education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 11

LIFE SCIENCES

JUNE 2024

MARKS: 150

TIME: $2^1/_2$ hours

This question paper consists of 16 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in your ANSWER BOOK.
3. Start the answer to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions for each question.
6. Do ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, tables or flow charts only when asked to do so.
8. The diagrams in this question paper are NOT necessarily all drawn to scale.
9. Do NOT use graph paper.
10. You must use a non-programmable calculator, protractor and compass where necessary.
11. Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1.1 to 1.1.9) in the ANSWER BOOK, e.g. 1.1.10 D.

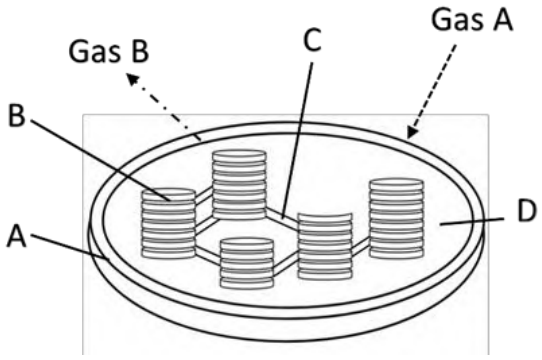
1.1.1 During which cellular process is carbon dioxide consumed and oxygen released?

A Cellular respiration
B Photosynthesis
C DNA replication
D Protein synthesis

1.1.2 What is the primary role of bacteria in the nitrogen cycle?

A Oxygen production
B Nitrate absorption
C Nitrogen fixation
D Photosynthesis

1.1.3 An adaptation of the chloroplast to improve the process of photosynthesis is:



A The protective single membrane that assists in active transport
B The stacks of thylakoids
C The liquid part of the stroma
D The membranes that contain chlorophyll

1.1.4 What is the primary purpose of vaccination in disease management?

A Killing pathogens in the body
B Preventing the spread of diseases to vectors
C Providing immediate immunity
D Boosting the immune system

1.1.5 In which way do stomata contribute to the process of photosynthesis in plants?

A Stomata regulate water loss and gaseous exchange
B Stomata release nitrogen
C Stomata absorb sunlight
D Stomata synthesize glucose

1.1.6 In which way could knowledge of the differences between innate and adaptive immune responses inform the development of vaccines?

A Accelerating natural selection
B Enhancing genetic diversity
C Designing targeted immune responses
D Increasing environmental sustainability

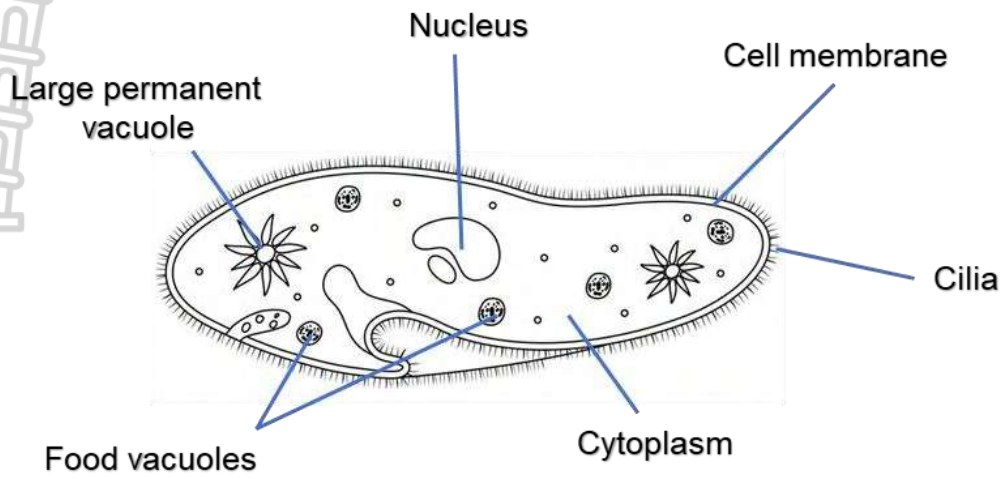
1.1.7 In which way do environmental conditions, such as light intensity and temperature, impact crop management?

A Increasing atmospheric carbon dioxide levels
B Optimizing irrigation techniques
C Reducing chlorophyll production
D Enhancing crop yield through light manipulation

1.1.8 How do pathogenic bacteria typically cause harm to their host organisms?

A By providing essential nutrients to the host organism
B By secreting toxins or enzymes that damage host tissues
C By forming symbiotic relationships with the host organism
D By competing with other bacteria in the environment

1.1.9 The diagram below shows a single-celled organism called *Paramecium*



Which structures will also be found in all animal cells?

A Cell membrane, vacuole, nucleus

B Vacuole, cytoplasm, nucleus

C Cell membrane, cytoplasm, nucleus

D Cell membrane, cytoplasm, cilia

(9 x 2) **(18)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers (1.2.1 to 1.2.9) in the ANSWER BOOK.

