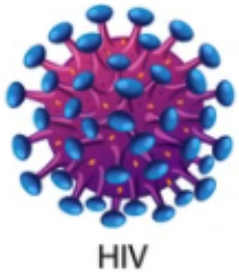
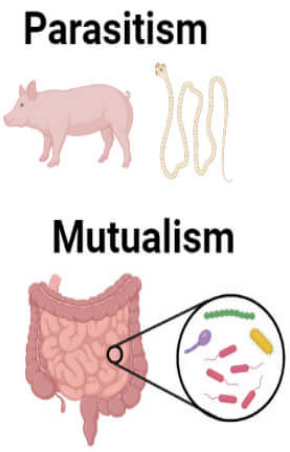
GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

LIFE SCIENCES

GRADE 11

REMOTE LEARNING WORKBOOK





TERM 1

WEEK 1: TOPIC: Biodiversity and classification of microorganisms

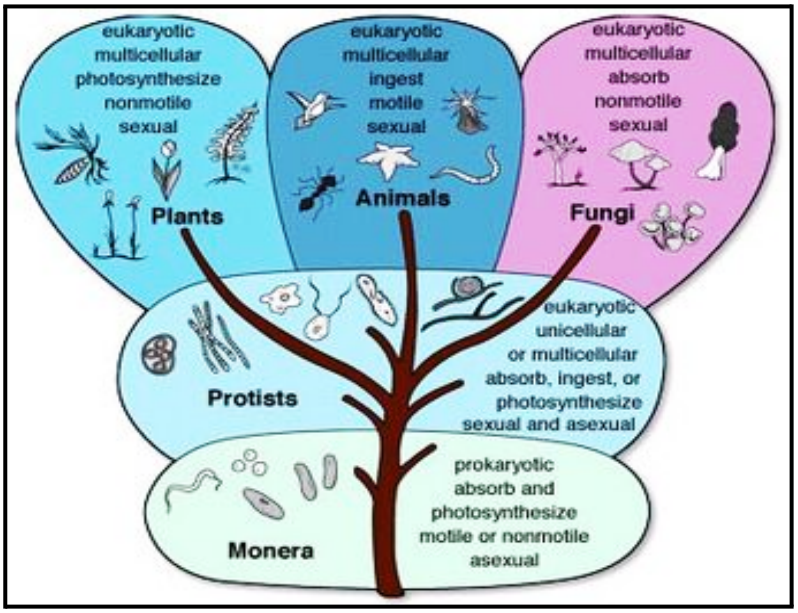
SUB-TOPIC: Basic structure of viruses, bacteria, Protista and fungi

NOTES & EXAM TIPS

Biodiversity in general, refers to the wide variety of plants, animals and microorganisms on Earth. Organisms which are too small to be seen with the naked eye are referred to as **micro-organisms**. Micro-organisms can be **unicellular** or **multicellular**. Some are harmful and cause diseases whilst others are very useful in the environment and to humans e.g. yeasts are used to make bread.

Classification of organisms

- Kingdom Monera – bacteria
- Kingdom Protista
- Kingdom Fungi
- Kingdom Plantae
- Kingdom Animalia



Biological terminology	
capsid	a protein coat surrounding the nucleic material of a virus
acellular	non-cellular
obligate parasite	obligate = forced; a parasitic organism that cannot complete its life-cycle without exploiting a suitable host (if an obligate parasite cannot obtain a host it will fail to reproduce)
host	an organism that harbours a parasite
pathogenic	an organism that causes disease
bacteriophage	a type of virus that infects bacteria; the word "phage" means to eat"
nucleoid	an irregularly shaped region within the cell of a prokaryote that contains all or most of the genetic material
prokaryotic	an organism where the nuclear material is **not enclosed** in a membrane
eukaryotic	any single or multicellular group of organisms that have a **membrane-bound nucleus** containing genetic material

flagellum	a **whip-like**, protruding filaments that help cells or microorganisms move; plural of flagellum is flagella
saprophytic	plant or fungal microorganisms that feeds on dead or decaying issues of other organisms
plasmid	a plasmid is a small, circular, double-stranded DNA molecule that is distinct from a cell's chromosomal DNA
phytoplankton	very small plants (algae) that float on or near the surface of water
zooplankton	consisting of small animals and the immature stages of larger animals which float on or near the surface of the water
chitin	a fibrous substance consisting of polysaccharides, which is the major constituent in the exoskeleton of arthropods and the cell walls of fungi
hyphae	a network of multi-celled threadlike filaments forming the mycelium of a fungus
mycelium	a vegetative mass or network of fungal hyphae found in and on soil or organic substrates
multinucleate	cells that have more than one nucleus per cell, i.e., multiple nuclei shared in one common cytoplasm
rhizoids	threadlike structures that anchor lower plants and fungi to a surface
budding	a form of asexual reproduction which involves the pinching off of offspring from the parent cell; the offspring cell is genetically identical to the parent
Spore	a reproductive cell capable of developing into a new individual without fusion with another reproductive cell

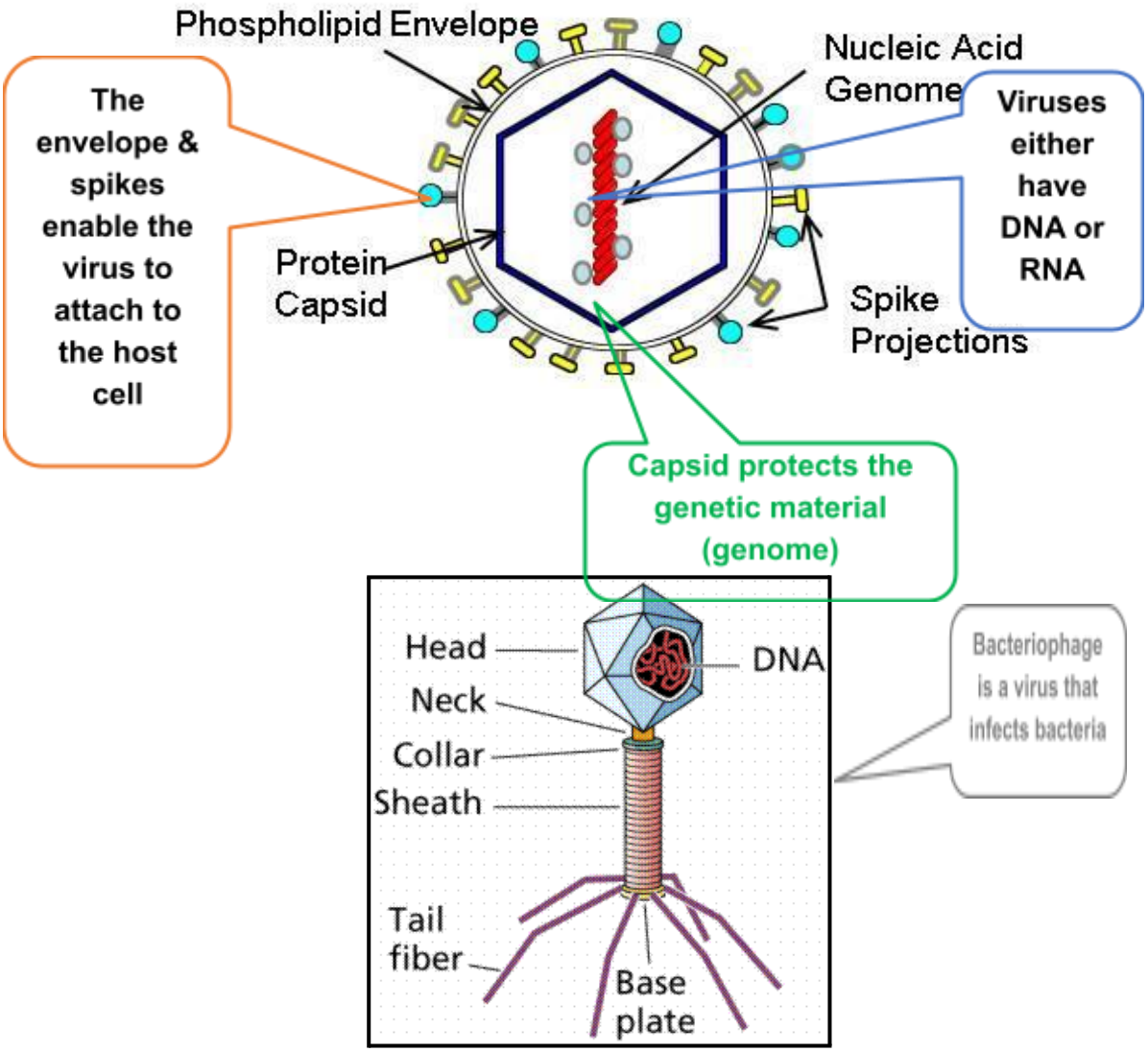
1. Viruses

Viruses are placed in a separate group and not in a kingdom because they display some non-living as well as living characteristics.

- Viruses occur in many different shapes,
- they cannot respire, feed or excrete waste
- They are acellular
- as they do not contain cytoplasm or membrane bound organelles
- If a virus cannot find a host, they can become dormant.

Introduction to viruses:
https://www.youtube.com/watch?v=8FqlTslU22s

Structure and characteristics of viruses



2. Bacteria

Bacteria belong to the Kingdom Monera. They are found everywhere on earth. Some are pathogenic and cause diseases such as tuberculosis, while most are useful.

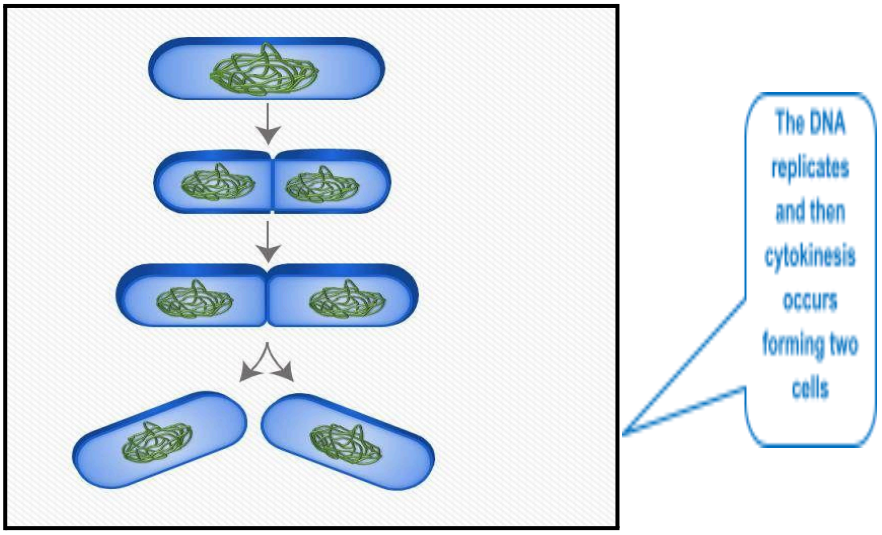
Structure and characteristics of bacteria

- Bacteria are unicellular
- They have no membrane around the nuclear material and therefor are said to be **prokaryotic**
- they occur in different shapes:

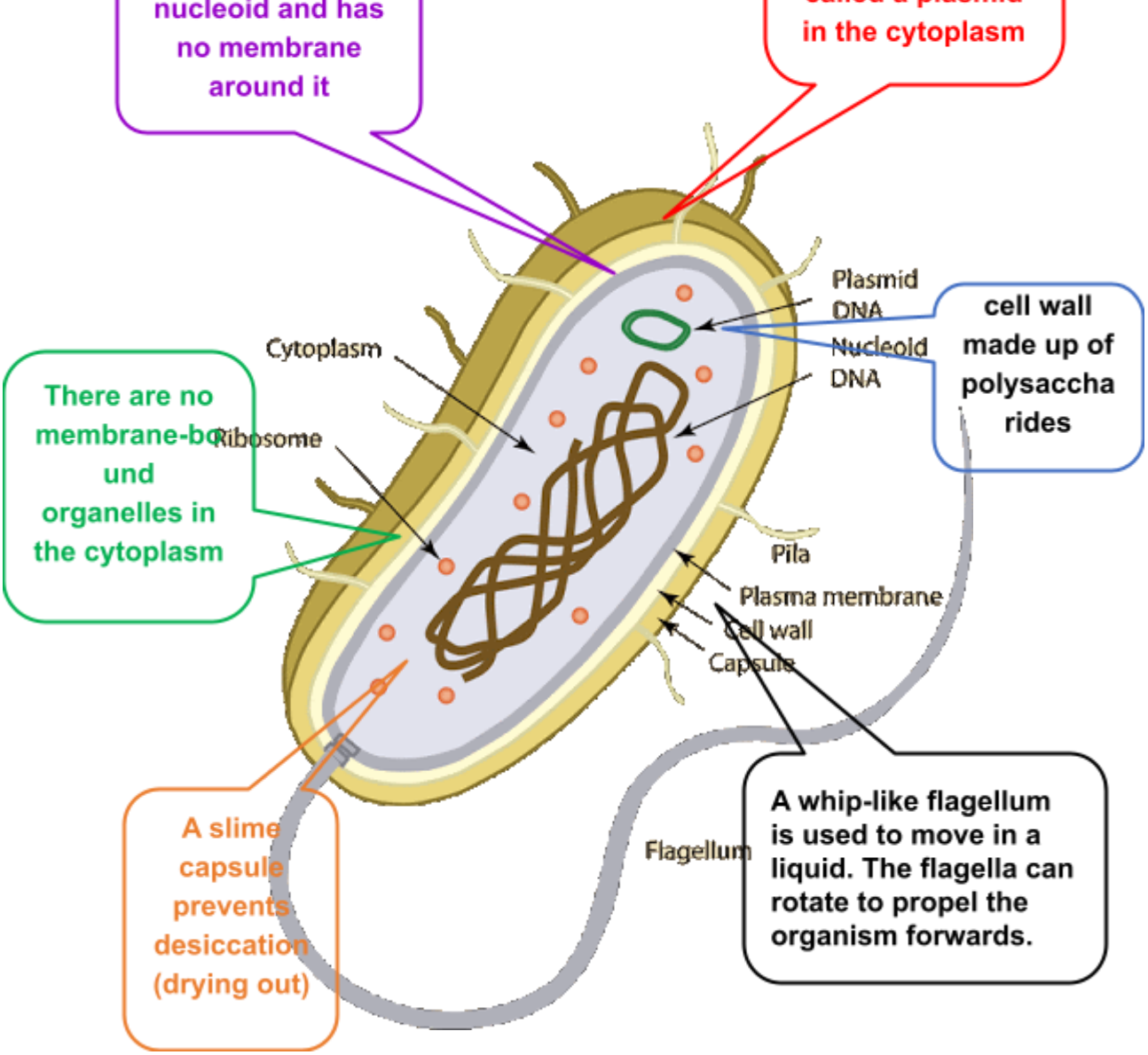
coccus – round	 Coccus
bacillus – rod-shaped	 Bacillus
spirillum – spiral-shaped	 Spirillum

vibrio – comma-shaped	 Vibrio

- Bacteria can be **autotrophic** or **heterotrophic**
    - **mutualistic, parasitic** or **saprophytic**
- Bacteria reproduce very rapidly by **binary fission**



Bacterial cell structure:
https://www.youtube.com/watch?v=4DYgGA9jdlE



3. Protista

The **Kingdom Protista** is a collection of **eukaryotic** organisms.

