Life Sciences

CLASS TEXT & STUDY GUIDE

Liesl Sterrenberg, Helena Fouché & Grace Elliott

GRADE

11

CAPS

3-in-1

THE ANSWER SERIES *Your Key to Exam Success*

Grade 11 Life Sciences 3-in-1 CAPS

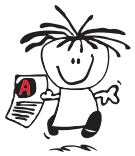
CLASS TEXT & STUDY GUIDE

This Grade 11 Life Sciences 3-in-1 study guide transforms a content-heavy Grade 11 curriculum into simple and manageable study material. Explanations are clear-cut and easy to comprehend, developing your exam skills as well as your perception of the biological world.

Key Features:

- Comprehensive, accessible notes per module
- Carefully selected, graded questions and answers per module
- 'Rapid-fire' questions for key concepts and terms
- Clear, explanatory diagrams
- Up-to-date, relevant material

This study guide enables learners of all levels to achieve their best results.



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THIS CLASS TEXT & STUDY GUIDE INCLUDES

1 Notes

- Diversity, Change and Continuity
- Life Processes in Plants and Animals
- Environmental Studies

2 Questions and Rapid Fire Questions

3 Detailed Memos
(in separate booklet)

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CONTENTS

NOTES with QUESTIONS:

WHAT IS LIFE SCIENCES?

'Life Sciences' is the scientific study of living things from molecular level to their interaction with one another and the environment.

- Living systems exhibit levels of organisation from molecules to biomes.
- Life on earth is dynamic, with homeostasis maintaining balance at every level of organisation.
- Life is characterised by changes over time.

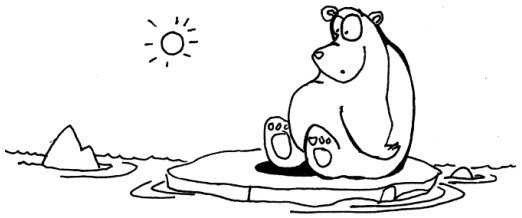
AIMS IN LIFE SCIENCES

Specific Aim 1: Knowing Life Sciences

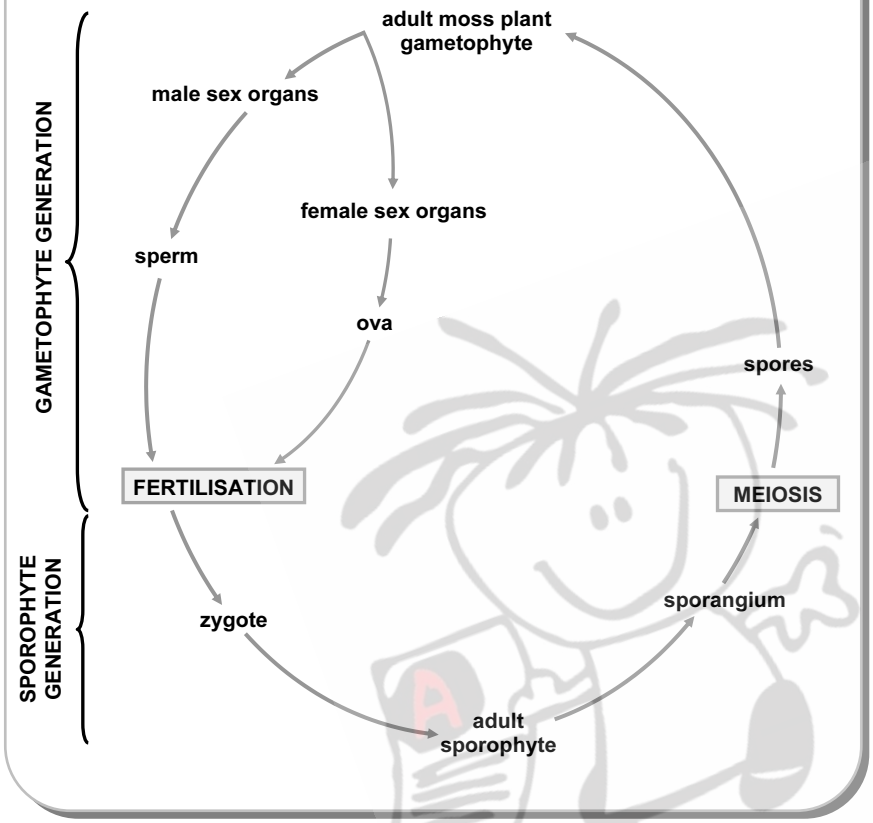
(concepts, processes, phenomena, mechanisms, principles, theories, laws, models, etc.)

Specific Aim 2: Investigating phenomena in Life Sciences

Specific Aim 3: Appreciating and understanding the history, importance and applications of Life Sciences in society.



The life cycle of Bryophytes is represented below. You do not have to learn it, it is simply given to illustrate the concepts in context and make them more understandable.

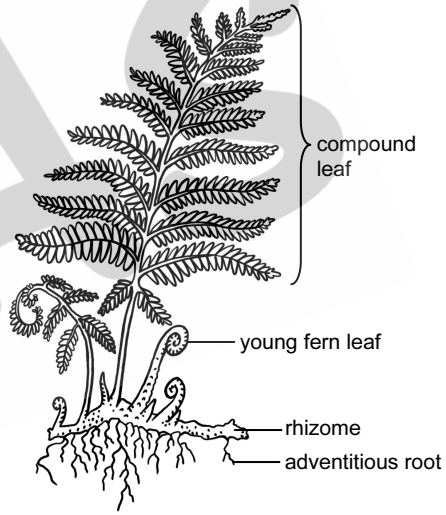


Overview

BRYOPHYTES	Structure of dominant generation (gametophyte)	Vascular tissue	Spores/ seeds	Fruits	Dependency on water for reproduction
mosses, liverworts, hornworts	thallus - no true roots, stems or leaves	absent	spores	none	water needed for fertilisation

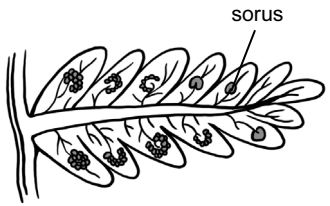
PTERIDOPHYTES (FERNS)

- Pteridophytes are a group of plants that are adapted to life on land.
- Ferns mostly occur in moist, shady environments.
- Unlike the Bryophytes, the **sporophyte generation** is the dominant generation in ferns.
- The adult fern plant represents the sporophyte generation.
- The fern has **true roots**, **stems** and **leaves** i.e. it is not a thallus.
- In most ferns (excluding tree ferns) the stem is a horizontal, underground **rhizome**.

