2.3 Explain why this has more effect to people with underlying conditions.

(2)

2.2.4 State one significance of vaccines in the human body.

(1)

(6)

ACTIVITY 3

- 3 The uterus is the female organ in which an offspring develops before birth. The lower end of the uterus is called the cervix.

Scientists investigated on the link between cervical cancer and infection with some type of Human Papilloma Virus (HPV).

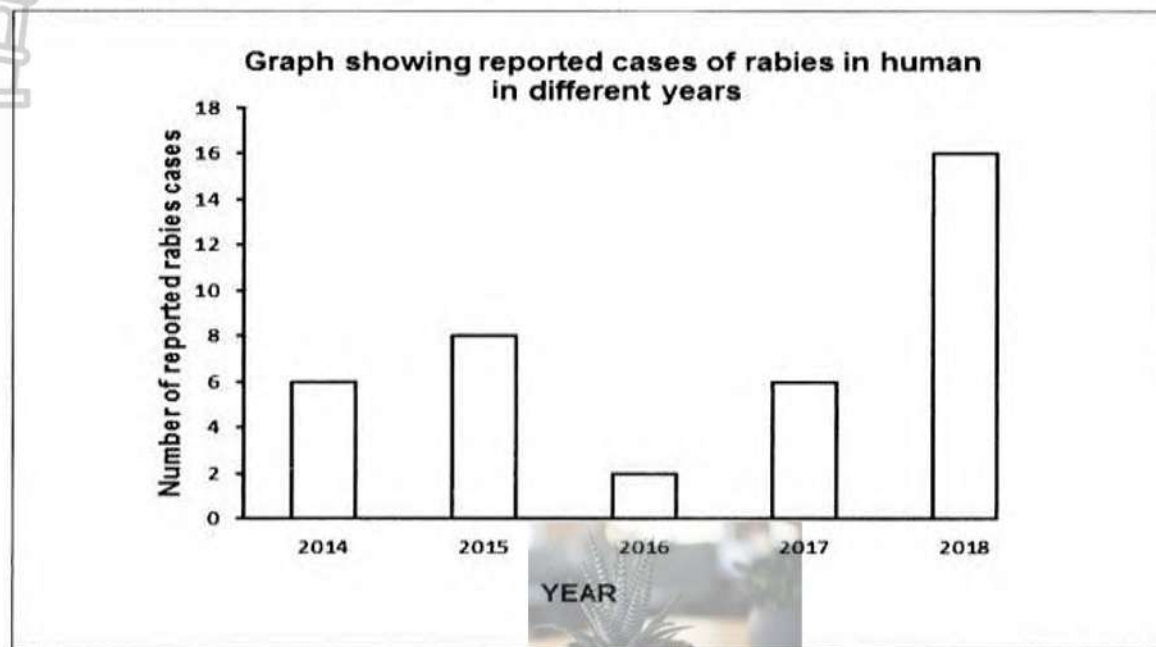
The table below shows the frequency of FIVE different types of HPV on females who had cervical cancer.

Type of HPV	Percentage of women with cervical cancer who have this type of HPV.
HPV6	2
HPV11	2
HPV16	66
HPV18	16
HPV 31	8

- 3.1 State the type of HPV that has higher chances of causing cancer. (1)
- 3.2 State THREE general characteristics of a virus. (3)
- 3.3 Explain why viruses are classified as non-living. (1)
- 3.4 Calculate the difference in percentage of women between HPV16 and HPV18.
 Show ALL your workings. (2)
- 3.5 Use the information in the table to draw a bar graph. (6)
- (13)**

ACTIVITY 4

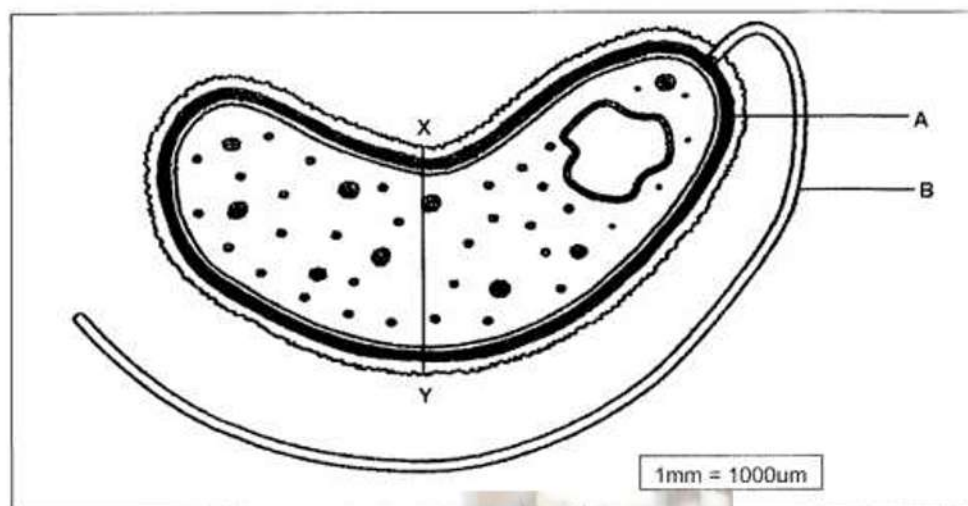
- 4 The graph below shows the number of reported rabies cases in humans in different years.



- 4.1 State the year that has the highest number of reported cases. (1)
- 4.2 Calculate the percentage increase in reported cases between 2014 and 2016. (3)
- 4.3 Describe the trend on the reported cases of rabies. (3)
- 4.4 State the two consecutive years where the increase in rabies was the greatest. (1)
- (8)**

ACTIVITY 5

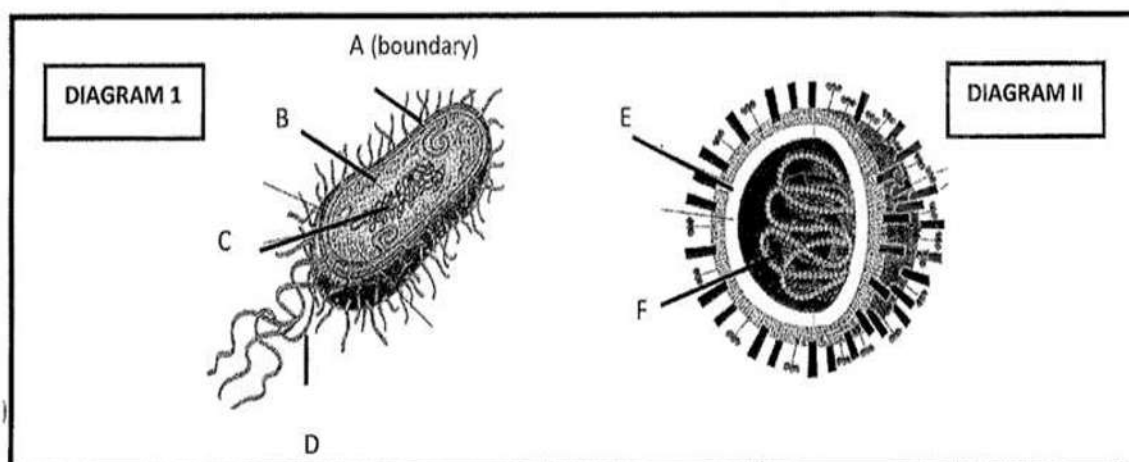
- 5 A diagram below represents a structure of a cholera bacterium. It has been magnified 50 000 times.



- 5.1 Identify part **A**. (1)
 5.2 Give a function for part **B**. (1)
 5.3 State TWO characteristics of a bacteria. (2)
 5.4 Calculate the actual width of the diagram (in micrometres) between point **X** and **Y**. (2)
 (6)

ACTIVITY 6

6. The diagram below shows two micro-organisms



- 6.1 Identify microorganism in diagram 1. (1)
 6.2. Write the LETTER and NAME of: (1)

(a) A part that carries genetic material. (2)

(b) A part that encloses genetic material of Diagram II. (2)

6.3 State the type of fertilisation that takes place in diagram 1. (1)

6.4 Describe TWO ways in which diagram II differs from living cells. (2)

(8)

ACTIVITY 7

7 Read the extract below.

South Africa's water crisis and rising cholera cases

Water is an essential but scarce resource. Worldwide, an estimated 663 million people do not have access to sufficient and safe water for domestic use and the demand is on the increase. It is estimated that the world will have to cope with a 40% water supply shortfall by 2030, which will unavoidably affect the availability of drinking water, sanitation and food production.

The rural communities now mostly rely on rain water, water from rivers, streams and dams of which they share with animals. The health department has recorded a high incidence of people seeking medical attention with symptoms like vomiting, dehydration and diarrhea.

7.1 Name the micro-organism that causes cholera in humans. (1)

7.2 State TWO symptoms of cholera mentioned in the extract. (2)

7.3 Name the type of medicine that is prescribed to treat cholera. (1)

7.4 The estimated population in 2030 is 8,5 billion.

Calculate the estimated number of people who will have to cope with supply shortfall in 2030. Show ALL your working. (2)

7.5 Explain how water crisis will negatively affect economy of South Africa. (2)

(8)

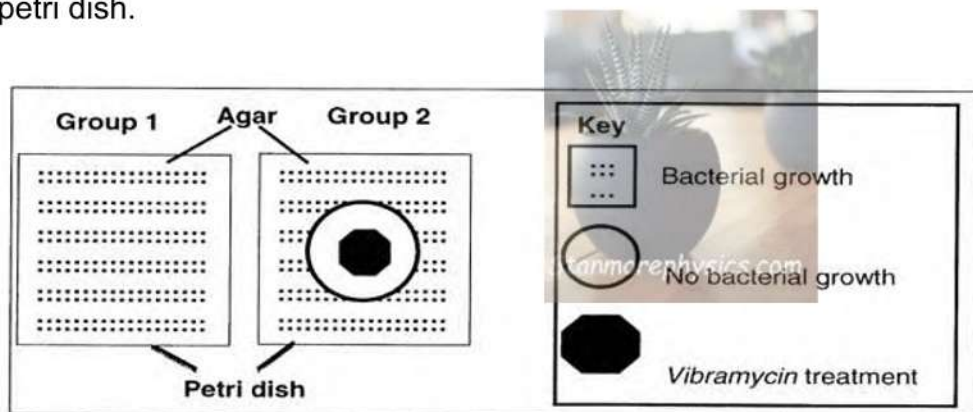
ACTIVITY 8

8

Grade 11 learners wanted to investigate whether a new antibiotic, called *Vibramycin*, could restrict the production of a population of *bacteria* which was resistant to other antibiotics.

Their investigation was set up as follows:

- The bacteria were cultured in the same type of agar medium in 20 petri dishes of the same size and then divided into 2 groups:
 - **Group 1:** 10 petri dishes were given no treatment
 - **Group 2:** 10 petri dishes were treated with *Vibramycin* of the same concentration.
- The petri dishes were then incubated under the same conditions and examined for bacterial growth.
- The diameter of the area where no bacteria grew was measured for each petri dish.



8.1 Identify the:

(a) Dependent variable.

(1)

(b) TWO factors that were kept constant in an investigation.

(2)

8.2 State why the scientist used more than one petri dish for each group.

(1)

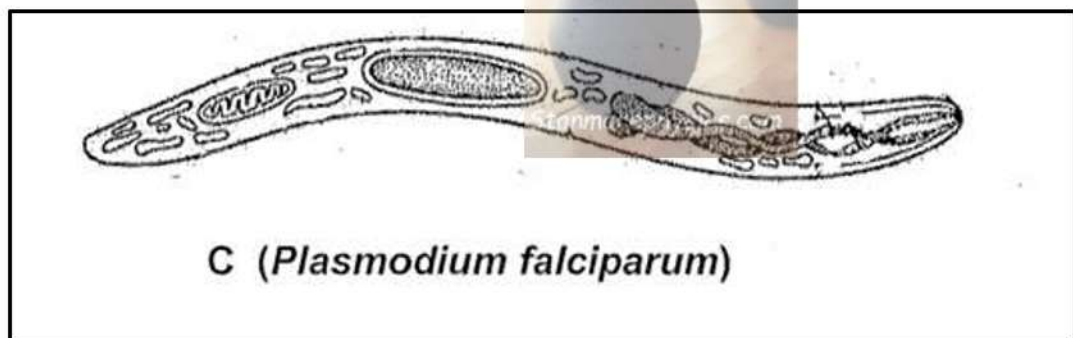
8.3 Describe the importance of group 1 in this investigation.

(2)

(6)

ACTIVITY 9

- 9 The diagrams below represent the structure of an Amoeba and Plasmodium falciparum



- 9.1 Give the name of the kingdom in which an Amoeba belongs. (1)
- 9.2 State TWO characteristics of a Protista. (2)
- 9.3 Give the NAME of a disease caused by organism **C**. (1)
- 9.4 List TWO symptoms of a disease named in QUESTION 9.3. (2)
- 9.5 Explain TWO ways in which organisms of kingdom named in QUESTION 9.1 play a role in maintaining balance on the environment. (4)
- (10)

ACTIVITY 10

- 10 Read the extract below and answer the questions that follow.

Most important of the tropical diseases

Malaria has been called the 'most important' of the tropical diseases by World Health Organisation (WHO, 1990). It leaves a heavy toll of illness and is lethal, especially to the children. It poses a risk to business travels, tourists and immigrants. Imported cases of malaria are increasingly seen in non-endemic area such as Europe and North America.

In many parts of Africa people are infected so frequently that they develop a degree of acquired immunity, and may become 'asymptomatic' carriers of the infection. Epidemics are most frequent in rural areas. The global distribution is mostly concentrated near the equator.

- 10.1 Name the vector of malaria. (1)
 10.2 State :
 (a) TWO reasons for high incidence of malaria in Central Africa (2)
 (b) ONE reason why malaria poses risk to business travelers. (1)
 10.3 Define the term asymptomatic as used in the passage. (2)
 (6)



ACTIVITY 11

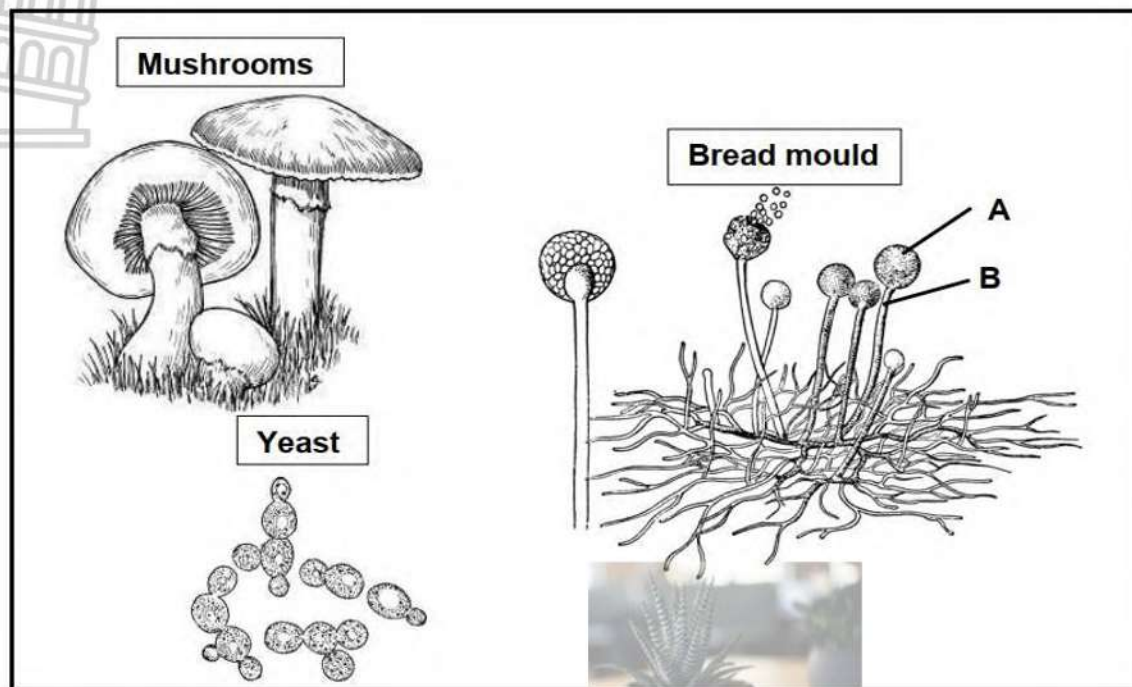
- 11 The table below shows the percentage of malaria over 7 years in Tanzania.

Year	Percentage growth of malaria
1	2.1
2	2.4
3	2
4	2.2
5	2.6
6	3.1
7	3.5

- 11.1 Name the protist that causes malaria. (1)
 11.2 Describe the changes of percentage growth of malaria in Tanzania over 7 years. (3)
 11.3 State TWO consecutive years where the growth of malaria was the greatest? (1)
 11.4 Tabulate TWO differences between bacteria and protists. (5)
 (10)

ACTIVITY 12

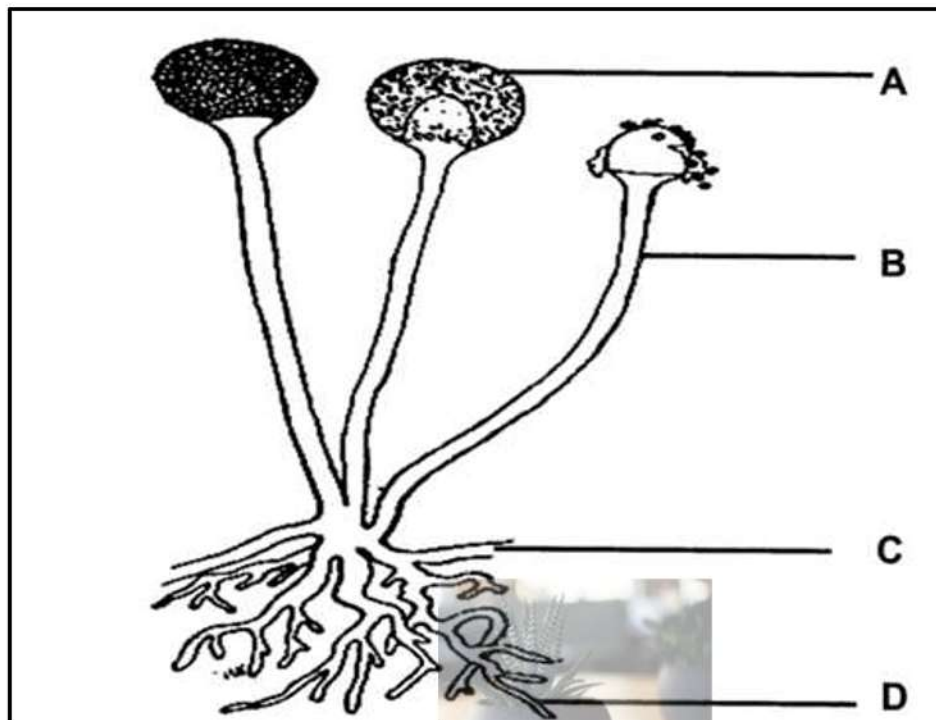
12. The diagrams below represent a group of micro-organisms



- 12.1 State the kingdom of the above organisms. (1)
- 12.2 Provide the labels for: (2)
- (a) **A**
- (b) **B**
- 12.3 Give the name of thread-like structures that make up the body of bread mould. (1)
- 12.4 State ONE structural difference between yeast and mushroom (2)
- 12.5 Give TWO benefits of yeast on economy. (2)
- (8)**

ACTIVITY 13

- 13 The diagram below is that of a bread mould.



- 13.1 Identify the kingdom to which the diagram above belongs. (1)
- 13.2 Give the LETTER and NAME of the part that: (7)
- (a) Anchors fungus to substrate (2)
 - (b) Provide branched horizontal coverage (2)
 - (c) Produce matured spores (2)

ACTIVITY 14

- 14 Grade 11 learners conducted an investigation to determine the optimum temperature for growth of bread mould.

The procedure of the investigation was as follows:

- FOUR plastic containers with lids were used
- Containers were labelled A, B, C and D
- A slice of bread was placed in each container
- 20 ml of water was sprinkled over each slice
- CONTAINER A: was placed in a fridge (cold)
- CONTAINER B: was placed in a cupboard (cool)
- CONTAINER C: was kept at room temperature (mild)
- CONTAINER D: was kept on a windowsill (warm)
- Containers were left in their respective conditions for a week.
- After a week the slices of bread were removed from the containers placed next to each other.
- The investigation was done several times.

The table below shows the results of the investigation.



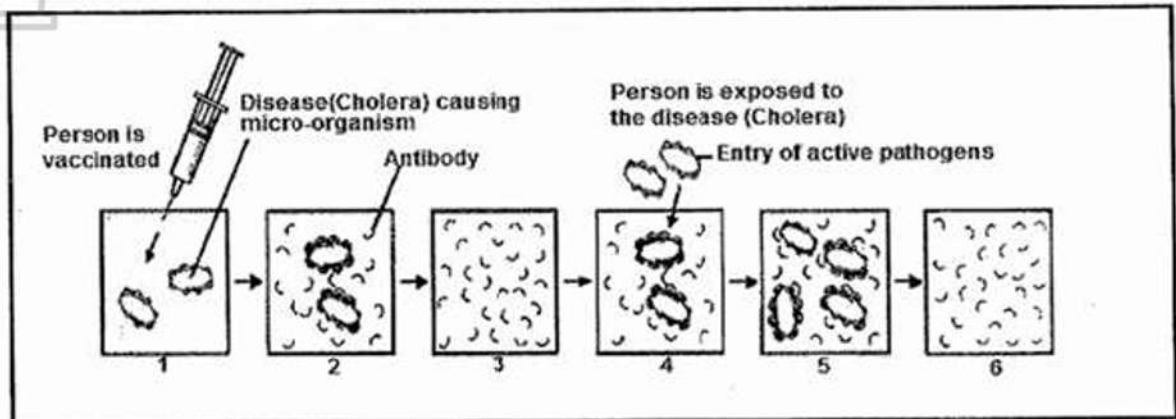
Container	Growth of bread mould (%)
A	5
B	25
C	50
D	75

- 14.1 Identify the independent variable. (1)
- 14.2 State why the results of the investigation may be considered reliable. (1)
- 14.3 Calculate the number of times the bread mould grew from **A** to **D**. (2)
- (4)

ACTIVITY 15

- 15 Cholera is caused by exposure to water that is contaminated by pollutants such as sewage.

The following diagrams show how the cholera vaccine works in humans.



- 15.1 State the substance contained by vaccine that is injected into human body. (1)
- 15.2 Explain the significance of the process shown in DIAGRAM 2. (2)
- 15.3 Name the type of immunity obtained through vaccination. (1)
- 15.4 Describe what happens when a person is later exposed to cholera bacteria as shown in DIAGRAM 4. (2)
- 15.5 Suggest THREE strategies to prevent a cholera outbreak in rural villages of our country. (3)
- (9)**

ACTIVITY 16

16

- 16.1 Describe the symbiotic relationship between the following: (4)
- (a) E. Coli and human Intestines (4)
- (b) Roots of plants and fungus mycorrhizae (4)
- (8)**

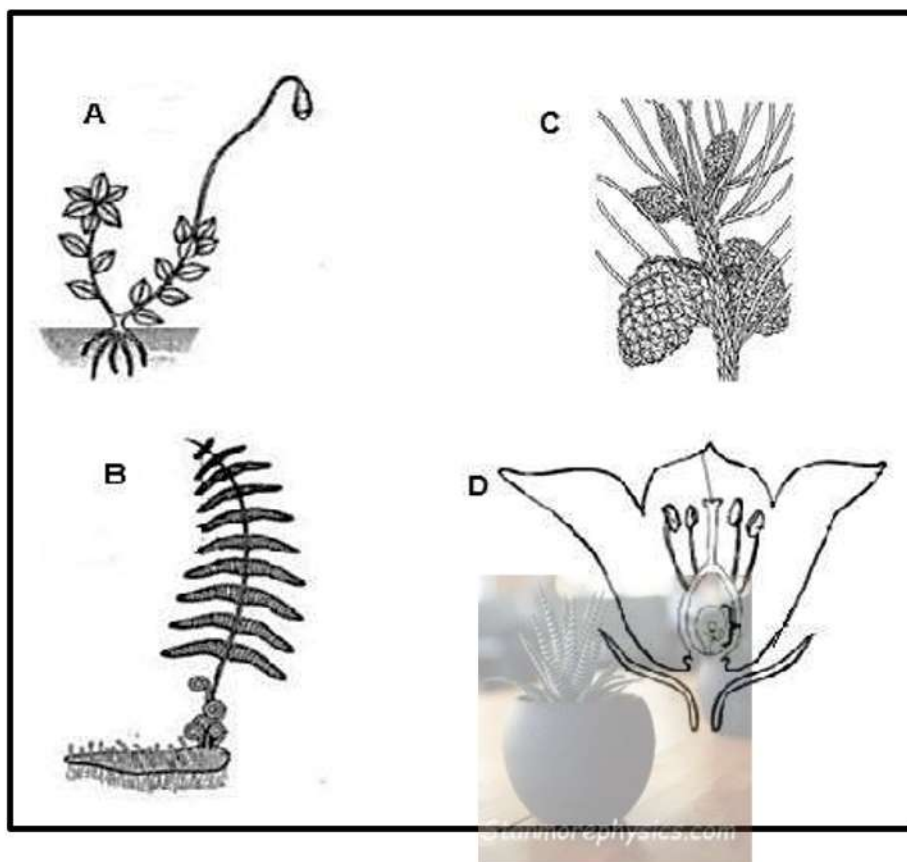
Topic: Biodiversity of Plants and Reproduction

ACTIVITY 1

No.	Description	Biological Term
1.1	Plants without true roots, stems and leaves	
1.2	A group of plants that have seeds enclosed in an ovary.	
1.3	The collective name for a filament and an anther	
1.4	A diagram showing the evolutionary relationship between organisms	
1.5	The protective cap that covers the sporangia in mosses	
1.6	The transfer of pollen grains from the anther to the stigma of another plant's flower	
1.7	Type of reproduction involving the fusion of gametes	
1.8	Dominant generation in the life cycle of ferns	
1.9	Reproduction which uses non-reproductive parts of a plant to produce new plants	
1.10	A reproductive structure found in gymnosperms and angiosperms only and consists of a plant embryo with a protective coat	
1.11	The collective name for a stigma, style and ovary	
1.12	The seed-bearing plants	
1.13	Female part of the flower consisting of a stigma, style and an ovary where ovules are produced	
1.14	A stem which grows horizontally	
1.15	The spore-producing generation	
1.16	The gamete-producing generation	
1.17	A group of sporangia on the pinna of a fern frond	
		(17 X 1) (17)

ACTIVITY 2

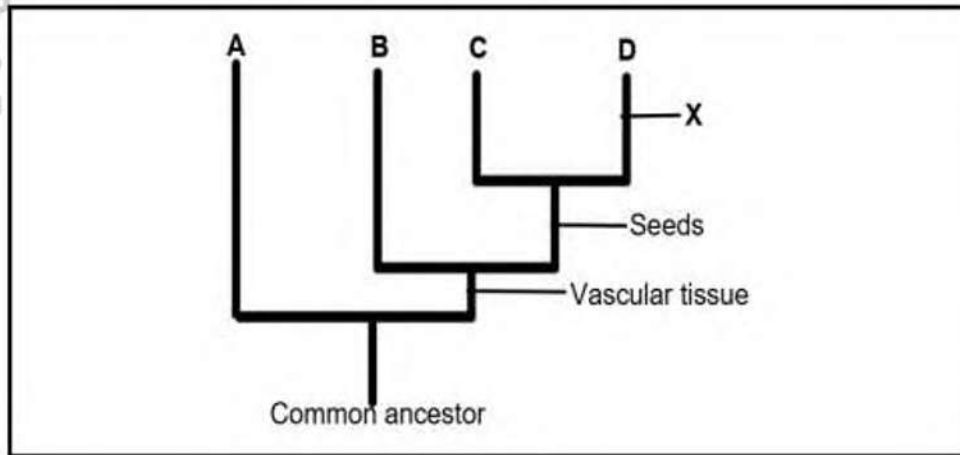
2. The diagram below illustrates different plants.