Structure and characteristics of Protista

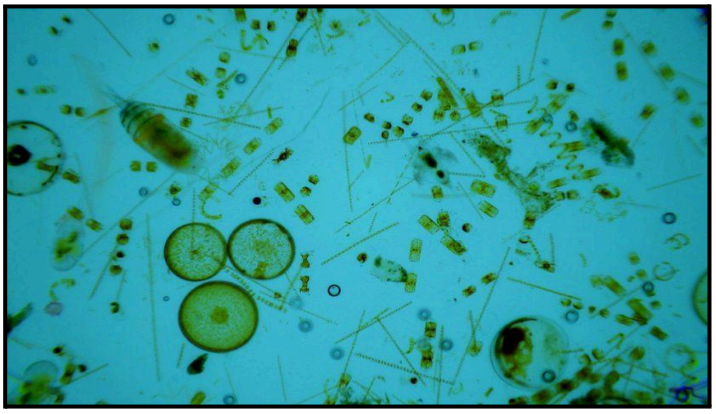
- Simple **unicellular** or **multicellular organisms**
- No tissue differentiation - **thallophytes**
- Found mainly in water
- **autotrophic** or **heterotrophic**
- some are **sessile** (permanently attached to a substrate) or free-floating
- others can move using **flagella** or **pseudopodia** (false feet)
- they can reproduce both sexually and asexually

There are **three groups** of **Protista**

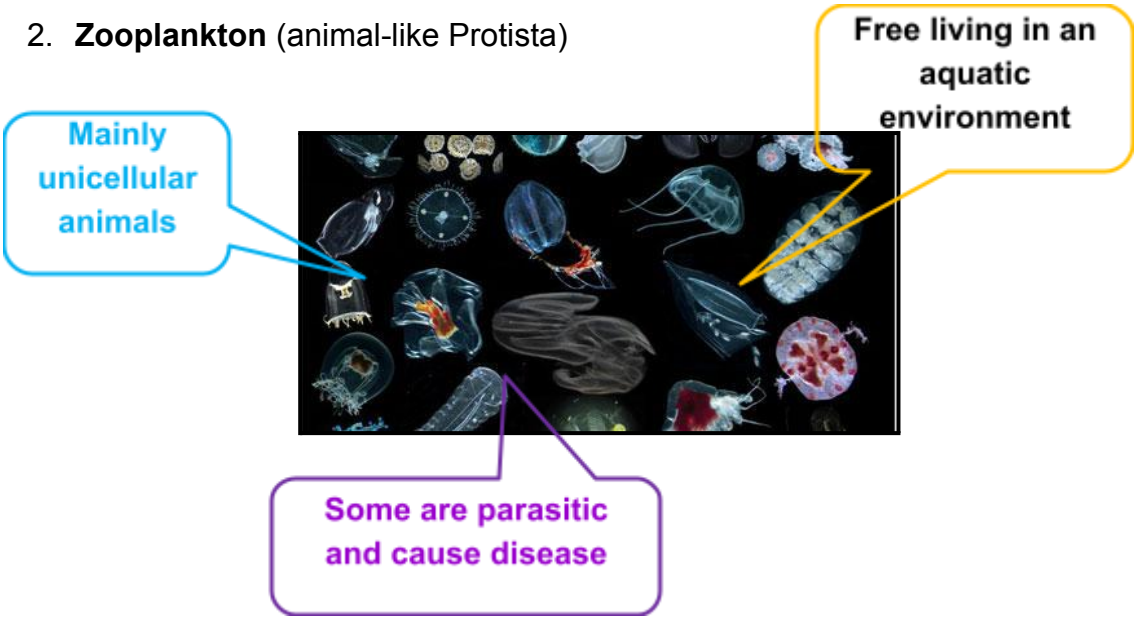
1. **Phytoplankton** (plant-like Protista)

Occur in aquatic environments

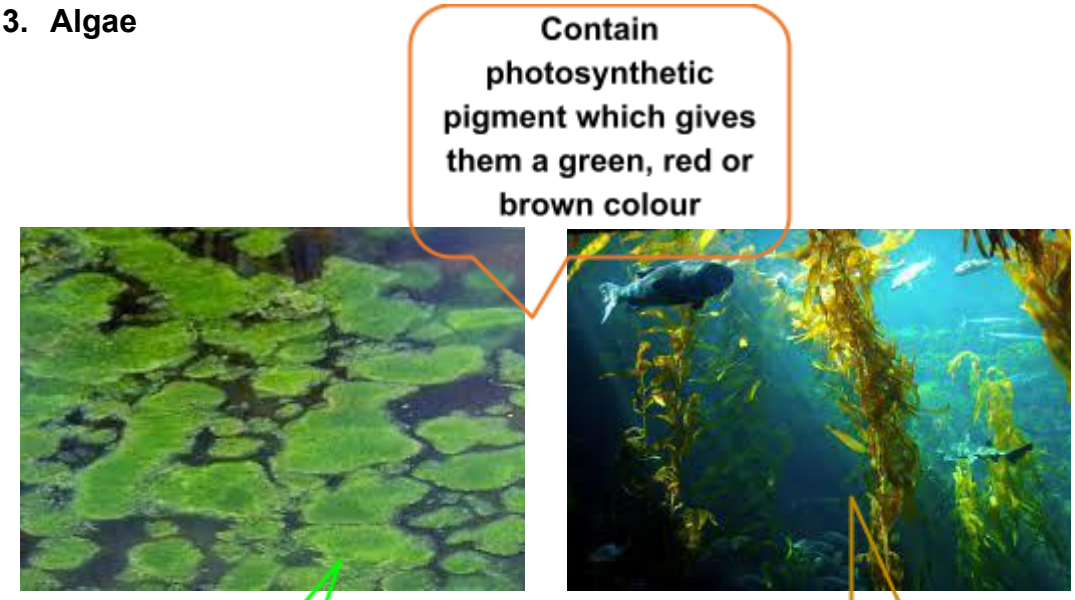
Mainly unicellular organisms



2. **Zooplankton** (animal-like Protista)



3. **Algae**



Protista and fungi structure and characteristics
https://www.youtube.com/watch?v=zK7Ckmxxqds

4. Fungi

The Kingdom Fungi includes **mould, yeast, mildew, rust, toadstools and mushrooms**

Structure and characteristics of Fungi

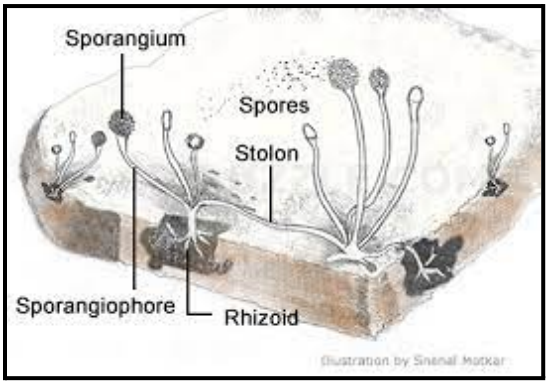
- Fungi are **eukaryotic** organisms – they have a defined nucleus bound by a nuclear membrane
- They are **heterotrophic** as they lack chlorophyll
- Fungi are **saprophytic** - live off dead organic matter
- or **parasitic** – live off living organisms
- some are **pathogens**
- The bodies of multicellular fungi are made up of threads called **hyphae**.
- All the hyphae together form a **mycelium**.
- The hyphae are often **multinucleate** (have many nuclei).

Multicellular fungi are made up of threads called hyphae

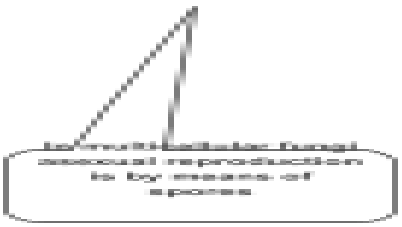
unlike plants, fungi cell walls contain chitin

Either unicellular or multicellular

- Fungi reproduce both sexually and asexually.



Asexual



ACTIVITIES/WORKSHEETS/EXAM TYPE QUESTIONS

QUESTION 1

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.4) in your ANSWER BOOK, for example 1.5 D.

1.1 Which of the following is applicable to viruses?

A They are mutualistic
B They are the simplest known living organism
C They are parasitic
D They are capable of respiration

1.2 The cell walls of fungi are composed of …

A chitin.
B cellulose.
C pectin.
D lignin.

1.3 Which statement correctly describes fungi and protozoans?

A Fungi and protozoans are all unicellular
B Fungi and protozoans all have chloroplasts
C Fungi and protozoans are eukaryotic
D Fungi and protozoans all have cell walls

1.4 A bacterium cell…

A has a nuclear membrane around its genetic material.
B is a prokaryote.
C Is a eukaryote.
D Contains mitochondria, vacuoles and plastids in the cytoplasm

(4x2) **(8)**

QUESTION 2

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.3) in your ANSWER BOOK.

2.1 An organism that consists of a nucleic acid surrounded by a shield of protein

2.2 A type of asexual reproduction whereby unicellular organisms like bacteria reproduce

2.3 A mode of nutrition where an organism is incapable of synthesizing organ compounds from raw material, therefore depending on other organisms for food **(3)**

QUESTION 3 *(Questions taken from various sources)*

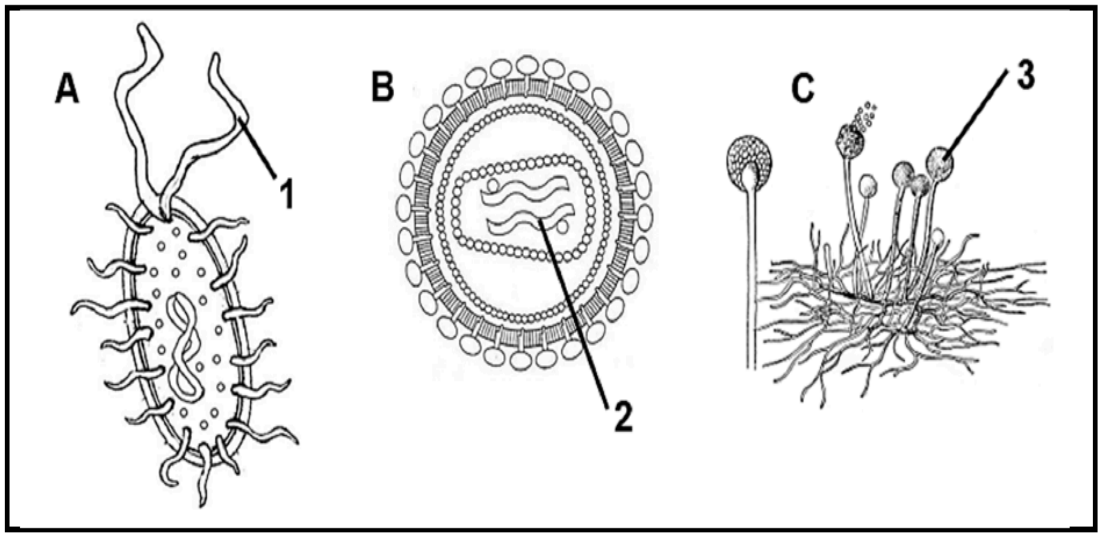
Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B or NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B,** or **none** next to the question number (3.1 to 3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	Comma-shaped bacteria	A B	Cocci Bacilli
3.2	Contains either DNA or RNA	A B	Bacteriophage Virus
3.3	Protective layer outside the cell wall	A B	Slime capsule Capsid