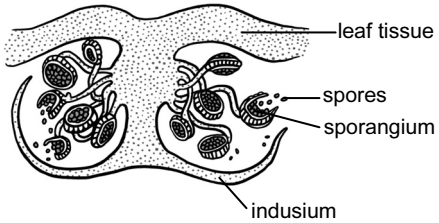


Adult fern plant - sporophyte generation

- **Adventitious roots** develop from the rhizome, anchor the plant in the soil and absorb water and mineral salts.
- The green compound **leaves** (fronds) with long leaf stalks develop from buds on the rhizome.
- Well-developed **vascular tissue** (xylem and phloem) is **present**.
- The sporophyte is perennial and therefore produces spores over many generations.
- Clusters of sporangia are found on the underside of the leaves.
- These clusters of sporangia are called **sori** (singluar: sorus).

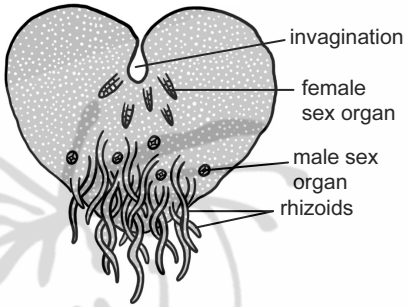


Underside of fern leaf



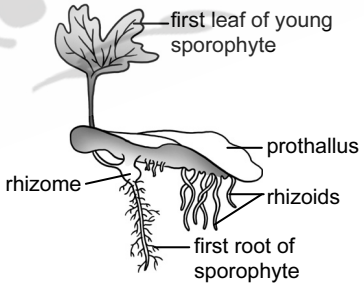
Structure of a sorus

- Spores are released from the sporangia and dispersed by the wind.
- When a spore germinates it gives rise to a green, **heart-shaped prothallus**, that represents the gametophyte generation.



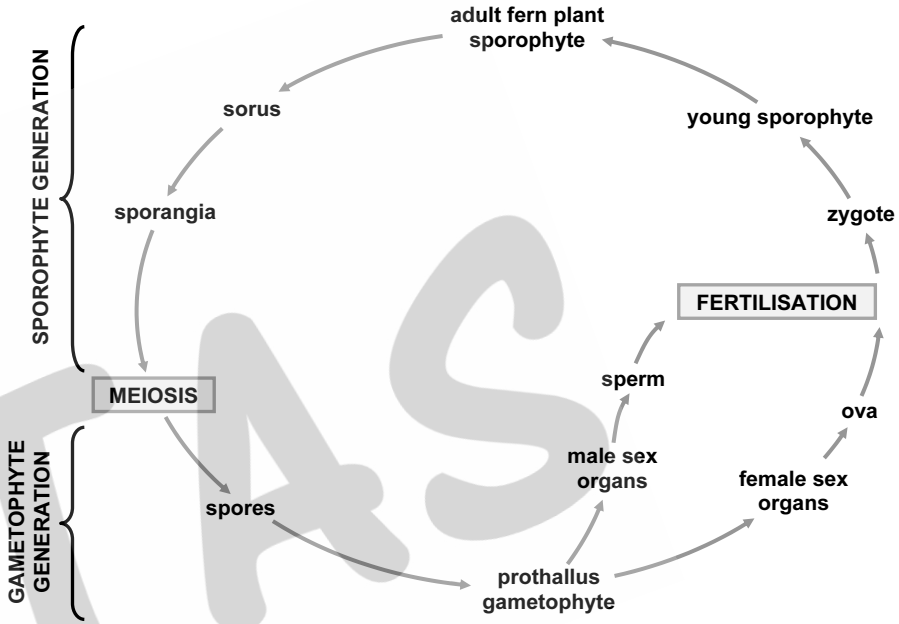
Prothallus - gametophyte generation

- The **gametophyte generation** is **less prominent**, has a shorter lifespan and disappears after one cycle of gamete formation and fertilisation.
- Rhizoids on the ventral (lower) surface of the prothallus anchor it in the soil.
- **Male and female sex organs**, which produce sperm and ova respectively, are also found on the ventral surface of the prothallus.
- Released sperm **need water** to move to the ovum in the female sex organ.
- Therefore, fertilisation is dependent on water.
- After fertilisation occurs a zygote is formed and this gives rise to the new fern plant (sporophyte).
- Initially, the young sporophyte lives parasitically on the gametophyte. When the young sporophyte is independent (absorbs its own water and mineral salts and can photosynthesise), the prothallus disappears.



Take note that ferns, just like mosses, produce no seeds and no fruit.

The life cycle of Pteridophytes is represented below. You do not have to learn it, it is simply given to illustrate the concepts in context and make it more understandable.



