Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2023

LIFE SCIENCES P1

MARKS: **150**

TIME: **2½ hours**

This question paper consists of 14 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 of 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 drawn to scale.
9. Do NOT use graph paper.
10. You may use a non-programmable calculator, protractor and a compass where necessary.
11. Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various options are given 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 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 During anaerobic respiration in animals, the pyruvic acid is converted to …

A ethyl alcohol.
B lactic acid.
C hydrochloric acid.
D acetic acid.

1.1.2 Which ONE of the following represents a metabolic waste excreted by the lungs?

A Urea
B Ammonia
C Carbon dioxide
D Uric acid

1.1.3 Which ONE of the following pathways correctly represents air movement in the lungs?

A Alveolus →bronchiole →trachea →bronchus
B Bronchiole →trachea →bronchus →alveolus
C Trachea →bronchus →bronchiole →alveolus
D Trachea →bronchiole →bronchus →alveolus

1.1.4 The blood vessel that transports absorbed nutrients from the small intestine to the liver is the …

A hepatic vein.
B hepatic portal vein.
C inferior vena cava.
D renal vein.

1.1.5 The gas released during photosynthesis is …

A carbon dioxide.
B oxygen.
C hydrogen.
D ozone.

1.1.6 The main organelle that is involved in cellular respiration is the …

A mitochondrion.
B nucleus.
C Golgi-apparatus.
D endoplasmic reticulum.

1.1.7 Which ONE of the following features will allow an increased rate of photosynthesis?

A leaf with …

A a thick cuticle.
B many mesophyll cells with many chloroplasts.
C few stomata on the leaf on the lower surface of the leaf.
D a large number of epidermal hairs.

1.1.8 During glycolysis, the glucose molecule is broken down to form …

A pyruvic acid, ATP and energised hydrogen ions.
B pyruvic acid, ADP and an oxygen atom.
C pyruvic acid, ADP and a hydrogen ion.
D pyruvic acid, ATP and carbon dioxide.

1.1.9 The gas released during Kreb's cycle is …

A oxygen.
B carbon dioxide.
C carbon monoxide.
D hydrogen.

1.1.10 ONE of the differences between photosynthesis and cellular respiration:

	Photosynthesis	Cellular respiration
A	Takes place only during the day	Takes place only at night
B	Manufactures glucose	Breaks down glucose
C	Energy is released	Energy is absorbed
D	Enzymes are required	No enzymes are required

(10 x 2) (20)

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 The tissue lining the inner walls of an alveolus

1.2.2 The double membrane covering the outside of the lungs and the inside of the thoracic cavity

1.2.3 The part of the brain that controls the rate of heartbeat and the breathing rate

1.2.4 The hormone that stimulates conversion glycogen into glucose

1.2.5 The removal of undigested food waste from the body

1.2.6 The end-product of protein digestion

1.2.7 The finger-like structures that absorb digested food nutrients

1.2.8 A building with transparent walls and roof, usually of glass, for the cultivation and exhibition of plants under controlled conditions

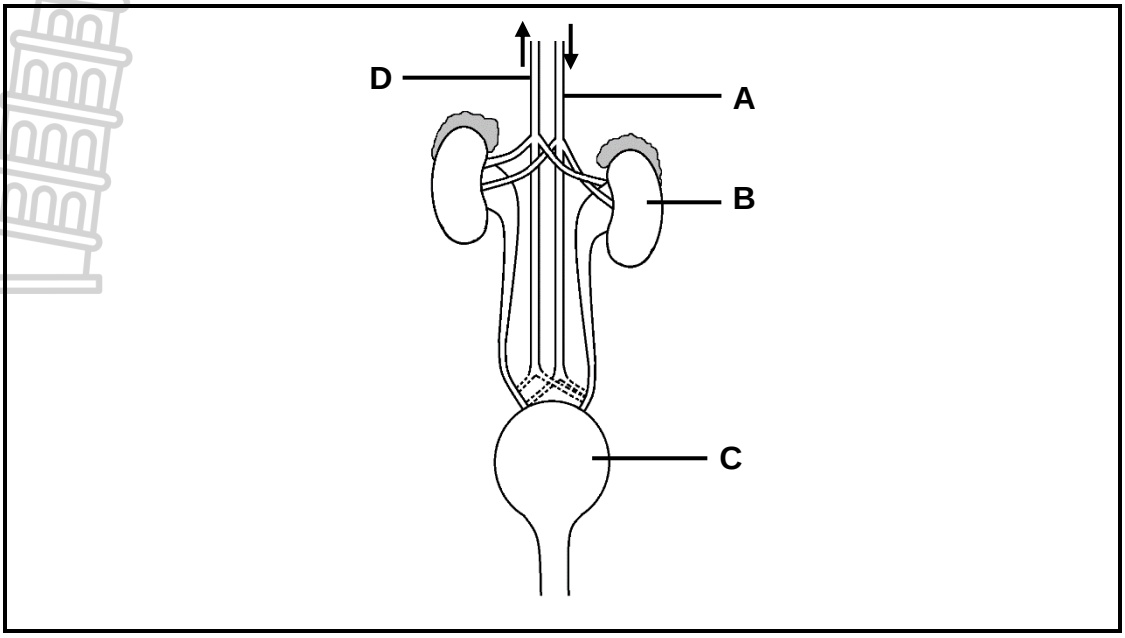
1.2.9 The protective outer membrane of the kidney (9 x 1) (9)