(3 x 2) **(6)**

QUESTION 4 *(EC P2 NOV 2019)*

4 Study the diagrams below of micro-organisms and answer the questions that follow.



4.1 Name the group of organisms to which **B** and **C** belong respectively. (2)

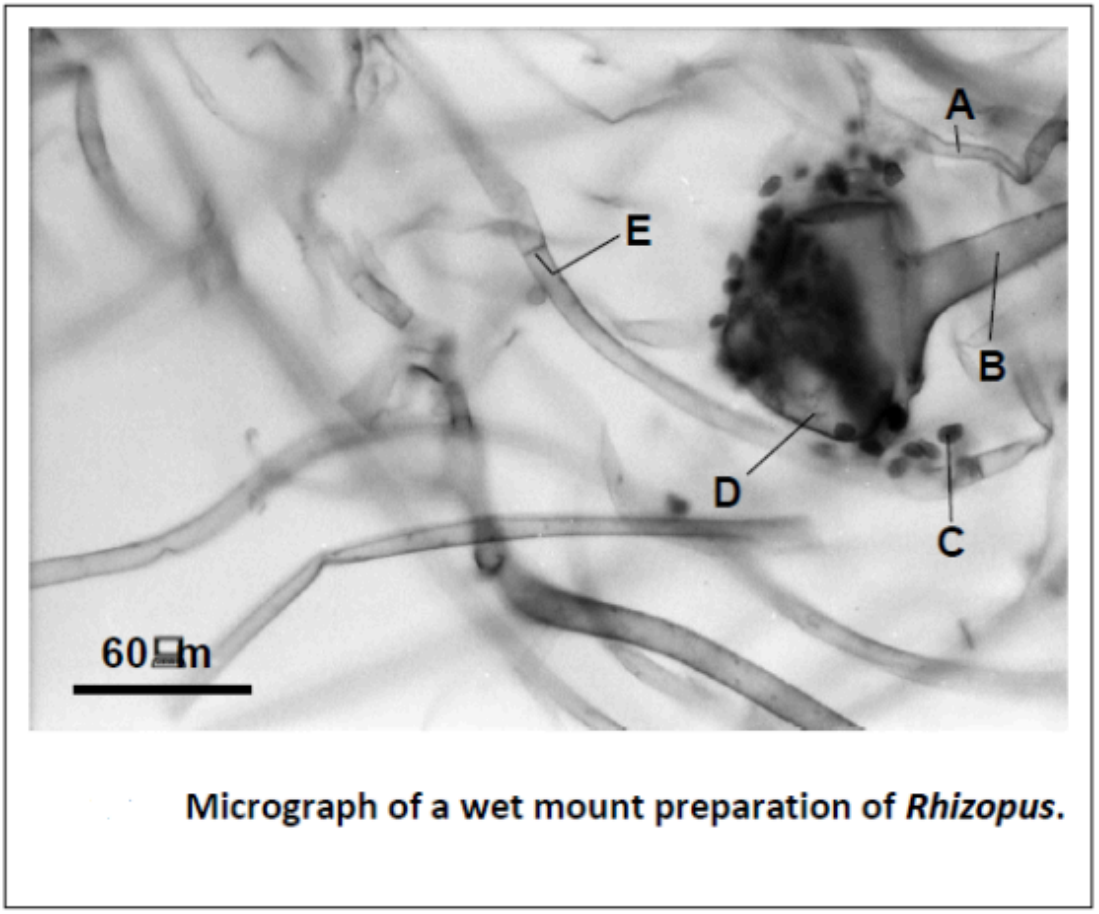
4.2 Provide labels for:
(a) **1**
(b) **2**
(c) **3** (3)

4.3 Give the LETTER of the organism that:
(a) Is not considered to be living (1)
(b) Is eukaryotic (1)

4.4 Name the shape of the bacterium in Diagram **A**. (1)
(8)

QUESTION 5

Study the micrograph and answer the questions.



Micrograph of a wet mount preparation of *Rhizopus*.

5.1 Identify the parts labelled **A** – **E**. (5)
5.2 Use the scale line to calculate the length of the structure labelled **C**. (4)
(9)

WEEK 2: TOPIC: Biodiversity and classification of microorganisms

SUB-TOPIC: Roles of viruses, bacteria, Protista and fungi in maintaining balance in the environment

NOTES & EXAM TIPS

MICRO-ORGANISMS AS PRODUCERS IN FOOD CHAINS

Autotrophic bacteria, phytoplankton and algae can manufacture their own food by photosynthesis. The carbohydrates they produce are available to consumers. These organisms form the first link in a food chain. Oxygen, the waste product of photosynthesis, is made available to other organisms for respiration.

1. **The role of micro-organisms as decomposers**

- Bacteria and fungi are the main decomposers.
- They break down dead plant and animal remains and return the nutrients to the soil.
- Organisms which break down dead organic matter to obtain nutrients are called saprophytes.

2. **The role of bacteria in the nitrogen cycle**

Bacteria play an important role in the nitrogen cycle.

- Free living bacteria can convert atmospheric nitrogen to ammonia and nitrates.
- Higher plants can only use nitrogen when it is in the form of nitrates, so they rely on bacteria for the conversion.
- Some plants form special relationships with nitrogen fixing bacteria.
- When plants and animals die, de-nitrifying bacteria return nitrogen to the atmosphere by a process called denitrification.

SYMBIOTIC RELATIONSHIPS

Symbiosis refers to the living together of two or more species of organism. A symbiotic relationship may benefit one or both members or it can be beneficial to one but harmful to the other one.

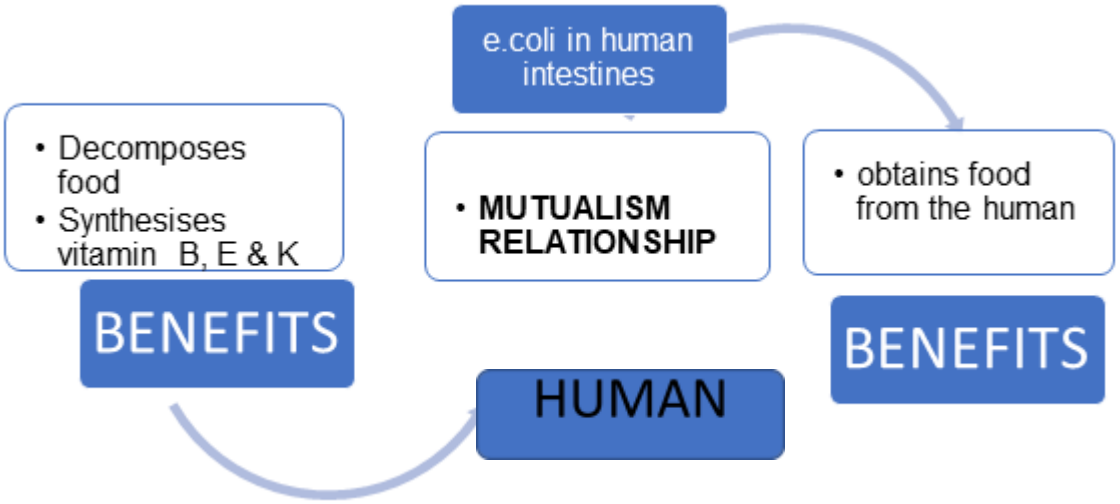
Three types of symbiosis occur:

- mutualism – both organisms benefit e.g. lichens
- commensalism – one species benefits whilst the other does not benefit, nor is it harmed
- parasitism – one species benefits whilst the other is harmed

1. **Relationship between nitrogen fixing bacteria and plants**

- Some nitrogen-fixing bacteria live in special nodules in the roots of legumes.
- They **produce nitrates** for the plant while the plant provides the bacterium with a **habitat**, **carbohydrates** and **water**.
- Both the plant and the bacteria benefit in this relationship. (**mutualism**)

2. **Relationship between *E. coli* bacteria and humans**



ACTIVITIES/WORKSHEETS/EXAM TYPE QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.3) in your ANSWER BOOK, for example 1.4 D.

1.1 Which of the following type of nutrition is a decomposer most likely to utilize?

A Ingestion
B Saprophytic
C Parasitic
D Autotrophic

1.2 De-nitrifying bacteria release nitrogen into the atmosphere through the process called…

A symbiosis.
B photosynthesis.
C nitrification.
D denitrification.

1.3 Which statement correctly describes fungi and algae?

A Fungi and algae live symbiotically as lichens
B Fungi and algae all have chloroplasts
C

(6)

D Fungi and algae are prokaryotic
Fungi and algae are heterotrophic

(3x2)

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.3) in your ANSWER BOOK.

2.1 Organisms which break down dead organic matter to obtain nutrients
2.2 Organisms that produce their own food by photosynthesis
2.3 A symbiotic relationship where one organism benefits while causing harm to their host

(3)

QUESTION 3 *(Questions taken from various sources)*

Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B or NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B,** or **none** next to the question number (3.1 to 3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
3.1	Can occur as saprotrophs, autotrophs or parasites	A: Fungi B: Bacteria
3.2	Algae and fungus living in a mutualistic relationship	A: Lichen B: Mycorrhizza
3.3	*E. coli* make vitamin K in the gut of humans	A: Commensalism B: Mutualism

(3 x 2) **(6)**

QUESTION 4

4.1 Name the form of nitrogen which higher plants use. (1)

4.2 Describe THREE ways in which nitrogen becomes available to higher plants. (3)

4.3 Briefly describe the ecological role of algae:

(3)

(a) as producers in ecosystems (2)

(b) in maintenance of oxygen-carbon dioxide balance **(9)**

QUESTION 5

A type of bacterium called *Escherichia coli* (*E.coli*) normally lives in the large intestine of humans. To determine whether *E.coli* is present in water, a chemical indicator is used. If the chemical indicator changes from a clear red colour to a cloudy yellow colour, this indicates that *E.coli* is present.
In an investigation conducted by a group of Grade 11 learners, samples taken from three rivers (X, Y and Z) were investigated for the presence of *E.coli*. Samples were taken from each river and put into glass bottles, which contained the clear red indicator solution. The bottles were then incubated at 37°C for two days. Only river Y showed presence of *E.coli*.

5.1 Explain two safety precautions that the learners should take when conducting this investigation. (4)

5.2 Suggest one reason for incubating the sample at 37°C. (1)

5.3 State how *E.coli* could have entered river Y. (1)

(6)

WEEK 3: TOPIC: Biodiversity and classification of microorganisms

SUB-TOPICS: Diseases caused by viruses, bacteria, protista and fungi. Immunity

NOTES & EXAM TIPS

EFFECTS AND MANAGEMENT OF DISEASES

Micro-organism	Disease	Effect	Management
Virus	Influenza	Fever, respiratory problems and muscle pains	Vaccination
Bacteria	Tuberculosis	Loss of appetite and weight, excessive coughing and sweating at night	Treatment of drugs for six months
Protista	Malaria	Headache, fever, joint pain, vomiting, convulsions and anaemia	Sleeping under mosquito nets. Insect repellents
Fungi	Ringworms	Itchy circular sores on the skin	Antifungal ointments Avoid sharing clothes

IMMUNITY

There are two types of immunity:

- Natural immunity – it is present at birth
- Acquired immunity - develops after **exposure** to pathogens or after **vaccination/immunisation**

RESPONSE OF PLANTS AND ANIMALS AGAINST AN INFECTING MICRO-ORGANISM

Plants and animals use active and passive response for protection.

Plants use the following to prevent pathogens from entering **(Passive response):**

- Thick buck of woody plants.
- Closely packed epidermal cells
- Waxy cuticle keeps out micro-organisms
- Chemical secretions of some plants are poisonous to many organisms

Plants use the following to fight the pathogens when infected **(Active response)**

- Releases chemical compounds such as **salicylic acid**
- Unaffected cells respond by producing various chemical defences to protect themselves.

Animals use the following to prevent pathogens from entering **(Passive response):**

- A multi-layered skin
- Antiseptic tears
- Mucus lined air passages which trap pathogens
- Enzymes (lysozyme) in the saliva
- Ear wax in the ear canal
- Hydrochloric acid and enzymes in the stomach

Animals use the following to fight the pathogens when infected **(Active response)**

- White blood corpuscles in our blood produce antibodies (which are specific in function) to fight diseases.
- Inflammation (swelling and redness) of infected areas.

VACCINATION

- Vaccinations or **immunisation** is the process of giving a **vaccine** either by **injection** or **orally** (by mouth) to prevent disease.