1.2.1 A protein coat surrounding the nucleic material of a virus

1.2.2 The tissue responsible for the transport of water and minerals in plants

1.2.3 A whip-like, protruding filament that help cells or microorganisms move

1.2.4 An organism that transmits pathogens from one host to another

1.2.5 The cells responsible for the production of antibodies in the immune system

1.2.6 The stage of cellular respiration that produces the majority of ATP (adenosine triphosphate)

1.2.7 Splitting of water molecules into oxygen atoms and hydrogen atoms.

1.2.8 Organising plants into hierarchical groups based on their shared characteristics.

1.2.9 The haploid phase in the life cycle of mosses

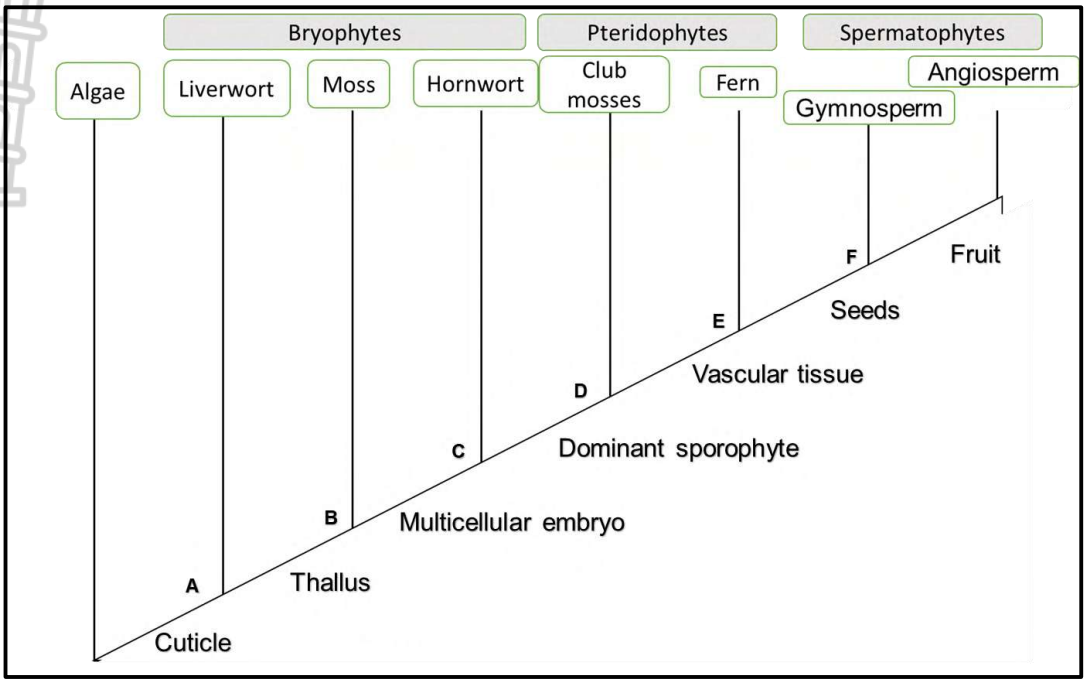
(9 x 1) **(9)**

1.3 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 number (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	The organelle involved in glycolysis	A: B:	Mitochondria Chloroplast
1.3.2	A vector-borne disease	A: B:	Malaria Bilharzia
1.3.3	Stored form of glucose in animal	A: B:	Starch Glycogen

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

1.4 The diagram below illustrates the cladistic relationship among the major groups of land plants. Using the cladogram below, answer the following questions:



1.4.1 Identify the common ancestor:

a) of gymnosperms and angiosperms (1)

b) of ferns and flowering plants (1)

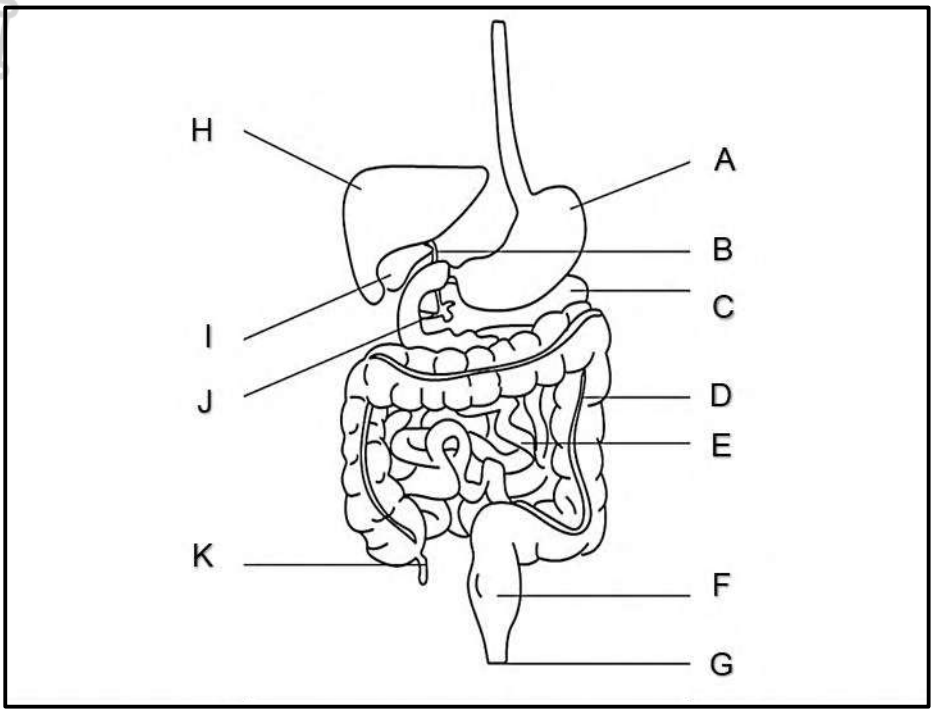
1.4.2 Based on the cladogram above, what difference can you infer between moss and ferns? (1)

1.4.3 Identify a clade that could represent plants adapted to tropical rainforests. (1)

1.4.4 Name ONE characteristic that supports your answer to QUESTION 1.4.3. (1)

1.4.5 Explain why seedless vascular plants can grow taller than nonvascular plants. (2)
[7]

1.5 The diagram below represents the digestive system of humans.



1.5.1 Identify the part labelled:

(a) **G** (1)

(b) **D** (1)