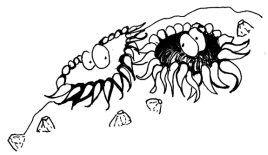
Overview

PTERIDO-PHYTES	Structure of dominant generation (sporophyte)	Vascular tissue	Spores/ seeds	Fruit	Dependency on water for reproduction
ferns	true roots, underground stem, large compound leaves	xylem and phloem present	spores	none	water needed for fertilisation

*The following two plant groups, Gymnosperms and Angiosperms, are both **seed-forming** plant groups and are collectively known as the **Spermatophytes**.*

Comparative table of the relationship between the mode of living and body plan of 6 phyla

Phylum	Mode of life	Symmetry and cephalisation	Number of tissue layers	Presence/absence of coelom and blood system	Type of body cavity	Presence/absence of through gut/complete gut
Porifera	▸ aquatic (sea water) ▸ sessile	▸ asymmetrical ▸ no cephalisation	▸ cellular (consist of loose cells)	▸ acoelomate ▸ no blood system	▸ spongocoel	▸ none
Cnidaria	▸ aquatic (fresh and sea water) ▸ sessile and free-living	▸ radially symmetrical ▸ no cephalisation	▸ two layers (diploblastic)	▸ acoelomate ▸ no blood system	▸ coelenteron	▸ absent ▸ only one opening
Platyhelminthes	▸ aquatic ▸ free-living and parasitic	▸ bilaterally symmetrical ▸ cephalisation	▸ three layers (triploblastic)	▸ acoelomate ▸ no blood system	▸ none	▸ absent ▸ only one opening
Annelida	▸ aquatic (fresh and sea water) ▸ terrestrial (moist environments) ▸ free-living	▸ bilaterally symmetrical ▸ cephalisation	▸ three layers (triploblastic)	▸ coelomate ▸ closed blood system	▸ coelom	▸ present ▸ two openings
Arthropoda	▸ occur everywhere - aquatic (fresh and sea water) terrestrial, underground, in the air ▸ free-living	▸ bilaterally symmetrical ▸ cephalisation	▸ three layers (triploblastic)	▸ coelomate ▸ open blood system	▸ coelom (haemocoel)	▸ present ▸ two openings
Chordata	▸ occur everwhere, terrestrial, in the air, aquatic (fresh and sea water) ▸ free-living	▸ bilaterally symmetrical ▸ cephalisation	▸ three layers (triploblastic)	▸ coelomate ▸ closed blood system	▸ coelom	▸ present ▸ two openings

UNIT 4

QUESTION 1

The kingdom Animalia is divided into 30 phyla that share specific properties with each other. Classify the animals below according to the six phyla that you have studied.

1.1 fish
1.2 leech
1.3 blue bottle
1.4 spider
1.5 dove
1.6 *Planaria*
1.7 sponge
1.8 sea anemone
1.9 crayfish
1.10 sea worm

QUESTION 2

2.1 Define the concept *symmetry*.

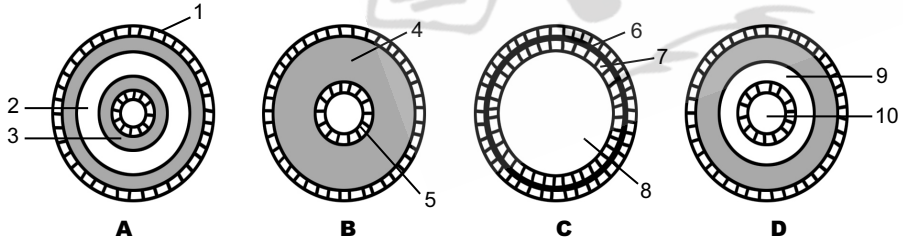
2.2 Identify the type of symmetry illustrated in the following animals that are marked from A to C, respectively. Give a reason for each.

A B C

2.3 Explain how animals with radial and bilateral symmetry differ from each other with respect to cephalisation.

QUESTION 3

Study the cross-sections of four groups of animals below and answer the questions that follow.



3.1 Identify the labels that are numbered from 1 to 10.

3.2 Classify A to D as diploblastic or triploblastic, according to the number of germ layers in the developing embryo.

3.3 Which of A, B, C or D is considered:

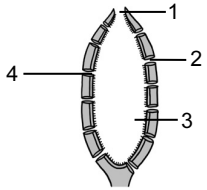
3.3.1 acoelomate? 3.3.2 coelomate? 3.3.3 pseudocoelomate?

3.4 Which one of A, B, C or D represents the most advanced and complex animal? Give a reason for your answer.

3.5 Give FOUR reasons why a coelom is considered biologically important.

QUESTION 4

Study the sketch below and answer the questions that follow.



4.1 To which phylum does this organism belong?

4.2 Why is this organism not considered diploblastic or triploblastic?

4.3 What type of symmetry does this organism have?

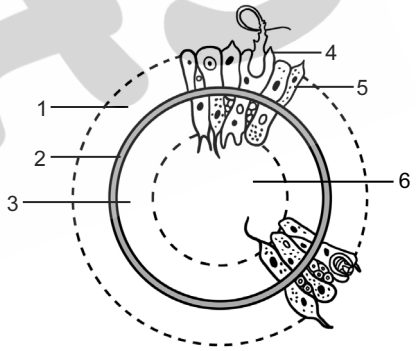
4.4 Identify the labels that are numbered 1 to 3.

4.5 This organism is considered acoelomate. Give a reason for this statement.

4.6 Identify the part numbered 4 and discuss the role it plays in filter feeding as it occurs in this organism.

QUESTION 5

Study the following representation of a section through an example of the phylum Cnidaria.



5.1 Identify the labels that are numbered from 1 to 6.

5.2 What type of symmetry is shown in the above organism? Give a reason for your answer.

5.3 Give one advantage and one disadvantage of the type of symmetry mentioned in Question 5.2.

5.4 What level of organisation occurs in Cnidaria?

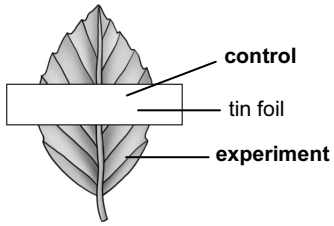
5.5 Name the two basic body forms that occur in Cnidaria.