- The antibodies stay in the blood and give long lasting protection against disease. e.g. vaccination of corona Virus to prevent COVID-19

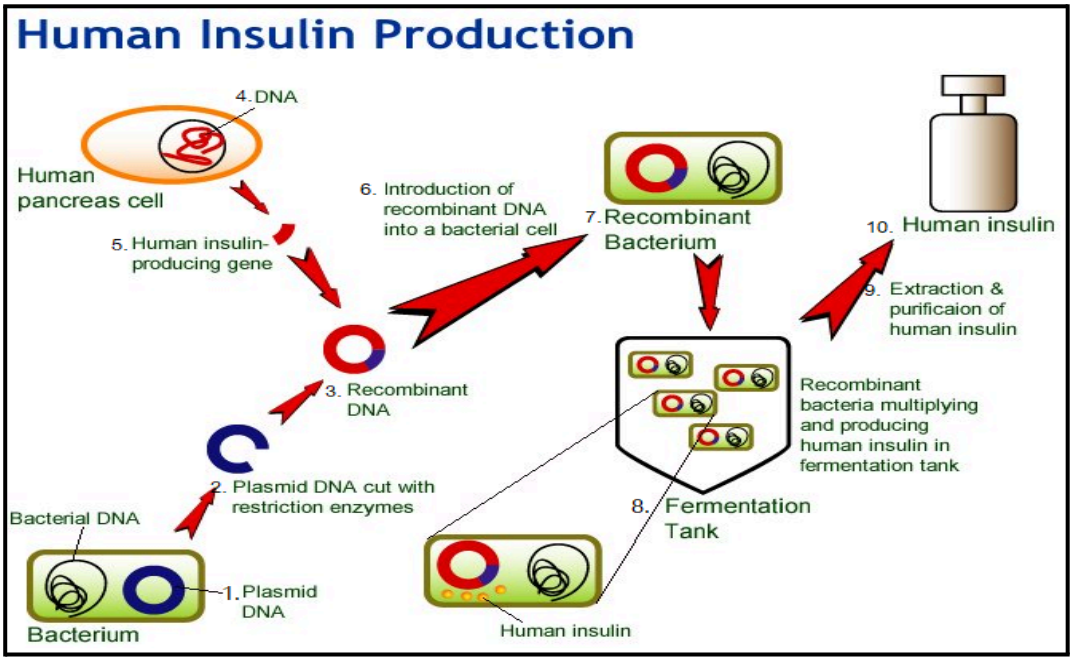
BIOTECNOLOGY

It is the use of **micro-organisms** to make products which are useful to humans. These include **medicines** such as **antibiotics** and **insulin** and foods such as **maas** (fermented milk), **bread**, **wine/beer** and **cheese**.

THE USE OF DRUGS TO FIGHT INFECTING MICRO-ORGANISMS

Antibiotics - are drugs that fight infections caused by bacteria.
- cannot fight infections caused by viruses.
- Example of antibiotic is penicillin which is produced from **fungus** called ***Penicillium***

THE USE OF MICRO-ORGANISMS IN MEDICINE PRODUCTION.



TRADITIONAL TECHNOLOGY

Micro-organisms such as yeast (fungus) can undergo alcoholic fermentation
During this process glucose is changed into ethyl alcohol, carbon dioxide and energy.

- **Beer** – Beer is made from maize, sorghum, millet, barley or rice and hops.
- **Wine** –Yeasts found on the skins of grape ferment the grape sugar after the grapes are crushed.
- **Bread** – Yeasts are used to make bread dough rise.
- **Cheese** – *Lactobacillus* bacteria can be used to convert milk sugar called lactose into lactic acid.
  - Lactic acid curdles the milk and forms a solid mass known as curds.
  - Curds are pressed and separated from the watery whey to make cheese.
- **Maas** – It is like yoghurt and is made by bacterial fermentation of milk.
  -Lactic acid thickens the milk and acts as a preservative.

ACTIVITIES/WORKSHEETS/EXAM TYPE QUESTIONS

ACTIVITY 1

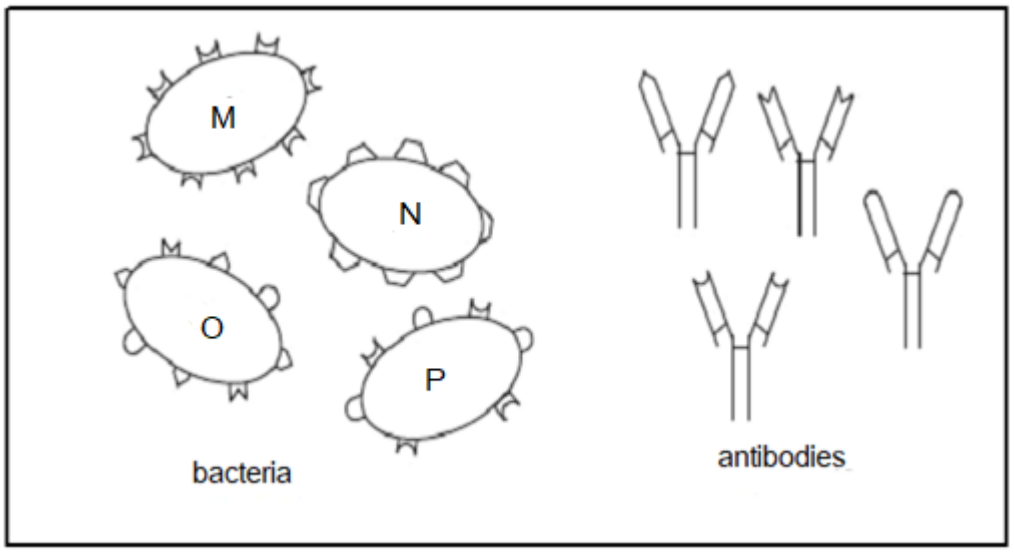
QUESTION 1

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.3) in your ANSWER BOOK, for example 1.4 D.

1.1 Viruses are mainly composed of …

A protein and nucleic acid.
B DNA and RNA.
C cytoplasm and nuclei.
D cellulose and protein.

1.2 A young woman stepped on a dirty, rusty nail. The following diagrams show bacteria isolated from the wound and a range of antibodies that were already present in her body. The antibodies have a specific shape that binds with the antigen found on the surface of the bacteria.



Which type of bacterium will most likely cause a severe infection?

A M
B N
C O
D P

1.3 Antibodies are proteins that . . .

A break down pathogens.
B catalyse biochemical reactions.
C are produced by T-cells that kill disease carrying viruses.
D bind with specific antigens. **(**3x2) **(6)**

QUESTION 2

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.3) in your ANSWER BOOK.

2.1 A relationship between two organisms which live together for the benefit of one or both organisms.
2.2 The ability to produce antibodies. **(3)**
2.3 The use of micro-organisms to make useful substances.

QUESTION 3 *(Questions taken from various sources)*
Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B or NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B,** or **none** next to the question number (3.1 to 3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	Microbes which cause disease.	A B	 Pathogens Vector
3.2	Malaria is caused by a…	A B	Bacteria Fungi
3.3	The process used by lymphocytes to engulf bacteria.	A B	Phagocytosis Vaccination

(3 x 2) **(6)**

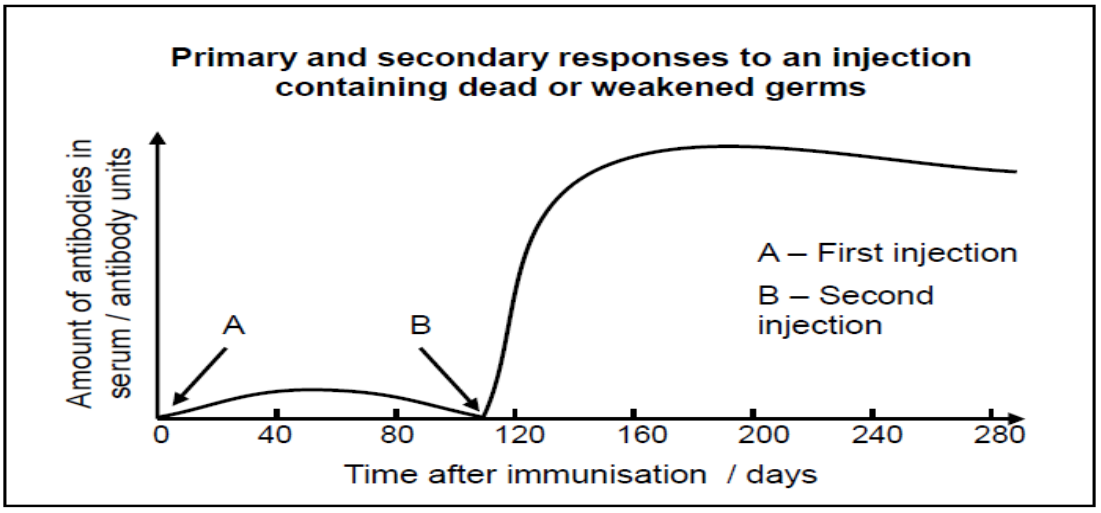
ACTIVITY 2
QUESTION 1

The table below shows the number of cases of TB and the number of deaths from TB around the world in 2009. Use the information in the table to answer the questions that follow.

REGION	NUMBER OF CASES OF TB (in 1000s)	NUMBER OF DEATHS FROM TB (in 1000s)
Africa	3 900	430
The Americas	350	20
Eastern Mediterranean	1 000	99
Europe	560	62
South-East Asia	4 900	480
Western Pacific	2 900	240

1.1 State the total number of deaths from TB in Africa. (1)
1.2 Calculate the percentage of deaths from TB compared to the number of cases of TB in Africa. Show your working. (3)
1.3 Draw a bar graph to show the number of deaths from TB for the following four regions: Africa, Eastern Mediterranean, South-East, Asia and Western Pacific. (6)
(10)

QUESTION 2
The graph below gives the body's response to a vaccination given by an injection and a booster injection. Answer the questions that follow.

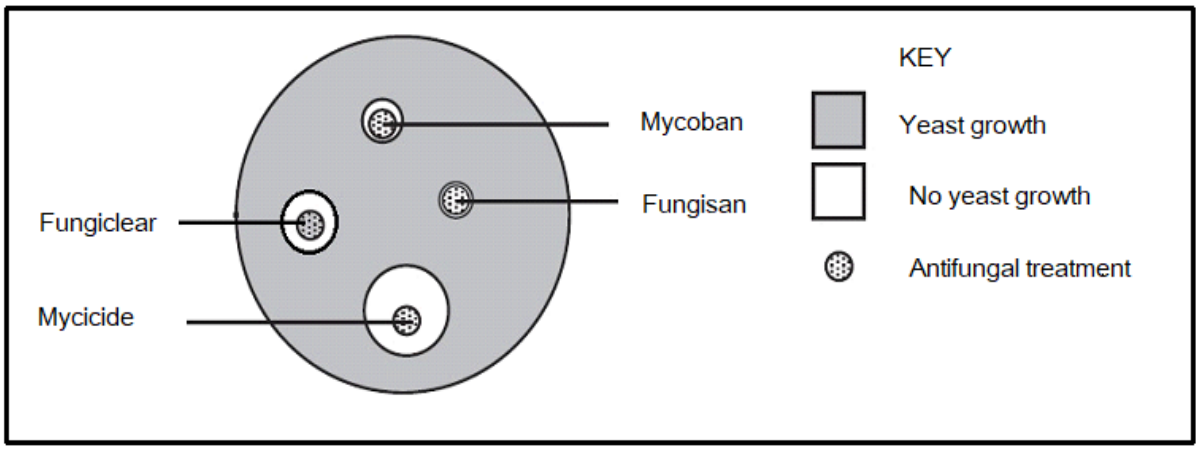


2.1 What happened to the antibody level after the first injection? (2)
2.2 What would happen to the person if infected after the second injection? (2)
2.3 Mention two common ways of receiving vaccines. (2)
2.4 Which cells in the immune system produce the antibodies? (1)
(7)

ACTIVITY 3
QUESTION 1

An investigation was carried out to test the effectiveness of four antifungal treatments (Fungiclear, Mycocide, Mycoban, and Fungisan) on preventing the growth of yeast in humans.

The petri dish with the treatments and yeast culture used in the investigation was placed in an incubator at 37^0 C.
The results are shown in the diagram below.



1.1 State the:
(a) Dependent variable (1)
(b) Independent variable (1)
1.2 Explain why the investigator put the petri dish in an incubator at 37^0 C. (2)
1.3 State any TWO factors that the investigator had to control in order for the investigation to be valid. (2)
1.4 State TWO ways in which the investigator could have increased the reliability of the investigation. (2)

1.5 Arrange the anti-fungal treatments in the order from MOST effective in preventing the growth of yeast to the LEAST effective in preventing the growth of yeast. (2)

(10)

WEEK 4: TOPIC: Biodiversity of plants

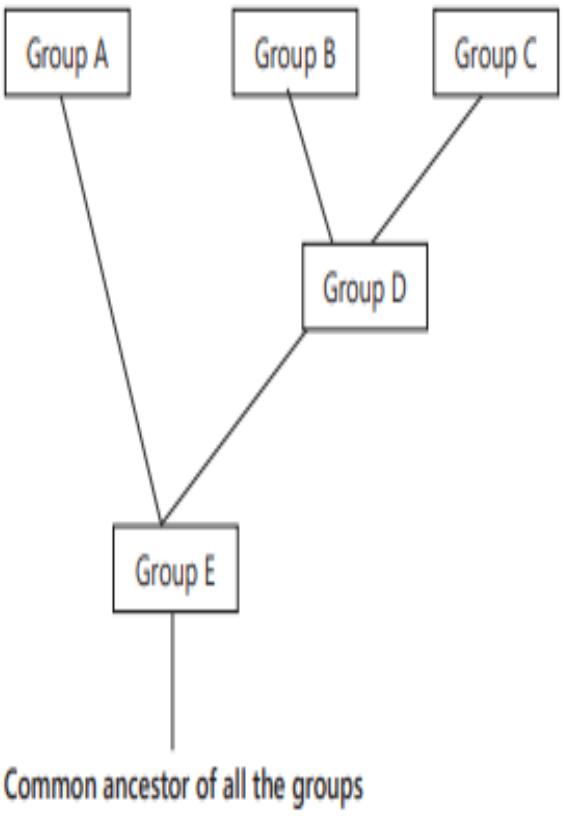
SUB-TOPIC: BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS & ANGIOSPERMS

NOTES & EXAM TIPS

Evolution of the plant groups

Evolution is a gradual process that causes changes in the characteristics in a population across many successive generations. To understand the evolutionary relationship of plants refer to the simplified phylogenetic tree alongside. A phylogenetic tree is a branching diagram that shows the evolutionary relationships between organisms. The organisms that appeared first (ancestors) are found at the base of the 'trunk' of this tree. Refer to the diagram alongside. The lines of the phylogenetic tree show the lines of descent:

- Group A, B and C all descended from the common ancestor E.
- Group E gave rise to groups A and D.
- Group D gave rise to groups B and C.
- Group B and C are closely related.
- Group A and Group B are not as closely related as Group B and C



Currently there are different plant species on earth, which are said to have emerged from a simple unicellular algae. These plants have been classified into four plant groups namely:

1. Bryophytes- mosses, liverworts, and hornworts
2. Pteridophytes-ferns
3. Gymnosperms- conifers, cycads, ginkgo biloba and pine tree
4. Angiosperms- flowering plants

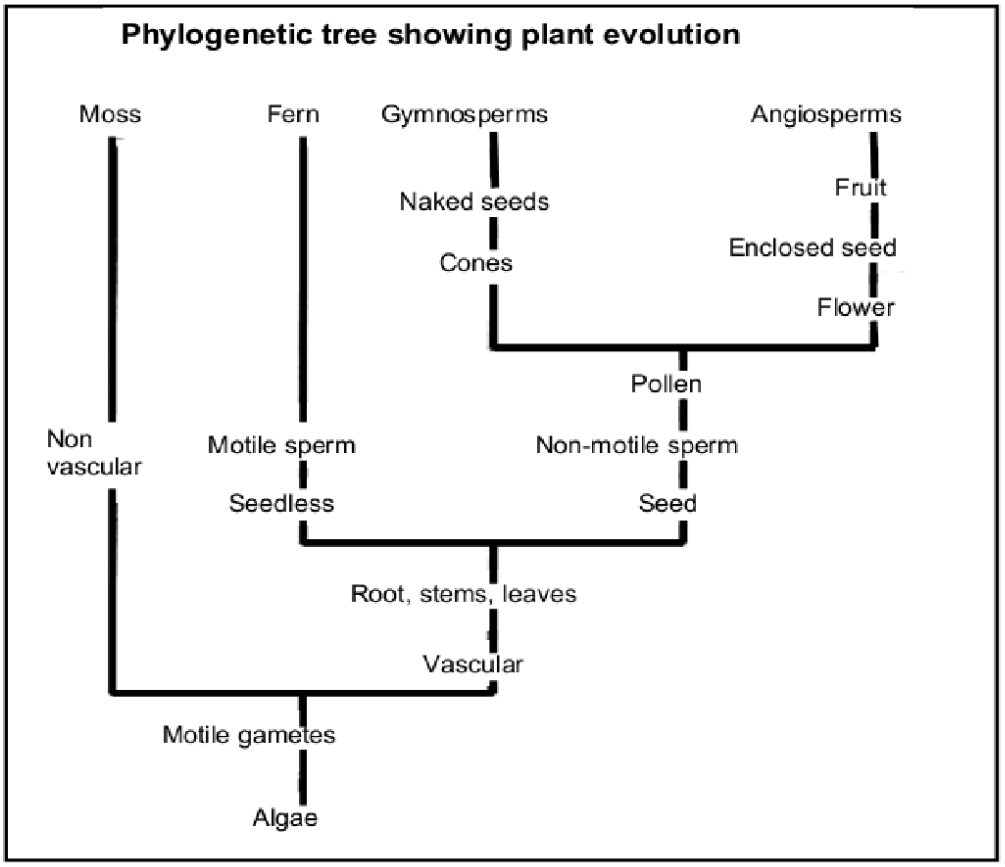
Plant group	Example	Diagram	Structure of dominant generation	Vascular tissue	Spores / seeds	Fruit bearing	Dependency on water for reproduction
BRYOPHYTES	Mosses, liverworts & hornworts	mosses  **Bryophytes** non-vascular land plants	1. Thallus plant: no true roots, stems or leaves 2. Gametophyte is dominant 3. Leave-like structures, stem-like structures and rhizoid	No xylem and phloem tissues	Sperm cells and egg cells in male and female reproductive organs. Spores: spread through wind No seeds	Do not bear fruit	Needs water for reproduction
PTERIDOPHYTES	Ferns	ferns  **Pteridophytes** seedless vascular plants	1. True leaves, roots and stem 2. Sporophyte is dominant 3. Gametophyte: Prothallus 4. Roots: adventitious roots 5. Leaves: monocot Leaves (sessal leaves) & dicot leaves (attached to petiole)	Possess xylem and phloem	Sperm cells and egg cells on prothallus No seeds	Do not bear fruit	Needs water for reproduction

GYMNOSPERM	Conifers, cycads, ginkgo biloba and pine tree	conifers  **Gymnosperm** pollen and 'naked' seeds	1. True roots, stem and leaves 2. Sporophyte dominant 3. Leaves: needle shaped 4. Male cone: In groups, smaller, carries pollen grains 5. Female cones: Larger cones, carries ovary 6. Stem: woody	Possess xylem and phloem	1. Produce spores 2. Produce seeds 3. Naked seeds	Do not bear fruit	Does not need water for reproduction Seeds are spread through wind
ANGIOSPERMS	Flowering plants	flowering plants  **Angiosperm** flowers and fruit	1. True roots, stem and leaves 2. Sporophyte dominant	Possess xylem and phloem	1. Male and female spores 2. Produces seeds 3. Seeds within fruit	Bear fruit	Does not need water for reproduction Seeds are spread through wind, water, insects and other animals

ACTIVITIES/WORKSHEETS/EXAM TYPE QUESTIONS

QUESTION 1

Study the phylogenetic tree below which shows how the four plant groups have evolved.



1.1 What is the ancestral/oldest form of all the plant groups shown? (1)

1.2 Give:

(a) TWO plants which depend on water for reproduction. (2)

(b) The plant group which is the best adapted to life on land. (1)

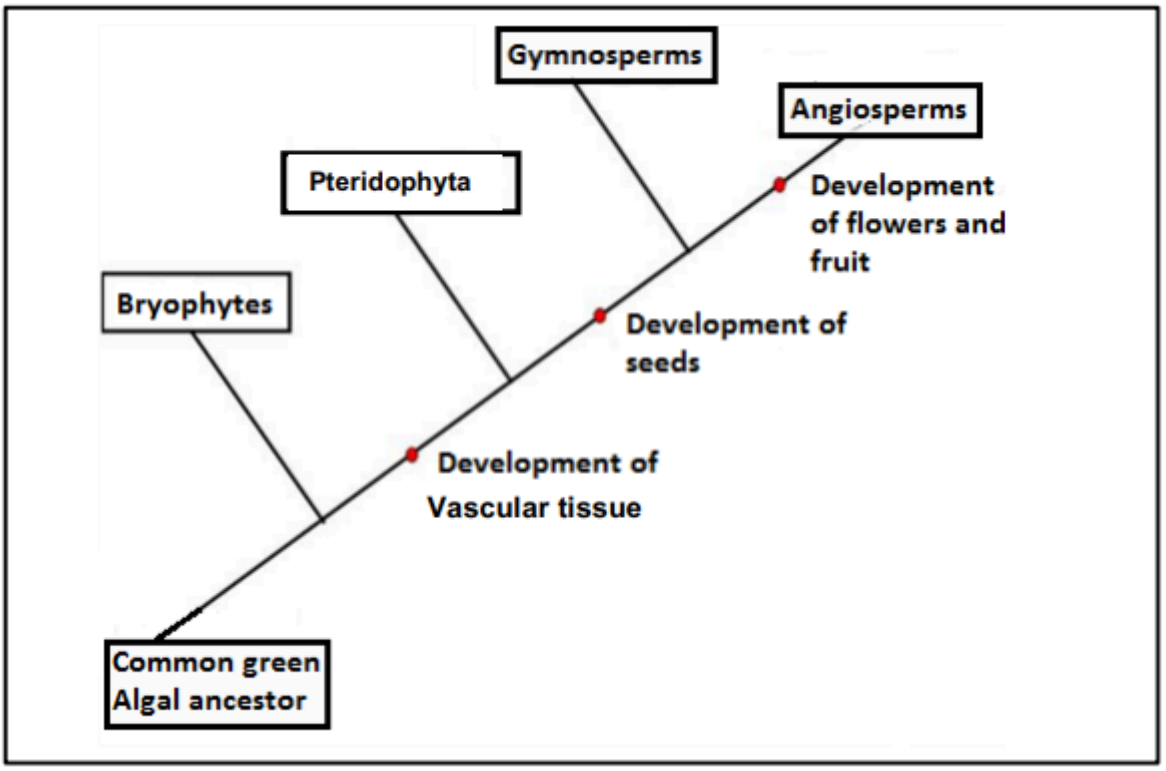
(c) TWO plant groups which are the most closely related. (2)

1.3 Describe how vascular tissue of gymnosperms enable them to survive on land. (2)

(8)

QUESTION 2

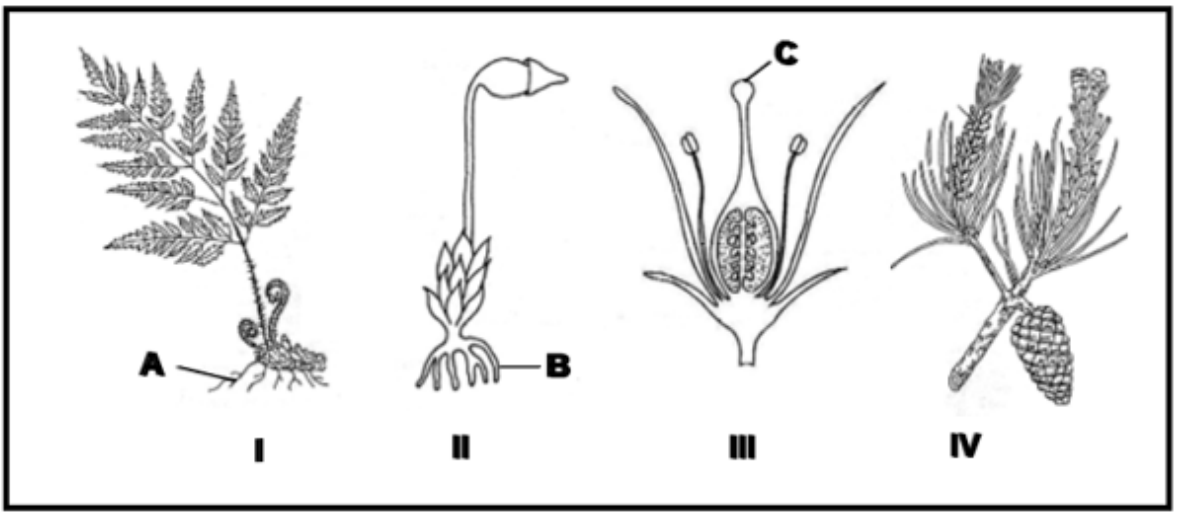
The diagram below shows the relationships between the plant groups studied.



2.1 Give a name for this type of diagram. (1)
2.2 Which terrestrial plant group is least suited to life on land? (1)
2.3 The Gymnosperms are more advanced than the Bryophytes. State TWO pieces of information from the diagram that support this statement. (2)
2.4 What feature do all four plant groups have in common with their algal ancestor? (1)
(5)

QUESTION 3

Study the diagrams below and answer the following questions.



3.1 Label structure **A**, **B** and **C** respectively (3)

3.2 Tabulate TWO differences between plant **I** and **IV** with relation to reproduction. (4)

3.3 State only the numbers of the plant groups which:

a) has no vascular tissues (1)

b) bears fruit (1)

c) produces seeds (2)

(11)

WEEK 5: TOPIC: Biodiversity of plants

SUB-TOPIC: Asexual and sexual reproduction

NOTES & EXAM TIPS

Asexual Reproduction occurs when there is only one parent that gives rise to an offspring which has the identical genetic makeup of the parent. It occurs in most single celled organisms such as bacteria and some multicellular organisms such as fungi and some plants.

Sexual Reproduction involves the combining of genetic information from two parents to produce a new organism that is a combination of both parents. It occurs in most complex organisms.

	Sexual Reproduction	Asexual Reproduction
Advantages	• High Genetic Variability • Facilitates adaptation • "Speeds" up evolution	• Saves energy • Courtship is a non-issue • Greatest increase in fitness for each individual
Disadvantages	• Energy Costly • Courtship is time/resource consuming • Usually sacrifices the fitness of one sex to the other.	• Low Genetic Variability • Adaptation to environment is difficult • "Retards" evolution

ACTIVITIES/WORKSHEETS/EXAM TYPE QUESTIONS

QUESTION 1

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.5) in your ANSWER BOOK.

1.1. Provided is a table of organisms and some data on their characteristics. Based on the information in the table, which organism is likely to produce offspring with the greatest genetic diversity?