- 2.1 Identify the group to which **A** and **B** belong. (2)
- 2.2 Which of the four groups (**A**, **B**, **C** or **D**): (2)
- (a) Are dependent on water for fertilisation. (2)
- (b) Produce seeds for reproduction. (2)
- 2.3 Explain how the dependency on water for reproduction is reduced in the group represented by **C**. (3)
- 2.4 List THREE similar structural features of the prothallus in ferns and the gametophyte in mosses, which make both to be poorly adapted to a terrestrial life. (3)
- 2.5 Explain how the presence of flowers have allowed for a greater diversity and abundance of angiosperms. (2)
- 2.6 Tabulate FOUR structural differences between group A and group B. (5)
- (19)

ACTIVITY 3

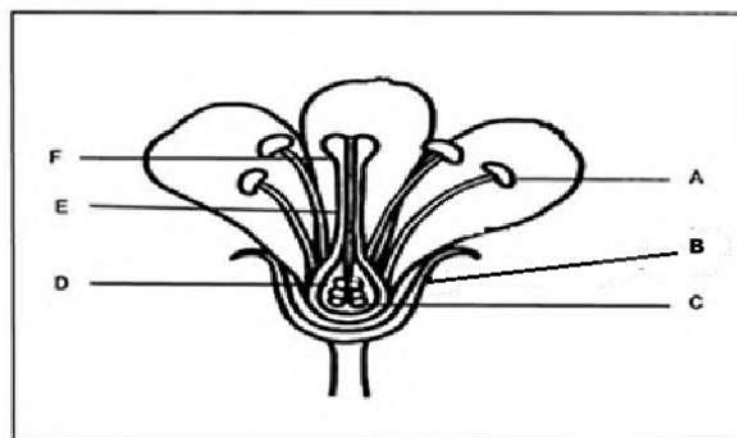
3. The diagram below shows possible evolutionary relationships in living organisms with four divisions.



- 3.1 Identify the kingdom represented by the phylogenetic tree above. (1)
- 3.2 Give the LETTER and NAME of the division that has
 (a) dominant gametophyte generation (2)
 (b) fronds as leaves (2)
- 3.3 State the evolutionary adaptation at X in division D that allowed it to be successful. (1)
- 3.4 Name the vascular tissue that transports manufactured foods. (1)
- (7)

ACTIVITY 4

- 4 The diagram below shows a flower.



- 4.1 Identify part:
 (a) D (1)
 (b) E (1)
 (c) F (1)

- 4.2 Name the collective term for **A** and **B**. (1)
- 4.3 Give the LETTER and NAME of the part that becomes a seed after fertilisation. (2)
- 4.4 State TWO functions of flowers. (2)
- (8)

ACTIVITY 5

- 5 Grade 11 learners conducted an investigation to determine the effect of petals on insect pollination in apple flowers.

When flowers are self-pollinated, the pollen tubes grow a little into the stigma and style, and fertilisation does not take place.

Method followed:

- 5 flowers with petals and 5 flowers without petals were used; flowers were from the same plant species
- Both groups of flowers were exposed to pollinating agents for ten days.
- After ten days the extent of pollination and fertilisation was recorded.

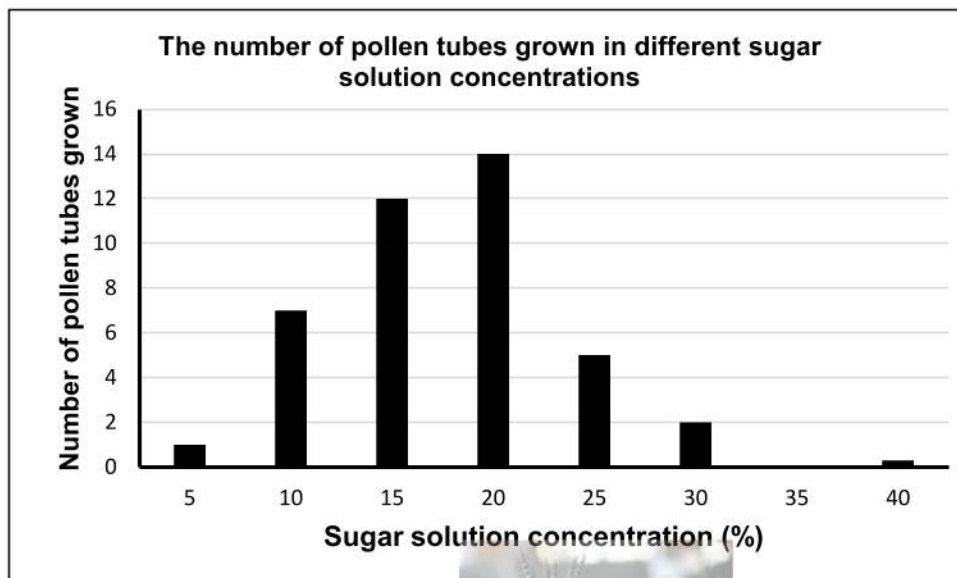
The results are shown in the table below:

Features	Type of flower	
	Flower with petals	Flower without petals
Pollen grains	135	33
Pollen tubes in style	72	7
Ovules fertilized	25	4

- 5.1 State the aim of the above investigation. (2)
- 5.2 Identify the: (1)
- (a) Independent variable (1)
- (b) Dependant variable (1)
- 5.3 State TWO ways in which the validity of this investigation was ensured. (2)
- 5.4 Explain (2)
- (a) why there was more pollen on the stigma of flowers with petals. (2)
- (b) why there are more pollen tubes present in the style of all flowers than the number of ovules fertilised. (2)
- 5.5 State a conclusion based on the results. (2)
- (12)

ACTIVITY 6

- 6 The graph below shows the relationship between sugar solution concentration and the number of pollen tubes grown.



- 6.1 State the concentration of sugar solution (%) that is best suited for the growth of pollen tubes. (1)
- 6.2 Explain the results obtained when the concentration of the sugar solution was 35% and above. (2)
- 6.3 State ONE function of pollen tubes. (1)

(4)

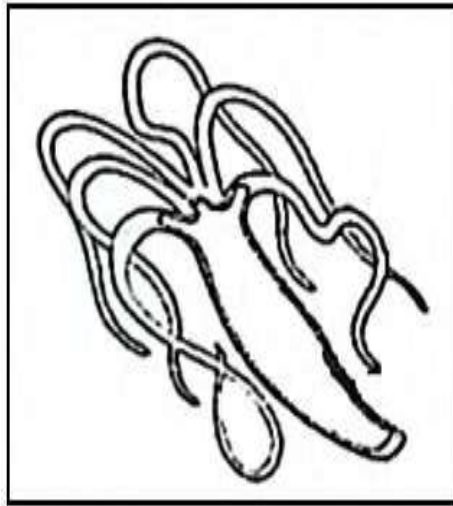
Topic: Biodiversity of Animals

ACTIVITY 1

No.	Description	Biological Term
1.1	Body wall consisting of two germ layers	
1.2	A gut with only one opening, used for both ingestion	
1.3	The arrangement of body parts such that an organism can be divided into identical parts vertically along any radius	
1.4	Body wall consisting of three germ layers	
1.5	The arrangement of body parts such that an organism can be divided into identical parts in only one way through the mid-longitudinal line	
1.6	Type of symmetry relating to organisms that have an irregular shape and can thus not be divided into two identical parts	
1.7	A true body cavity that is lined on both sides by mesoderm	
1.8	Blood system in which the blood is always confined to the blood vessels	
1.9	A body cavity that is lined by mesoderm on one side only	
1.10	Blood system in which the blood is always confined to the blood vessels	
1.11	Concentration of sense organs at the anterior end of an animal leading to the formation of a head	
1.12	The germ layer in animals that gives rise to muscles and other internal organs	
1.13	Embryonic layer that gives rise to the digestive tract and associated organs	
1.14	Type of blood system that has blood vessels and haemocoels	
1.15	Removal of solid waste from the gut	
1.16	The gut that runs through organism with two openings, the mouth and anus	
1.17	Animals that remain attached to the substrate for their entire life cycle	
1.18	Shedding of the skeleton in arthropods to allow growth	
1.19	Removal of solid waste from the gut	
		(19 X1) (19)

ACTIVITY 2

- 2 The diagram below represents an animal species called Hydra.



- 2.1 Identify the phylum to which this organism belongs. (1)
2.2 Name the type of symmetry in this organism. (1)
2.3 Explain ONE advantage of the symmetry mentioned in QUESTION 2.2 with regard to the mode of living for this organism. (3)
2.4 Name THREE phyla that you have studied, which have a coelom. (3)
(8)

ACTIVITY 3

- 3 A female locust uses her abdomen to make a hole in sandy soil in which to lay her eggs. She then secretes a sticky substance onto the eggs which hardens in a short while. The sticky substance and the eggs together form an egg pod.

A grade 11 learner wanted to investigate the influence of the amount of water in the soil on the number of egg pods formed by the female locusts.

The following procedure was followed:

- The learner put 25 male and 25 female locusts in a large cage
- She then put 9 troughs of sandy soil in the cage, each containing different amounts of water
- The number of egg pods that formed was counted

The results of the investigation are shown in the table below

Amount of water (ml) added to 100g of sandy soil	Number of egg pods formed
0	0
2	1
4	2
6	12
8	19
10	20
12	24
14	18
16	12

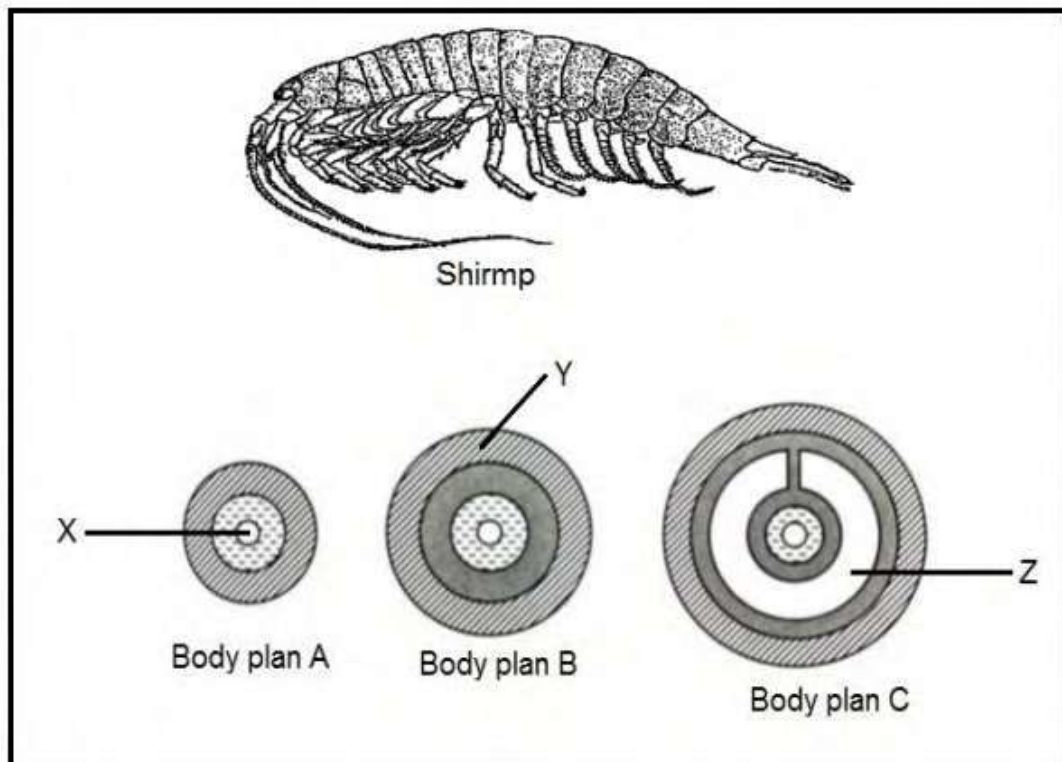
- 3.1 Identify the: (1)
- (a) Dependent variable (1)
- (b) Independent variable (3)
- 3.2 State THREE factors that should be kept constant. (3)
- 3.3 Calculate the percentage increase in the number of egg pods formed when the amount of water added was 6ml and when it was 10ml. (3)
- Show all your working. (6)
- 3.4 Draw a line graph to show the result of this investigation. (14)

ACTIVITY 4

- 4 Explain THREE roles of earthworms and insects in agriculture and ecosystems. **(6)**

ACTIVITY 5

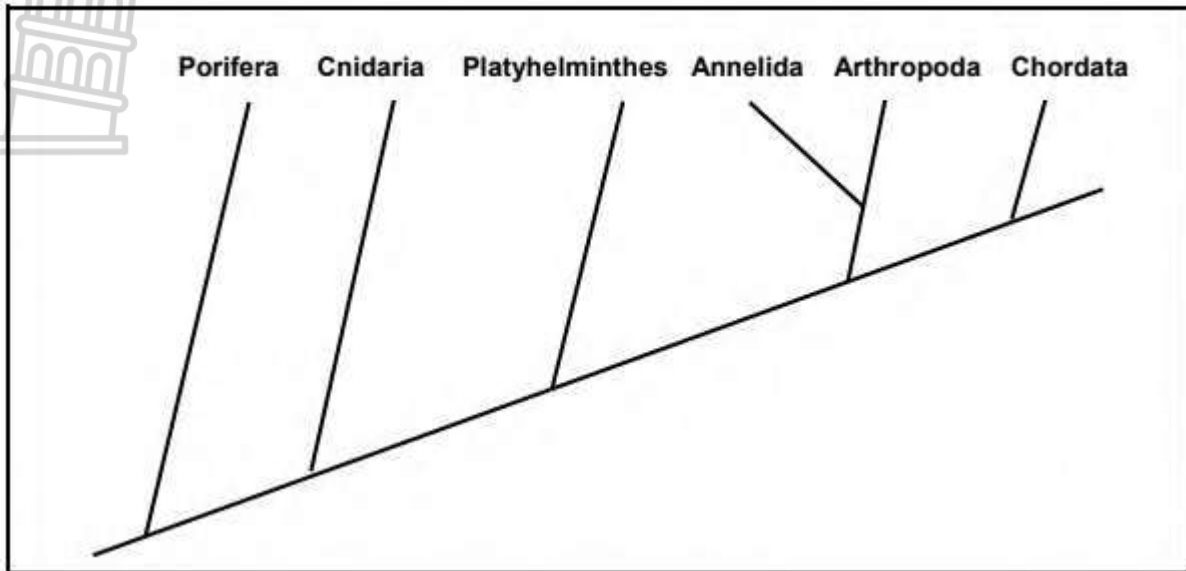
- 5 The diagrams below show a shrimp and three body plans. The shrimp is an arthropod found in all oceans.



- 5.1 Identify: (1)
 (a) X (1)
 (b) Y (1)
 5.2 Name the kingdom to which the shrimp belongs. (1)
 5.3 Give a body plan between (A, B or C) that is associated with the shrimp. (1)
 5.4 Is the body plan mentioned in QUESTION 5.3 diploblastic or triploblastic? (1)
 5.5 Explain ONE advantage of the symmetry of the shrimp (2)
 5.6 Name the type of skeleton found in the shrimp. (1)
 5.7 State TWO disadvantages of type of skeleton mentioned in QUESTION 5.6. (2)
 5.8 Explain how cephalisation and symmetry of the shrimp are appropriate to its mode of life. (3)
 5.9 Explain TWO advantages of the development of part Z to animals with body plan C. (4)
(17)

ACTIVITY 6

- 6 The diagram below shows the relationship between animal phyla



- 6.1 Identify the above diagram. (1)
- 6.2 Name a phylum in which the animals are mostly radially symmetrical. (1)
- 6.3 Identify: (1)
- (a) The phylum that was the first to evolve from the common ancestor. (1)
- (b) TWO phyla that are closely related. (2)
- 6.4 Give a reason for your answer in QUESTION 6.3 (b). (1)
- 6.5 Name ONE phylum with organisms that are triploblastic. (1)
- (7)

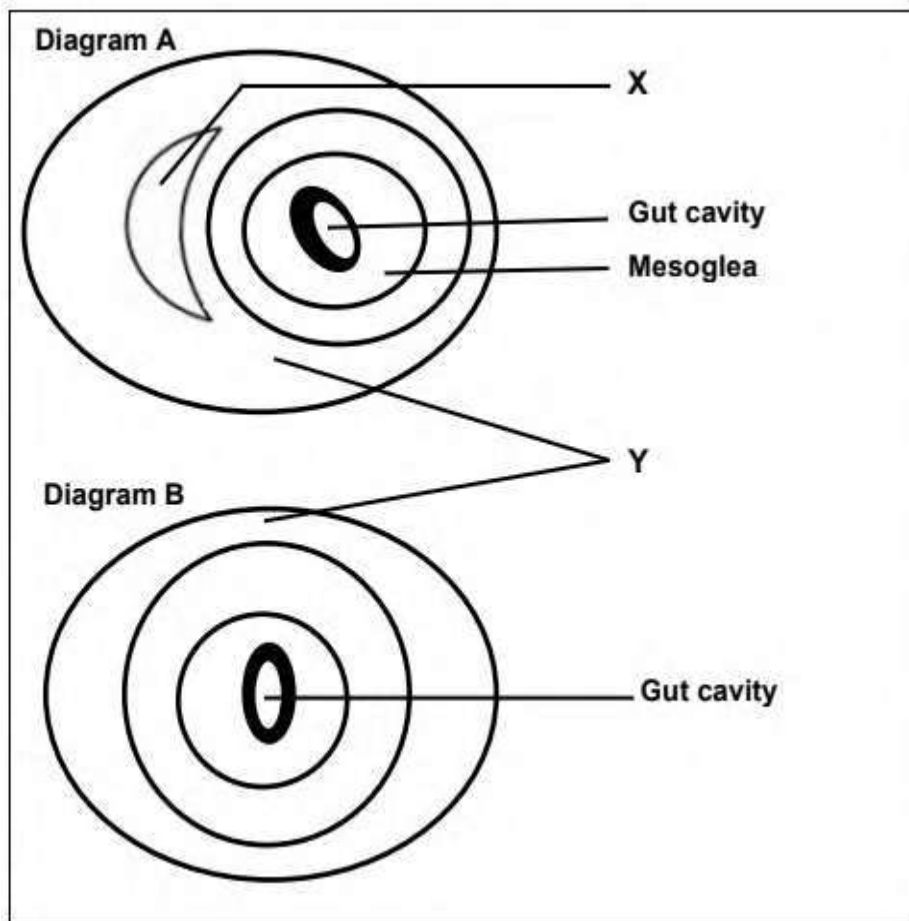
ACTIVITY 7

7. Describe how the body plan of Hydra relates to its mode of life. (8)



ACTIVITY 8

- 8 The diagram below shows the arrangement of body tissues.



- 8.1 Use letters **A** and **B** to place the diagrams in their correct evolutionary sequence. (2)
- 8.2 Give THREE animal groups represented by diagram **A**. (3)
- 8.3 Identify the organism between (**A** or **B**) that is radially symmetrical. (1)
- 8.4 Name the phylum that preceded the cnidarians. (1)
- 8.5 Identify: (1)
- (a) **X** (1)
- (b) **Y** (1)
- 8.6 Explain TWO advantage of structure **X**. (4)

(13)

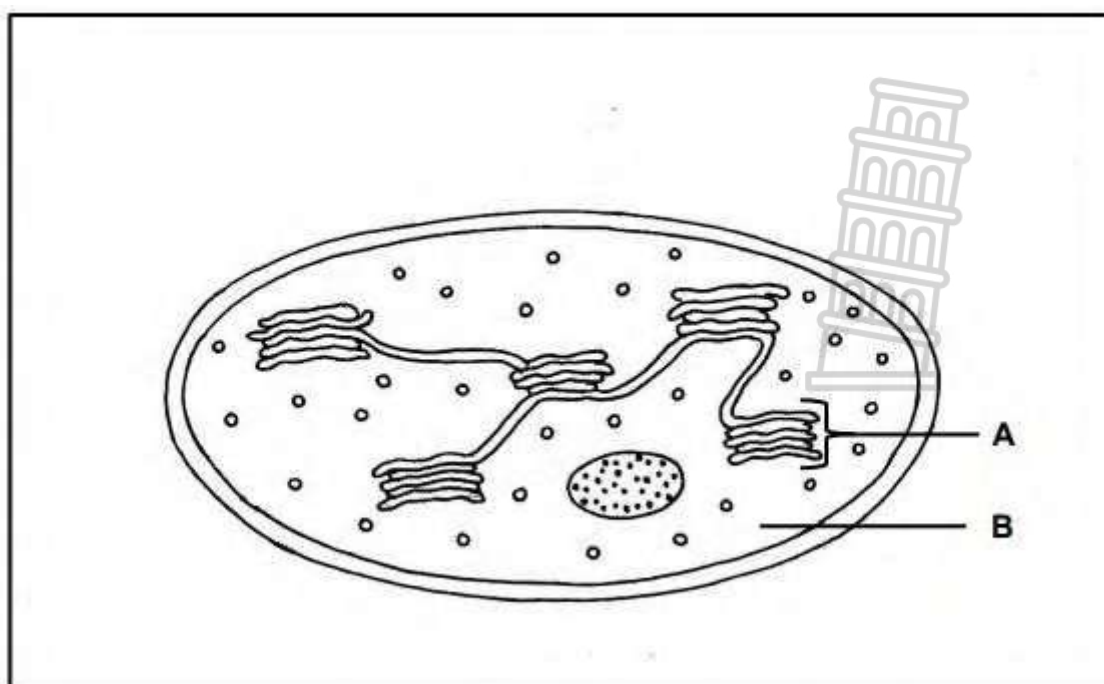
Topic: Photosynthesis

Activity 1

No.	Description	Biological Term
1.1	The green, light-trapping pigment in photosynthesis found in plant leaves.	
1.2	Site of reactions of the light independent phase in the chloroplast.	
1.3	The organic molecules that act as catalysts and control the chemical reactions during photosynthesis.	
1.4	The organelle in which photosynthesis takes place	
1.5	Gas given off by green plants during photosynthesis	
1.6	Organisms that cannot photosynthesize and obtain food from other organisms	
1.7	Part of the chloroplast that contains chlorophyll	
1.8	Green plants that produce their own food through photosynthesis	
1.9	Stored form of glucose in plants	
1.10	The splitting of water molecules into hydrogen and oxygen in the presence of light.	
		10x1 (10)

Activity 2

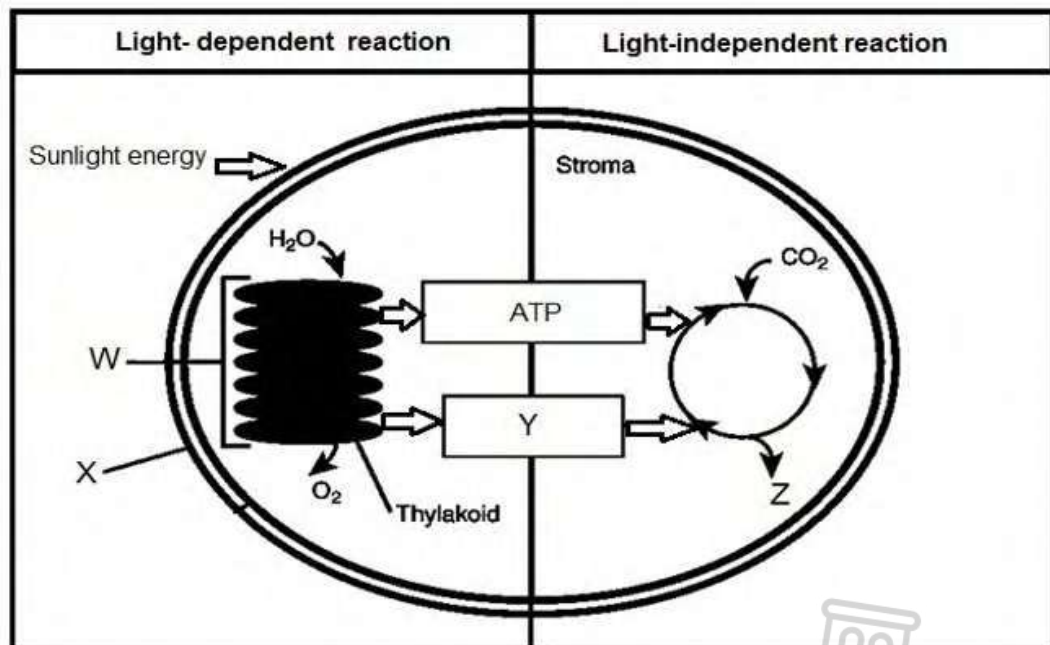
Study the diagram below and answer the questions based on it.