1.5.2 Give the LETTER of the part that:

(a) Stores glycogen (1)

(b) Contains the villi (1)

1.5.3 Give the LETTER and NAME of the part that:

(a) Starts protein digestion (2)

(b) Stores bile (2)

1.5.4 Give ONE function of:

(a) The pancreas (1)

(b) The colon (1)

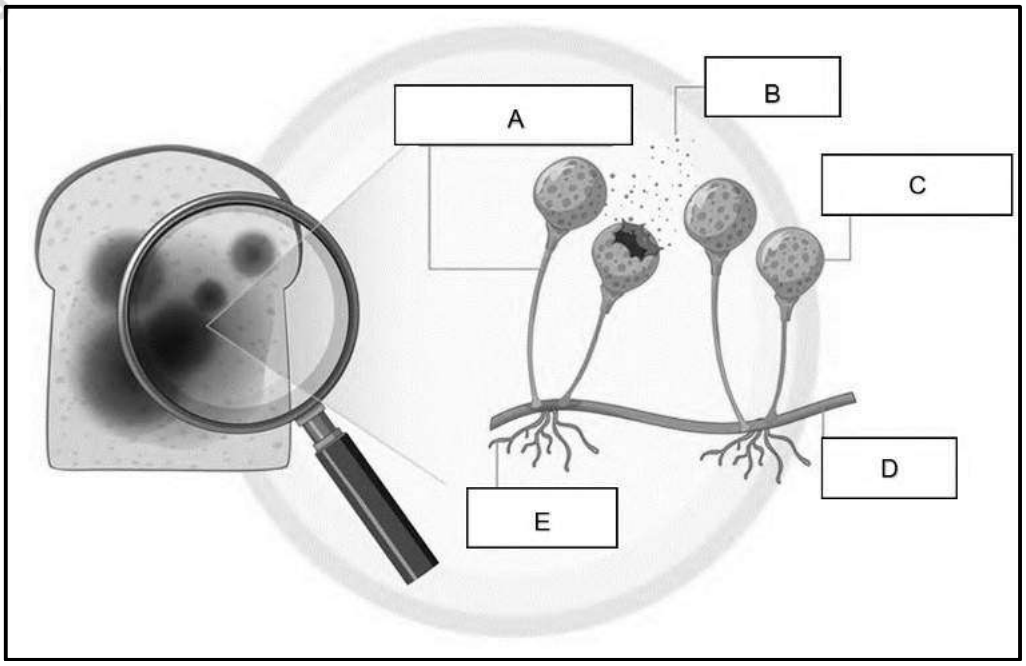
(10)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below shows mould growing on bread.



2.1.1 Name the Kingdom of organisms to which **bread mould** belongs. (1)

2.1.2 Label the structures:

(a) **A** (1)

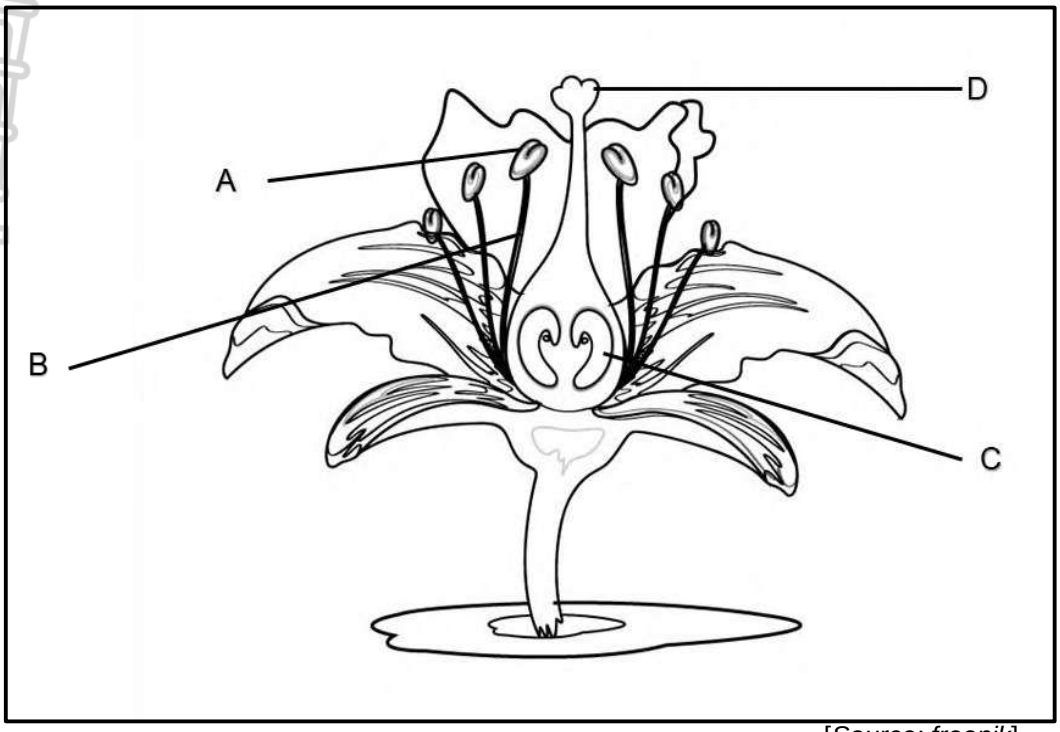
(b) **D** (1)

2.1.3 Briefly describe the ecological role of mycorrhiza in ecosystems. (4)

2.1.4 Explain the role of the mycelium in bread mould's nutrition. (2)

2.1.5 Describe the process of asexual reproduction using sporangia in bread mould. (3)
(12)

2.2 The diagram below shows the structure of a flower.



[*Source: freepik*]