5.6 What type of neural network occurs in Cnidaria and where it is situated in the body?

5.7 Describe the role and functioning of the cell, numbered 4, in the feeding process of this organism.

5.8 This animal only has one opening to the exterior. What effect does this have on the feeding process?

Practical Investigation: Light is essential for photosynthesis



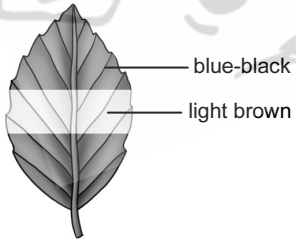
Method

- Destarch a potted plant with green leaves (place the plant in a dark cupboard for 48 hours).
- Cover a portion of a leaf with tin foil. *(The leaf must remain attached to the plant.)*
- Place the plant in the sun for approximately 48 hours.
- Pick the leaf and remove the foil.
- Test for the presence of starch as in the Investigation on p. 2.4.

*The **experiment** is the part of the leaf that is exposed to light, while the **control** is the part that is covered with tin foil.*

Results

- The iodine solution in the control remains **light brown**.
- The iodine solution in the experiment turns from **light brown** to **blue-black**.



Deduction

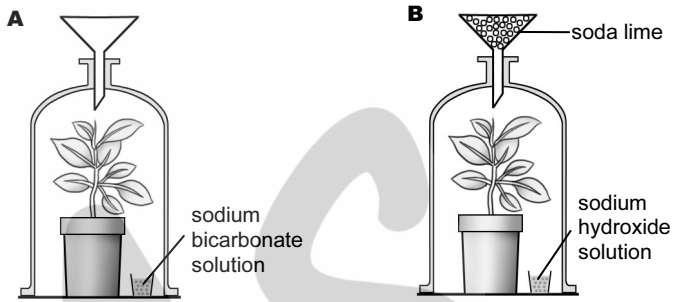
The parts that are blue-black contain starch due to photosynthesis.

Conclusion

Light is essential for photosynthesis.

The following three Practical Investigations can be performed as learner investigations, demonstrations or as interpretation of the data.

Practical Investigation: Carbon dioxide is essential for photosynthesis



Method

- Destarch two potted geraniums by placing the plants in a dark cupboard for **48** hours.
- Set up the apparatus as shown in the above illustration.
- **Soda lime** is used to absorb CO_2 from the air flowing in.
- **Sodium hydroxide** is used to absorb CO_2 from the air in the bell jar.
- **Sodium bicarbonate** is used to release CO_2 into the air in the bell jar.
- Water both plants well and place them in the sun for at least 24 hours.
- Take a leaf from each plant and test for the presence of starch as in the Investigation on p. 2.4.

Results

A (experiment) : Iodine solution turns from **light brown** to **blue-black**

B (control) : Iodine solution remains **light brown**

Deduction

A: Starch is produced; photosynthesis takes place in the presence of CO_2.

B: No starch is produced; no photosynthesis could take place in the absence of CO_2.

Conclusion

CO_2 is essential for photosynthesis.

PROCESS OF CELLULAR RESPIRATION

We distinguish between:

- **Aerobic respiration** (which requires oxygen)
- **Anaerobic respiration** (which does not require oxygen)

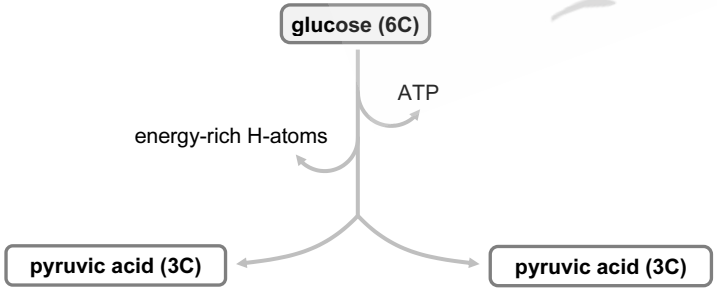
Aerobic respiration

Three stages can be distinguished:

- **Glycolysis**
- **Krebs cycle**
- **Oxidative phosphorylation**

Glycolysis

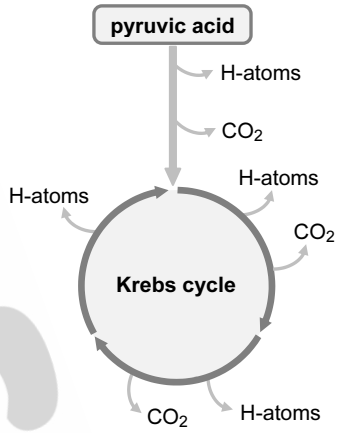
- Glycolysis occurs in the **cytosol** just outside the mitochondrion.
- This phase requires no oxygen and is therefore an **anaerobic** phase.
- **Glucose** (which consists of 6 carbon atoms) is broken down step by step.
- Two molecules of **pyruvic acid**, with 3 carbon atoms each, are formed.
- Energy-rich **H-atoms**, as well as a small amount of energy, is released and stored in **ATP**.
- Coenzymes (hydrogen carriers) carry the energy-rich hydrogen atoms to the third phase (oxidative phosphorylation).