1.3 Indicate whether each of the descriptions 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 numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	The site of chemical reactions of the dark phase	A: B:	Stroma Cytoplasm
1.3.2	Function of haemoglobin	A: B:	Transport of oxygen Transport of CO_2
1.3.3	Site of tubular excretion	A: B:	Collecting duct Urethra

(3 x 2) (6)

1.4 The diagram below represents the human kidneys.



1.4.1 Identify parts:

(a) **A** (1)

(b) **D** (1)

1.4.2 Name the:

(a) Blood vessel that transports blood containing metabolic waste products directly into the kidney (1)

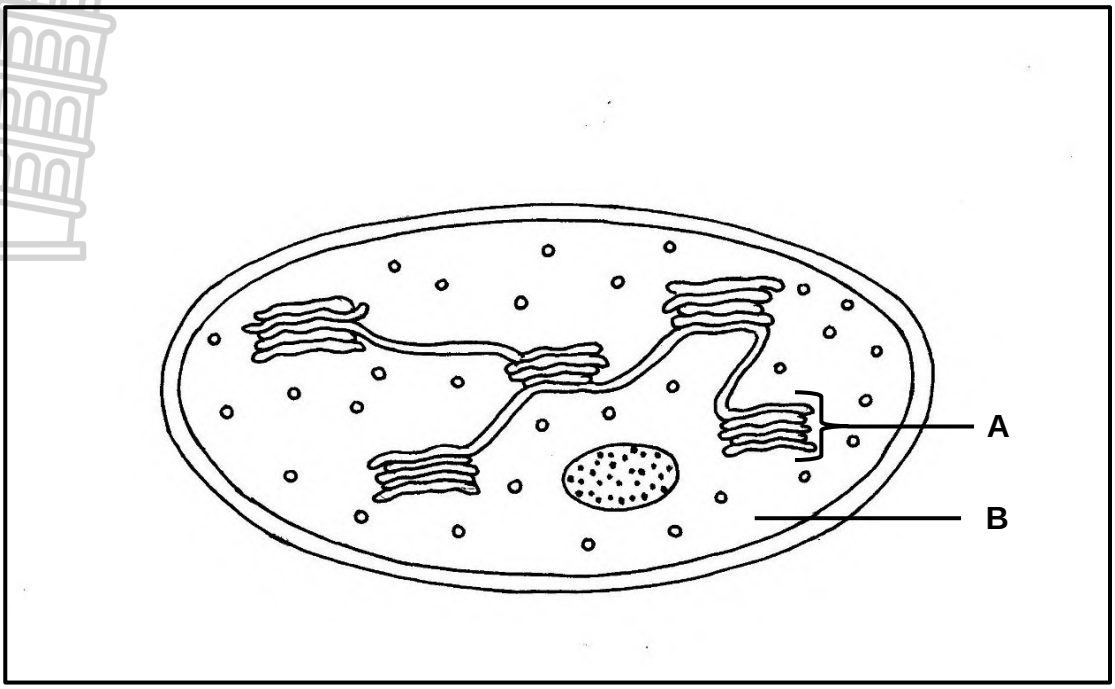
(b) Tube that transports urine into part **C** (1)