- 2.1 Identify the... (1)
- (a) Organelle above (1)
- (b) Name of the biological process in plants the occurs in the organelle that is shown above. (1)
- 2.2 Give the LETTER and the NAME of the structure where light independent phase occurs. (2)
- 2.3 Name and describe the phase of photosynthesis that occurs on the structure labelled A. (4)
- 2.4 Mention TWO biological importance of photosynthesis. (2)
- (10)**

Activity 3

- 3 The diagram below represents an organelle and the process of photosynthesis.



- 3.1 Identify the organelle shown above in which photosynthesis occurs. (1)
- 3.2 Identify part: (1)
- (a) **W** (1)
- (b) **X** (1)
- 3.3 Identify molecule: (1)
- (a) **Y** (1)
- (b) **Z** (1)
- 3.4 Describe the role of the water molecule during the light dependent reaction of photosynthesis. (4)
- 3.5 Explain why an increase in the concentration of carbon dioxide may not necessarily lead to an increase in the rate of photosynthesis. (2)
- (11)**

Activity 4

- 4 The passage below relates to the agricultural use and manipulation of the factors that affect the rate of photosynthesis

THE AGRICULTURAL USE OF THE FACTORS THAT LIMIT PHOTOSYNTHESIS

Flowers, fruit, and vegetables can all be grown in plastic tunnels or greenhouses. The farmers use these structures to regulate the light intensity, temperature, and carbon dioxide concentration.

Artificial lighting in greenhouses increases the light intensity. The glass or plastic walls of the greenhouses trap the heat of the sun within the structures, thereby raising the temperature.

Carbon dioxide concentration of the air within the structure is increased by pumping carbon dioxide into the structure. This ensures that plants grow as fast as possible and to maximize the crop yield.

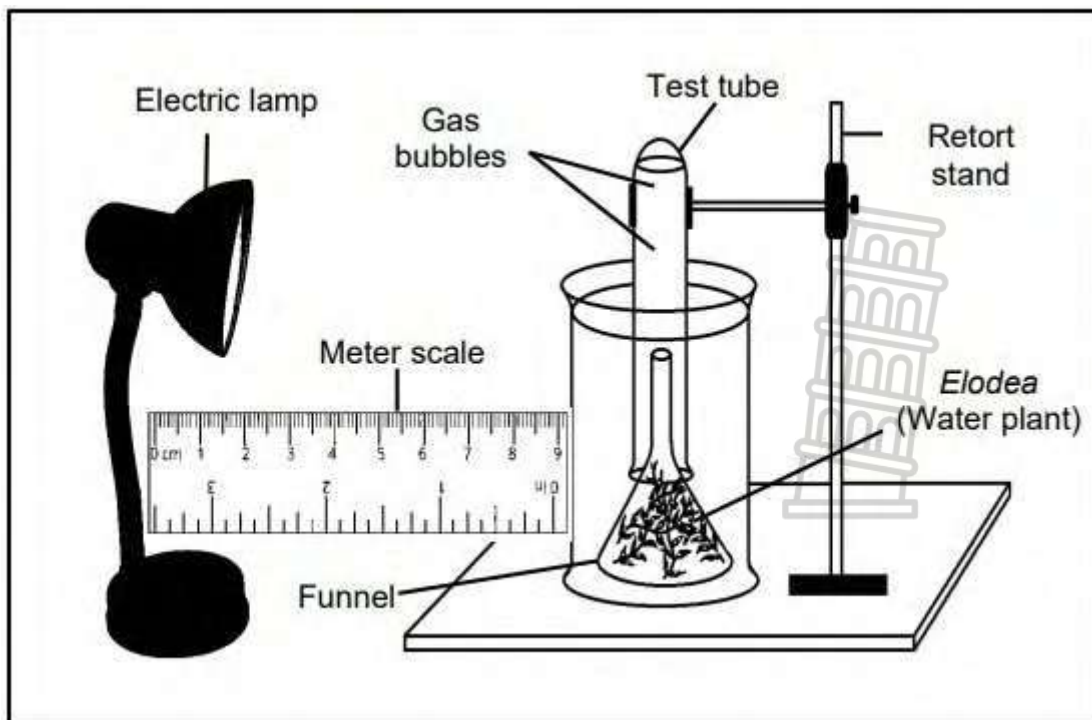
- 4.1 Name TWO limiting factors of photosynthesis that are mentioned in the passage. (2)
- 4.2 Explain why a continuous increase in carbon dioxide levels will not cause the rate of photosynthesis to increase continuously (4)
- 4.3 Explain ONE other value of greenhouses to agriculture, besides its influence on the limiting factors of photosynthesis. (2)
- (8)**

Activity 5

- 5 An experiment was conducted to determine the effect of light intensity on the rate of photosynthesis.

The procedure was as follows:

- Water plants of the Elodea species were placed under a glass funnel in a beaker containing water.
- A test tube containing water with no air bubbles was fitted over the glass funnel as shown in the diagram.
- Two pinches of bicarbonate of soda were added to the water before the start of the experiment.
- After switching off all the lights, a lighted table lamp was placed 1 metre away from the beaker.
- A meter scale was placed between the table lamp and the beaker.
- The number of air bubbles released by the plants in a 1-minute period was counted and recorded in a table.
- The above steps were repeated at different light intensities by moving the lamp to different distances.
- A test was conducted to identify the gas collected in the test tube.



- 5.1 Identify the independent variable in the experiment. (1)
- 5.2 How was the dependent variable measured in this experiment? (1)

- 5.3 Name the gas released as bubbles. (2)
- 5.4 State TWO variables that should have been kept constant during this experiment. (2)
- 5.5 Why was a pinch of bicarbonate of soda added to the beaker at the start of the experiment? (2)
- 5.6 Describe the test conducted to identify the gas mentioned in QUESTION 5.3 (2)
- 5.7 The table below shows the number of bubbles released by the Elodea plants when the light source was at different distances.

DISTANCE BETWEEN THE PONDWEED AND LIGHT SOURCE (METRES)	NUMBER OF BUBBLES GIVEN OFF IN 1 MINUTE
1,0	8
0,5	28
0,25	105
0,125	105

- (a) Calculate the percentage increase in the number of bubbles when the light source was shifted from 1,0 m to 0,5 m. Show ALL your calculations. (3)
- (b) Explain how the result obtained in this experiment is beneficial for the greenhouse farming of crops. (2)
- (17)**



Activity: 6

6 Read the extract below.



THE RELEVANCE OF PHOTOSYNTHESIS TO ALL LIVING THINGS

Photosynthesis is essential to all life on earth. It is the only biological process that can capture energy that originates in outer space (sunlight) and convert it into carbohydrates that every organism uses to power its metabolism.

The energy extracted today by the burning of coal and petroleum products represents sunlight energy captured and stored by photosynthesis almost 200 million years ago. The Earth has a concentration of carbon dioxide of approximately 0.04% in the atmosphere. However, studies on plant growth have found plants perform better in environments with 4% carbon dioxide.

- 6.1 Name the organelle in green plants that is responsible for the process above. (1)
- 6.2 Explain TWO ways in which the organelle mentioned in QUESTION 6.1 is structurally suitable for photosynthesis. (4)
- 6.3 From the extract, state:
 - (a) TWO sources of energy captured and stored by photosynthesis (2)
 - (b) The organic compound that is formed during photosynthesis. (1)
- 6.4 According to the extract “...*studies on plant growth have found plants perform better in environments with 4% carbon dioxide...*”

How many times greater is this concentration of carbon dioxide compared to earth's atmosphere? Show ALL your workings. (2)
(10)



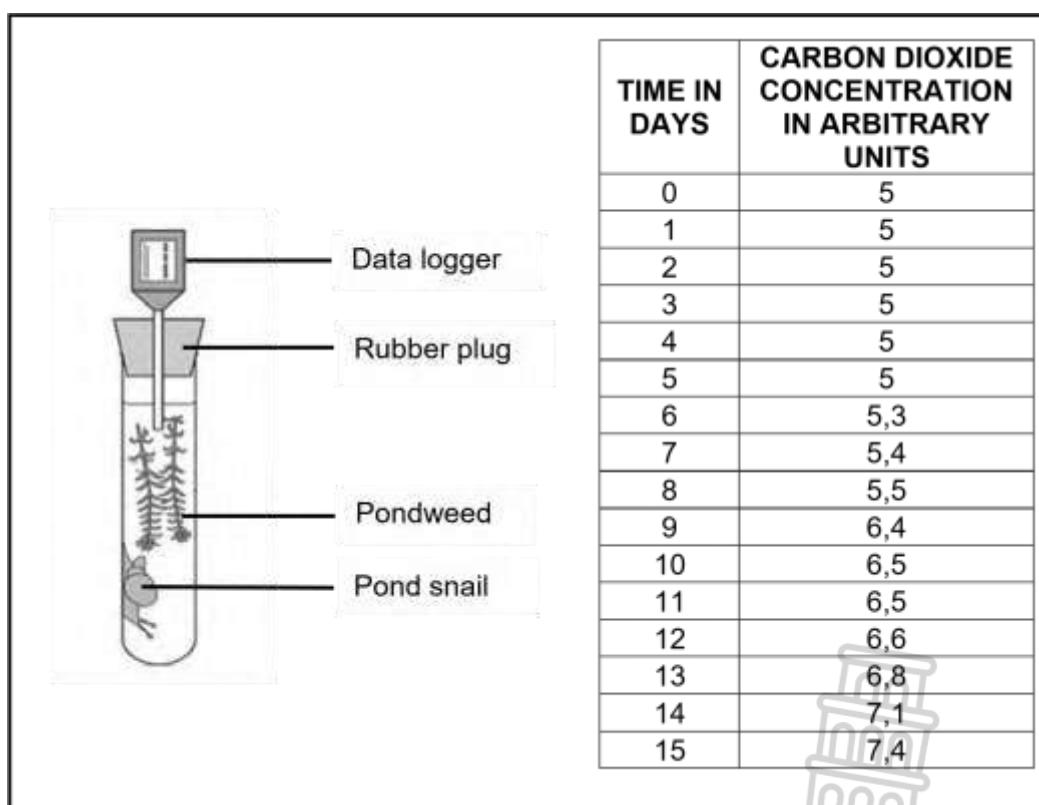
Activity 7

- 7 A scientist investigated how photosynthesis and respiration affect carbon dioxide levels in water. The experiment used pondweed (a plant) and a pond snail (an animal).

Experimental design:

- The apparatus was left in a well-lit room for 5 days.
- After 5 days, the scientist completely covered the boiling tube with black paper.
- A data logger was used to record carbon dioxide (CO_2) levels every day for 15 days.

The results are shown in the table below.



- 7.1 Identify the dependent variable of the investigation. (1)
- 7.2 State a suitable control for the investigation. (2)
- 7.3 Account for the carbon dioxide concentration between day 0 and day 5. (2)
- 7.4 Explain a reason why carbon dioxide concentration increased after day 5. (2)
- 7.5 The snail died on day 10. Explain why this happened. (2)
- 7.6 State a suitable conclusion for the investigation. (2)
- (11)**

Activity 8

- 8 An experiment was carried out to calculate the rate of photosynthesis in a group of plants at different concentrations of carbon dioxide. This was repeated at two different light intensities. The results are given below.

CO ₂ concentration (%)	Rate of photosynthesis (Arbitrary units)	
	Low light intensity	High light intensity
0.00	0	0
0.02	20	20
0.04	29	35
0.06	35	47
0.08	39	68
0.10	42	84
0.12	45	89
0.14	46	90
0.16	46	90
0.18	46	90

- 8.1 Identify the dependent factor in the above graph (1)
- 8.2 Up to what values does CO₂ concentration act as a limiting factor at high light intensities? (1)
- 8.3 Name TWO limiting factors of photosynthesis other than the ones mentioned in QUESTION 8.2 (2)
- 8.4 Draw a line graph to represent the rate of photosynthesis under various concentrations of CO₂ AT LOW LIGHT INTENSITY. (7)
- (11)**



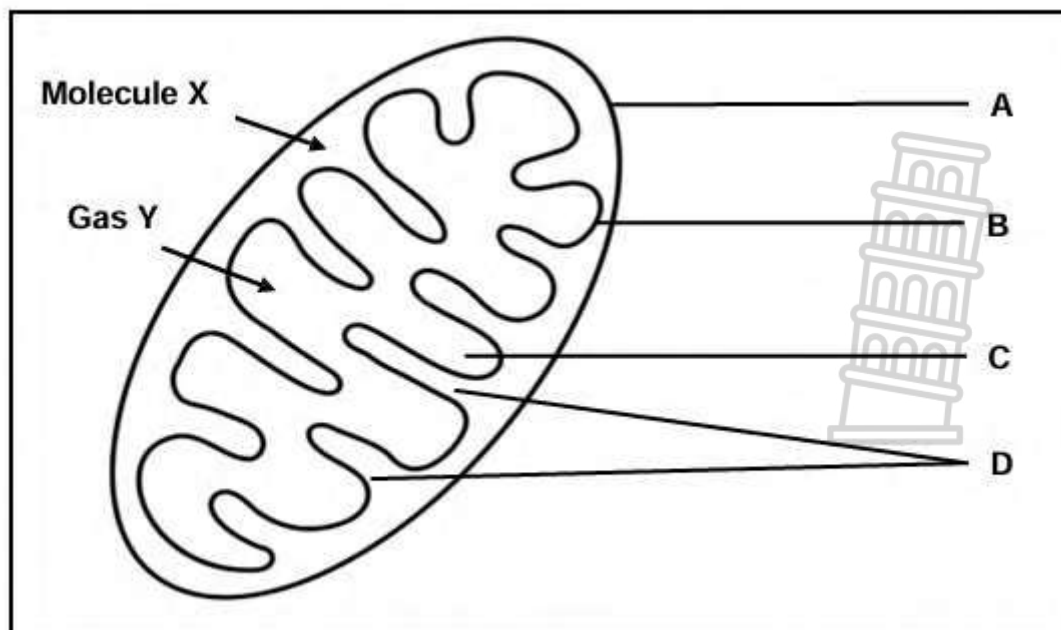
Topic: Cellular Respiration

Activity 1

No.	Description	Biological Term
1.1	The organelle in which respiration takes place	
1.2	The type of anaerobic respiration that occurs in yeast cells	
1.3	The process during which glucose is converted into pyruvic acid	
1.4	The gas which is essential for the Krebs cycle to occur	
1.5	The acid that accumulates in the muscles of humans during continuous strenuous physical activity	
1.6	General energy carrier molecule in cells	
1.7	A 6-carbon molecule that is broken down during cellular respiration to provide energy in living cells	
1.8	A micro-organism used in manufacturing beer and bread	
1.9	The phase of cellular respiration during which most ATP is formed	
1.10	The type of respiration that occurs in the presence of oxygen	
		10x1 (10)

Activity 2

2 The diagram below shows a cell organelle responsible for cellular respiration.



2.1 Identify:

(a) Part A

(1)

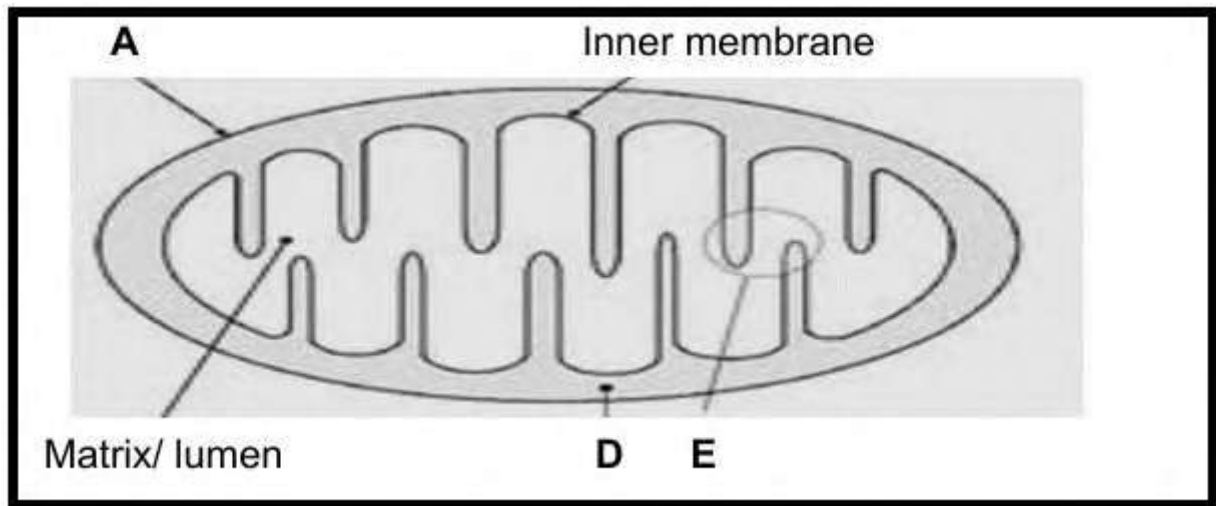
(b) Gas Y

(1)

- (c) Molecule **X** (1)
- 2.2 Give the LETTER and NAME of the part that
- (a) Contains enzymes responsible for production of energy carriers (2)
- (b) Is folded to increase the surface area for attachment of enzymes (2)
- 2.3 Name the phase of aerobic respiration that:
- (a) Occurs outside the organelle shown above. (1)
- (b) Releases energized hydrogen atoms and carbon dioxide (1)
- 2.4 Give TWO end products of aerobic respiration in muscle cells. (2)
- (11)**

Activity 3

3 The diagram below shows a mitochondrion which is responsible for cellular respiration.



- 3.1 The LETTER and NAME of part that is permeable to oxygen and pyruvic acid that are required for last two phases of cellular respiration. (2)
- 3.2 Name TWO things found in the matrix/lumen for manufacturing of enzymes that are required for the cellular respiration (2)
- 3.3 Describe the inner layer of the mitochondrion and how it is adapted to cellular respiration. (2)
- 3.4 Name the phase that occurs outside mitochondria (1)
- (7)**

Activity 4

- 4 Read the passage below.

Both aerobic and anaerobic respiration are used to supply energy during exercise. During some types of exercise, such as in sprinting the body is unable to supply enough oxygen to the muscles and lactic acid builds up in the cells. This is because the body cannot inhale enough oxygen to meet the muscles' requirements and the muscles go into 'oxygen debt'. This debt can 'repaid' breathing when the sprint ends.

In a 100m sprint, the total oxygen required by the muscles may be as much as 8 litres per minute. It is impossible for the body to deliver this amount of oxygen during the few seconds it takes to run the race. The maximum oxygen that can be taken into the body is about 4 litres per minute.

- 4.1 Write down a word equation for aerobic respiration. (2)
- 4.2 Describe how lactic acid is formed in the muscle cells. (3)
- 4.3 Explain how the 'oxygen debt' referred to in the passage is repaid. (3)
- 4.4 The runner took 12 seconds to complete the 100-m sprint.

Calculate the amount of oxygen in litres that he would need to inhale per second to prevent going into oxygen debt.

(2)
(10)

Activity 5

- 5 In cellular respiration glucose is broken down in a step-wise process to release energy as ATP.

- 5.1 Describe what happens to the glucose molecule during glycolysis (4)
 - 5.2 Tabulate TWO differences between the products of aerobic and anaerobic cellular respiration in animals cells (5)
 - 5.3 Draw and label the cell organelle in which cellular respiration occurs (4)
- (13)**

Activity 6

- 6 The table below represents the lactic acid levels in the blood of a long distance runner before, during the race that lasted for 20 minutes and after the race.

Time (minutes)	0	10	20	30	40	50	60
Concentration of lactic acid in blood (arbitrary units)	18	18	50	90	45	20	18

- 6.1 Name the type of respiration that takes place in the cells of the runner after 10 minutes into the race. (1)
- 6.2 How long did the lactic acid concentration continue to increase after the end of the race? (1)
- 6.3 Calculate the percentage decrease in lactic acid concentration between 30 and 50 minutes. (3)
- 6.4 Draw a line graph to illustrate the levels of lactic acid in the blood of the runner. (6)
- 6.5 State ONE difference between the type of respiration named in QUESTION 6.1 and the other type that occurred before the race started. (2)
- (13)**

Activity 7

- 7 During the manufacture of beer, sugars are converted to alcohol and carbon dioxide by the fermentation of yeast.
- The increase in carbon dioxide produced causes a change in pH.
- During the process of fermentation, some of the energy is lost as heat.
- The following procedure was carried out in an investigation into beer making:
- The ingredients were placed into a brew container, together with a packet of yeast.
 - The temperature of the brew, and the room, and the pH of the beer were monitored using three sensors, over a seven-day period, at intervals of 12 hours.

The results were recorded in the table below:



Time	Changes in temperature and pH		
	Temperature °C		pH
	Room	Brew	Brew
Day 1	25	24,5	8,4
	18,5	20,5	7,5
Day 2	21,5	22,0	7,2
	17,7	20	7,2
Day 3	21,0	21,5	7,0
	19,5	20,5	7,7
Day 4	20,5	21,0	6,6
	18,0	19,5	6,5
Day 5	20,7	20,8	6,6
	17,7	18,5	6,6
Day 6	20,0	20,5	6,6
	19,8	18,5	6,6
Day7	20,0	20,5	6,6
	18,0	18,5	6,6

- 7.1 Describe the relationship between the following: (2)
- (a) The brew temperature and the room temperature. (2)
- (b) The brew temperature and time (2)
- 7.2 Explain why was there a change in the pH during the investigation? (2)
- 7.3 How long did it take for the initial pH to decrease by one unit? (1)
- 7.4 Explain why the room temperature always remains below the brew temperature. (2)
- (9)**

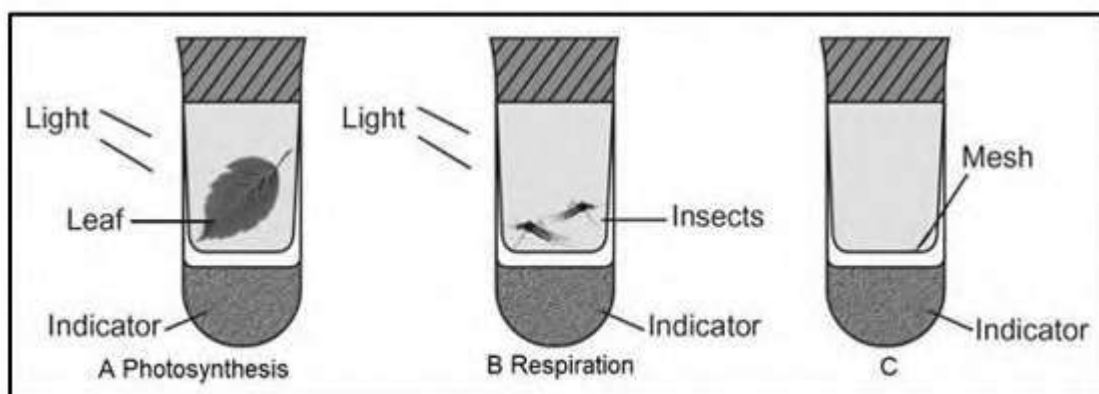


Activity 8

- 8 An investigation was conducted to determine the amount of CO_2 present in the test tubes below.
- All the test tubes were exposed to the same light.
 - An indicator was added to each test tube to test for the amount of carbon dioxide.
- The colour changes of the indicator showed the amount of carbon dioxide present.