2.2.1 Identify:

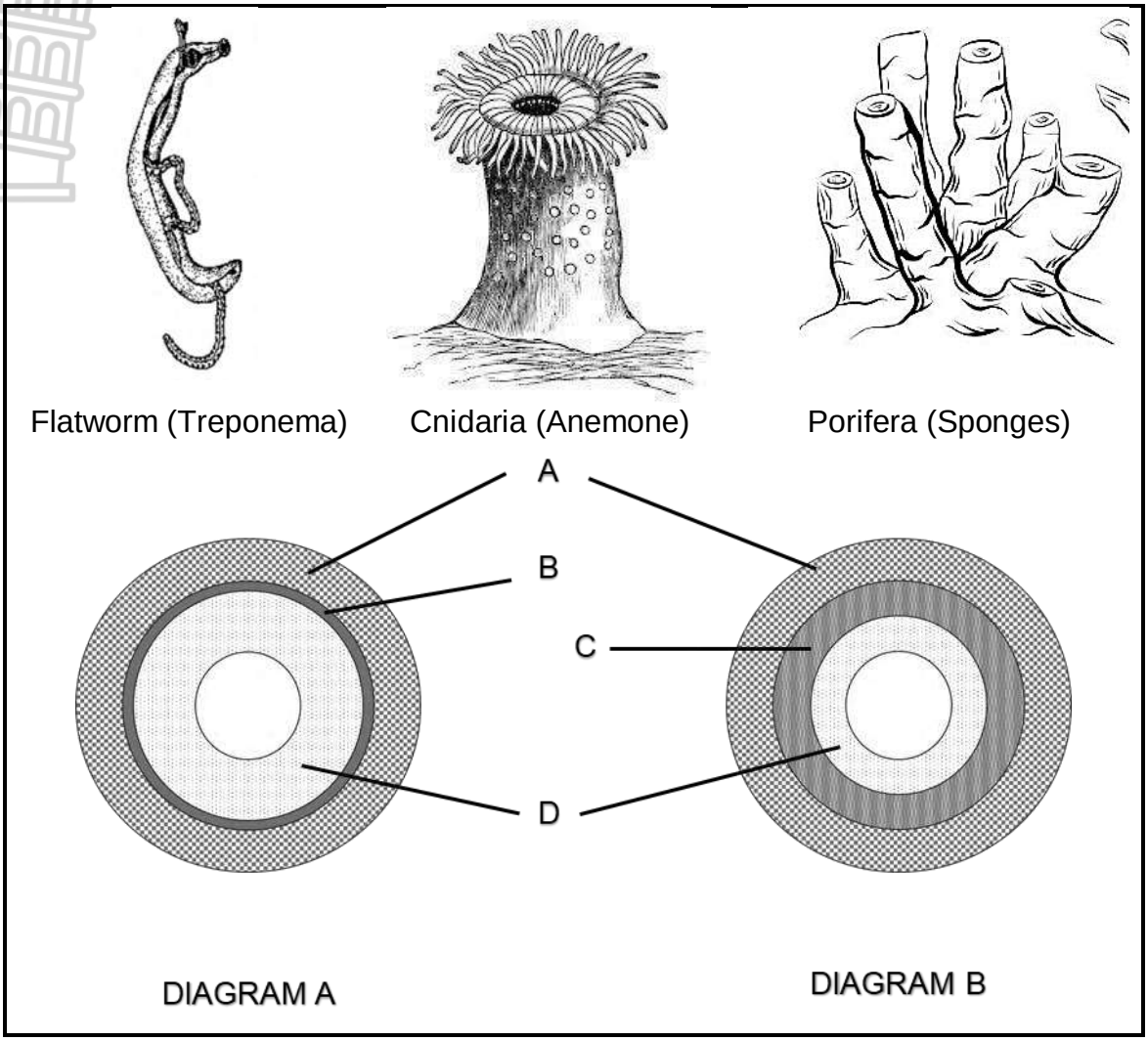
(a) Structure **A** (1)

(b) The process taking place in structure **C** (1)

2.2.2 Describe the process of cross-pollination. (4)

2.2.3 Explain TWO adaptations of a flower for insect pollination. (4)
(10)

2.3 The diagrams below represent various animals and a cross-section of the body plans.



2.3.1 Name **A** and **D**. (2)

2.3.2 Which diagram, **A** or **B**, represents a triploblastic organism? (1)

2.3.3 Which organism, Flatworms, Cnidaria or Porifera, shows bilateral symmetry? (1)

2.3.4 Describe THREE roles of arthropods in the environment. (3)

2.3.5 Explain TWO advantages of a through-gut system in animals. (4)
(11)

2.4 Exploring the intricate relationship between dentition and nutrition unveils the fascinating adaptations in the structure of teeth, shedding light on how different animals have evolved to meet their dietary needs.

2.4.1 What is a *herbivore*? (1)

2.4.2 Compare and contrast the dental adaptations of herbivores and carnivores. (4)

2.4.3 Predict the potential changes in the dental structure of an omnivore if its diet changes from raw uncooked food to soft cooked food. (4)

2.4.4 Explain how the changes named in QUESTION 2.4.3 would be advantageous. (2)

2.4.5 Identify the organelle and describe the structures involved in cellular respiration. (3)

2.4.6 Explain how these structures named in QUESTION 2.4.5 contribute to the production of ATP and the release of energy during cellular respiration. (3)
(17)
[50]

QUESTION 3

3.1 A fusiform body plan is a streamlined, spindle-shaped body tapered at both ends. An example of a fish with a fusiform body plan is the tuna. This type of body plan is well-suited for fast and efficient movement through water

On the other hand, a non-fusiform flatfish body plan is characterised by a flattened and laterally compressed shape. Flatfish, such as the Flounder, are a notable example. These fish are adapted to life on the seafloor, and their bodies are flattened from side to side. Flatfish exhibit a unique adaptation, where one eye migrates to the other side of the head during development, allowing them to lie flat on the substrate.