Representation of Glycolysis

Krebs cycle

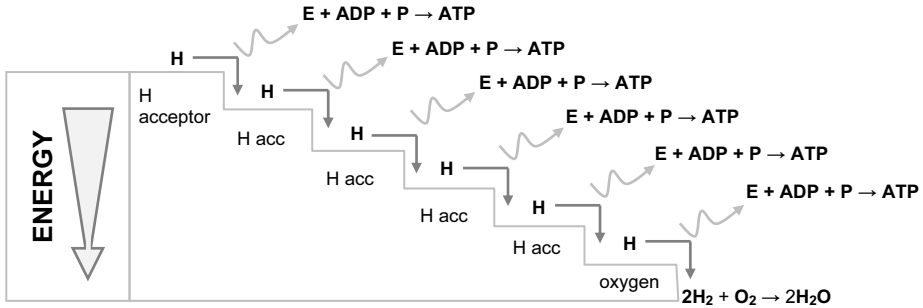
- The Krebs cycle takes place **inside** the **mitochondrion**.
- This phase is an **aerobic** phase as it requires oxygen.
- Pyruvic acid enters the mitochondrion.
- A series of cyclic reactions take place.
- Energy-rich **H-atoms** and **CO_2** is released.
- Coenzymes act as hydrogen carriers that transmit the energy-rich H-atoms to the next phase.



Representation of the Krebs cycle

Oxidative phosphorylation

- Oxidative phosphorylation takes place on the **inner** folded **membrane** (cristae) of the **mitochondrion**.
- This phase requires oxygen and is therefore an **aerobic** phase.
- Energy-rich **H-atoms** from the Krebs cycle are carried to a hydrogen transfer system by coenzymes.
- H-atoms are transferred from one hydrogen acceptor to the next.
- Every time an H-atom is transferred from one acceptor to the next, **energy** (E) is released.
- This energy binds a phosphate (P) molecule with ADP to form ATP, which is the energy carrier in the cell.
- Oxygen is the final hydrogen acceptor. Two hydrogen atoms combine with one oxygen atom to form a molecule of **water** (H_2O).



Representation of Oxidative phosphorylation

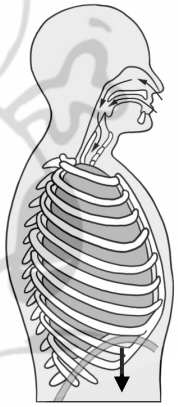
VENTILATION OF THE LUNGS

*This process is also known as the **mechanism of breathing**.*

- The movement of air between the atmosphere and the lungs is caused by a **difference in air pressure** between the atmospheric air and the air in the thoracic cavity and lungs (alveoli).
- The movement of the respiratory muscles (diaphragm and intercostal muscles) changes the volume of the thoracic cavity, which causes the difference in pressure.
- Ventilation of the lungs takes place in two phases, i.e.
  - **Inhalation** - air moves from the environment into the lungs.
  - **Exhalation** - air moves from the lungs to the environment.

Inhalation

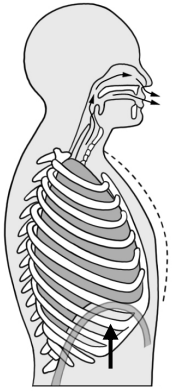
- The diaphragm contracts and becomes flatter.
- The thoracic cavity enlarges from top to bottom.
- The external intercostal muscles contract,
- causing the ribs to move upwards and outwards.
- The thoracic cavity enlarges from side to side and from front to back.
- The abdominal muscles relax so that the abdominal cavity can accommodate the viscera (all the internal organs) being pushed down by the diaphragm.
- The total volume of the thoracic cavity is increased.
- The pressure in the thoracic cavity and lungs decrease.
- The elastic lungs expand.
- Since the atmospheric pressure is higher than the pressure in the thoracic cavity and the lungs, O_2-rich air flows into the lungs.



*Inhalation is an **active process**, because it is associated with contraction of the diaphragm and external intercostal muscles, which increases the volume of the thoracic cavity.*

Exhalation

- The diaphragm relaxes and returns to its original dome shape.
- The thoracic cavity becomes smaller from top to bottom.
- The external intercostal muscles relax,
- causing the ribs to move downward and inward.
- The thoracic cavity reduces in size from side to side and from front to back.
- The total volume of the thoracic cavity is reduced.
- The pressure in the thoracic cavity and lungs increase.
- Since the pressure in the chest cavity and lungs is higher than the atmospheric pressure, CO_2-rich air flows out of the lungs.



*Exhalation is a **passive process**, because it is associated with relaxation of the diaphragm and external intercostal muscles, which decreases the volume of the thoracic cavity.*

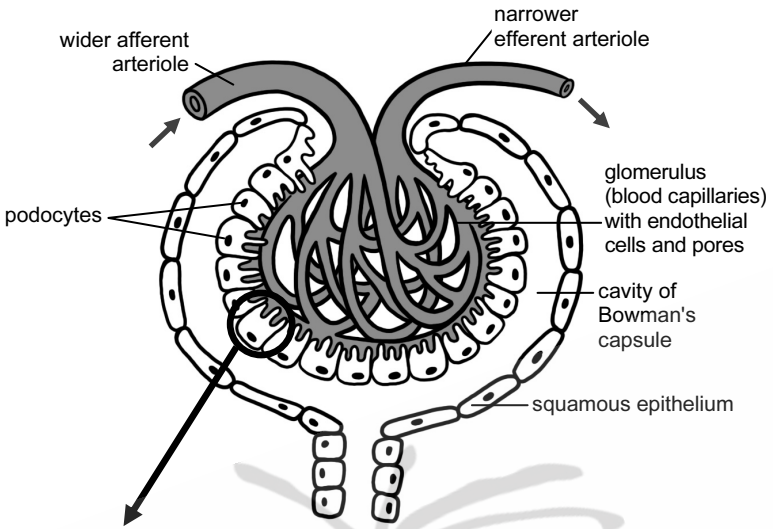
What happens when you whistle, sneeze, cough or shout?

- Exhalation is forced and becomes an active process.
- The internal intercostal muscles contract, causing the ribs to move even further inward.
- The abdominal muscles contract and the intestines are pushed up against the diaphragm, forcing it further upward.
- The volume of the thoracic cavity is further reduced.
- The pressure within the chest cavity is significantly increased.
- Air is forced from the lungs, making whistling, sneezing, coughing or shouting possible.