The results are shown in the table below:

Amount of carbon dioxide	Colour change
Normal	Orange
Low	Purple
High	Yellow



- 8.1 Explain ONE reason why the test tubes were sealed tightly with a rubber stopper. (2)
- 8.2 Explain the expected difference in colour between test tube A and B. (4)
- 8.3 Tabulate THREE differences between photosynthesis and respiration. (7)

(13)

Activity 9

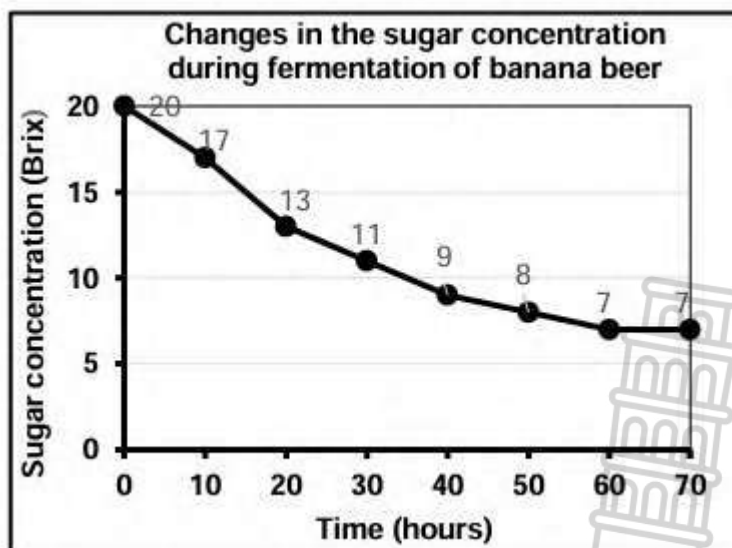
- 9 The extract below describes the microbial activities that occur during the production of banana beer.

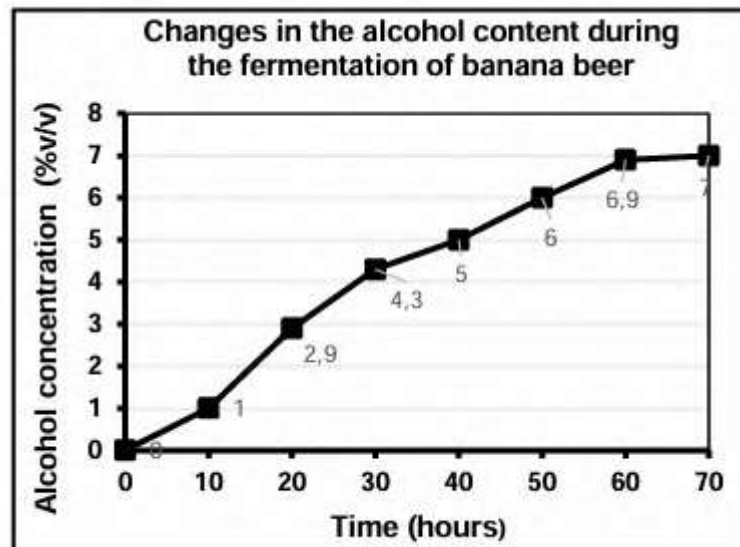
Banana beer, *urwagwa*, is one of the oldest and major alcoholic drinks traditionally made in Rwanda. The banana beer is manufactured from the fermentation of banana juice and roasted red sorghum.

When a microbial analysis was done, lactic acid bacteria and yeast were found growing together during the 70-hour fermentation period. The process involved lactic acid fermentation followed by alcoholic fermentation.

A symbiotic relationship could explain the presence of both yeast and lactic acid bacteria in the banana beer, with lactic acid bacteria creating an acid medium favourable for the multiplication of yeast. The yeast produces vitamins and increases other nutritional factors such as amino acids into the environment, for growth of lactic acid bacteria.

The graphs below show the biochemical changes that occurred during the fermentation process.





- 9.1 From the graph, indicate the:
- Initial sugar level of banana juice (1)
 - Final alcohol content of the banana beer (1)
- 9.2 Name ONE by-product, other than alcohol, formed during the fermentation process. (1)
- 9.3 Describe the symbiotic relationship between lactic acid bacteria and yeast during the fermentation process (4)
- 9.4 Calculate the percentage decrease in sugar concentration from the 10th hour to the 70th hour. Show ALL your working. (3)
- 9.5 From the graph, determine the completion of fermentation? (1)
- 9.6 Explain why the sugar level decreased with fermentation time. (3)
- (14)**

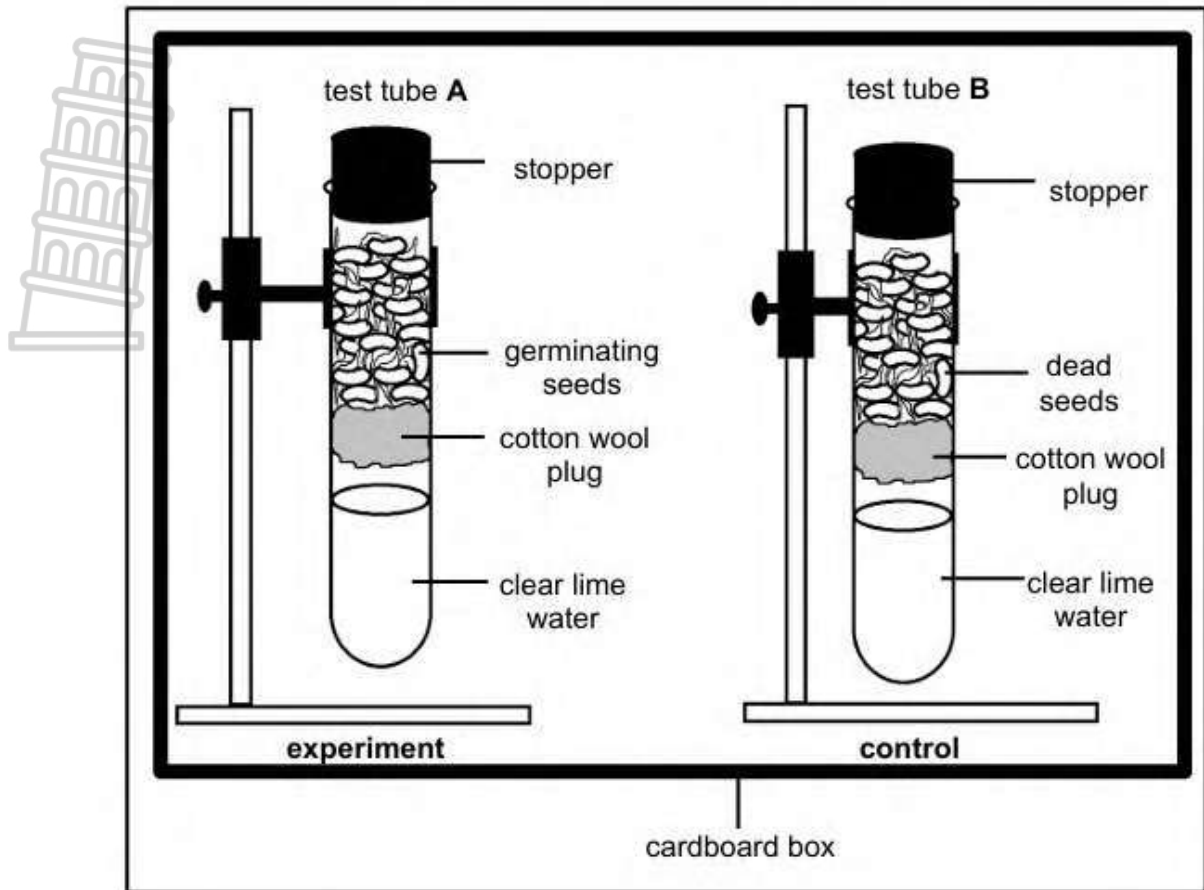
Activity 10

- 10 An investigation was conducted to determine which gas was released during cellular respiration.

The procedure was as follows:

- 120 seeds of the same species were germinated
- 60 of them were separated and placed in boiling water for 30 minutes
- The other germinating seeds were placed in test tube A, while the seeds from the hot water were placed in test tube B after cooling
- Both sets of apparatus were rinsed with formalin to remove any micro-organisms which might have been present
- Both sets of apparatus were set up as shown in the diagram below:





- 10.1 Name the gas released during cellular respiration. (1)
- 10.2 How was the test for the gas mentioned in QUESTION 10.1 carried out? (1)
- 10.3 Why were germinating seeds used in the experiment? (2)
- 10.4 Explain why the result was different in the control part as compared to the experiment (2)
- 10.5 Why was a cotton wool plug used as a barrier instead of using a rubber block? (2)
- 10.6 The size of the seeds and the rate of metabolism in the seeds vary and, therefore, the result obtained in this experiment may not be reliable.
- How would you improve the reliability of this experiment? (1)
- 10.7 Give a reason for keeping both sets of apparatus in a cardboard box (1)
- 10.8 Which TWO environmental factors must be kept constant during this experiment? (2)
- (12)

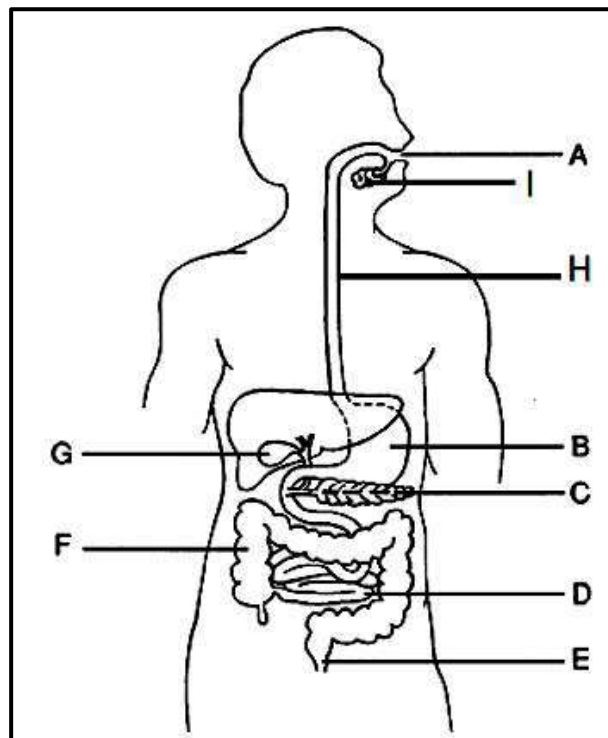
Topic: Animal Nutrition

Activity 1

No.	Description	Biological Term
1.1	The round ball of food pushed down the oesophagus during swallowing.	
1.2	An automatic wave of muscle contraction and relaxation that moves food in one direction through the digestive tract.	
1.3	A protein that acts as a catalyst to regulate or speed up most biochemical reactions in living cells	
1.4	Specialized cells in the pancreas that secrete insulin and glucagon	
1.5	The ability of an organism to maintain a constant internal environment within narrow limits regardless of the changes in the internal or external environment	
1.6	A disorder characterised by high glucose levels resulting in increased fatigue, dehydration and lack of energy	
1.7	The physical and chemical breakdown of food into its simplest form	
1.8	Ductless glands which secrete their secretions directly into the bloodstream	
1.9	Tiny finger-like projections lining the wall of the small intestine and increasing the surface area for food absorption	
1.10	The group of animals that feed on both plant and animal matter	
1.11	The removal of undigested food from the body	
1.12	A process in nutrition whereby absorbed nutrients are taken up by the cells	
1.13	The process whereby the products of digestion are diffuse into the bloodstream	
1.14	The part of the soft palate which closes the opening to the nasal cavity when swallowing	
1.15	The arrangement, type, and number of the teeth in an organism's mouth	
1.16	A fluid produced by the liver and stored in the gall bladder that aids the digestion of lipids in the small intestine	
		16x1 (16)

Activity 2

- 2 The diagram below shows a human digestive system.

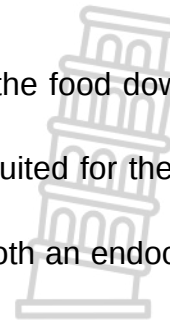


2.1 Identify parts:

- | | |
|--------------|-----|
| (a) B | (1) |
| (b) E | (1) |
| (c) F | (1) |
| (d) G | (1) |
| (e) I | (1) |

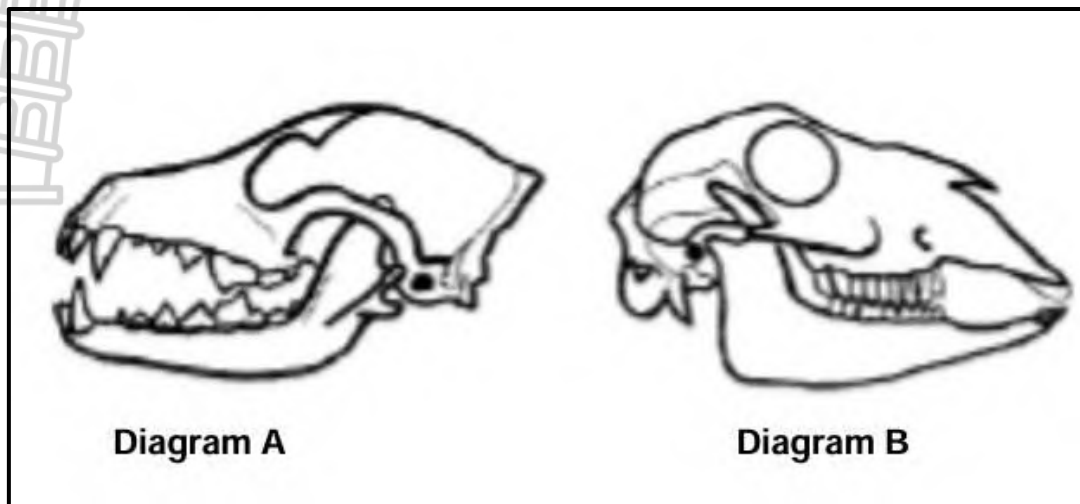
2.2 Give the LETTER and the NAME of the part:

- | | |
|---|-----|
| (a) that secretes insulin and glucagon | (2) |
| (b) where physical digestion takes place | (2) |
| (c) that contracts and relaxes involuntarily pushing the food down to the stomach | (2) |

2.3 Explain ways in which part labelled **D** is structurally suited for the efficient absorption of digested nutrients (4)2.4 Explain why can the part labelled **C** be regarded as both an endocrine and an exocrine gland (2)2.5 Describe the role of part labelled **G** in digestion (2)**(19)**

Activity 3

3 The diagrams below show represents skulls of animals



3.1 Identify a skull that belongs to a carnivore (1)

3.2 Give TWO visible reasons for your answer in QUESTION 3.1 (2)

3.3 The dental formula below belongs to a sheep

$$\frac{0.0.3.3}{4.0.3.3}$$

$$4.0.3.3$$

(a) State the NAME and the TOTAL NUMBER of the teeth found only at the lower jaw (2)

(b) How many teeth does the sheep have all together? (1)

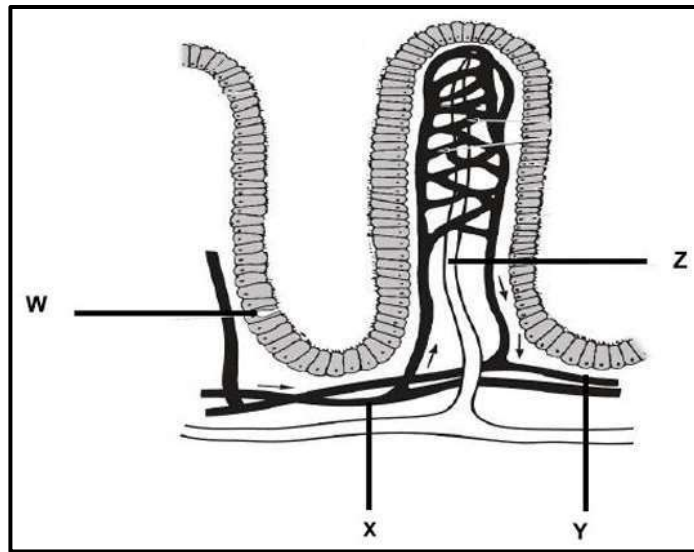
(c) With reference to the above dental formula, explain why the sheep is not adapted to consume meat (2)

(8)



Activity 4

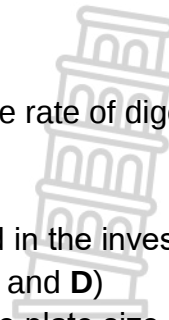
- 4 The diagram below represents a structure associated with the human digestive system.



- 4.1 Identify the structure shown in the diagram above (1)
 4.2 Give the name of the organ in which this structure is found (1)
 4.3 Identify parts:
 (a) **W** (1)
 (b) **Z** (1)
 4.4 Explain ONE way in which cell **W** is adapted for its function. (2)
 4.5 Explain ONE difference in the nutrient content of vessel **Y** as compared to vessel **X**. (2)
 4.6 Describe TWO ways in which the structure represented in the diagram is adapted to increase the amount of nutrients that are absorbed. (4)
(12)

Activity 5

- 5 A scientific investigation was conducted to determine the rate of digestion of different food types.
 The procedure was as follows:
- 48 teenage boys with no health conditions participated in the investigation
 - The boys were divided into four equal groups (**A, B, C** and **D**)
 - All boys fasted for 8hrs after which all were given same plate size of foods
 - Group **A** was given rice
 - Group **B** was given beef
 - Group **C** was given cheese
 - Group **D** was given fruits
 - Each boy drank 500ml of water after their meals
 - All the boys engaged in no physical activities after the meals.
 - Bowel transit time of each group was measured



- Average bowel transit time was calculated in each group

The table below shows the results of the investigation

FOOD TYPE	AVERAGE BOWELTRANSIT TIME (minutes)
Rice	92
Beef	196
Cheese	270
Fruits	28

- 5.1 State: (1)
- (a) the dependent variable (1)
- (b) how the dependent variable was measured (1)
- 5.2 Explain why all the boys fasted for 8 hours before being given food (2)
- 5.3 State THREE factors that were kept constant for this investigation. (3)
- 5.4 Apart from the sample size, give ONE other way in which the reliability of the results were ensured for this investigation. (1)
- 5.5 Calculate, how many times the rate of digestion of beef is higher than the food with the least digestion time? Show ALL working. (3)
- 5.6 Explain the consequences if the boys were allowed to engage in physical activities after the meals. (2)
- 5.7 State a conclusion for this investigation. (2)
- (15)**

Activity 6

- 6 The table below shows the nutritional information on a 360g breakfast cereal packet bought at a local supermarket.

Nutrients and energy	Average values per 30g of cereal only	Average values per 30g of cereal with 100 ml of skim milk
Energy (kJ)	430	572
Protein (g)	4,8	9,2
Carbohydrates (g)	23, 0	28,0
Dietary fibre (g)	4.2	4.2
Fat (g)	1,8	2,4
Sodium (mg)	110	260
Cholesterol (mg)	0	1,8

- 6.1 Using the information from the table, discuss the effect of adding 100 ml skim milk to 30g of cereal on its nutritional value. (2)
- 6.2 Calculate the amount of energy (kJ) that is provided by 100 ml of skim milk. Show all your working. (2)
- 6.3 State TWO ways in which the dietary fibre/roughage contained in the cereal is important. (2)
- 6.4 Draw a bar graph using data in the table to compare the average values of protein, carbohydrates and fat found in 30g of cereal only and in 30g of cereal with 100 ml of skim milk. Plot both data-sets on the same set of axes. (6)
- (12)**

Activity 7

- 7 The table below shows the details of a meal eaten by a Grade 11 learner.

Food eaten	Carbohydrate (g)	Protein (g)	Fats (g)	Vit C (g)	Iron (g)
Sausage	5	9	24	0	1
Fried potato chips	70	8	20	20	2
Beans	20	10	1	4	3
Fruit pie	60	2	25	1	1
Ice cream	20	0	12	0	0

- 7.1 Which food has the least overall nutritional value? (1)
- 7.2 Name TWO foods from the table that provide the most energy for the Grade 11 learner (2)
- 7.3 The total energy value for this meal is 5000 kJ. In one day, this learner requires a total of 15 000 kJ energy. Calculate the percentage of daily energy needed that this meal provides. Show all calculations. (3)
- 7.4 Explain what would happen if this learner regularly ate more than 15 000 kJ per day (2)
- 7.5 Draw a pie chart showing the proportion of carbohydrates from each of the food types in the meal eaten by the Grade 11 learner. (6)
- (14)**

Activity 8

- 8 Read the following extract and answer the questions that follow.

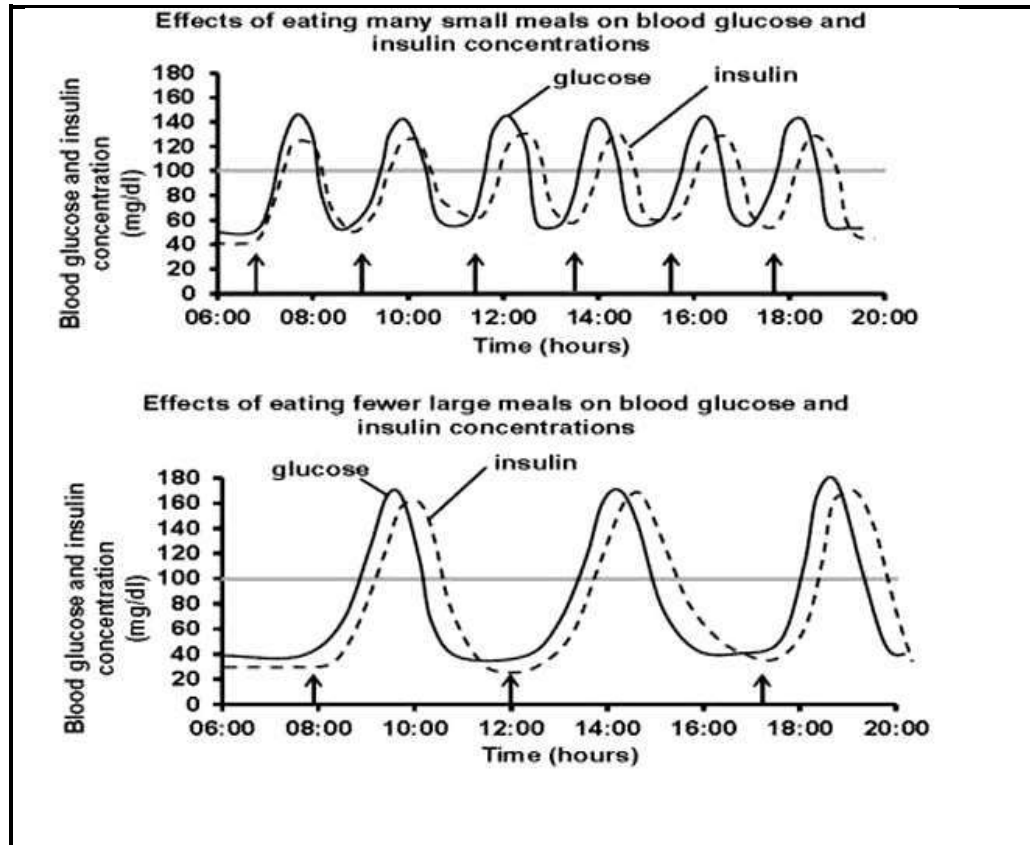
Insulin is a hormone that allows cells to absorb and use glucose. It regulates the amount of glucose that circulates in the blood stream. It also instructs the liver to store excess glucose. In people with insulin resistance, the cells are unable to use insulin effectively. When the cells cannot absorb glucose, levels of glucose build up in the blood. Therefore, the pancreas makes extra insulin to overcome the low rate of glucose absorption and diabetes is less likely to develop. This means that the blood glucose levels will stay within the healthy range. Over time, the pancreas's ability to release insulin begins to decrease which leads to the development of type 2 diabetes.