A group of ichthyologists (fish specialists) wanted to investigate the effect of body shape in aquatic organisms on hydrodynamic efficiency.

The following protocols were followed:

- They chose two species, one with a fusiform body plan (tuna) and another with a non-fusiform body plan (flatfish). They selected healthy organisms, representative of their species, and accustomed to captivity.
- They used the same water tunnel to simulate hydrodynamic conditions
- They used the same water flow rates for the tuna and flatfish
- They conducted five trials for each type of fish, varying parameters such as water flow rate and direction.
- They recorded swimming performances using high-speed cameras placed strategically around the tank.
- Results of speed, acceleration, and manoeuvrability were recorded in a table.

3.1.1 Identify the dependent variable for this investigation. (1)

3.1.2 Explain why the flatfish was included in the investigation. (2)

3.1.3 List TWO conditions that made this investigation valid. (2)

3.1.4 Identify ONE way in which the investigation was made reliable. (2)

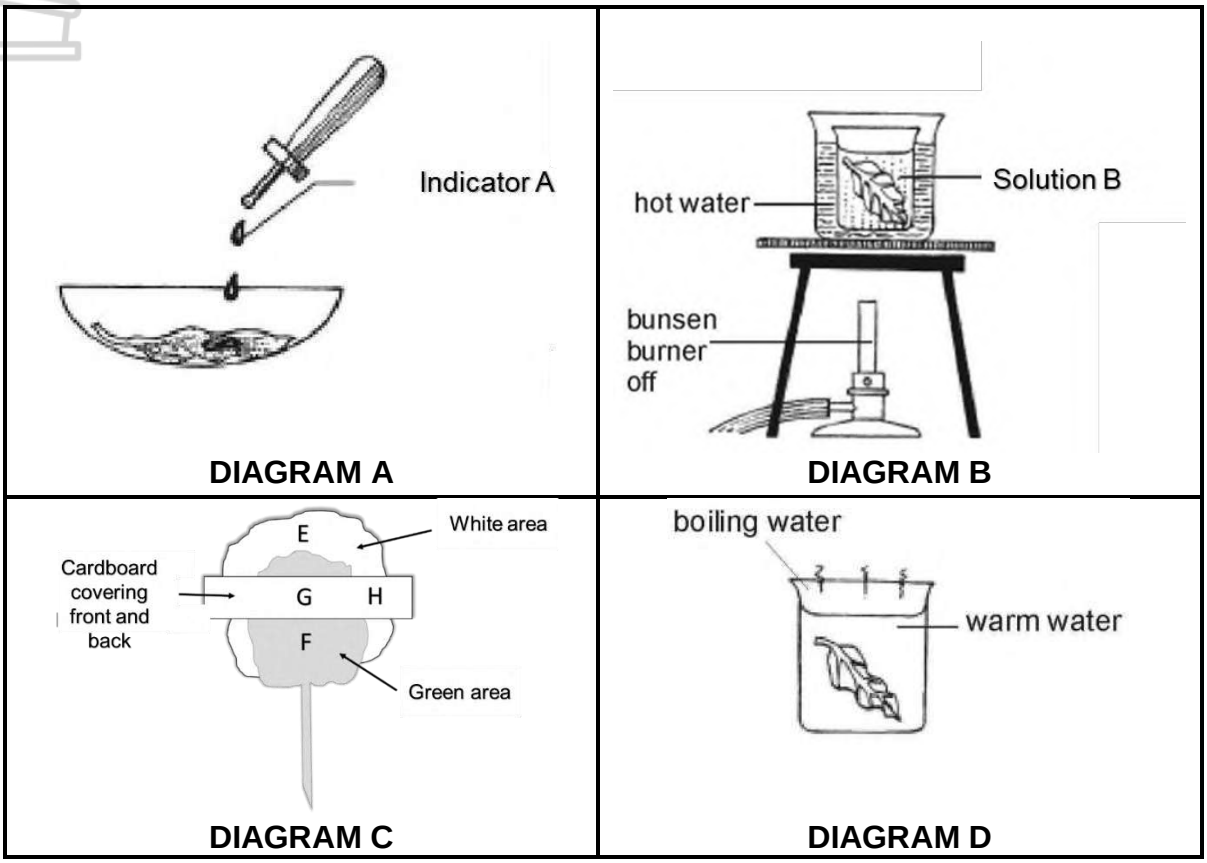
3.1.5 List THREE planning steps for this investigation. (3)

3.1.6 Explain why the fish needed to be accustomed to captivity. (2)

3.1.7 Explain how the migration of the eye of the flatfish is a beneficial adaptation. (2)
(14)

3.2 A variegated leaf is characterised by irregular patterns of colouration, ranging from shades of green to white. This variation results in areas of the leaf having reduced or no chlorophyll content, leading to lighter-coloured patches on the leaf surface.

A variegated geranium plant was destarched for 24 hours. Then a strip of cardboard was placed over a leaf section on the plant and exposed to light for 24 hours.