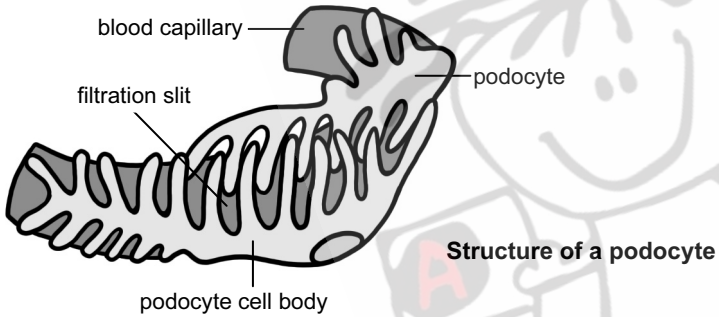
Practical Investigation: Demonstration of breathing movements

Requirements

- glass bell jar
- glass Y-tube
- rubber stopper with hole
- two balloons
- rubber sheet
- string



Malpighian body



Structure of a podocyte

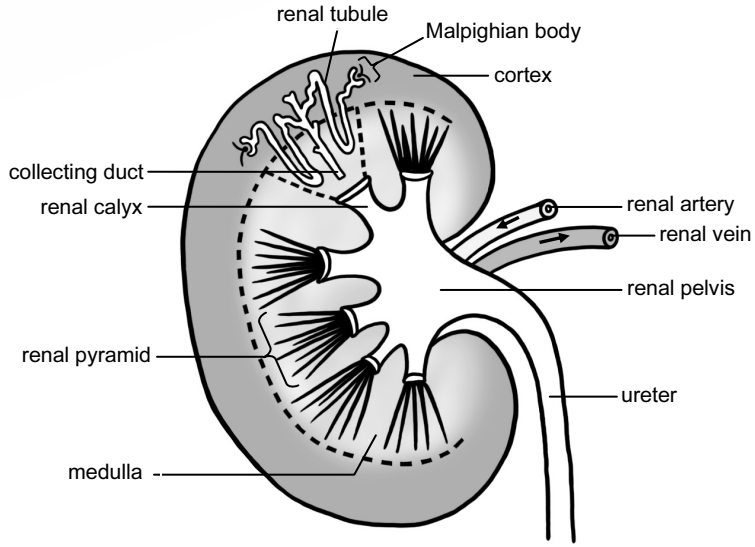
- The inner wall of the **Bowman's capsule** consists of specialised cells, the **podocytes**.
- The podocytes are cells with projections between which small openings, the **filtration slits**, occur.
- The cavity between the inner and outer wall of the Bowman's capsule is known as the **cavity of the Bowman's capsule**.

***NB**: The blood in the glomerulus is separated from the cavity of the Bowman's capsule by a thin endothelial cell layer with pores and the podocyte layer with filtration slits.*

Renal tubule

- The renal tubule is a long convoluted tubule that is situated partially in the cortex and partially in the medulla.
- The tube consists of three parts: the **proximal convoluted tubule**, the **loop of Henle** and the **distal convoluted tubule**.
- The **proximal convoluted tubule** follows directly after the Bowman's capsule and is situated in the cortex.
- The renal tubule is at its widest in this part and is lined with a single layer of cuboidal epithelium.
- The **loop of Henle** consists of a descending limb, which extends down into the medulla and forms a hairpin loop, and an ascending limb which extends up into the cortex.
- The loop of Henle is situated in the medulla.
- The **distal convoluted tubule** is situated in the cortex and, just like the proximal convoluted tubule, it is lined with a single layer of cuboidal epithelium.
- The distal convoluted tubule opens into a **collecting duct** together with a number of distal convoluted tubules from other nephrons.
- A few collecting ducts converge and form the **ducts of Bellini**.
- The ducts of Bellini are the tubes forming the pyramids that open into the renal calyx of the renal pelvis.

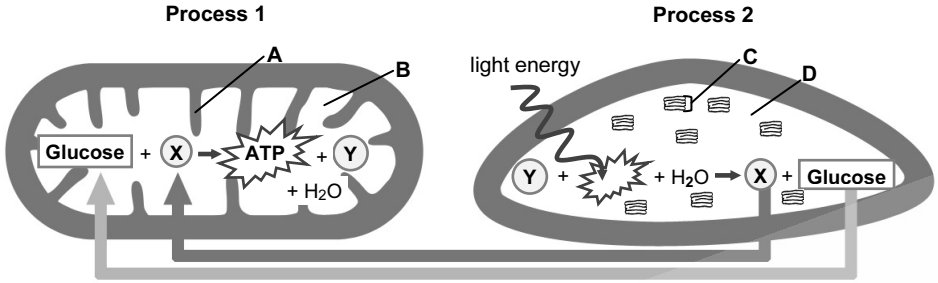
The following diagram shows the macro- and microscopic structures of the kidney. The position of the nephrons is clearly visible.



Position of nephrons in the kidney

QUESTION 3

The diagram below shows a simplified view of the relationship between two biochemical processes.



3.1 Identify ...

3.1.1 process 1

3.1.2 process 2

3.2 Name the organelles in which the following processes occur:

3.2.1 process 1

3.2.2 process 2

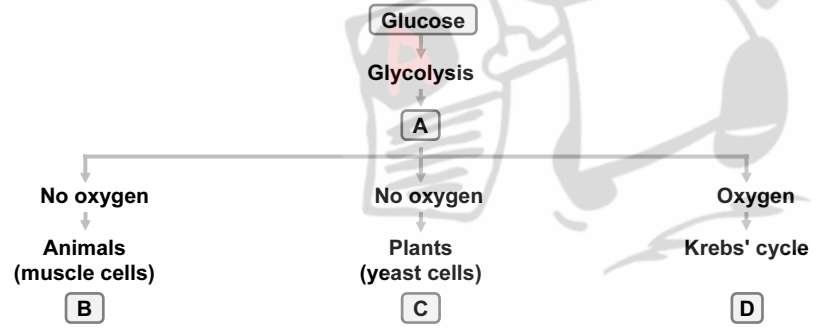
3.3 Provide labels for the parts A, B, C and D.