Organism	Kingdom	Mode of reproduction
Bell tree dahlia	Fungi	Asexual
Bell tree dahlia	Plantae	Asexual
Spruce	Plantae	Sexual
Hydra	Animalia	Asexual

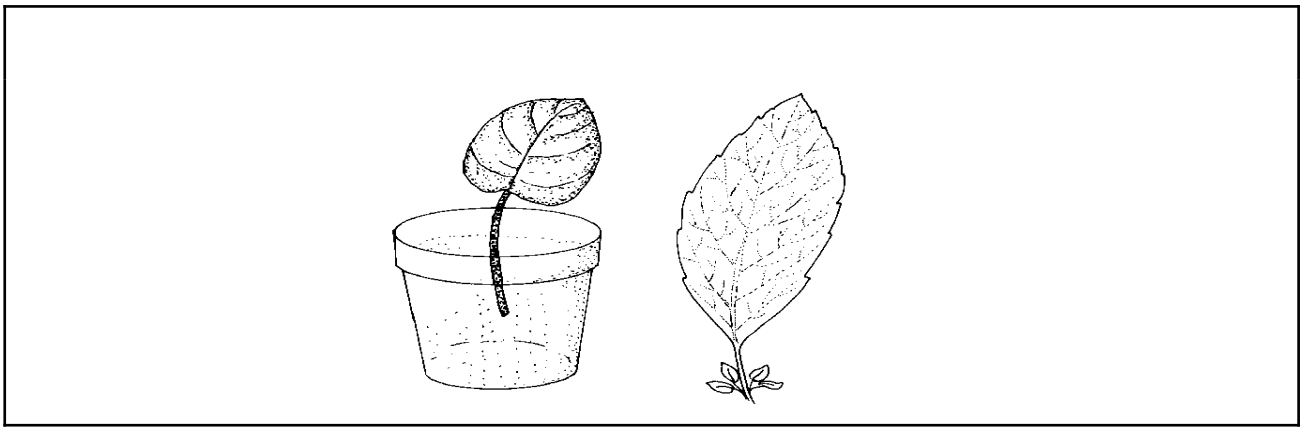
A Black mold
B Bell tree dahlia
C Spruce
D Hydra

1.2 A plant that grows a new plant from a piece of the stem has which type of reproduction?

A Nonsexual
B Sexual
C Unisexual
D Asexual

1.3 A piece of a geranium plant is cut and placed it in a jar of water in the window. Several weeks later the piece has grown into a new plant.

Which of the following is true about the genetic relationship between the first plant and the new one?



A The two plants are different genetically.
B The two plants are slightly different genetically.
C The two plants are genetically identical.
D There is no way to know the genetic relationship.

1.4 One of the key advantages of asexual reproduction is…

A offspring compete for food and space
B large numbers of offspring reproduce quickly
C extreme temperatures can wipe out entire colonies
D offspring are genetic clones

1.5 A gardener noticed that the offspring of his strawberry plants looked identical, while all the flowering plants looked different. Which is likely true of the plants?

A The strawberries reproduced asexually, while the flowering plants reproduced sexually.
B The strawberries reproduced sexually, while the flowering plants reproduced asexually.
C Both the strawberries and flowering plants reproduced sexually.
D Both the strawberries and flowering plants reproduced asexually

(10)

QUESTION 2

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.4) in your ANSWER BOOK.

2.1 A type of reproduction that does not involve the fusion of male and female gametes.
2.2 The non-reproductive parts of a plant.
2.3 Cell that forms when a sperm fertilizes an egg.
2.4 New organism that results from reproduction. **(4)**

QUESTION 3

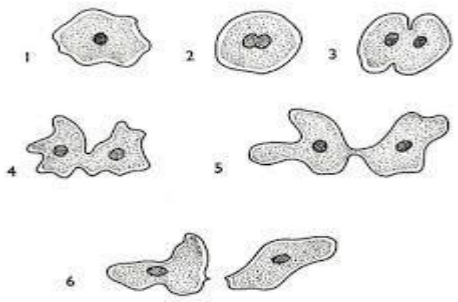
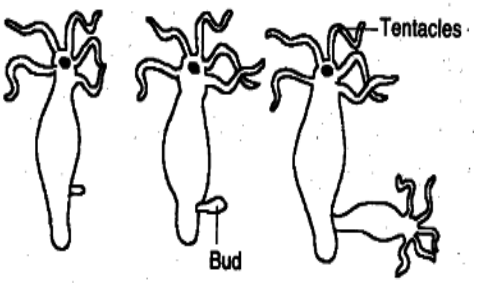
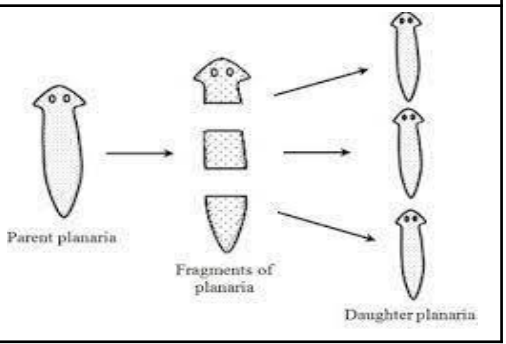
Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B or NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B,** or **none** next to the question number (3.1 to 3.3) in the ANSWER BOOK.

COLUMN I		**COLUMN II**	
3.1	Passes genetic information onto future generations	A B	Sexual reproduction Asexual reproduction
3.2	This type of reproduction occurs by breaking off.	A B	Budding Binary fission
3.3	Biological name for egg and sperm cells	A B	Zygote Gametes

(3 x 2) **(6)**

QUESTION 4

Complete the following chart below to answer the questions.

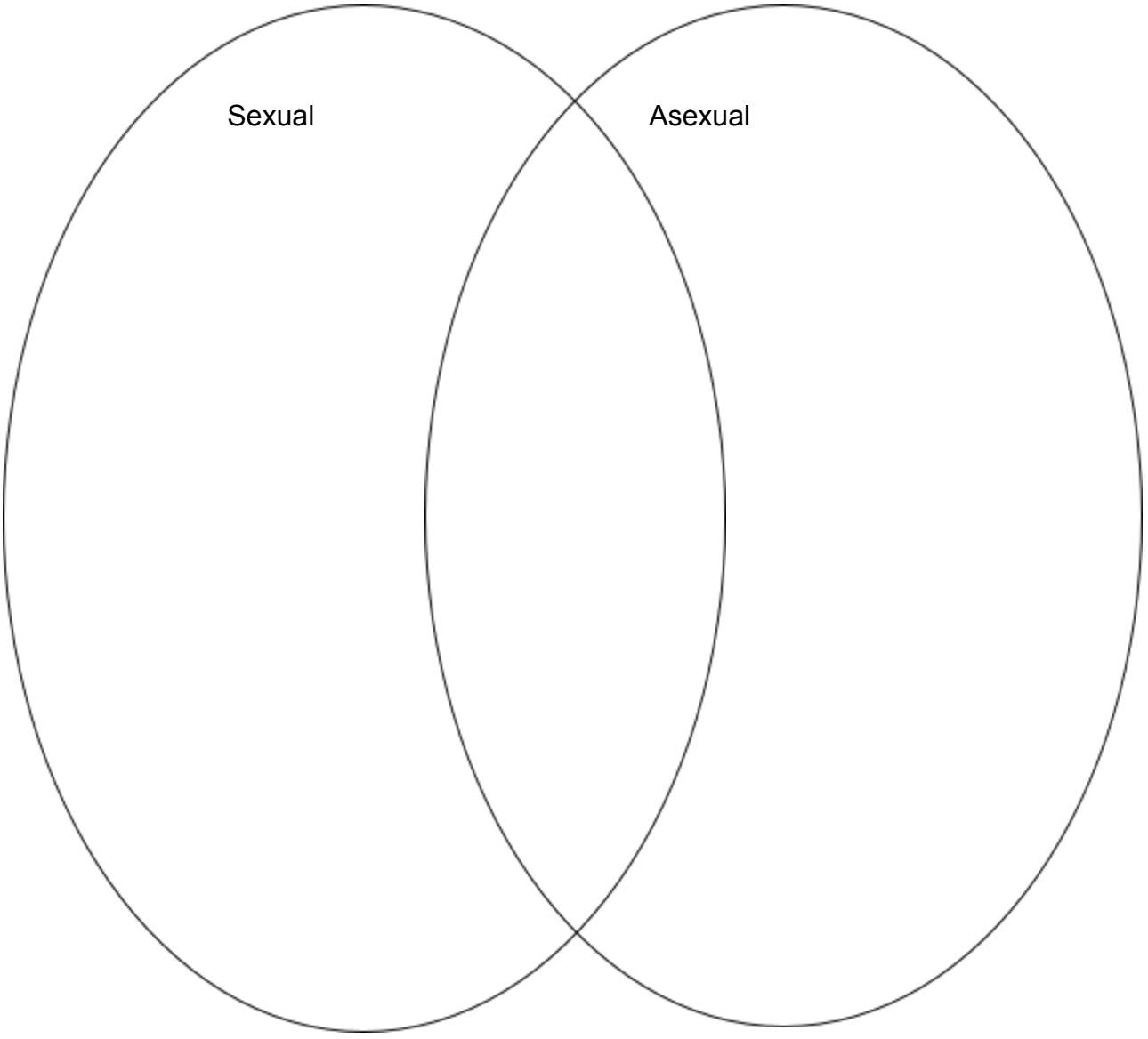
Name	Type of Reproduction (Asexual or Sexual)	What happens?	Example/Drawing
Binary Fission			
Budding			
Fragmentation			

(9)

QUESTION 5

Fill in the Venn Diagram with similarities and differences between sexual and asexual reproduction. You should have at least two characteristics in each circle and in the space they overlap.

Reproduction



(6)

QUESTION 6

6.1 Name and explain:

a) ONE advantage and
b) ONE disadvantage of sexual reproduction (6)

6.2 Name and explain:

a) ONE advantage and
b) ONE disadvantage of asexual reproduction (6)
(12)

WEEK 6: TOPIC: Biodiversity of plants

SUB-TOPIC: Flowers as reproductive structures

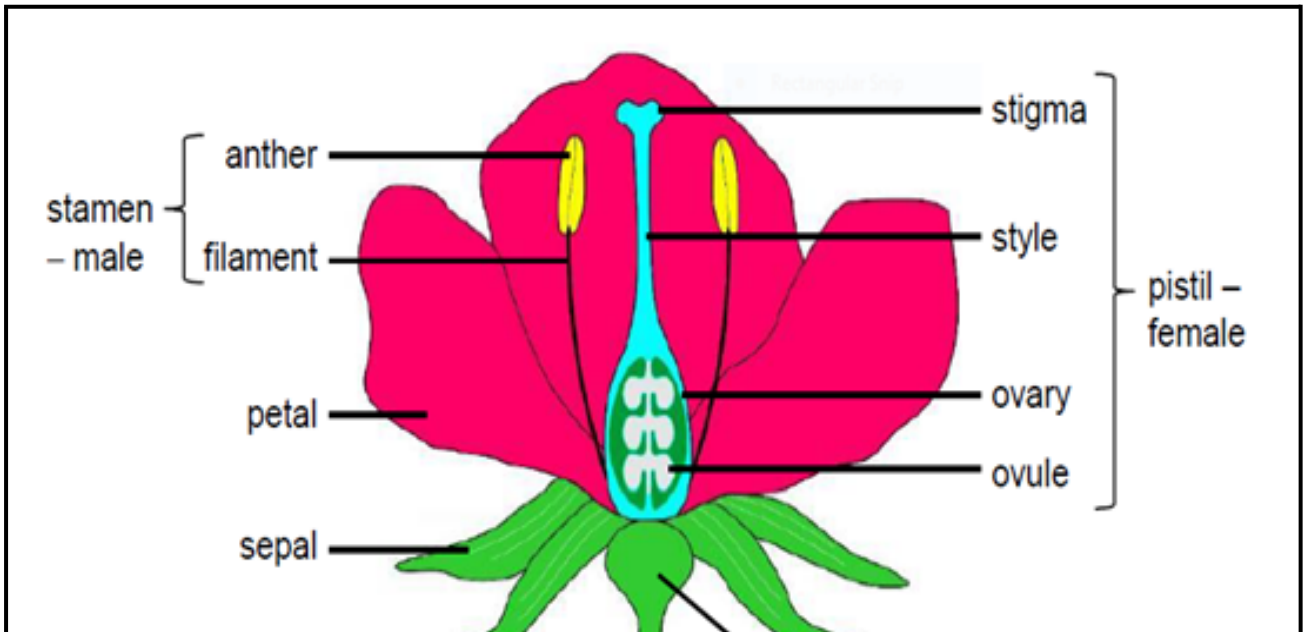
NOTES & EXAM TIPS

Reproduction in all biotic factors must occur to ensure that the species survive. Flowers undergoes sexual reproduction. Flowers have the following functions: to contain and protect the reproductive organs and to attract pollinators.