- 8.1 Name the gland that secretes insulin. (1)
 8.2 Give a reason why glucose is required in the cells (1)
 8.3 Describe how insulin resistance leads to type 2 diabetes. (4)
 8.4 Explain how normal glucose levels are maintained when a healthy non diabetic person consumes food containing a high percentage of glucose. (4)
(10)



Activity 9

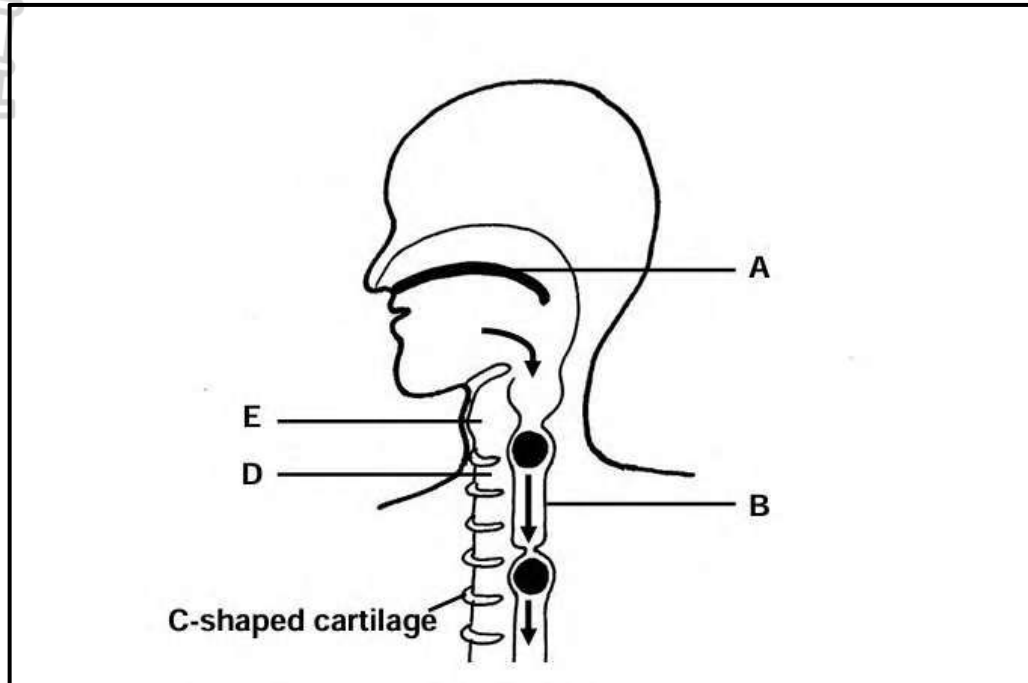
- 9 The graphs below show the effects of eating many small meals and eating fewer large meals on blood glucose and insulin concentrations in a normal person. The arrows on the graphs below indicate when meals were eaten. The normal blood glucose concentration is 100 mg/dl.



- 9.1 State what happens to the blood glucose concentration immediately after a meal is eaten. (1)
- 9.2 State the normal blood glucose level as shown by the graph above. (1)
- 9.3 Tabulate TWO ways in which eating fewer large meals and eating many small meals affect the blood insulin levels differently, using the information from the table. (5)
- 9.4 Explain why eating many small meals per day is better for a diabetic person than eating fewer large meals a day. (4)
- (11)**

Activity 10

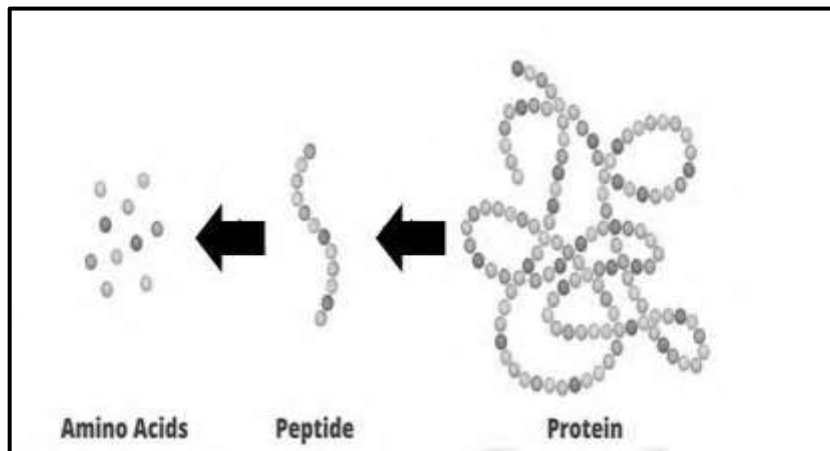
- 10 The diagram below represents the upper parts of the digestive and gaseous exchange systems.



- 10.1 Identify the:
- (a) Part that separates the nasal cavity from the mouth cavity (1)
 - (b) Process that facilitates the movement of food through part **B** (1)
 - (c) TWO muscles that are involved in the process mentioned in QUESTION 10.1 (b) (2)
- 10.2 Explain why food normally flows into part **B** instead of part **D** (2)
- 10.3 State how the C-shaped cartilage rings on part **D** provide a functional advantage of part **B** (2)
- 10.4 Explain the possible consequence of bacterial infection at part **E** (2)
- 10.5 Explain why an obstruction/blockage in part **D** for more than 20 minutes may lead to death (4)
- (14)**

Activity 11

- 11 The diagram below shows one of the five phases of human nutrition.



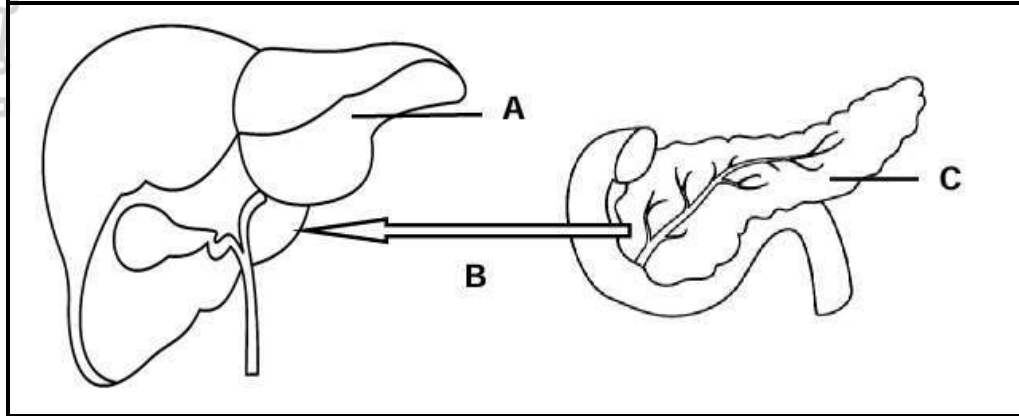
- 11.1 Based on the diagram above, name the phase of human nutrition shown. Also, name the enzyme responsible for breaking down proteins during this phase. (2)
- 11.2 Where in the human body will the enzyme mentioned in QUESTION 11.1 be produced? (1)
- 11.3 During which phase of human nutrition will proteins be formed in the human body? (1)
- 11.4 Identify and discuss the final phase of human nutrition. Mention the structure(s) involved and their biological importance. (3)
- 11.5 Bread is masticated in the human mouth.



- (a) Explain the importance of mastication in human nutrition. (2)
- (b) Explain why bread tastes sweeter after a short period of time in the mouth. (2)
- (11)**

Activity 12

- 12 The diagram below represents parts of digestive system which regulates high glucose level in blood.



12.1 Identify each of the following:

- (a) Organ **A** (1)
- (b) Gland **C** (1)
- (c) Hormone **B** (1)

12.2 Name the disorder which can be caused by the insufficient release of hormone **B**. (1)

12.3 State why Gland **C** is regarded as an endocrine gland. (3)

12.4 Give TWO functions of organ A in maintaining the glucose level in the blood. (2)

(9)

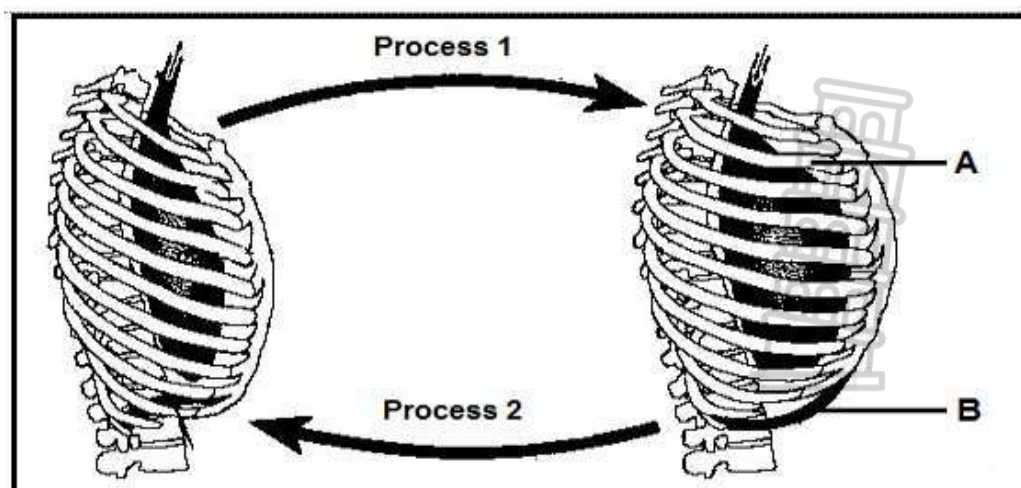
Topic: Gaseous Exchange

Activity 1

No.	Description	Biological Term
1.1	Process of taking air into and expelling it from the lungs	
1.2	The control centre that is activated when carbon dioxide levels increase in the blood	
1.3	The maximum number of individual an environment can support in a specific season.	
1.4	The tissue lining the inner walls of an alveolus	
1.5	Double membrane surrounding the lungs	
1.6	Type of tissue that lines the nasal passages	
1.7	The cartilaginous leaf-shaped structure which covers the opening of the trachea	
1.8	The tissue making up the rings that surround the trachea	
1.9	The part of brain that controls the breathing rate	
1.10	The structure of respiratory system that contracts and flattens altering the volume of the chest cavity and is important in the breathing.	
		10x1 (10)

Activity 2

- 2 The diagram below shows a mechanical process of air moving in and out of the lungs in humans.



- 2.1 Identify: (2)
- (a) Process 1 (1)
- (b) Process 2 (1)
- (c) Part B (1)

2.2 State the changes in structure labelled **A** during:

(a) Process 1

(1)

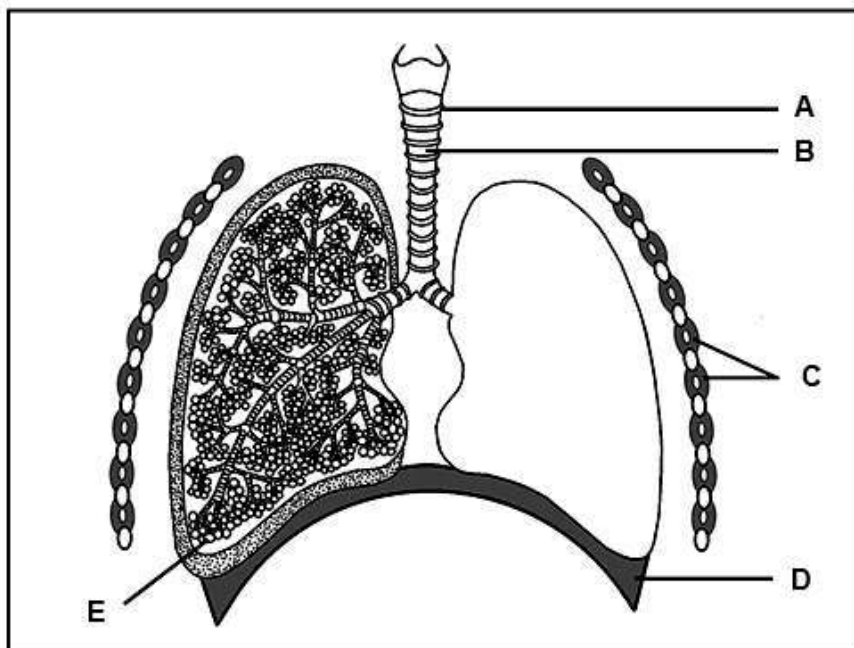
(b) Process 2

(1)

(5)

Activity 3

3 The diagram below shows the human lungs



3.1 Identify part:

(a) B

(1)

(b) E

(1)

3.2 Describe the role of part **C** and **D** during exhalation

(4)

3.3 Bronchoalveolar Carcinoma is a rare form of lung cancer that originates and damages the cells lining part **E**.

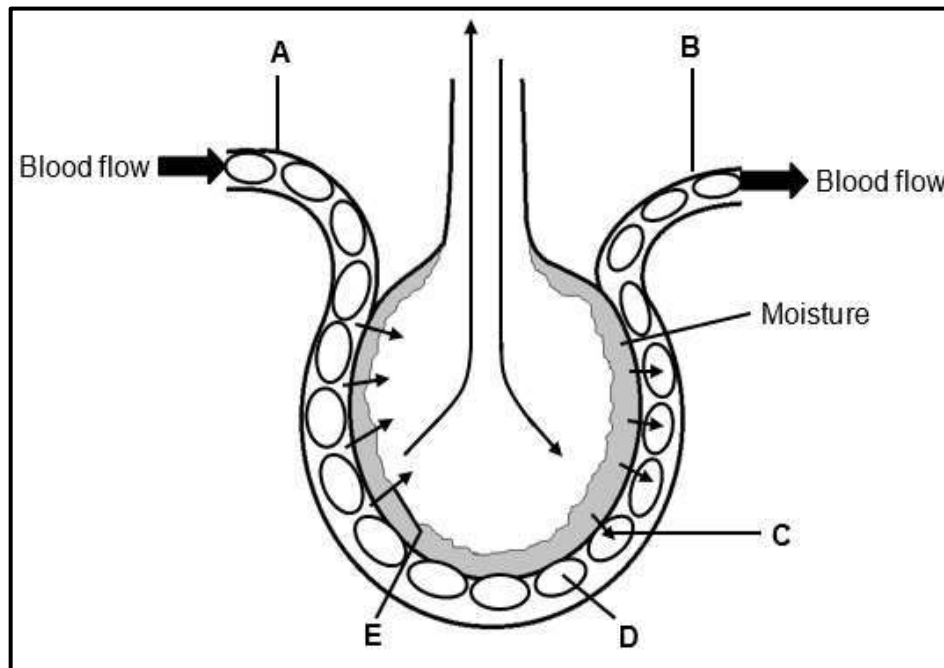
Explain how this disease may result in death if it is not detected earlier.

(3)

(9)

Activity 4

- 4 The diagram below represents the structure of an alveolus.



- 4.1 Identify the:

- (a) Gas represented by **C**
(b) Process at **E**

(1)
(1)

- 4.2 Give the LETTER and NAME of the part that:

- (a) Transports deoxygenated blood
(b) Contains haemoglobin
(c) Connected to pulmonary vein

(2)
(2)
(2)

- 4.3 Name the tissue that lines the:

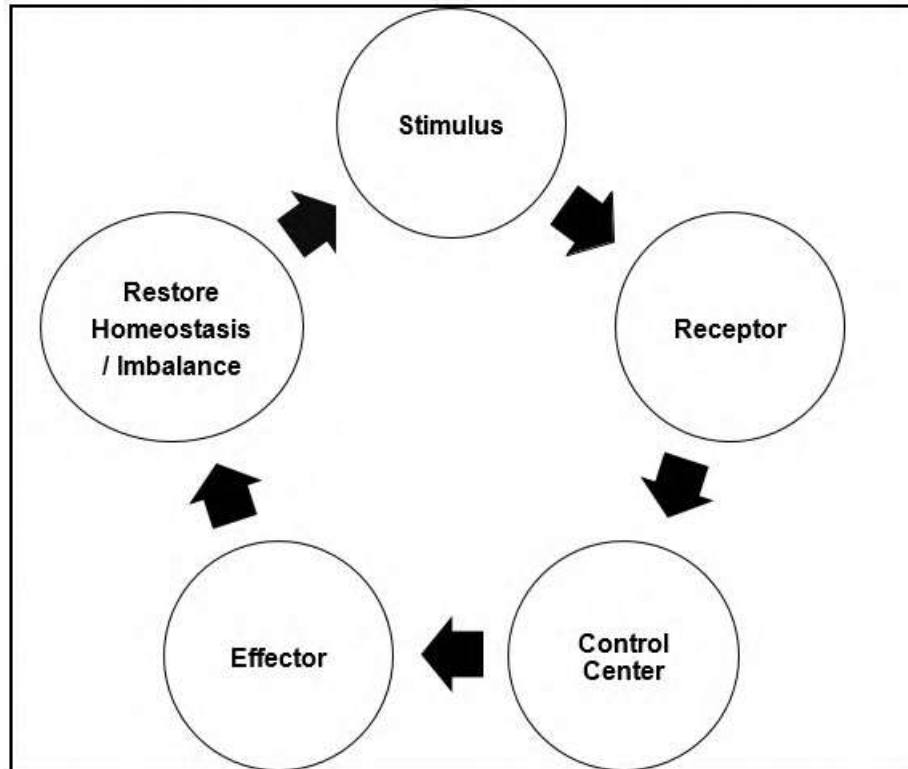
- (a) Alveolus
(b) Blood capillary

(1)
(1)

(10)

Activity 5

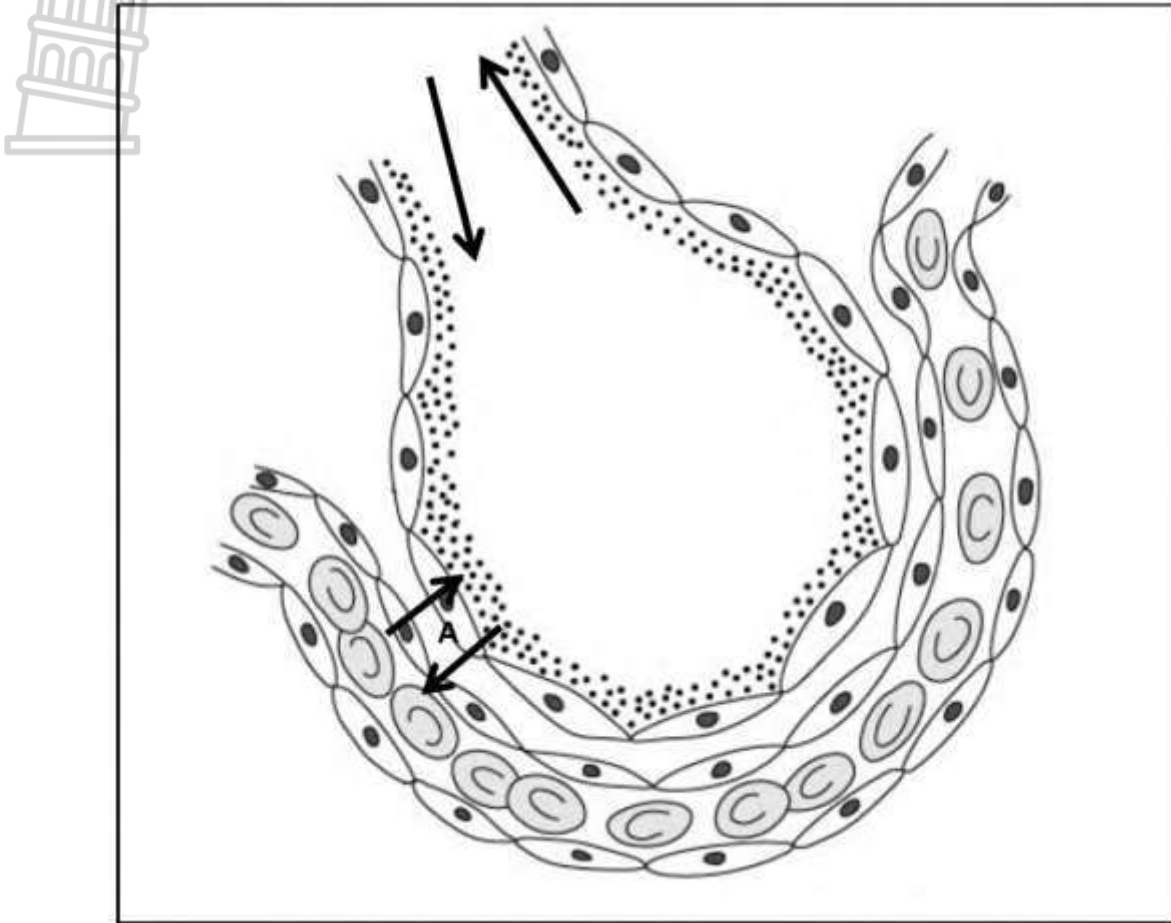
- 5 Negative feedback mechanisms are essential processes which ensure homeostasis. A simple negative feedback loop with its components is shown below.



- 5.1 Define the term homeostasis (2)
- 5.2 Carbon dioxide regulation is an important example of a negative feedback mechanism. When the level of carbon dioxide in the human body becomes too high which part of the body acts as the:
- (a) Receptor (1)
- (b) Effectors (2)
- 5.3 Give TWO reasons why it is important for carbon dioxide levels in the blood not to remain high. (2)
- (7)

Activity 6

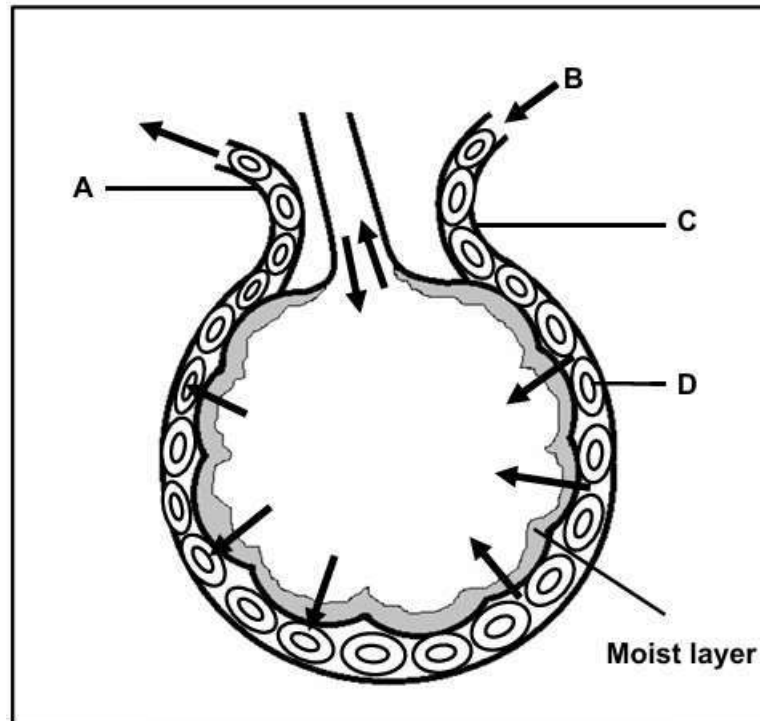
- 6 The diagram below shows an alveolus, a small, hollow, air-filled sac located in the lungs.



- 6.1 Identify the type of movement represented by **A**. (1)
6.2 Identify and describe TWO visible features of the alveolus that make it an effective gaseous exchange surface. (4)
6.3 List TWO ways in which oxygen is transported in the body. (2)
6.4 Describe how a bullet wound to the chest could affect effective ventilation of the lungs. (5)
(12)

Activity 7

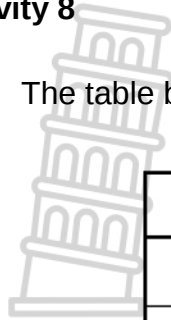
- 7 The diagram below represents an alveolus.



- 7.1 Identify the gas which is at high concentration in blood vessel B. (1)
 - 7.2 State TWO ways in which this gas in **B** is transported in the blood. (2)
 - 7.3 Which large blood vessel receives blood from **A**? (1)
 - 7.4 Give an observable reason for your answer to QUESTION 7.3 (1)
 - 7.5 Explain TWO ways in which the blood cell labelled **D** is structurally suited for its function. (4)
 - 7.6 Explain why it is not advisable to sleep in an unventilated room where a heater is switched on. (3)
- (12)**

Activity 8

- 8 The table below shows the composition of inhaled air and exhaled air.

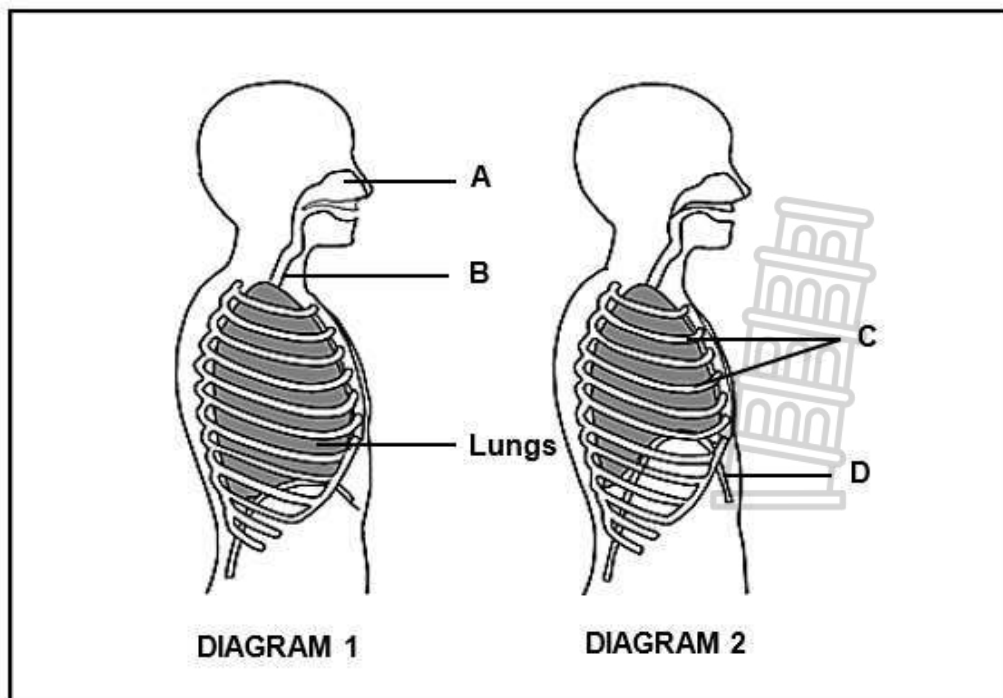


GAS	INHALED AIR	EXHALED AIR
Oxygen	21%	16%
Carbon dioxide	0,04%	4%
Nitrogen	78%	78%

- 8.1 Give ONE reason why the oxygen concentration of exhaled air is lower than the inhaled air. (1)
- 8.2 Calculate the difference between the carbon dioxide concentration of exhaled air and inhaled air. Show ALL workings. (2)
- 8.3 Describe the homeostatic control of carbon dioxide when it is high in the blood. (5)
- (8)**

Activity 9

- 9 The diagrams below represent the process of breathing in humans.