3.4 Identify the gases X and Y.

3.5 Tabulate FOUR differences between process 1 and 2.

QUESTION 4

Study the diagram below and answer the questions that follow.



4.1 In which organelle in living cells does the above process take place?

4.2 Identify the substance labelled A.

4.3 Name ONE product formed at B and TWO products formed at C.

4.4 Name the TWO by-products that are released during the Krebs cycle, represented by D.

4.5 Name the phase of cellular respiration that follows the Krebs cycle.

4.6 Is the phase mentioned in Question 4.5 aerobic or anaerobic?

4.7 Which compound is the final hydrogen acceptor during the phase mentioned in 4.5?

QUESTION 5

5.1 Tabulate FOUR differences between aerobic and anaerobic respiration.

5.2 State TWO similarities between aerobic and anaerobic respiration.

QUESTION 6

The combustion in the engine of a car can be compared to respiration in a cell. The following equation represents both processes:

fuel + oxygen → carbon dioxide + water + energy

6.1 Name a fuel that is used in an animal cell.

6.2 In which state is water that is formed during cellular respiration?

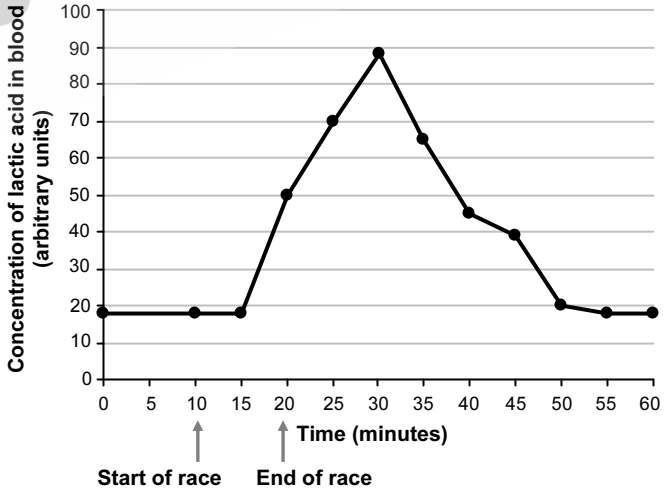
6.3 Car engines sometimes do not burn the fuel completely due to a lack of oxygen. This is referred to as incomplete combustion.

6.3.1 Name the process that is similar to incomplete combustion which occurs in plants and animals.

6.3.2 Name TWO products of the process mentioned in 6.3.1, when it takes place in yeast cells.

QUESTION 7

The concentration of lactic acid in the blood of an athlete was measured at intervals before, during and after a long-distance race which lasted 10 minutes. The results are represented in the graph below.



7.1 What is the 'normal' lactic acid concentration in the blood?

7.2 For how long did the concentration of lactic acid continue to increase after the end of the race?

Resource partitioning in plants: A forest ecosystem

- In a forest ecosystem the plants form different vertical layers or strata.
- This formation of layers is known as **stratification**.
- Light is a limited resource in a forest.
- The different plant layers (strata) are adapted to survive at different intensities of light, and therefore the resource is divided between the different layers of plants.
- The strata in a forest ecosystem include:
  - **Tall trees (A)** that form the top leaf canopy and get the most sunlight.
  - **Short trees (B)** that form the understorey and are exposed to less light.
  - **Shrub layer (C)** that is adapted to survive in an environment with low light intensity.
  - **Shade plants and herbaceous layer (D)** that occur closest to the forest floor and consist mainly of mosses, ferns and herbs which are shade plants.

Epiphytes grow on tree trunks, and creepers/vines grow around branches to maximise the amount of light they can absorb for photosynthesis to maximise growth.

Decrease in light intensity from A to B to C to D

Some organisms of different species live together in a relationship. Such a relationship of co-existence is known as **symbiosis**.

Three types of symbiosis can be distinguished:

- mutualism
- commensalism
- parasitism

MUTUALISM

- Mutualism is a symbiotic relationship between two organisms of different species, where **both benefit**.

Examples of mutualism

Bees and flowers

- Bees are attracted by the bright colours of flowers, where they find and feed on nectar and pollen.
- While the bee is feeding, pollen grains stick to its body.
- As the bee moves to the next flower, the pollen is transferred and cross-pollination takes place.
- Both organisms benefit:
  - the bee gets food from the flower.
  - the flower is cross-pollinated.

Honeybird and honey badger

- The honeybird and honey badger both prefer honey, honeycomb, bees and larvae to any other food.
- These two need each other to get to the honey.
- The honeybird can find the beehive, but is not big or strong enough to tackle swarms of bees.
- It is not difficult for the honey badger with its strong, sharp, raking claws to break open the beehive, but it is difficult to find one.

- In some areas there are water shortages.
- Larger communities, such as towns and cities, have water purification plants to purify drinking water that is piped to homes.

Possible actions to recycle water

- Individuals can make a difference by reusing grey water for watering vegetable gardens or flower beds.

Grey water is untreated waste water from baths, basins, showers and washing machines. Waste water from toilets and kitchen sinks is known as black water and must be purified before recycling.