Key terminology

pollination	the transfer of pollen grains from the anther to the stigma of the flower
cross pollination	pollination occurs between different plants of the same species
self pollination	pollination occurs within flowers of the same plant
corolla	all the petals of a flower together form the corolla
calyx	Formed by the green structures around the petals(petals) together, serves to protect the flower and its reproductive organs
receptacle	the thickened part of the stem from which the flower organs grow
perianth	the non- reproductive part of the flower, the calyx and corolla that form a protective envelope surrounding the sexual organs
stamen	male part of the flower consisting of a filament and pollen and pollen producing anthers
pistil	female part of the flower consisting of a stigma, style and an ovary where ovules are produced
fruit	a fleshy, often sweet layer, formed around the seed in angiosperms following fertilization

In a typical plant, the outermost whorl is called the **calyx** and consists of a number of green sepals. All the floral parts are attached to a **receptacle.** The corolla is made up of

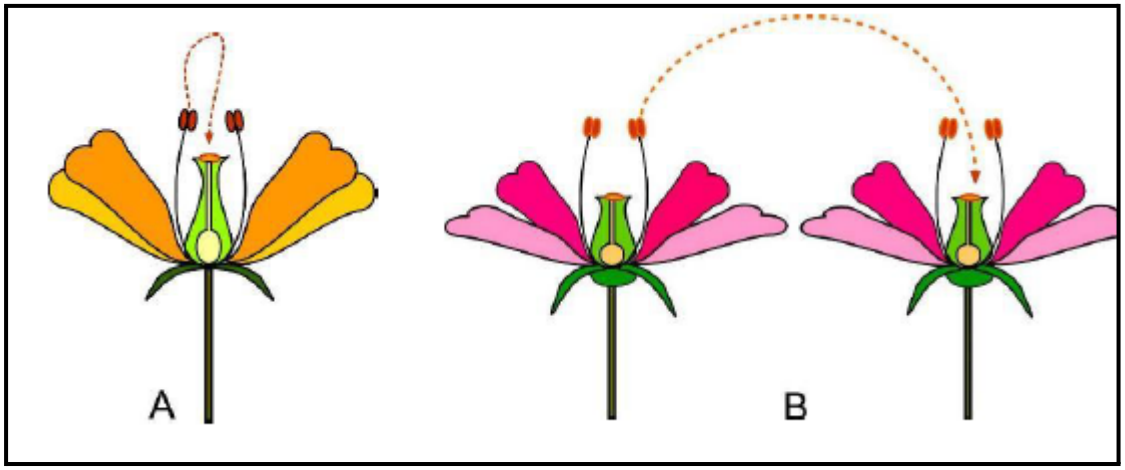


coloured petals to attract pollinators. The calyx and corolla are collectively known as **perianth.**

The stamens are the male part of the flower. Each stamen consists of a filament and a bi-lobed anther with four pollen sacs or microsporangia. Pollen (microspores) are haploid and produced by **meiosis**. The female parts of the flower usually consist of carpels fused together to form one or more pistils. Each pistil consists of a stigma, style and ovary. Ovules are formed inside by meiosis. When pollen grain lands on the stigma it germinates by growing down the style towards the ovule carrying the male gametes to fertilize the ovule. The fertilized ovule forms a seed, and the ovary wall thickens to become a fruit. In general fruit do not develop without fertilization.

Pollination

Pollination can be defined as the transfer of pollen from an anther to the stigma of the same or the stigma of a different flower of the same species. Self-pollination occurs when pollen is transferred between flowers of the plant or the anther and the stigma of the same flower. Most plants are adapted to prevent self-pollination for example, the pollen may ripen before the stigma. The pollen will then be dispersed before the stigma is mature. In other flowers, the stigma is mature before the anther mature and receive pollen from other plants of the same species. Some flowers are adapted to be incompatible with their own pollen.



Types of pollination: (A) Self-pollination (B) Cross-pollination

Cross- pollination occurs when pollen is transferred from the flower of one plant to the flower of another plant of the same species. Cross-pollination is important because it creates genetic diversity. This means that the offspring are genetically important to the parent. Genetic diversity ensures that a species has a better chance of surviving unfavourable conditions.

Pollination is vital for the production of fruit crops (e.g. apples and pears) and seed crops (e.g. maize, legumes, wheat).

Plants rely on wind, water or pollinators such as insects and birds, to transfer pollen from one flower to another.

Adaptations for pollination through insects

Flowers show a varietyof adaptations to ensure that pollination takes place.

Insects such as butterflies, bees and moths visit flowers for pollen and nectar which they use as food. When these insects visit the flowers, the pollen becomes attached to their bodies and this transferred to the stigma of the next flower they visit.

Flowers that are pollinated by insects have the following **characteristics**

- Flowers are brightly coloured. Butterflies are attracted by all brightly- coloured flowers, bees by blue, purple and red flowers and moths by white and yellow flowers.
- The flowers are usually large. In some cases, the individual flowers are small, they are grouped together to make them more visible e.g. sunflowers.
- Some flowers give off pleasant smells to attract insects such as bees, butterflies and months; others give unpleasant smell to attract insects such as flies.
- Some flowers such as Iris have hairs or special markings which lead the insects to the nectaries which produce the nectar.
- The pollen grains are sticky or rough so that they can become attached to the insects.
- Sweet scent to attract moths and butterflies.

Wind Pollinated flowers

Examples of wind-pollinated flowers are maize, grasses, poplar and oak tree. Their flowers are adapted for wind -pollination in the following ways:

- The flowers are usually small, green, with reduced scent and nectar
- They produce a large amount of pollen to increase the chances of pollination since most of the pollen does not find its ‘target’(the stigma of another flower of the same species)
- Filaments of the stamens are long and thin so that they can sway in the wind.
- The anthers are attached to their filaments in such a way that they are easily moveable
- The stigma is large and sticky to trap as pollen as possible

Birds pollinated flowers

Aloes and Strelitzia (the wild banana plant, also known as the bird of paradise) are examples of bird-pollinated flowers usually have:

- Long tube-shaped flowers
- Bright red and yellow flowers
- Produce large quantities of dilute nectar
- Stamens and stigmas protrude beyond the petals
- Open during the day
- Little or no scent because birds have a poor sense of smell

ACTIVITIES/WORKSHEETS/EXAM TYPE QUESTIONS

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.5) in your ANSWER BOOK, for example 1.1.6 D.

1.1.1 The part of the flower which becomes the fruit:

A. Petals
B. Ovary
C. Ovule
D. Anther

1.1.2 Select the incorrect statement:

A. The stamen is made up of the anther and filament
B. The ovules become the seed
C. The petals are not always brightly coloured
D. The ovary becomes the fruit

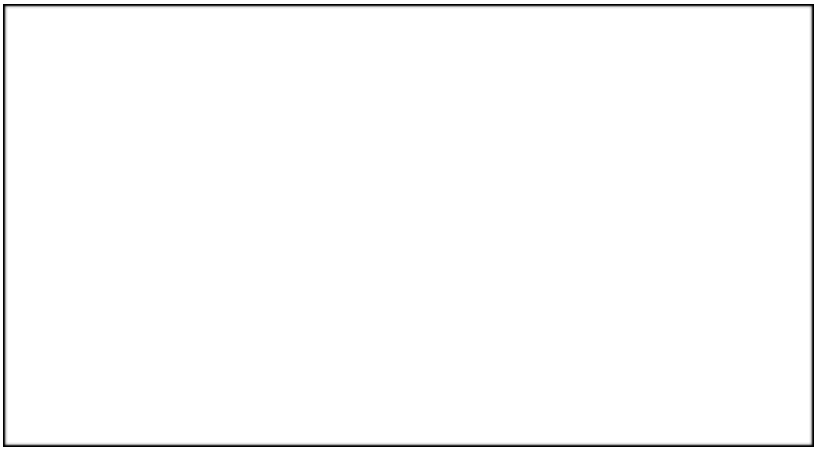
1.1.3 Which of the following is not part of the pistil?

A. Ovary
B. Filament
C. Stigma
D. Style

1.1.4 The flowers of wind pollinated plants have . . .

A. brightly coloured petals.
B. pollen that are very light and float easily.
C. stigmas that are larger and feathery.
D. nectar that produces sugary and sticky substances.

1.1.5 Which process is illustrated by the diagram below?



A. Cross pollination
B. Water pollination
C. Wind pollination
D. Self-pollination

(10)

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 – 1.2.6)

1.2.1 Bilobed structure at the tip of the filament containing pollen grains

1.2.2 The basal enlarged portion of the pistil of the flowers containing ovules

1.2.3 The part of the pistil of plants that receives pollen during pollination

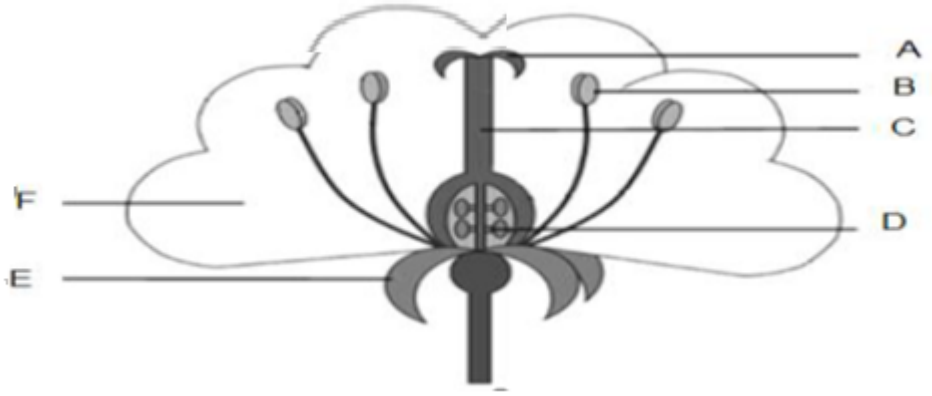
1.2.4 Transfer of pollen from an anther to the stigma of the same or the stigma of a different flower of the same species

1.2.5 A fleshy often sweet layer formed around the seeds in angiosperm following fertilization

1.2.6 The thickened part of the stem from which the flower organ can grow

(6)

1.3 Study the diagram below showing the structure of a flower.



1.3.1 What type of pollination can be linked to the flower? (1)

1.3.2. Identify the parts labelled **A** and **B.** (2)

1.3.3 What do we call **F** and **E** together? (1)

1.3.4 Using the LETTER only identify the following:

a) Part which receives pollen (1)

b) Structure where a seed can form (1)

c) Part where pollen is produced (1)

(7)

QUESTION 2

2.1 A Grade 11 learner wanted to investigate the preference of two pollinating agents, sunbirds and hummingbirds to visit two different types of flower species of Salvia, *Salvia nemorasa* and *Salvia greggi.* The total number of visits to the flowers of these plant species was recorded over a period of 24 hours.
The results are shown in the table below:

Flowers species	**Number of visits to the flowers by pollinators**	
	Sunbirds	Hummingbirds
S.nemorasa	4	86
S.greggi	110	10

2.1.1 State the dependant variable. (1)

2.1.2 State ONE way in which the investigator ensured that the investigation was valid. (1)

2.1.3 State ONE way that the investigator could increase the validity of the investigation. (1)

2.1.4 What can the researcher conclude from the results? (2)

(5)

2.2

2.2.1 The following table compares flowers pollinated by pollinators with flowers which are wind pollinated. Copy the table into your book and complete it.
The difference between pollinator and wind pollinator

Feature	**Pollination by pollinator**	**Wind pollinated**
flower	(a).	Small and inconspicuous
stigma	(b).	(g)
stamens	(c).	(h).
pollen	(d)	(i).
scent	(e).	(j).
Energy spent	(f).	(k)

(11)

2.2.2 Explain why pollinators visit flowers. (2)

2.2.3 Describe how the reproductive organs of the flower make the Angiosperm the most successful group of plants on earth at present. (4)

2.2.4 Tabulate TWO differences between self-pollination and cross pollination. (5)

(22)

WEEK 7 & 8: TOPIC: Biodiversity of animals

SUB-TOPIC: Porifera, Cnidaria, Platyhelminthes, Annelida, Arthropoda & Chordata

NOTES & EXAM TIPS

ANIMAL PHYLA

Only six of the approximately 33 animal phyla will be discussed. The phyla will be discussed in order from the simplest to the more advanced.

Key terminology:

Invertebrates	organisms without a backbone.
Vertebrates	animals that have a backbone or spinal column.
Spicule	a minute (very small) sharp-pointed object or structure that is typically present in large numbers, found in sponges
Nematocyst	a specialized cell in the tentacles of a jellyfish or other coelenterate, containing a barbed or venomous coiled thread that can be projected in self-defense or to capture prey
Mesoglea	the tissue in jellyfish that functions as a hydro-static skeleton.
Acellular	not consisting of, or not containing cells.
Haemocoel	the body cavity of most invertebrates containing circulatory fluid.

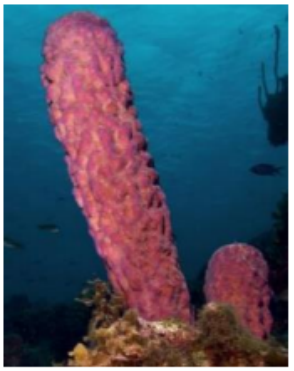
Exoskeleton	a thick, rigid outer covering that protects and supports bodies and provides places for muscles to attach in animals, e.g. arthropods
Ecdysis (moulting)	the process of casting off the outer cuticle in arthropods.

Six phyla are studied, including:

- Phylum Porifera e.g. sponges
- Phylum Cnidaria e.g. blue bottles, jelly fish, sea anemones
- Phylum Platyhelminthes e.g. flukes, tapeworms, free-living planarians
- Phylum Annelida e.g. leeches, earthworms and polychaetas
- Phylum Arthropoda e.g. crab, spider, locust, millipede, centipede, fly
- Phylum Chordata e.g. fish, mammals, birds, reptiles, amphibians

Phylum Porifera

· aquatic (live in water)
· asymmetrical with no cephalization
· function at a cellular level
· acoelomate
· no openings to the gut
· sessile organisms that feed by filtering out floating particles from the water column
· the body is made up of millions of spicules which protect and support the sponge.



Filter-feeding sponge

Phylum Cnidaria

· aquatic, mostly marine but some live in freshwater habitats
· radially symmetrical with no cephalisation
· diploblastic which means they have a cellular ectoderm and a cellular endoderm.
· they also have an acellular jelly-like layer between these two layers called the mesoglea.
· acoelomate
· one opening to the gut that acts as both the mouth and the anus. the mouth often has tentacles that help catch prey.