3.2.1 Identify:

(a) Indicator **A** (1)

(b) The chemical in solution **B** (1)

3.2.2 Give the LETTER/s of the part/s n DIAGRAM **C**:

(a) that will test positive for starch (1)

(b) that will test negative for starch (3)

3.2.3 Arrange the diagrams in the correct sequence for a Starch test. (2)

3.2.4 Explain why solution **B** was used in the procedure. (2)

3.2.5 Explain why a variegated leaf was used in this investigation. (2)

3.2.6 Describe the effect of increasing light intensity on photosynthesis. (2)

(14)

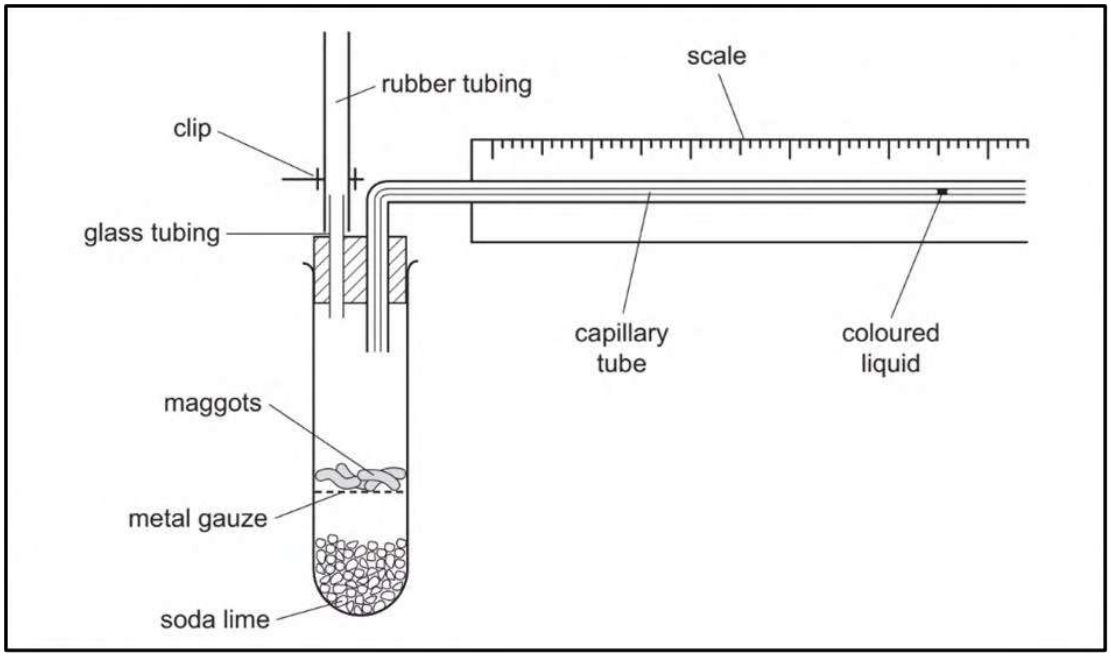
3.3 Flies lay eggs which hatch into larvae.

An investigation was carried out on the respiration rate of larvae.

The setup shows some living larvae in a large test tube.

- The apparatus was left to settle with the clip open.
- The clip was then closed, and a drop of coloured liquid was introduced into the open end of the capillary tube.

During the investigation, the drop of coloured liquid moved along the capillary tube towards the test tube.



[Source: Cambridge 2012, Practical]

3.3.1 What is meant by *respiration rate*? (2)

3.3.2 Describe a suitable control for this investigation. (1)

3.3.3 What is the function of the soda lime in this investigation? (1)

3.3.4 Explain how the movement of the coloured liquid in the capillary tube relates to the metabolic activity of the larvae. (2)

3.3.5 Tabulate TWO differences between photosynthesis and aerobic respiration. (5)

3.3.6 Describe the importance of lactic acid fermentation in muscle cells during strenuous physical activity. (3)
(14)

3.4 Read the following extract on fermentation.

> Fermentation is a metabolic process in which microorganisms convert nutrients, typically carbohydrates, into alcohol and acids such as lactic acid and acetic acid. Humans have been using fermentation to change the nature of food products for centuries. Many foods you eat every day are formed through the process of fermentation. Some you may know and eat regularly include cheese, yoghurt, beer, and bread. Other products that are less common to many people include Kombucha, Miso, Kefir, Kimchi, Tofu, and Salami.

3.4.1 What is *fermentation*? (2)

3.4.2 Name the primary end products of fermentation mentioned in the text. (2)

3.4.3 Explain how humans use fermentation in the food industry. (2)

3.4.4 Give TWO examples of human-useable nonfood products that are produced by fermentation. (2)

(8)

[50]

TOTAL SECTION B: 100

GRAND TOTAL: 150

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PROVINCIAL ASSESSMENT

GRADE 11

LIFE SCIENCES

JUNE 2024

MARKING GUIDELINES

MARKS: **150**

These marking guidelines consist of 8 pages.

PRINCIPLES RELATED TO MARKING LIFE SCIENCES

1. **If more information than marks allocated is given**
   Stop marking when maximum marks are reached and put a wavy line and 'max' in the right-hand margin.

2. **If, for example, three reasons are required and five are given**
   Mark the first three irrespective of whether all or some are correct/incorrect.

3. **If the whole process is given when only part of it is required**
   Read all and credit relevant parts.

4. **If comparisons are asked for and descriptions are given**
   Accept if differences/similarities are clear.

5. **If tabulation is required but paragraphs are given**
   Candidates will lose marks for not tabulating.

6. **If diagrams are given with annotations when descriptions are required**
   Candidates will lose marks.

7. **If flow charts are given instead of descriptions**
   Candidates will lose marks.

8. **If the sequence is muddled and links do not make sense**
   Where sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If the sequence and links become correct again, resume credit.

9. **Non-recognised abbreviations**
   Accept if first defined in the answer. If not defined, do not credit the unrecognized abbreviation but credit the rest of the answer if correct.

10. **Wrong numbering**
    If the answer fits into the correct sequence of questions but the wrong number is given, it is acceptable.