- 9.1 Name the breathing muscles:
(a) Represented by **D** (1)

- (b) Found between C (1)
- 9.2 Which diagram (1 or 2) shows exhalation? (1)
- 9.3 State TWO observable features to support your answer in QUESTION 9.2 (2)
- 9.4 Identify the LETTERS representing the air pathway where coronaviruses would settle and multiply, before gaining entry into the lungs. (2)
- 9.5 If the coronavirus infects the thin inner lining of the alveoli, large amounts of mucus and fluid are secreted as a reaction. This substantially lowers the efficiency of gaseous exchange. This condition is known as pneumonia.
- (a) Explain why there is a substantial increase in breathing rate and heart rate amongst the patients who suffer from pneumonia. (4)
- (b) A ventilator is a machine that actively pumps highly concentrated oxygen directly into the lungs of the patient through an attached tube inserted into the part labelled B.

Explain why the patients require a ventilator to maintain life (4)
(15)

Activity 10

- 10 Wearing a face mask is recommended to reduce the spread of the corona virus. There are some concerns about the efficiency of breathing when wearing a face mask.

Scientists investigated the effect of wearing face masks on the carbon dioxide levels in blood.

They:

- Obtained permission from 150 healthy volunteers, aged 30, to participate in the investigation
- Applied a sensor to the participants' skin to measure the carbon dioxide levels in the blood
- Asked the participants to:
 - Sit still for 10 minutes without wearing a face mask
 - Sit still for 10 minutes while wearing a face mask
 - Exercise for 10 minutes without wearing a face mask
 - Exercise for 10 minutes while wearing a face mask
- Allowed a 15-minute interval between each 10-minute phase
- Recorded the carbon dioxide levels at the end of each 10-minute phase
- Ensured that the face mask covered the nose and mouth

- 10.1 Identify the:
- (a) Independent variable (1)
- (b) Dependent variable (1)
- 10.2 Give ONE reason why the results at the end of this investigation may be considered reliable. (1)

- 10.3 Give a reason why the carbon dioxide levels were measured while participants were sitting still. (1)
- 10.4 Describe the homeostatic control of carbon dioxide when it is high in blood. (5)
- (9)

Activity 11

- 11 Grade 11 learners carried out an investigation to determine the effect of physical activity on the heart rate and breathing rate of humans.

The procedure for the investigation was as follows:

- They chose five learners of the same age to participate in their investigation
- They measured the heart rate and breathing rate of each learner before the physical activity
- The learners each walked a distance of 5km and also ran a distance of 5km
- They measured the heart rate and breathing rate of each learner after walking and running.

The table below shows the result of their investigations.

Physical activity	Average heart rate (beats per minutes)	Average breathing rate (breaths per minutes)
Rest	71	12
Walking	88	13
Running	120	17

- 11.1 Identify the independent variable in the investigation. (1)
- 11.2 State TWO planning steps the learners considered for this investigation. (2)
- 11.3 State ONE way in which the learners ensured validity of their investigations (1)
- 11.4 State the effect of running on the breathing rate, using the results in the table above. (1)
- 11.5 Explain your answer in QUESTION 11.4. (2)
- 11.6 Calculate the difference in the learner's heart rate between rest and running. (2)
- 11.7 State the conclusion that can be drawn from the results of the investigation. (2)
- (11)

Activity 12

- 12 The table below shows the result of an investigation showing the smoking habits of men aged 40-70 and the number that die from lung cancer.

Smoking habits of men	Number of deaths per 100 000
Non-smokers	10
Cigars only	20
Pipes only	22
Mixed	85
Cigarette smoking	110
TOTAL	247

- 12.1 Represent the information in the above table as a histogram graph. (6)
(6)



Topic: Excretion

Activity 1

No.	Description	Biological Term
1.1	Part that stores urine temporarily.	
1.2	Blood vessel that transport blood containing metabolic waste products directly into the kidney.	
1.3	The removal of metabolic waste products from living organisms.	
1.4	The structural and functional unit of the human kidney	
1.5	A network of capillary blood vessels inside Bowman's capsule.	
1.6	Tube that transports urine from the bladder to outside	
1.7	Blood vessel that carries purified deoxygenated blood away from the kidney.	
1.8	The control of water content and salt balances in the blood and tissue fluid.	
1.9	The hormone secreted by the adrenal gland to regulate the salt concentration of the blood.	
1.10	The hormone secreted by the pituitary gland to regulate water levels in the blood.	
1.11	The functional and structural unit of the human kidney	
1.12	The control of water content and salt balances in the blood and tissue fluid	
1.13	Specialised cells with filtration slits found lining Bowman's capsule.	
1.14	A network of capillary blood vessels inside Bowman's capsule.	
1.15	Tube that transports urine from the bladder to outside the body.	
1.16	The blood vessel that carries oxygenated blood filled with waste to the kidney.	
1.17	Tube that transports metabolic waste from the kidney to the bladder.	
1.18	Glands that secrete hormones	
1.19	Control centre for water in the blood	
1.20	Control centre for salt	
		10x1 (20)

Activity 2

- 2 Read the extract below

Hypernatremia is the medical term used to describe having too much sodium in the blood. Sodium is an important nutrient for proper functioning of the body.

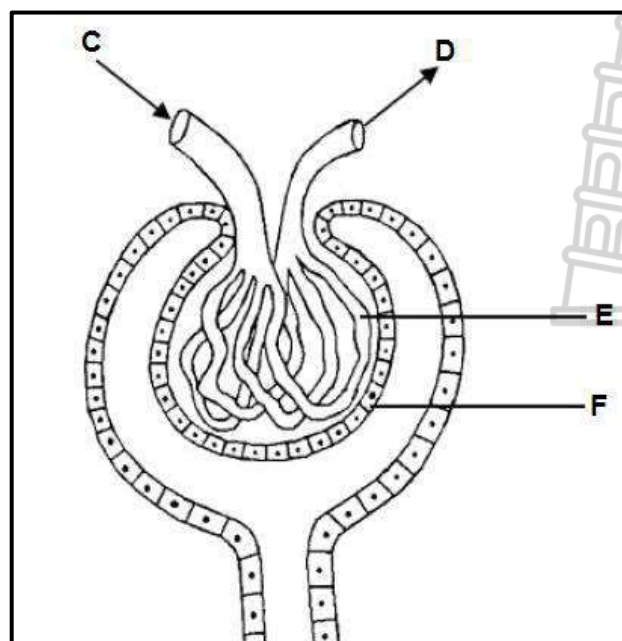
Most of the body's sodium is found in the blood.

Hypernatremia can occur when there is too much water loss or too much sodium gain in the body. The result is too little body water for the amount of total body sodium.

- 2.1 What is hypernatremia? (1)
2.2 According to the extract, state TWO possible reasons for hypernatremia. (2)
2.3 Explain why sodium ions are actively pumped out at certain regions of the loop of Henle into the medulla region of the kidney. (3)
2.4 Describe how constant sodium concentration in the blood of a healthy human is maintained, when the level of sodium is decreased below the normal level. (4)
2.5 Explain why the levels of antidiuretic hormone (ADH) remains high in a patient who is severely dehydrated with diarrhoea and vomiting. (2)
(12)

Activity 3

- 3 The diagram below shows part of a human nephron.



3.1 Identify:

(a) Part of the nephron shown in the diagram. (1)

(b) Part labelled F. (1)

3.2 Name the process that takes place in part E. (1)

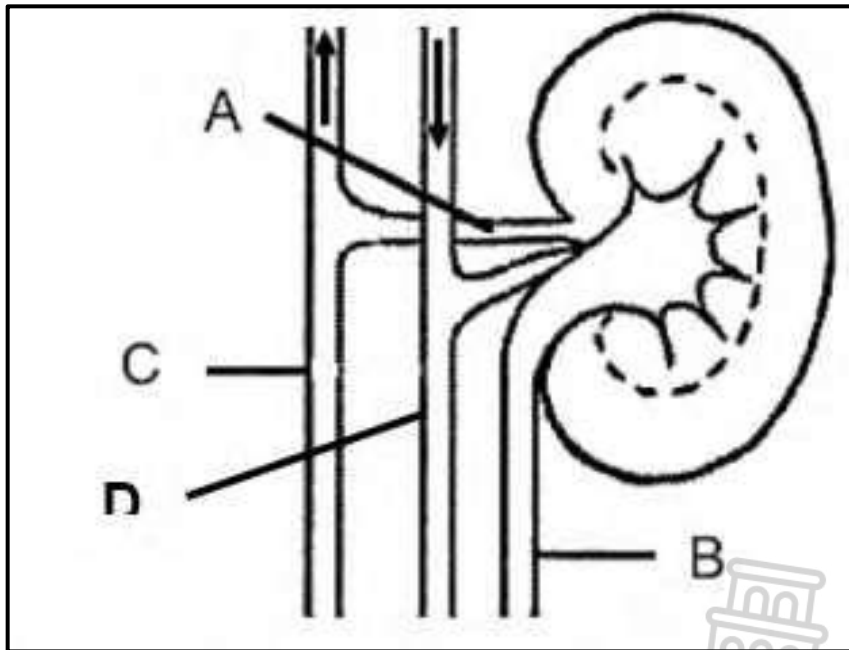
3.3 Give the LETTER and NAME of the part that contains single layer of endothelial cells that assists in the process named in QUESTION 3.2. (2)

3.4 Explain the significance of part C being wider than D. (2)

(7)

Activity 4

- 4 The accompanying diagram shows part of the excretory system of the human body. Study the diagram and the table below before answering the questions that follow.



4.1 Give only the LETTER of the part that:

(a) Transport metabolic waste to the bladder. (1)

(b) Has a higher concentration of urea in the blood. (1)

(c) Has a lower concentration of urea in the blood. (1)



The table below shows the composition of fluid in Structure A and Structure B of the diagram.

	Structure A	Structure B
Component	Concentration (%)	Concentration (%)
Urea	3	200
Glucose	10	0
Amino acids	5	0
salts	72	150
Proteins	800	0

- 4.2 By comparing the contents of structures A and B, what conclusion can be drawn regarding the functions of the kidney? (2)
- 4.3 Would you consider that the person with the medical report shown above suffers from diabetes mellitus? Explain your answer. (2)
- 4.4 Which organic substances in the table are considered to be useful? Give a reason for your answer. (2)
- (9)**

Activity 5

- 5 A group of Grade 11 learners conducted an investigation to compare the amount of substances filtered into Bowman's capsule and present in a day's urine output. The table below shows the results:

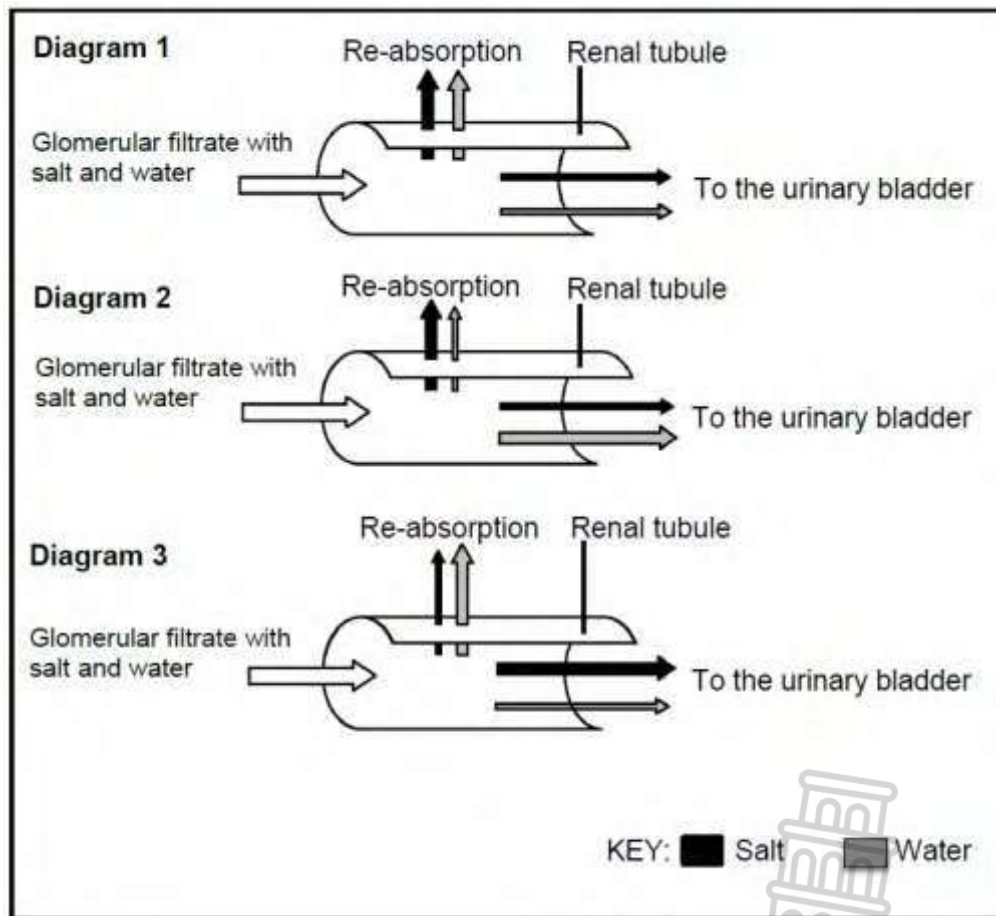
Substance	Filtrate	urine
Water	180 litres	1,5 litres
Salts	500 g	15 g
Glucose	200g	0 g
Urea	40 g	42 g

- 5.1 Explain why the urea concentration is higher in the urine than in the filtrate. (2)
- 5.2 Calculate the percentage of filtered salts which are reabsorbed. Show calculations. (3)

- 5.3 Give ONE reason for the presence of 200 g glucose in the filtrate and none in the urine. (1)
- 5.4 Name and describe the role played by the hormone secreted when the level of water in the blood drops below normal. (2)
- (8)**

Activity 6

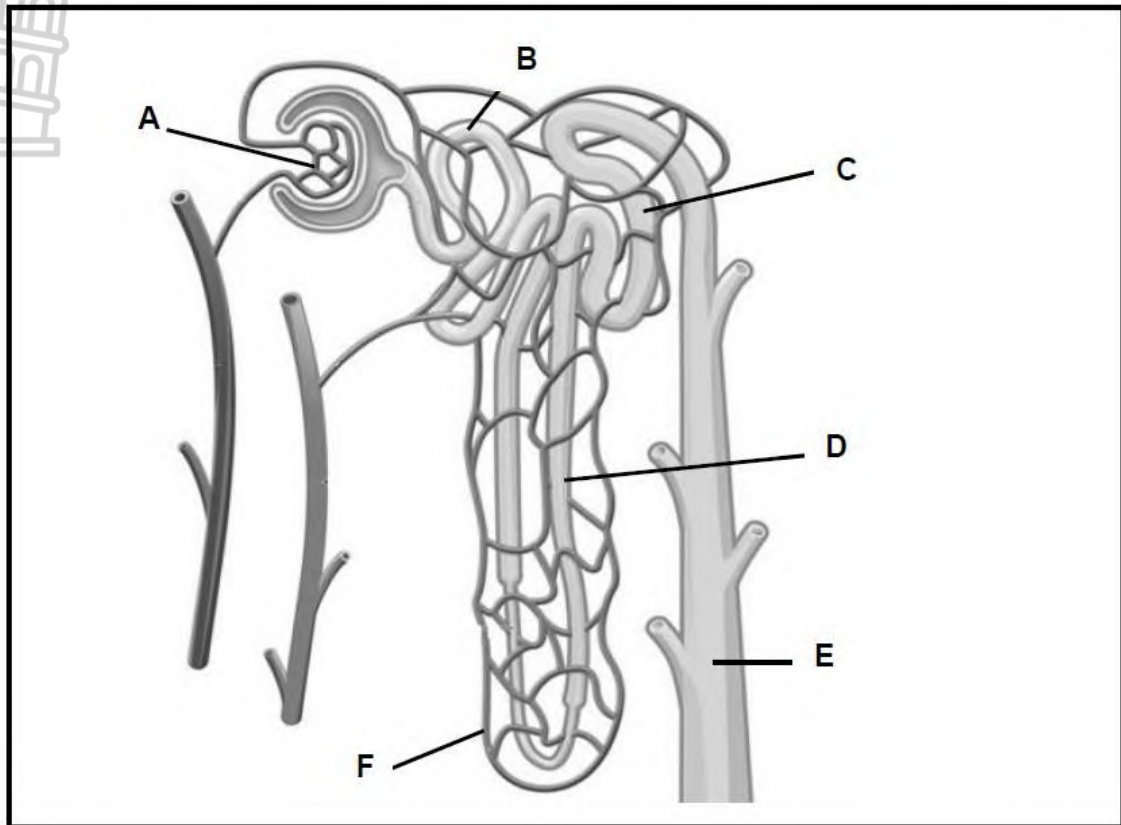
- 6 The diagrams below show the re-absorption of salt and water through the tubules of a nephron in the kidney under three different conditions. The width of the arrows represents the amounts of salt and water.



- 6.1 Name the gland in a human body that that secrete a hormone that is responsible for regulating the:
- (a) Water content (1)
- (b) Salt content (1)
- 6.2 Explain the role of the hormone secreted by the gland mentioned in QUESTION 6.1 (a) when the water levels in the blood are low. (2)
- 6.3 Which diagram (1, 2 or 3) would represent a person who had eaten salty chips on a hot day without any intake of water? (2)
- 6.4 Explain your answer to QUESTION 6.2 (1)
- (9)**

Activity 7

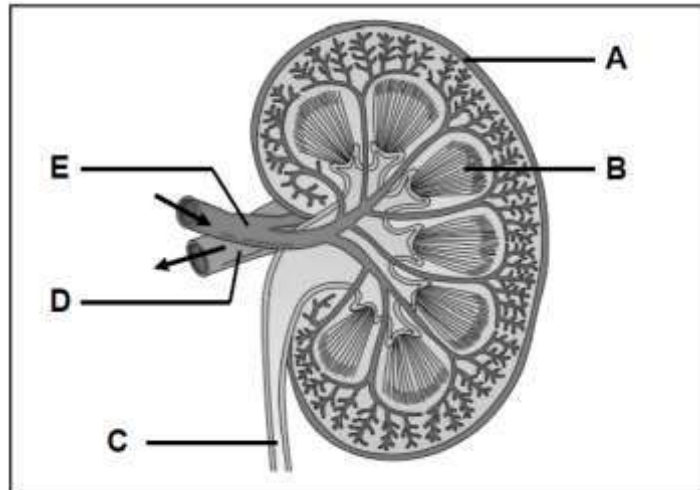
- 7 The diagram below shows a nephron.



- 7.1 Identify part **A**, **B** and **E**. (3)
- 7.2 Give the LETTER and NAME of the part that:
- (a) Has a rich supply of mitochondria. (2)
 - (b) Has a density of blood capillaries. (2)
 - (c) Consists of many folds that increases the rate of reabsorption. (2)
- 7.3 Tabulate TWO differences between the content of the blood at **A** and **F** in health person. (5)
- (14)**

Activity 8

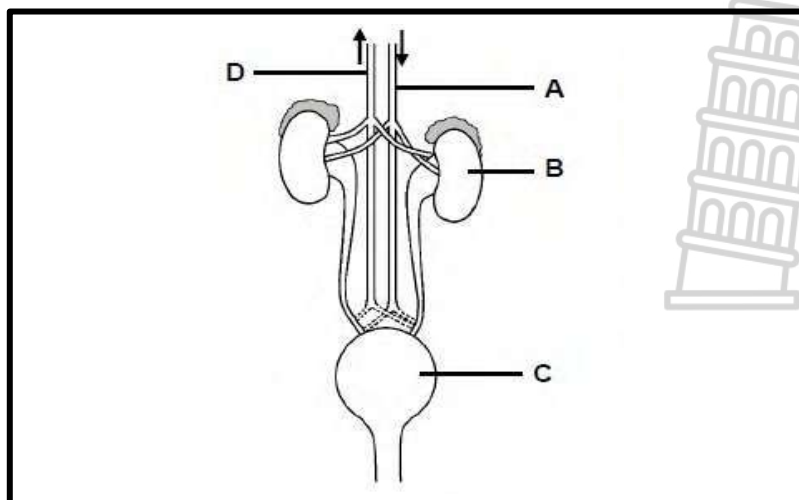
- 8 Study the longitudinal section through the human kidney and answer the questions that follow.



- 8.1 Give only the LETTER of the following description. (1)
 (a) Protects the kidney from mechanical injury (1)
 (b) Transports urine to the bladder (1)
 (c) Carries filtered blood from the kidney. (1)
 8.2 Briefly explain how dehydration and drug abuse can cause kidney failure. (2)
 8.3 Give TWO ways in which kidney stones can be prevented. (2)
(7)

Activity 9

- 9 The diagram below represents the human urinary system.

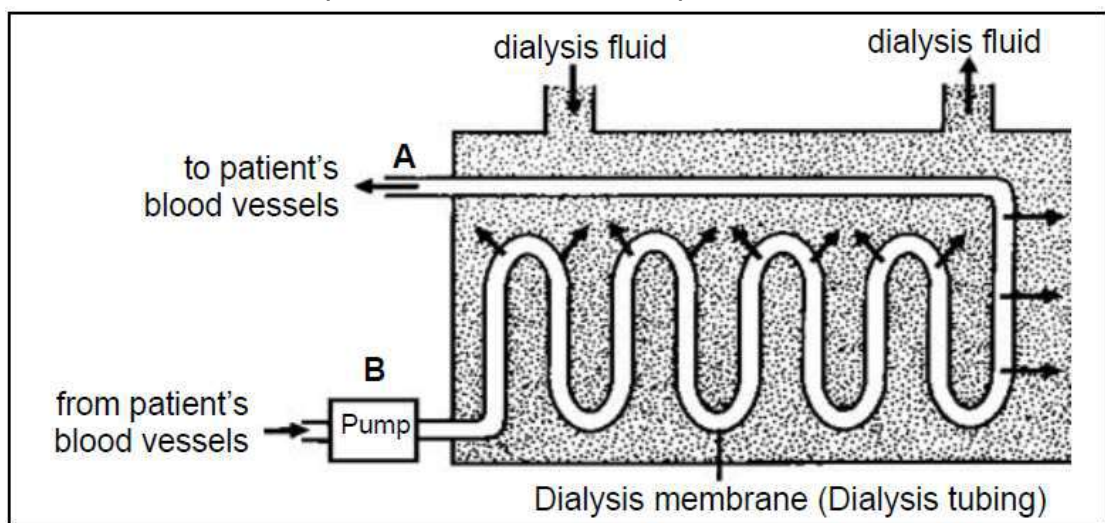


- 9.1 Identify parts: (1)
 (a) **B** (1)
 (b) **C** (1)

- 9.2 Give ONE functional difference between parts **A** and **D** (2)
- 9.3 Which ONE of the blood vessels has the highest blood pressure (1)
- 9.4 Name and describe the role of the hormone secreted by the gland that is located on part B in the regulation of lower salt levels in the blood. (4)
- 9.5 Describe the homeostatic control of water balance in an athlete participating in a comrades marathon. (5)
- (14)**

Activity 10

- 10 An extract on renal failure and its treatment is given below (the diagram represents the dialysis machine, used to treat patients with renal failure).



Extract:

Kidneys can become so damaged that they no longer function properly, and we say that the person has renal failure. People with severe renal failure can be treated by dialysis, using a dialysis machine, to purify the blood. Dialysis is the separation of molecules by size, the smaller molecules diffusing through a dialysis tubing (selectively permeable membrane). The process takes between three and six hours and needs to be done two or three times a week.