- Cnidarians occur in two different body forms:
  - a sessile polyp phase
  - a free-swimming medusa

Cnidarians have stinging organelles in their cells called nematocysts that they use for catching their prey and for protection. Cells that contain nematocysts are called cnidocytes or nematocytes

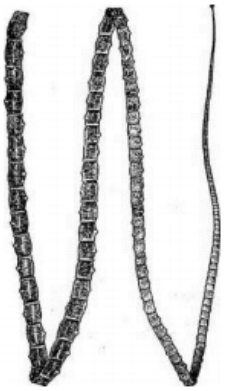
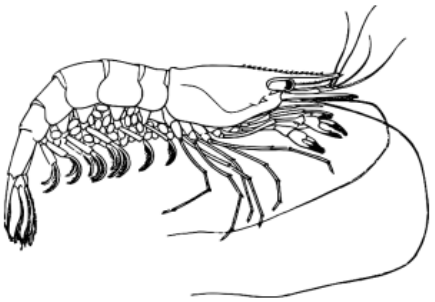
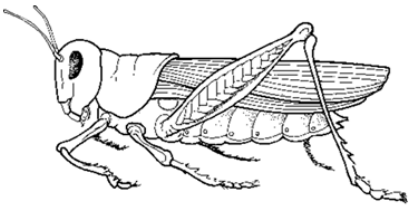
Polyp e.g. sea anemone

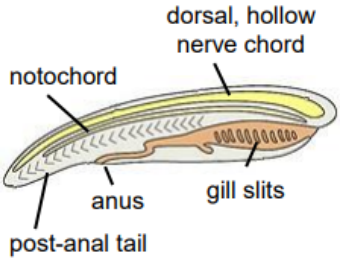
Medusa e.g. jellyfish

Phylum Platyhelminthes

· most are internal parasites but some are aquatic and free-living
· bilaterally symmetrical with cephalization – a definite anterior, posterior, dorsal and ventral side because they are bilaterally symmetrical
· dorsoventrally flattened which means they appear squashed from the dorsal to the ventral side
· have their sense organs and nerve tissue concentrated in the anterior region of their body (cephalisation) which allows them to detect what lies ahead of them – aids in

Free-living *Planaria*

feeding and avoiding danger · triploblastic which allows them to develop tissues and organs e.g. nervous tissue and reproductive organs · acoelomate and therefore no circulatory system · one opening to the gut – the digestive cavity branches around the body to transfer nutrients around the body	 Tapeworm
Phylum Annelida · aquatic (freshwater and marine) and terrestrial habitats · bilaterally symmetrical with cephalization · triploblastic · coelomate - coelom is a fluid-filled cavity that is used as a hydrostatic skeleton for movement · segmented which means their bodies consist of repeating segments, called metameres.	 An earthworm
Phylum Arthropoda · aquatic (freshwater and marine) and terrestrial · bilaterally symmetrical with cephalisation · triploblastic · coelomate – the coelom is filled with a fluid, which acts like blood, called a haemocoel. arthropods therefore have an open circulatory system · more advanced segmentation of body parts so that each segment has a particular form and function i.e. abdomen, thorax and head · all arthropods have jointed appendages that are used for movement and feeding · two openings to the gut (a through-gut) · a waterproof exoskeleton made of chitin The exoskeleton: ▪ protects the arthropod from drying out ▪ prevents diffusion of gases across its waterproof surface; arthropods have therefore developed gaseous exchange organs such as gills and lungs	 Diagram of a shrimp  Diagram of a locust

▪ does not grow as the arthropod grows and it must be shed regularly (ecdysis) and regrown; the arthropod is vulnerable during regrowth of the exoskeleton because it is weaker and requires a lot of energy	
Phylum Chordata · aquatic (freshwater and marine) and terrestrial · bilaterally symmetrical with cephalisation · triploblastic · coelomate · segmented body · two openings to the gut (through-gut) · all vertebrates have a rod-like support named a notochord which may develop into the vertebral column Vertebrates …. · have a hollow dorsal tubular nerve cord (spinal column) which often forms the anterior brain (e.g. humans) · initially develop pharyngeal gill slits that disappear in terrestrial chordates at adulthood · have a post-anal tail · Chordata can be ectothermic or endothermic. The body temperature of exothermic animals is regulated by the external environment whereas the body temperature of endothermic animals is regulated by internal metabolic reactions. Examples of endothermic animals are humans and birds.	 Anatomy of a lancelet  A shark - a typical chordate  Diagram of a chimpanzee

ACTIVITIES/WORKSHEETS/EXAM TYPE QUESTIONS

QUESTION 1 *(question taken from various sources)*

1.1 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.1.1 to 1.1.2) in your ANSWER BOOK.

1.1.1 The phylum of all animals with a vertebral column in the adult.

1.1.2 Concentration of nervous tissue and sense organs at the anterior end of an organism. **(2)**

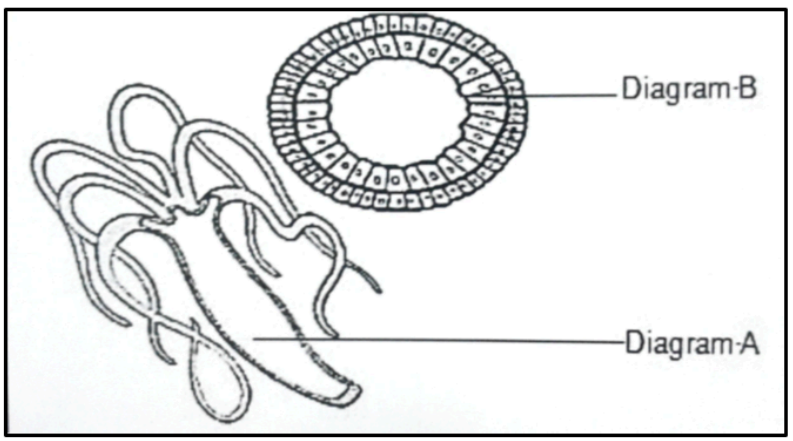
1.2 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B or NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B,** or **none** next to the question number (1.2.1 to 1.2.4) in the ANSWER BOOK.

COLUMN I		**COLUMN II**	
1.2.1	Characteristic to Chordate	A B	 Endoskeleton Closed blood system
1.2.2	Phyla that are triploblastic	A B	Platyhelminthes Annelida
1.2.3	Animals that have a complete tube-like gut with two openings	A B	Arthropoda Cnidaria
1.2.4	Segmented bodies and jointed legs	A B	Annelida Arthropoda

(4 x 2) **(8)**

QUESTION 2 *(D12, June,2016)*

The diagram **A** below shows a complete animal while **B** shows a cross section through the main body stalk. Study the diagrams below and answer the questions that follow.



2.1 Identify the phylum to which this organism belongs. (1)

2.2 Name the kind of symmetry shown in this organism. (1)

2.3 Explain the advantage this symmetry has for the mode of living of this organism. (2)

(4)

QUESTION 3 *(KZN, March. 2020)*

Complete the following table showing different animal groups and their features. Write down only the number of the question and the answer

Animal group (phylum)	Named example of	Type of symmetry	Tissue layers	Gut openings
3.1	Sponges	Asymmetrical	Cell differentiation-no tissue layers	No through-gut, filter feeding
Cnidaria	Jellyfish	Radial symmetry	3.2	Blind-gut

(2)

3.3 Differentiate between diploblastic and triploblastic animals. (2)

3.4 State ONE disadvantage of having a blind gut in the organism mentioned in QUESTION 3.1 (1)

3.5 Briefly describe THREE characteristics present in the body plans of Annelids that allows them to survive in their environment. (6)

(11)

WEEK 9: TOPIC: Biodiversity of animals

SUB-TOPIC: Role of invertebrates in agriculture and ecosystems

NOTES & EXAM TIPS

Invertebrates perform numerous functions in the ecosystem that provide us with food, clean water and air, and even clothes. Below are three of the main roles that invertebrates play.

Key terminology

detritus	organic matter produced by the decomposition of dead organisms
humus	organic component of soil, formed by the decomposition of leaves and other plant material by soil microorganisms
aeration	the process of turning or puncturing compacted soil to allow air and water penetration

Pollination

Pollination is the transfer of pollen from the male parts of a flower to the female parts of a flower of the same species by a pollinator.

- Pollination results in fertilisation for the production of fruits and seeds.
- Bees are the most important pollinators because they spend their entire life collecting pollen and nectar for their developing young.
- There are many other invertebrates that pollinate flowers (examples include: ants, moths, butterflies).

Soil aeration

Invertebrates like earthworms, burrow in the soil and make tunnels through the soil. These tunnels allow gases to move through and aerate the soil. The activities of earthworms are important because:

- Their tunnels accelerate the decomposition of nutrients to be reused for plant growth.
- The community structure of the habitat is dependent on soil nutrients and plant growth.
- Their tunnels improve drainage of the soil.
- The earthworms act as pumps when they move through the tunnels by pushing and pulling air around their tunnels
- Their tunnels loosen the soil and allow plant roots to penetrate deeper into the soil.

Decomposition

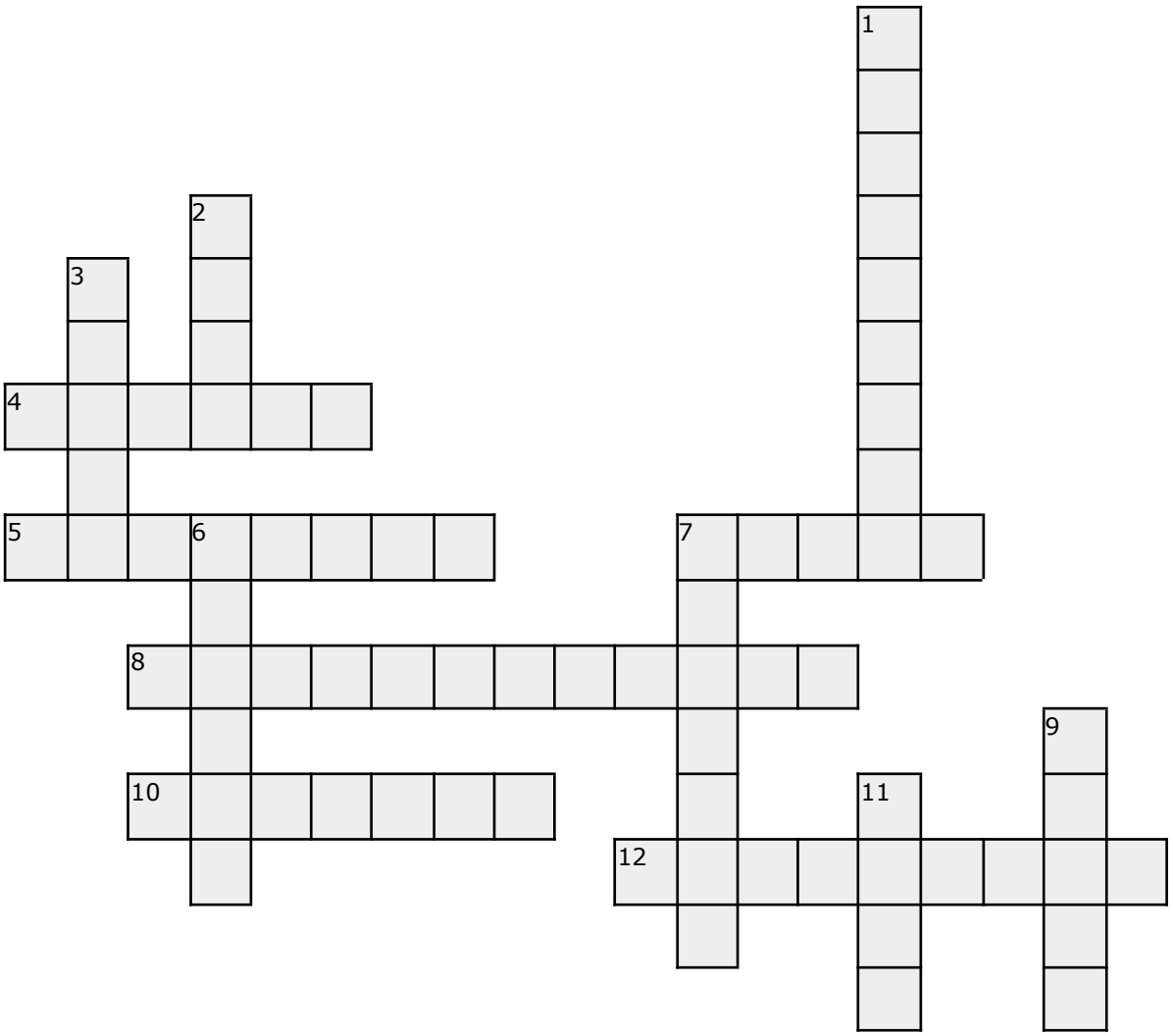
Decomposition is the process that decays or breaks down organic molecules from dead organisms into simpler organic molecules that are released into the environment and reused in nutrient cycles.

- Invertebrates (worms, beetles etc.) break down complex organic molecules (detritus), such as leaf litter, into simpler molecules.
- Microscopic decomposers (i.e. bacteria and fungi) can further break down the organic matter into humus.
- Humus is the organic part of soils which greatly improves the quality of soils for plants

ACTIVITIES/WORKSHEETS/EXAM TYPE QUESTIONS

Question 1

Complete the crossword puzzle.



Across

4. A sweet treat made by bees
5. It’s used to make candles
7. A group of bees looking for a new home
8. It’s necessary for the production of fruit
10. A sweet liquid bees collect from flowers
12. A person who takes care of bees

Down

1. A machine used to remove honey from frames
2. A bee house
3. A male bee
6. A tool used to calm bees
7. A part of the bee's body used for defence
9. The only female that lays eggs in the hive
11. It protects the beekeeper's face from the bees