The impact of alien invasive plants on water quality

- Alien plants are plants that are intentionally or accidentally brought to an area outside their natural habitat or country where they then establish themselves.
- Due to the absence of their natural enemies or diseases in their new habitat, as well as the fact that they are resilient and reproduce quickly, invasive plants are often more successful than indigenous plants that belong to that area.
- Alien plants that flourish, successfully crowding and out-competing indigenous plants, are known as **invasive plants**.
- An example of an alien invasive plant that threatens water quality in freshwater sources such as lakes, dams and slow moving rivers, is the water hyacinth *(Eichhornia crassipes)*.
- Water hyacinths are floating water plants with bright green leaves that grow in the form of rosettes.
- It has distinctive swollen leaf stalks (petioles) and light purple or blue flowers.
- The plants reproduce rapidly and form a carpet-like cover on the water surface.
- This blocks sunlight from other photosynthetic organisms (aquatic plants) in the deeper layers of the water.
- This causes the death of many of these aquatic plants.
- The dead plant material decomposes, leading to a drastic increase in decomposition bacteria.
- Decomposition bacteria use large amounts of oxygen during the process of decomposition.
- Less oxygen is available for other aquatic organisms, causing many of them to die.

NB: *This is the same phenomenon, i.e. eutrophication, that occurs during algal bloom.*

- The dense, carpet-like plant mass also clogs waterways, irrigation pipes and canals.
- Alien plants that block up waterways may also impact on the supply of water to purification plants.
- The stagnant water also increases the risks of water-borne diseases.

Dams, rivers and lakes are frequently cleared at great expense to counteract the adverse effects of these invasive plants. *[See Alien Plant Invasion on p. 3.54]*

Possible actions against invasive plants

- Create awareness of the negative impact of alien plants.
- Remove alien vegetation using mechanical, chemical and biological control.
- Encourage the planting of indigenous plants.

A dam overgrown with water hyacinth

A water hyacinth

MODULE 2: MEMO
UNIT 1

QUESTION 1

1.1 It is the production of carbohydrates (**glucose**) from **carbon dioxide** and **water** by using **radiant energy** from the sun, which is trapped by **chlorophyll**. **Oxygen** is released.

1.2 chloroplast (of plant cells)

1.3 A - light phase B - dark phase (Calvin cycle)

1.4 A - granum/grana B - stroma

1.5 1 - radiant energy (1 and 2 in any order)
2 - water

1.6 O_2 1.7 CO_2

1.8 glucose 1.9 starch

QUESTION 2

See pg. 2.3 in the notes under the heading *'Importance of photosynthesis'*.

QUESTION 3

3.1 See pg. 2.3 in the notes under the heading *'Factors that influence the rate of photosynthesis'*.

3.2 It is to provide optimal conditions of light, temperature and CO_2 for maximal growth of the cultivated plants.

3.3 See pg. 2.7 in the notes, under the heading *'Role of optimum light, temperature and CO_2 enrichment in a greenhouse system'*.

3.4 1 - temperature 2 - light intensity/CO_2 concentration

QUESTION 4

4.1 The presence of starch is an indication that photosynthesis took place.

4.2 leaf 1

4.3 CO_2, H_2O and sunlight are the raw materials needed for photosynthesis to take place.

4.4 $CO_2 + H_2O$ + radiant energy $\xrightarrow[\text{enzymes}]{\text{chlorophyll}}$ glucose + O_2

QUESTION 5

5.1
- softens the leaf
- kills the cells/stops metabolism
- makes cells more permeable to alcohol and iodine solution

5.2 chlorophyll is soluble in alcohol and will be extracted from the leaf

5.3 alcohol is highly flammable

5.4 alcohol boils at a lower temperature than water

5.5 iodine solution

5.6 iodine solution changes from light brown to blue-black

QUESTION 6

A - test for the presence of starch in a leaf/test if a leaf produced starch during photosynthesis

B - to determine whether chlorophyll and light are essential for photosynthesis

C - to determine whether sunlight is essential for photosynthesis

D - to determine whether CO_2 is essential for photosynthesis

QUESTION 7

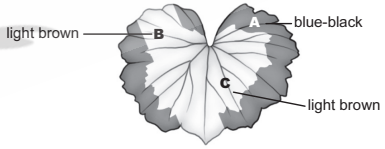
7.1 To remove all the starch from the plant, to ensure that the starch that causes a positive test at the end of the experiment was formed under experimental conditions.

7.2 place plant in a dark cupboard for 48 hours

7.3 chlorophyll light

7.4 Only the parts of the leaf that contain chlorophyll and were exposed to light will photosynthesise.

7.5



7.6 test more than one leaf 7.7 chlorophyll

7.8 In the absence of light the chloroplasts changed to leucoplasts and thus the grass will not be green anymore.

QUESTION 8

8.1 A - the iodine solution stays light brown
B - the iodine solution turns blue-black

8.2 A - Photosynthesis did not occur, since no CO_2 was present. No starch was formed; iodine solution remains light brown.

B - Photosynthesis occurred because everything (including CO_2 from sodium bicarbonate) required for photosynthesis was present. Starch was formed; iodine solution turned blue-black.

8.3 CO_2 is essential for photosynthesis to take place.

8.4.1 The plant in the experiment is given all the components needed for photosynthesis, including the factor that is being investigated.

The plant in the control is given all the components for photosynthesis, excluding the factor that is being investigated so that it can be compared with the experiment.

8.4.2 A

8.5 carbon dioxide

8.6
- use the same type of plant
- destarch both plants
- place both plants in the sun for 24 hours

8.7.1 absorbs all the CO_2 in the bell jar

8.7.2 releases CO_2 into the bell jar

8.7.3 absorbs CO_2 from air flowing in

8.8 Soil organisms respire and release CO_2 into the bell jar; this can influence the experiment if the soil is left uncovered.

8.9 CO_2 is essential for photosynthesis to take place.

8.10 accepted