- 10.1 According to the extract, define renal failure. (1)
- 10.2 Name the process illustrated in the diagram above? (1)
- 10.3 Explain the significance of the dialysis tubing being selectively permeable (2)
- 10.4 Give ONE function of part **B**. (1)
- 10.5 Use information in the extract to explain how blood is purified in the dialysis machine. (3)
- 10.6 State other TWO processes other than the one mentioned in 10.4 above (2)
- (10)**

Topic: Population Ecology

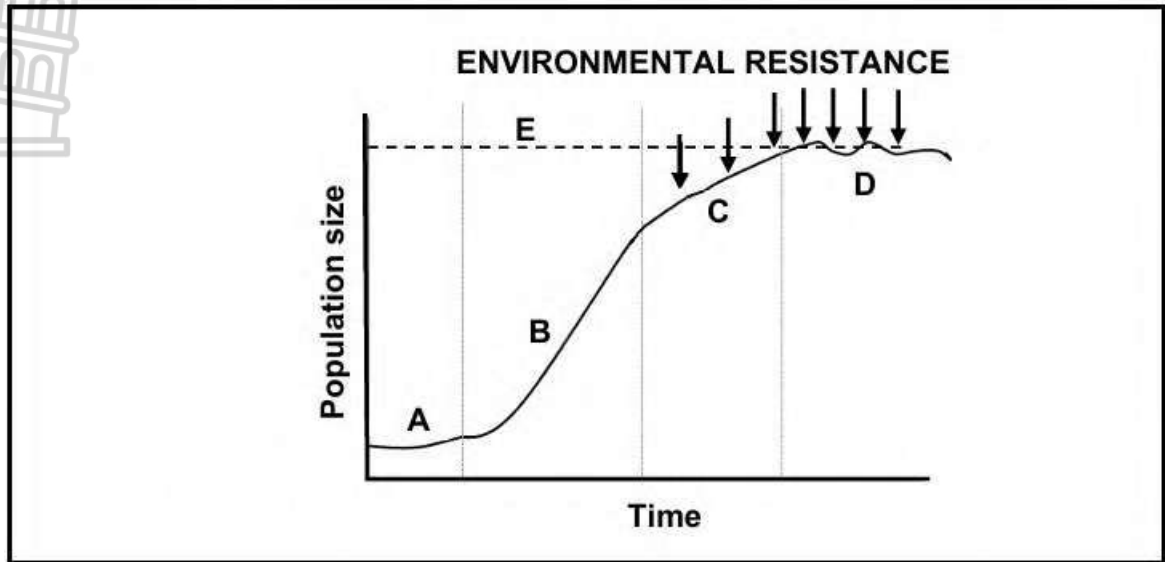
Activity 1

No.	Description	Biological Term
1.1	An organism that captures and kills another organism for food	
1.2	A direct method whereby all individuals in a human population are counted	
1.3	A group of organisms of same species living in same habitat at the same time.	
1.4	The maximum number of individuals that an area can support.	
1.5	Plant and animal species that remain stable in their environment	
1.6	Factors that will exert an influence on a population regardless of its size	
1.7	A process of initial colonisation of land in a previously disturbed area	
1.8	Temporary movement of organisms into or out of an area due to seasonal changes in resources.	
1.9	The type of competition between members of different species.	
1.10	Co-existence of different species living in the same habitat by using resources differently.	
1.11	A community interaction where the competing species coexist in the same habitat since they use the resources in slightly different	
1.12	A symbiotic relationship in which both species benefit from the association	
		10x1 (10)



Activity 2

- 2 The graph below shows the population growth curve.



- 2.1 Name the type of growth form shown in the graph above. (1)
- 2.2 Provide the following labels: (1)
- (a) Stage **D** (1)
- (b) Line **E** (1)
- 2.3 Explain why the growth at stage A is slow. (2)
- 2.4 Name TWO factors that could form part of environmental resistance. (2)
- 2.5 Name TWO inherent factors that would cause an increase in population size. (2)
- (9)**

Activity 3

- 3 Dandelions are weeds that often grow on school's sports fields. The groundsman at a school is responsible for making sure that the soccer field is well maintained and has no weeds.

He wanted to calculate the number of dandelion weeds on their soccer field.

- The size of the soccer field is 2 500 m².
- He used 1 m x 1 m (1 m²) quadrats and took 15 samples across the field.
- The number of dandelions in each sample were recorded in the table below.

Sample number	Number of dandelion plants
1	22
2	3
3	7
4	4
5	15
6	0
7	3
8	0
9	12
10	3
11	0
12	14
13	4
14	7
15	2



Dandelion plant

- 3.1 What is this method of estimating population size called? (1)
 - 3.2 The grounds man did not know where to place the quadrats on the field. Explain how he should go about determining where to place them. (2)
 - 3.3 Calculate the total number of dandelions on the field. (5)
 - 3.4 Why were fifteen samples taken instead of five? (1)
 - 3.5 Give ONE reason why the groundsman would want to know the total number of weeds on the field. (1)
- (10)**

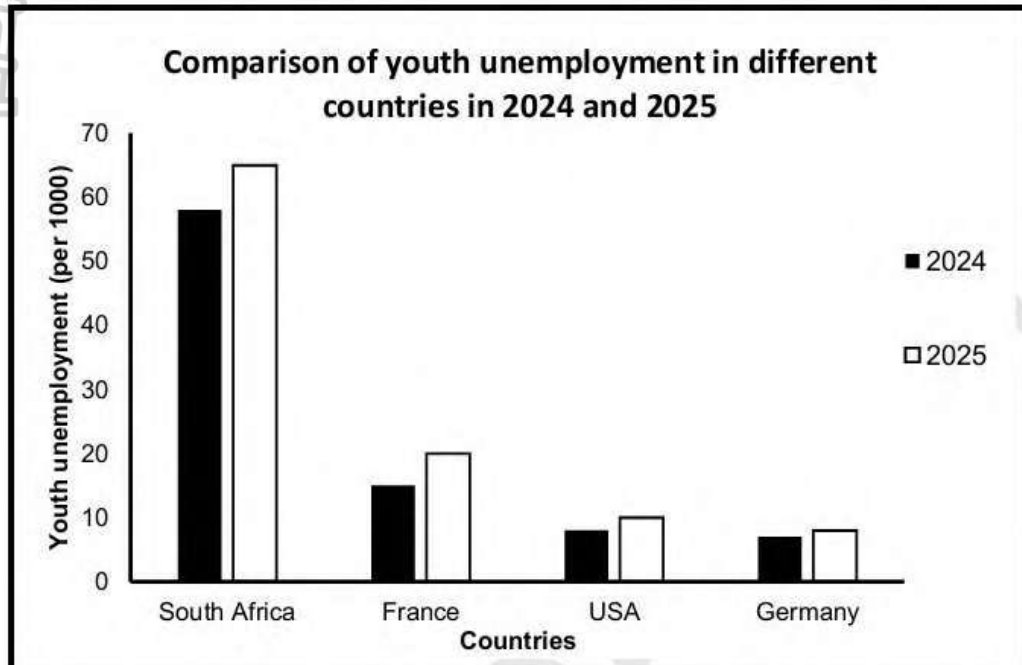
Activity 4

- 4 Tabulate TWO differences between a developed country and a developing country that affects their population growth curves.

(5)

Activity 5

- 5 The graph below shows a comparison between youth unemployment in different countries in 2024 and 2025.



- 5.1 Which country above is classified as a developing country? (1)
- 5.2 Explain ONE reason for your answer in QUESTION 5.1 (2)
- 5.3 Calculate the percentage increase in the youth unemployment in France between 2024 and 2025. Show ALL working. (3)
- (6)

Activity 6

- 6 Read the extract below.

THE ECOLOGICAL ROLES OF LIONS

Lions are the apex predator of the African savanna since they hunt in packs. They play the critical role of managing large herbivores population of buffalos, impalas, zebras, and even elephants and giraffes. In a balanced ecosystem, the number of herbivores needs to be kept in balance. If there are too many herbivores the ecosystem will inevitably degrade.

- 6.1 Name the type of relationship between lions and the herbivores (1)
- 6.2 Explain why: (2)
- (a) lions are successful predators in the savanna.

- (b) the number of herbivores needs to be kept in balance in the ecosystem. (2)
- 6.3 Name TWO symbiotic interactions that benefit one species. (2)
- (7)

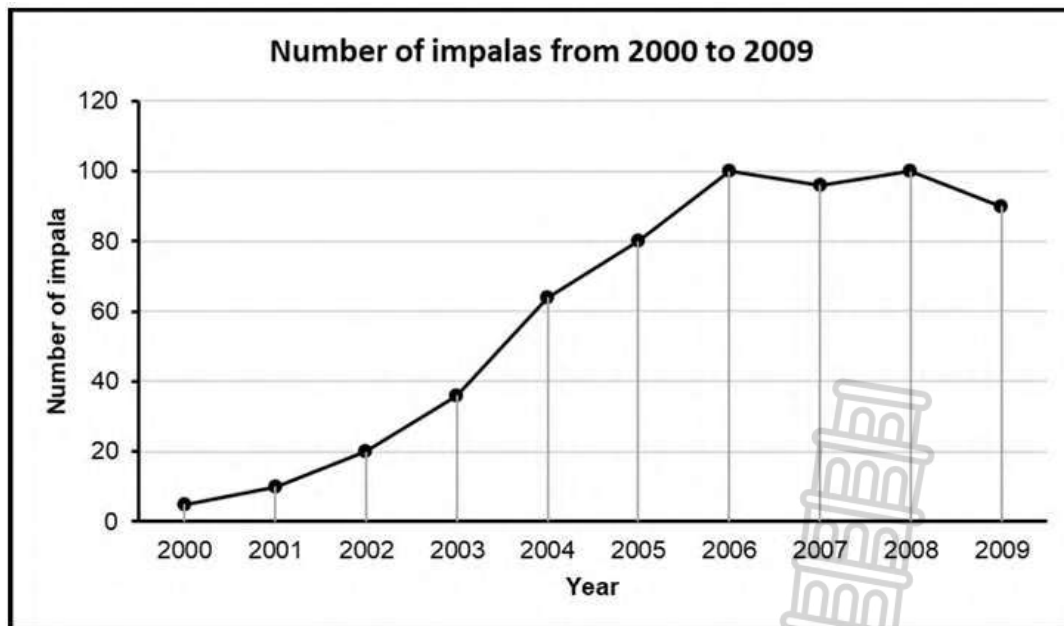
Activity 7

- 7 An investigation was conducted to determine the changes in the population size of impala in a nature reserve over time.

The procedure was as follows:

- Mark re-capture method was used every year from 2000 to 2009 to determine the population size of impala in the nature reserve.
- Each year, during the month of April, first sample of impala was captured, marked and released back to the nature reserve.
- The impalas were given 3 weeks after release to mix in their habitat after which the second sample was taken.
- The number of marked and unmarked impalas were counted.
- The population of the impala was determined using the Petersen index.

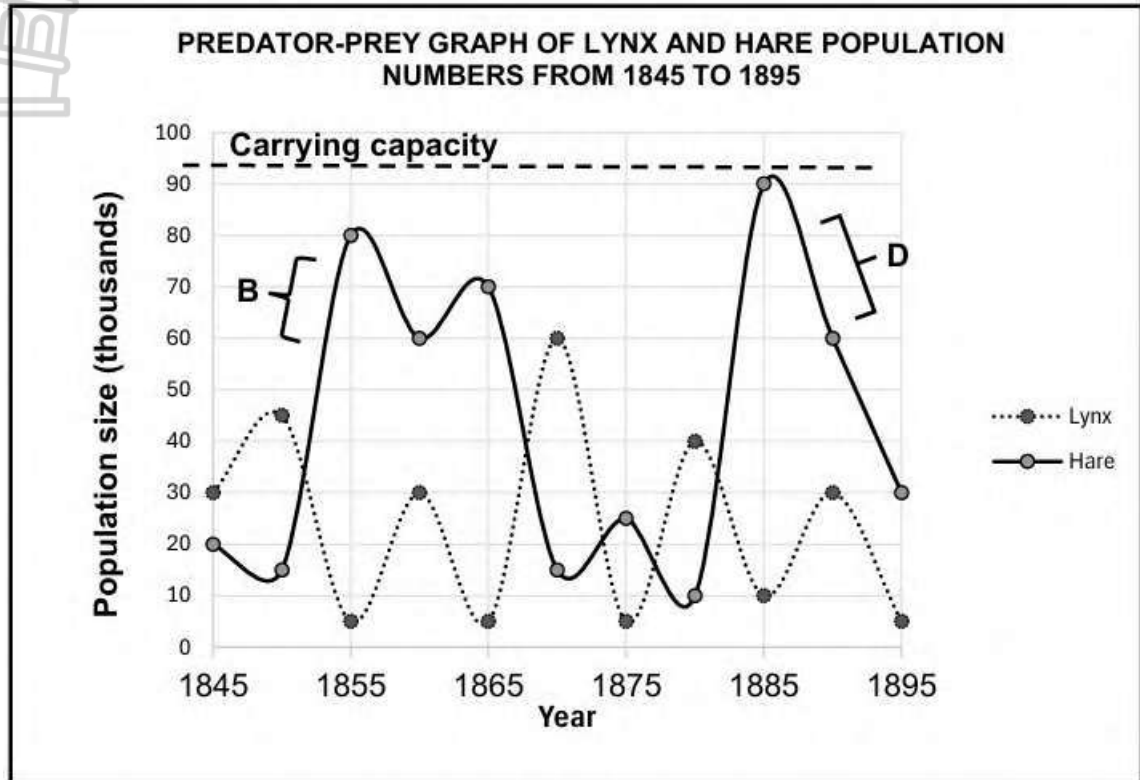
The graph below illustrates the result of the investigation.



- 7.1 State: (2)
- (a) the aim of the investigation. (2)
- (b) the dependent variable. (1)
- 7.2 State ONE way in which validity was ensured in the investigation. (1)
- 7.3 Identify the type of growth form show on the graph. (1)
- 7.4 Name the growth phase from 2000 to 2002 (1)
- 7.5 Explain the pattern of growth in the phase mentioned in QUESTION 7.4 (2)
- (8)

Activity 8

- 8 The graph below shows the interaction of between the lynx and hare population over time.

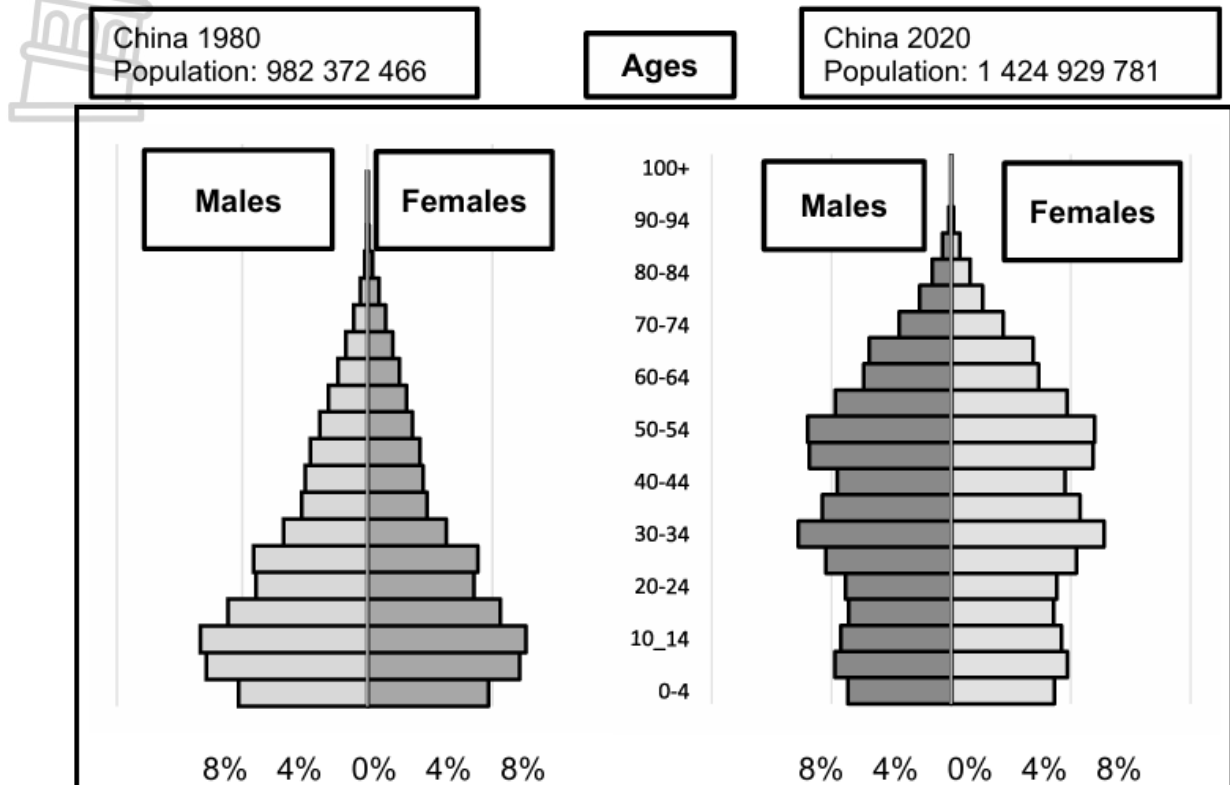


- 8.1 Name the:
- Prey species (1)
 - Predator species (1)
- 8.2 What is the carrying capacity of the hare population in the above predator-prey graph? (1)
- 8.3 In which years is the population size of the hare twice as much as the lynx population? (2)
- 8.4 Identify the phase marked:
- B** (1)
 - D** (1)
- 8.5 State TWO other density-dependent factors that may have a negative effect on a population. (2)

(9)

Activity 9

- 9 The graphs below show the population pyramids of China in the years 1980 and 2020.



- 9.1 What is the name of the graph shown above, used to illustrate the distribution of a population in a country? (1)
- 9.2 In which year did China:
(a) Lack basic resources for its growing population? (1)
(b) Improve life expectancy of its population? (1)
- 9.3 Explain your answer to QUESTION 9.2 (b) by referring to the graph. (2)
- 9.4 Determine the total number of males in the 2020 Chinese population if the percentage of males is 51,2%. Show ALL workings. (2)
- 9.5

The Chinese government introduced the One Child Policy in 1980 and other economic reform policies in the following years. These policies were designed to slow down the rapid population growth and increase the number of people of working-age. Under the One Child Policy married couples were allowed to have one child.

- (a) Explain how these policies affected the pre-reproductive age and the working-age population percentages from the year 1980 to the year 2020. (4)
- (b) Give TWO other strategies governments can implement to reduce population growth in a country. (2)
- (13)**

Activity 10

- 10 Competition and symbiosis exist in ecosystems to allow organisms to compete and interact with each other and share limited environmental resources. Competition often causes some organisms to die out if they are outcompeted while others survive. The diagrams below show organisms competing.



DIAGRAM 1

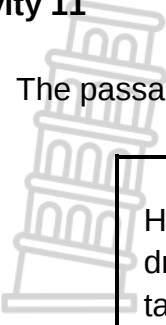


DIAGRAM 2

- 10.1 Name the type of competition that occurs in:
- (a) DIAGRAM 1 (1)
- (b) DIAGRAM 2 (1)
- 10.2 Name and describe TWO symbiotic relationships that can benefit one organism in an ecosystem. (4)
- (6)**

Activity 11

- 11 The passage below relates to symbiotic relationships between different organisms.



Hyenas hunt in packs. They take down their prey by biting and dragging it to the ground, because they are fast predators. They tackle prey that are fast runners and are also able to kill an animal too large for one hyena. Zebras are one of the major prey of hyenas.

- 11.1 Give TWO reasons mentioned in the extract why hunting in packs makes hyenas successful hunters. (2)
- 11.2 Name the type of relationship shown between hyenas and zebras? (1)
- 11.3 Zebras live in herds.
Explain ONE reason why living in herds is an advantage. (2)
Explain why the chances of the zebra and hyena populations reaching carrying capacity are limited. (3)
- (8)**

Activity 12

- 12 A researcher wanted to determine the size of the snail population in a garden. 50 snails were randomly collected. Each snail was marked and then returned to the garden. A week later she caught 75 snails and found that 15 had been marked.

- 12.1 Calculate the size of the snail population. Show ALL your calculations.

Formula: $P = \frac{F \times S}{M}$

P = Estimated total number of snails in the population.

F = Number caught and marked in the first catch.

S = Number caught in the second catch.

M = Number marked in the second catch.

- 12.2 Name the method used above to determine the population size.

(3)

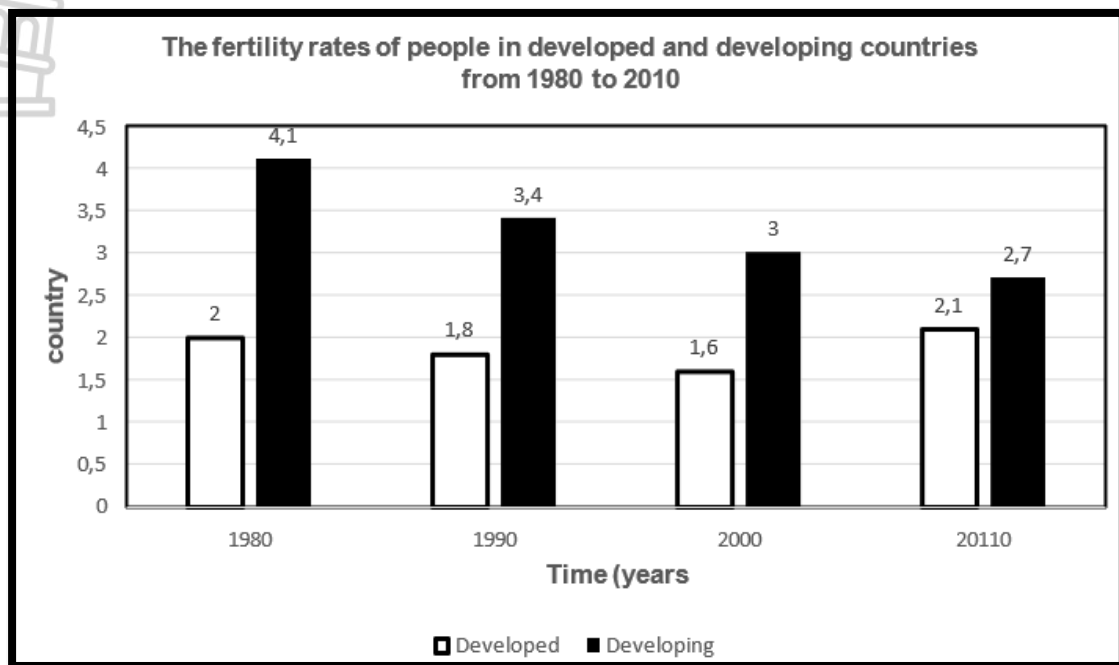
(1)

(4)



Activity 13

- 13 The graph below shows a comparison between the fertility rates of people in developed and developing countries from 1980 to 2010.



- 13.1 Describe the trend in fertility rate for developed countries. (2)
- 13.2 Tabulate ONE difference between developed and developing countries with regards to life expectancy. (3)
- (5)

Activity 14

- 14 Read the following passage and answer the questions that follow.

SOCIAL ORGANISATION IN NAKED MOLE RATS

Naked mole rats (*Heterocephalus glaber*) are burrowing rodents, found in East Africa. They have no fur (naked) and they have a lack of pain sensation in their skin. Colonies of 70–80 live together in a burrow system. They have one breeding female (the queen) and only she and two or three males reproduce. The queen prevents other females from breeding by being very aggressive towards any other females who behave like a queen. The rest of the colony is workers. The workers are divided into classes, who carry out different functions. Some work on building tunnels and some are 'soldiers' that protect the colony from outsiders and predators.

- 14.1 Explain the following:

- (a) ONE disadvantage of having only one breeding female in the colony (2)
 - (b) ONE advantage of the different workers carrying out different functions (2)
- (4)**



Topic: Human Impact

Activity 1

No.	Description	Biological Term
1.1	The access, by all people at all times, to adequate, safe and nutritious food	
1.2	A layer in the stratosphere that filters out harmful UV light from the sun	
1.3	Water-bearing rock from which water is obtained using bore-holes	
1.4	The use of living organisms to regulate the numbers of a pest species	
1.5	A plant species introduced into an environment from another country	
1.6	A layer in the atmosphere that is damaged by chlorofluorocarbons (CFCs)	
		6 x1 (6)

Activity 2

- 2 Coastal provinces in South Africa have experienced adverse weather patterns, causing severe damage to communities.

Explain the impact of global warming on the weather patterns.

(5)



Activity 3

- 3 A farmer conducted an investigation to determine which type of fertiliser (A or B) would provide a better yield for her wheat crop.

The investigation was carried out as follows:

- She divided her farm into two plots (1 and 2) of the same size.
- She planted the same type of crop, namely wheat, in both plots.
- She used a different type of fertiliser in each plot.
- She used water from a river which flows through the farm to irrigate her crop.
- She recorded the yield of wheat per plot

The results were as follows:

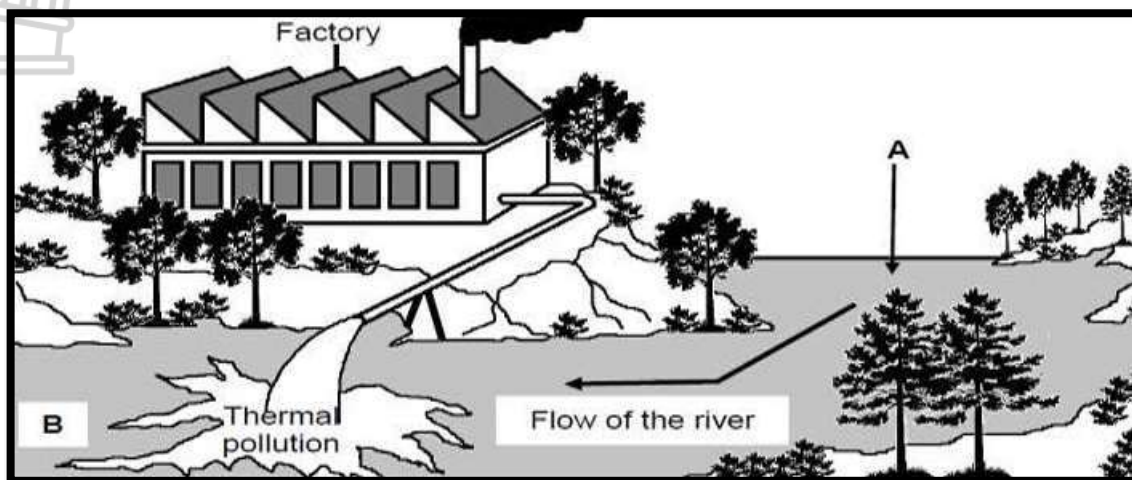
Plot	Fertiliser	Yield of wheat (tons)
1	A	7,8
2	B	12,6

- 3.1 Identify the dependent variable in this investigation. (1)
- 3.2 List TWO factors that were kept constant in this investigation. (2)
- 3.3 Other than repeating the investigation, state ONE way in which the reliability of the results could be increased. (1)
- 3.4 Explain how the excessive use of fertilisers can affect biodiversity if they are washed into the river. (4)
- 3.5 If the farmer plants wheat repeatedly over many years, state ONE negative effect this may have. (1)
- (9)**



Activity 4

- 4 A factory was built on the banks of a river close to a fishing village. The factory used water from the river to cool down the machinery. The water was then released back into the river causing thermal pollution.