11. **If the language used changes the intended meaning**
    Do not accept.

12. **Spelling errors**
    If recognizable accept provided it does not mean something else in Life Sciences or if it is out of context.

13. **If common names are given in terminology**
    Accept provided it was accepted at the Provincial memo discussion meeting.

14. **If units are not given in measurements**
    Candidates will lose marks. Memorandum will allocate marks for units separately

15. Be sensitive to the sense of an answer, which may be stated in a different way.

16. **Caption**
All illustrations (diagrams, graphs, tables, etc.) must have a caption

17. **Code-switching of official languages (terms and concepts)**
A single word or two that appears in any official language other than the learners' assessment language used to the greatest extent in his/her answers should be credited if it is correct. A marker that is proficient in the relevant official language should be consulted. This applies to all official languages.

18. No changes must be made to the marking memoranda without consulting the Provincial Internal Moderator who in turn will consult with the Provincial Internal Moderator.

SECTION A

QUESTION 1

1.1	1.1.1		B✓✓	(2)
	1.1.2		C✓✓	(2)
	1.1.3		B✓✓	(2)
	1.1.4		D✓✓	(2)
	1.1.5		A✓✓	(2)
	1.1.6		C✓✓	(2)
	1.1.7		D✓✓	(2)
	1.1.8		C✓✓	(2)
	1.1.9		C✓✓	(2)
1.2	1.2.1		Capsid✓/Protein capsule	(1)
	1.2.2		Xylem✓/vascular tissue	(1)
	1.2.3		Flagella✓	(1)
	1.2.4		Vector✓	(1)
	1.2.5		(B) Lymphocytes✓ NOT T-lymphocytes	(1)
	1.2.6		Electro transport chain✓/ oxidative phosphorylation	(1)
	1.2.7		Photolysis✓	(1)
	1.2.8		Taxonomy✓	(1)
	1.2.9		Gametophyte✓	
1.3	1.3.1		NONE✓✓ (Glycolysis occurs in cytoplasm)	(2)
	1.3.2		Both A and B✓✓	(2)
	1.3.3		B only✓✓	(2)
1.4	1.4.1		a) F✓/Fern	(1)
			b) D✓/Club Mosses	(1)
	1.4.2		ferns have vascular tissue / true leaves, while mosses lack these features✓ (MUST GIVE THE **COMPARISON** FOR ONE MARK)	(1)
	1.4.3		Bryophytes✓/liverwort/moss/hornwort	(1)
	1.4.4		adaptations for high humidity✓/ consistent rainfall (Any 1)	(1)
	1.4.5		- by providing a more efficient way to transport water and nutrients✓ throughout the plant body✓ **OR** - compete more effectively for resources✓ - in dry environments✓	(2)
1.5	1.5.1	(a)	Anus✓	(1)
		(b)	Large intestine✓/ descending colon	(1)
	1.5.2	(a)	H✓	(1)
		(b)	E✓	(1)
	1.5.3	(a)	A ✓– STOMACH✓	(2)
		(b)	I ✓– GALBLADDER ✓	(2)
	1.5.4	(a)	- EXOCRINE GLAND ✓/release enzymes - ENDOCRINE GLAND✓/release hormones (Any 1)	(1)
		(b)	egestion✓/water absorption/Vitamin K production	(1)

[50]

SECTION B

QUESTION 2

2.1 2.1.1 Fungi✓ (1)

2.1.2 a) sporangiophore✓ (1)

b) hyphae✓/ stolon (1)

2.1.3 Mycorrhiza is:
- a symbiotic association✓
- between fungi and plant roots✓
- The fungi help in nutrient/ water absorption✓ for the plants
- the plant provides the fungi with organic compounds✓ formed through photosynthesis. (4)

2.1.4
- acting as a network of hyphae✓ / its extensive branching structure
- responsible for nutrient **absorption** ✓ / maximizes the surface area for nutrient uptake✓ (2)

2.1.5 Within the sporangium
- numerous spores develop✓
- through mitosis✓
- it eventually bursts✓/release the spores into the environment
- spores can then germinate ✓/develop into new fungal individuals.

(Any 3) (3)

2.2 2.2.1 a) Anther✓ (1)

b) Fertilisation✓ (1)

2.2.2
- the transfer of pollen ✓
- from the anther of a flower on one plant ✓
- to the stigma of a flower on another plant ✓
- of the same species. ✓ (4)

2.2.3
- Presence of Nectar✓/sugary reward
- attracts insects✓/ encourages repeated visits by pollinators.
- Bright Colours✓ / Patterns
- attract the attention of insects✓ / aids in the recognition of the flower/facilitate pollination.
- Large petals✓
- Form a landing platform for insects visiting the plant✓(Any 2 x 2) (4)

MARK FIRST TWO ONLY

2.3 2.3.1 A - ectoderm✓ (1)

D - endoderm✓ (1)

2.3.2 B✓ (1)

2.3.3 Flatworms✓ (1)

2.3.4
- pollinators✓
- decomposers✓
- contributors to nutrient cycling✓
- serve as a food source✓ for various animals
- contribute to biodiversity ✓

MARK FIRST THREE ONLY (3)

2.3.5
- Efficient Nutrient Absorption: ✓
- specialized regions for digestion and absorption✓
- Continuous Feeding✓
- allowing them to extract nutrients from food as it passes through different digestive compartments. ✓

MARK FIRST TWO ONLY (4)

2.4.1 An herbivore is an animal that primarily consumes plant material✓ as its main source of nutrition. (1)

2.4.2 **Herbivores** have flat molars✓ for grinding✓ plant material
Carnivores have sharp molars✓ for shearing✓