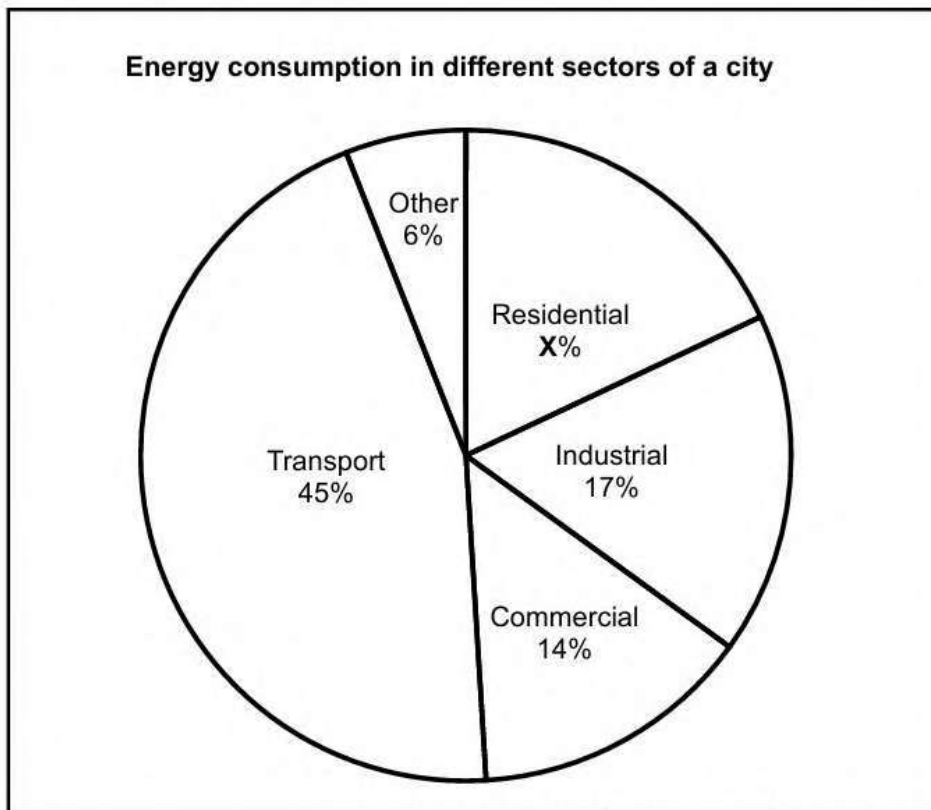
- 4.1 Describe how thermal pollution affects the water quality. (2)
 4.2 Suggest ONE way in which the factory can reduce thermal pollution. (1)
 4.3 How will thermal pollution affect the fishermen in the village, economically? (2)
 4.4 During the lockdown of the country due to Covid-19 restrictions, the factory was closed for a period of 4 months.

Explain the impact that this would have had on the biodiversity in area **B**. (2)
 (7)



Activity 5

- 5 Energy in South Africa is mainly generated from coal power stations. The pie chart below shows the energy consumption in different sectors of a South African city in 2007



[Adapted from *Energy Scenarios for CT to – 2050*, 2011]

- 5.1 Determine the value of X. Show ALL calculations. (2)
- 5.2 Which sector consumes the most energy in this city? (1)
- 5.3 The residential energy consumption in this city increased by 3% in 2009. Give TWO possible reasons for this increase. (2)
- 5.4 Explain the impact of the increased use of energy generated from coal power stations on climate change. (4)
- 5.5 South Africa, like many other countries, has signed a declaration to reduce its CO₂ output over time.

Explain TWO strategies that could be implemented by the South African government to achieve this reduction in CO₂ output.

(4)
(13)

Activity 6

- 6 Read the following passage and answer the questions that follow.

FOOD WASTAGE AROUND THE WORLD

Every year, a third of all food for human consumption, about 1,3 billion tons, is wasted in the world. The UN Food and Agriculture Organisation (FAO) estimated that the carbon footprint of wasted food was equivalent to 3, 3 billion tons of carbon dioxide a year. The FAO suggests that more efficient use of food could contribute to global efforts to cut greenhouse gases and thus limit global warming. In the industrial world, much of the waste comes from consumers buying too much and throwing away what they do not eat. In developing countries, it is mainly the result of inefficient farming and a lack of proper storage facilities.

- 6.1 Define the term food security? (2)
- 6.2 Explain how wastage of food contributes to loss of energy and global warming. (3)
- 6.3 State TWO effects of global warming. (2)
- 6.4 Use the information in the passage to suggest TWO ways in which food wastage could be reduced. (2)
- (9)**

Activity 7

- 7 Water hyacinth is an invasive alien species. It grows and floats in dams and lakes. It is a fast-growing species which can invade, cover and take over the whole dam or lake.
- 7.1 What is meant by invasive alien species? (2)
- 7.2 Explain TWO ways in which alien plants, like the water hyacinth, could upset the balance in ecosystems. (4)
- (6)**

Activity 8

- 8 The table given below shows the volume of medical waste generated in two provinces over a period of nine years. Study the information and answer the questions that follow:

MEDICAL WASTE GENERATION (tons)									
YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003
WESTERN CAPE	357	366	398	383	399	410	426	444	452
EASTERN CAPE	252	256	261	267	270	276	278	289	291

- 8.1 Which province has shown the most rapid increase in medical waste generation? (1)
- 8.2 What was the total amount of waste generated by the two provinces between 1999 and 2002? (2)
- 8.3 State any THREE negative effects of dumping medical waste in water resources. (3)
- 8.4 How can plastic bags dumped in rivers as part of medical waste affect marine animals? (1)
- 8.5 What is meant by biodegradable waste? (2)
- 8.6 There are THREE principles of waste management. Mention any TWO. (2)
- (11)**



Activity 9

- 9 Read the extract below.

HUNTING WILDLIFE FOR FOOD

An organisation, Trade Records Analysis of Fauna and Flora in Commerce (TRAFFIC), did an investigation to find out about the extent of the illegal killing of wildlife for use as bush-meat (meat from wildlife) and the influence of this on the environment.

The organisation reported that the illegal killing of wildlife, both for trade and consumption, had been on the increase in many African countries during the past two years. It also reported that some species, such as impala, were preferred to other species of wildlife.

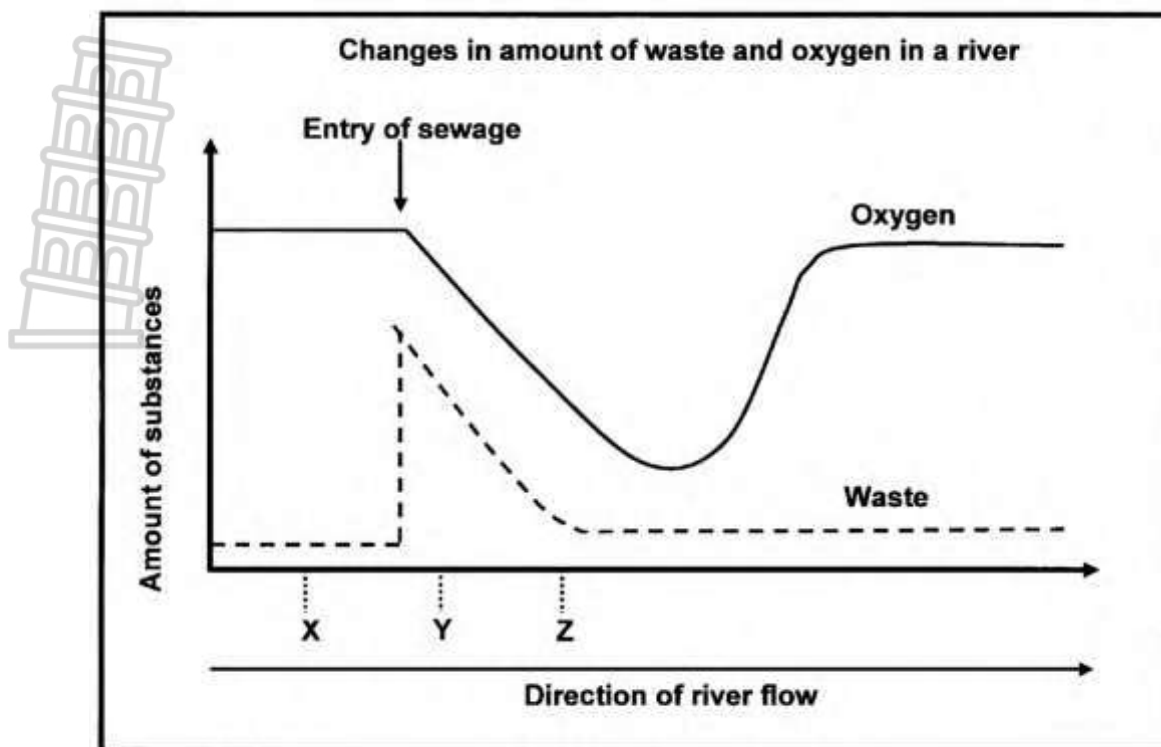
One of the organisation's recommendations was that the hunting of wildlife should be legalised. This would enable governments in these countries to control the number of animals being hunted and also to restrict the age of animals that may be hunted. It also recommended that only those animals that were very old and weak in a population should be hunted.

[Adapted from an article 'Wildlife Under Siege', *Endangered Wildlife*, 2000]

- 9.1 What is the illegal hunting and killing of animals called? (1)
 - 9.2 State ONE way in which humans destroy wildlife habitats. (1)
 - 9.3 Give TWO reasons for the increase in the illegal killing of wildlife. (2)
 - 9.4 Explain how the increase in the killing of wildlife will influence the environment. (3)
 - 9.5 Explain why the organisation recommended that only very old and weak animals in a population should be killed if hunting is legalised. (3)
- (10)**

Activity 10

- 10 A group of learners collected water samples at different places (X, Y and Z) along the same river to compare the level of substances (oxygen and waste) as well as the organisms present.
- The graph below shows the changes in the amount of substances (waste and oxygen) in the water along the course of the river. The point at which sewage enters the river is indicated.



The presence or absence of certain animal species can be used as indicators of the degree of water pollution in a river, as shown below:

ORGANISM PRESENT	DEGREE OF WATER POLLUTION
Mayfly nymph	Unpolluted
Leeches	Moderately polluted
Sludge worms	Severely polluted

- 10.1 Which organism (listed in the table) would most likely have been present at:
 - (a) Y (1)
 - (b) Z (1)
- 10.2 State TWO factors that should be kept constant while collecting the water samples. (2)
- 10.3 Name TWO dependent variables in this investigation. Be specific. (2)
- 10.4 Use the graph to describe the relationship between the amount of oxygen and the amount of waste from the point of entry of sewage. (3)
- 10.5 Explain why the oxygen level is highest in region X (2)
- 10.6 State TWO ways in which the degree of water pollution caused by sewage can be reduced. (2)

(13)

Activity 11

11 Read the extract below.

WATER CRISIS IN SOUTH AFRICA

The impact of the water scarcity will be one of South Africa's biggest problems soon. Recently a province had to switch off the water supply because the dams were 'so close on the edge'. It is stated that people are using more water than what's available; the demand is more than the supply.

About 37% of the clean, drinkable water is being lost through poor infrastructure (leaking pipes, dripping taps) and wastage. About 60% is used for irrigation.

Industries and mines also contribute to the water crisis by polluting our water bodies. They generate harmful waste which is sometimes dumped into water bodies, creating acid mine drainage. The impact of climate change also adds to the water crisis.

There is a suggestion that South Africa needs to work with neighbouring countries to come up with solutions. An example is to grow the agricultural products in neighbouring countries with a higher rainfall, and then South Africa imports these products.

[Adapted from mg.co.za/article and www.news24.com]

- 11.1 Refer to the extract and state TWO causes of the water crisis facing South Africa. (2)
 - 11.2 State how importing agricultural products from neighbouring countries would reduce South Africa's water crisis. (1)
 - 11.3 Explain how switching off the water supply would affect the industries that depend on water. (2)
 - 11.4 The South African government could possibly solve the water crisis increasing the cost of water. Give TWO ways in which this solution could help to reduce the water crisis. (2)
- (7)**

Activity 12

- 12 A group of grade 11 learners at an Eastern Cape High School wanted to investigate the oxygen level in a nearby river in order to determine its pollution level. A low oxygen level indicates that the water is polluted. They followed the following procedures:
- Using a rope, bucket and protective gloves, they collected some water from the river, before and after a sewage outflow pipe (which pumps out human waste including faeces into the river).
 - They labelled the samples of water A and B.
 - The learners then added a few drops of methylene blue to each sample, A and B.

NB: Methylene blue is an indicator which changes colour as follows:

- A low level of oxygen will be indicated by a loss of the blue colour.
- A high level of oxygen will be indicated by a darker blue colour.

Their results are shown in the table below:

SAMPLE	COLOUR CHANGE OF METHYLENE BLUE
A	Darker blue
B	Loss of blue colour

- 12.1 Which one of the samples (A and B) was taken after the sewage outflow pipe and why did the learners take two samples of water: A and B? (3)
- 12.2 Provide an explanation for choosing either sample A or B in QUESTION 12.2 above. (3)
- 12.3 Explain TWO ways in which learners could improve the investigation. (4)
- 12.4 Why did the learners wear protective gloves when collecting the water samples? (2)
- (12)**



Question 13

- 13 A team of environmental monitors from the Department of Water Affairs took samples downstream from a paint factory. The team tested the water for concentrations of metal pollutants. Three months later the monitors repeated the test. The results of the investigation are shown in the table below, together with the human tolerance levels for these metal pollutants.

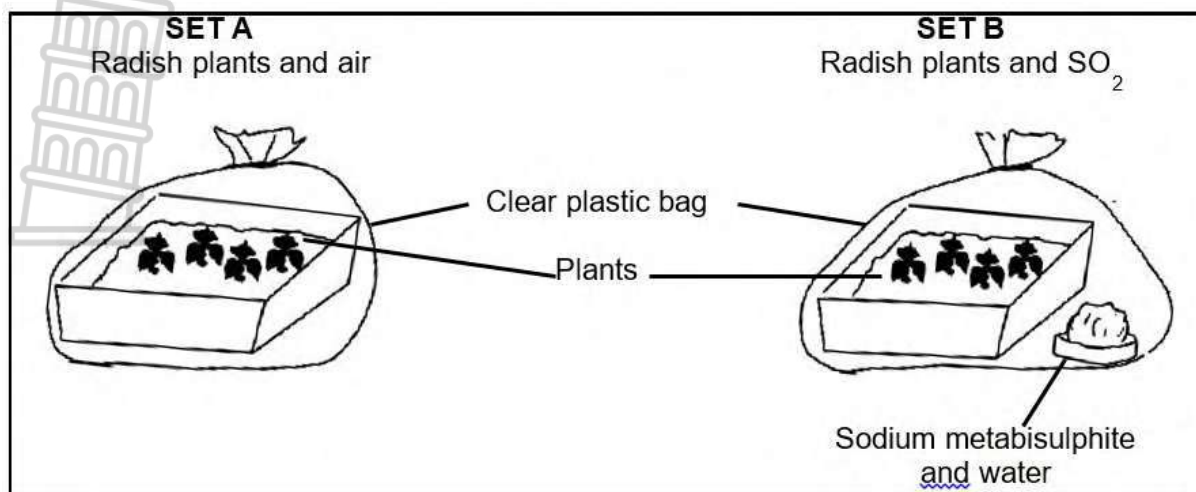
METAL POLLUTANTS	CONCENTRATION (x 10 mg/ℓ)		
	RESULTS OF FIRST TEST	RESULTS OF SECOND TEST (THREE MONTHS LATER)	CONCENTRATION THAT HUMANS CAN TOLERATE
Arsenic	0,03	0,02	5
Cadmium	0,02	0,60	1
Lead	2,10	3,80	5
Mercury	0,04	0,23	5

- 13.1 Which metal pollutant has decreased in concentration between the two tests? (1)
- 13.2 Give TWO possible reasons why there could be a decrease in the metal named in QUESTION 14.1 (2)
- 13.3 Which metal concentration has increased the most in the last three months? (1)
- 13.4 Explain whether the present concentrations of the metals are a risk for human health. (2)
- (6)**

Activity 14

- 14 A pupil thinks that sulphur dioxide (SO₂) will have a toxic effect on germinating Seeds. She does an investigation over a two-week period, as shown in the diagram below, to test her idea. Sodium metabisulphite, when mixed with water, releases sulphur dioxide.
- Cotton wool is placed in two trays.
 - Five radish seeds are placed on the cotton wool in each tray.
 - The seeds are covered with clear plastic bags.
 - A solution of sodium metabisulphite and water is placed in one plastic bag with the seeds.

The plants which resulted from germination are counted.



The following results were obtained:

DAY	NUMBER OF PLANTS IN SET A	NUMBER OF PLANTS IN SET B
2	2	2
4	4	4
6	4	2
8	4	0

- 14.1 Identify the dependent variable in this investigation. (1)
- 14.2 Explain THREE ways in which the reliability of the results can be ensured. (6)
- 14.3 State TWO effects of air pollution on human health. (1)
- (8)



Scientific Investigations

General suggestions for improvement for both P1 and P2

- A greater emphasis on practical work and practical tasks of good quality in Grades 10 and 11 will assist in preparing learners more adequately for questions based on scientific investigations.
- Learners must be challenged to design their own investigations, by being given an 'observation', 'hypothesis' or 'aim'. This is especially important since knowledge of scientific investigations is assessed in both Paper 1 and Paper 2.

Variable

Learners must be warned about avoiding these common errors when designing a scientific investigation:

- Incorrectly writing the independent variable as 'effect of temperature'. This will lead to loss of a mark. The effect of 'indirectly' refers to a dependent variable.
- Using 'result' instead of the 'aim' to extract the **variables** can sometimes lead to an incorrect dependent variable. Sometimes the results indicate how the dependent variable was measured.

Example:

Aim: To determine the effect of temperature on the enzyme activity.

The table below shows the results of the investigation.

Temperature (°C)	Average mass of the (g)
------------------	-------------------------

- Independent variable is **Temperature**
- Dependent variable is **growth (of the chicken)** NOT "the average mass of the chicken"

Some of the clues to look for when identifying an Aim of the investigation:

- Grade 12 learners/scientists/ conducted/did an investigation to demonstrate/determine...
- An investigation was done/carried out/conducted to determine/demonstrate...

- Scientists investigated the ...

Clues to assist learners to identify variables from the Aims with various key concepts:

1. Relationship: the variables are separated by the word '**and**'

- independent/dependent variable **and** dependent/independent variable.

Example 1:

An investigation was done to determine the **relationship** between the height of the head and bite force in lizards.

- Independent variable is **the height of the head**
- Dependent variable is **bite force**

Example 2:

An investigation was conducted to determine the **relationship** between seed germination and the amount of abscisic acid found in the seed.

- Independent variable is **seed germination**
- Dependent variable is **amount of abscisic acid**

2. Effect/influence

- Independent variable comes after the word "**of**"
- Dependent variable comes after the word "**on**"

Example 1:

An investigation was carried out to determine the **effect** of caffeine on body temperature.

- Independent variable is **caffeine**
- Dependent variable is **body temperature**

Example 2:

An investigation was carried out to determine the **influence** of alcohol on the volume of urine produced.

- Independent variable is **alcohol**
- Dependent variable is **volume of urine**

3. Affect

- The word “**affect**” separates the independent variable from dependent variable

Example:

An investigation was done to determine how temperature **affect** the growth of chicken.

- Independent variable is **temperature**
- Dependent variable is **growth of chicken**

4. Lead/result with

- The word “**lead to**”/”**result with**” separate the independent variable from dependent variable

Example :

An investigation was done to determine if progesterone treatment **lead to/result with** the development of gestational diabetes mellitus.

- Independent variable is **progesterone treatment**
- Dependent variable is **development of gestational diabetes mellitus**

5. Use of

- The word “**use of**” separates the dependent variable from independent variable

Example:

An investigation was done to determine the number of conviction (number of people found guilty) of criminals with the **use of** DNA evidences.

- Independent variable is **DNA evidences**
- Dependent variable is **number of conviction**

6. Caused

- The word “**caused**” separate the independent variable from dependent variable

Example :

Doctors conducted an investigation to determine if the ground beef **caused** the thyrotoxicosis.

- Independent variable is **ground beef**
- Dependent variable is **thyrotoxicosis**

Conclusion

- A conclusion must come from altering the aim to show the relationship between the variables.
- The focus must be on the **aim** and the **results** of the investigation will assist learners on writing a conclusion
- Learners must understand that the different types of data (continuous and discontinuous data) require different ways of stating a conclusion

Life Sciences requires learners to be explicit when writing these conclusions and not use terms such as 'directly proportional' or 'inversely proportional'.

The difference between validity and reliability.

Validity of the investigation:

- All the factors that can influence the results are kept constant. Learners must be encouraged to use the term '*validity*' as opposed to '*fairness*'.
- The validity of the investigation increases/is improved when all the factors that can influence the results are kept constant and only the independent variable is changed

Reliability of the results:

- When the investigation is repeated or when the sample size is increased will the same results be achieved?
- Reliability of the results is increased/improved when an investigation is repeated or *measurements of the dependent variable* are repeated or when the investigation is done over a long period of time or when a sample size is increased.

Learners must understand these terms to be able to apply them in any given investigation.

The purpose of a control or a baseline.

A '**control**' is a group in an experiment that does not receive the treatment of the independent variable tested.

Example:

Aim: To investigate that light is necessary for photosynthesis

- In the control set-up the potted plant will be placed in a dark place.
- Light as independent variable is removed from the set-up

A '**baseline**' is the measurement taken before the treatment of the independent variable tested.

Example:

Aim: An investigation was carried out to determine the effect of caffeine on body temperature and pulse rate.

The procedure:

- **At the start** of the investigation each man's **body temperature was measured (baseline)** and the average of all the participants was calculated. Also, at the start of the investigation of each man's **pulse rate was measured (baseline)** and the average of all was calculated. Each man drank 100 ml of an energy drink containing the same amount of caffeine. Their body temperature was then measured every 15 minutes for a period of 1 hour and average of all participants was calculated.
- The initial body temperature/pulse rate will be used to compare with the body temperature/ pulse rate after the intake of an energy drink containing caffeine.
- Both these factors serve as a point of reference to compare, if it is the independent variable that causes the results that will be obtained.

Learners need to be taught to identify when an experimental setup is a control and what its purpose is in the given investigation or how a control can be set up for a given investigation.

Graphs

Learners must be taught the skill of drawing different graphs, from Grade 10, and they must be exposed to the criteria used to assess a graph.

Example: Line graph

CRITERIA	ELABORATION	MARK
Correct type of graph (T)	Line graph drawn	1
Caption of graph (C)	Both variables included	1
Axes labels (L)	Correct labels and units on X- and Y-axes	1
Scale for X- and Y-axes (S)	Equal spacing between intervals for each axis	1
Plotting of points (P)	1 to 4 points plotted correctly	1
	All 5 points plotted correctly	2

This includes how to write a heading. Headings in a graph must be explicit and not written with 'vs/versus'. The heading must include both variables (independent and dependent).

Calculations

Calculations form an integral part of data interpretation and analysis; therefore, learners must be able to do simple calculations when required to do so. Examples of calculations expected in Life Sciences:

Calculating a difference (by how much): **bigger value – smaller value** OR **final value – initial value**

Calculating percentage: $\frac{\text{value given}}{\text{total}} \times 100$

- Calculating percentage increase: $\frac{\text{bigger value} - \text{smaller value}}{\text{smaller value}} \times 100$

OR

$$\frac{\text{final value} - \text{initial value}}{\text{initial value}} \times 100$$

- Calculating percentage decrease: $\frac{\text{bigger value} - \text{smaller value}}{\text{bigger value}} \times 100$

OR

$$\frac{\text{initial value} - \text{final value}}{\text{initial value}} \times 100$$

- Calculating 'by how times': $\frac{\text{Bigger value}}{\text{Smaller value}}$ OR $\frac{\text{final value}}{\text{initial value}}$

- Calculating average: $\frac{\text{Total of all values given (add them)}}{\text{Total number of the values given}}$



OR

$$\frac{\text{Sum of all values given (add them)}}{\text{total number of the value given}}$$

Learners are expected to round off their answers into two decimal points unless stated otherwise. (This instruction will be included in the examination instructions to candidates in future.)