OR

Herbivore incisors may be adapted✓ for cropping✓
Carnivores pointed canines✓ for tearing flesh ✓

(4)

2.4.3
- a reduction in tooth wear ✓
- a decrease in the size of chewing surfaces✓
- a reduction in the development of jaw muscles due to decreased chewing effort✓
- canines may reduce in size/length✓ (4)

2.4.4
- less energy would be required/ expended for chewing✓/ mastication
- allowing for more efficient digestion✓ (2)

2.4.5
- mitochondria✓
- cristae✓/folded inner membranes
- a fluid-filled matrix✓ (3)

2.4.6 inner membrane /cristae
- increase/provide a large surface area✓ for reactions
- optimizing ATP synthesis ✓ /provides ample space for electron transport chain proteins✓/ facilitates ATP production through oxidative phosphorylation (Any 2)

The fluid-filled matrix
- contains ribosomes that produce specific enzymes for the Krebs cycle✓/supports the tricarboxylic acid (TCA) cycle / causing the efficient breakdown of glucose (Any 1) (3)

[50]

QUESTION 3

3.1 3.1.1 hydrodynamic efficiency✓ of the aquatic organisms (1)

3.1.2
- Control✓
- to compare a non-fusiform to a fusiform✓ (2)

3.1.3
- Using the same water tunnel✓
- Using the same flow rates✓

MARK FIRST TWO ONLY (2)

3.1.4 Conducting five trials✓ for each type of fish

MARK FIRST ONE ONLY (2)

3.1.5 Decide on
- WHO – the scientists/fish specialists/ichthyologists are going to be
- WHAT- Species Selection: Choose representative species with distinct body plans
- WHEN – The optimum season for the fish
- WHERE – the laboratory setting/ tank to be used
- HOW – working protocol and measurements/ apparatus used

(any reasonable interpretation of planning)

MARK FIRST THREE ONLY (3)

3.1.6
- To ensure natural/consistent behaviour in fish✓
- to reduce stress ✓ (2)

3.1.7
- it enhances their survival✓ in their specific habitat
- camouflaging✓ itself in the sand /serves as a form of natural concealment/hiding from predators

OR

- improved depth perception ✓in the flatfish's horizontal orientation
- aiding in effective hunting✓ / capturing prey (Any 1 x 2) (2)

3.2 3.2.1 a) Iodine solution✓ (1)

b) Alcohol✓/ ethanol (NOT Methanol) (1)

3.2.2 a) Part **F** ✓/green part of leaf open to light (1)

b) Part **E** ✓/ white part of leaf open to light
Part **H**✓/ white part of leaf covered with cardboard
Part **G**✓/ green part of leaf covered with cardboard (3)

3.2.3 **C – B – D - A**✓✓ (2)

3.2.4
- Solution **B** (alcohol) was used to remove chlorophyll✓
- Alcohol breaks down cell membranes✓ and extracts pigments (2)

3.2.5
- To Compare✓
- the effect of presence and absence of chlorophyll/ Green part with chlorophyll and White parts with no chlorophyll✓
- To isolate the effect of light (independent variable) ✓ (2)

3.2.6 Increase in Light Intensity
- Leads to higher rate of photosynthesis✓
- Saturation of photosynthetic pigments✓/chlorophyll
- cause the rate of photosynthesis to plateaus✓ as all available chlorophyll molecules are already engaged in light absorption.

(Any2) (2)

3.3 3.3.1 the speed✓/frequency at which cells
extract energy from the nutrients✓/glucose (2)

3.3.2 performing the same experimental setup and conditions but without the presence of living larvae✓ (1)

3.3.3 Absorbs carbon dioxide ✓ (1)

3.3.4 is related to the metabolic activity of the larvae✓
because it indicates the production of carbon dioxide✓ by larvae
providing a measure of the larvae's respiration rate✓ (2)

3.3.5

Characteristic	Photosynthesis	Aerobic Respiration
Location in Cells	Chloroplasts/ (mainly in plant cells)	Mitochondria/ (found in both plant and animal cells)
Purpose	Conversion of light energy into chemical energy	Harvesting chemical energy from organic molecules
Reactants	Carbon dioxide, water, and light energy	Oxygen and organic molecules (e.g., glucose)
Products	Glucose and oxygen	Carbon dioxide, water, and energy (ATP)
Energy Input/Output	Requires light energy as an input	Releases energy (ATP) during the process
Processes Involved	Light-dependent reactions and Calvin cycle	Glycolysis, Krebs cycle, and Electron Transport Chain
Byproducts	Oxygen is released as a byproduct	Water and carbon dioxide are released as byproducts
Occurs in...	Autotrophs (plants and some bacteria)	All living cells, both autotrophs and heterotrophs

Tabulate x 1 (**MARK FIRST TWO ONLY**) (5)

3.3.6 Alternative ✓/ a rapid/temporary pathway
For ATP production✓
during periods of high energy demand✓/ low oxygen
preventing muscle fatigue✓ (Any 3) (3)

3.4 3.4.1 Fermentation is:
- a metabolic process✓
- in which microorganisms✓ / bacteria / yeast
- convert organic compounds/carbohydrates✓
- into simpler compounds✓ /alcohol/lactic acid (2)

3.4.2
- alcohol
- lactic acid (2)

3.4.3
- to change the nature of food products for centuries
- by changing the flavour✓ /texture /using it to preserve food (prevent spoilage) for longer✓/changing the nutritional value (2)

3.4.4
- Biogas/Biofuel
- Vinegar
- Biopolymers/bioplastic
- Enzyme/antibiotic production

MARK FIRST TWO ONLY (2)

[50]

TOTAL SECTION B 100

GRAND TOTAL 150