(c) Part that stores urine temporarily (1)

1.4.3 Give THREE functions of part **B**. (3)

1.4.4 Which ONE of the labelled blood vessels has the highest blood pressure? (1)

1.5 The diagram below represents an organelle that plays an important role in a plant cell.



1.5.1 Name the:

(a) Organelle shown in the diagram (1)

(b) Biochemical process in which the organelle shown in the diagram plays an important role (1)

1.5.2 Give the LETTER and NAME of the structure in which the light dependent reaction takes place. (2)

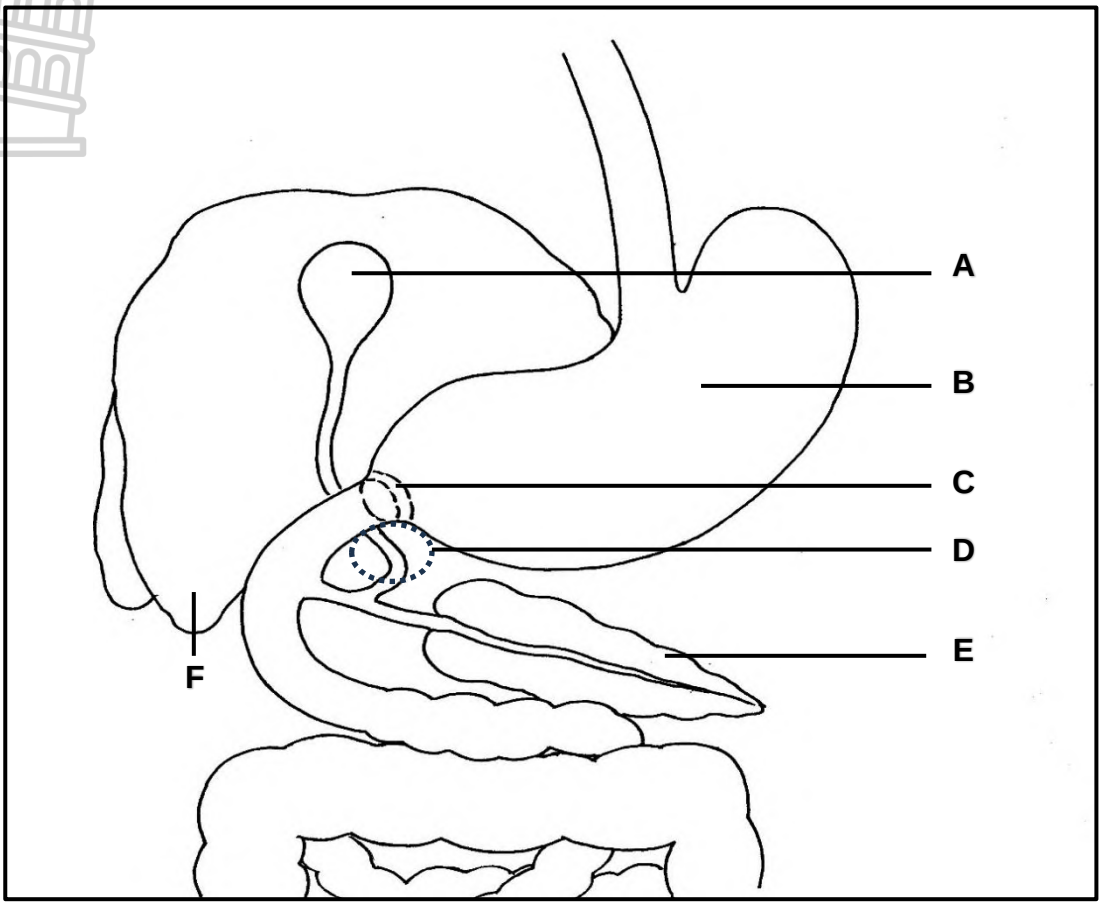
1.5.3 Give a reason(s) for your answer in QUESTION 1.5.2. (2)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents part of the alimentary canal.



2.1.1 Identify:

(a) Part **A** (1)

(b) Part **C** (1)

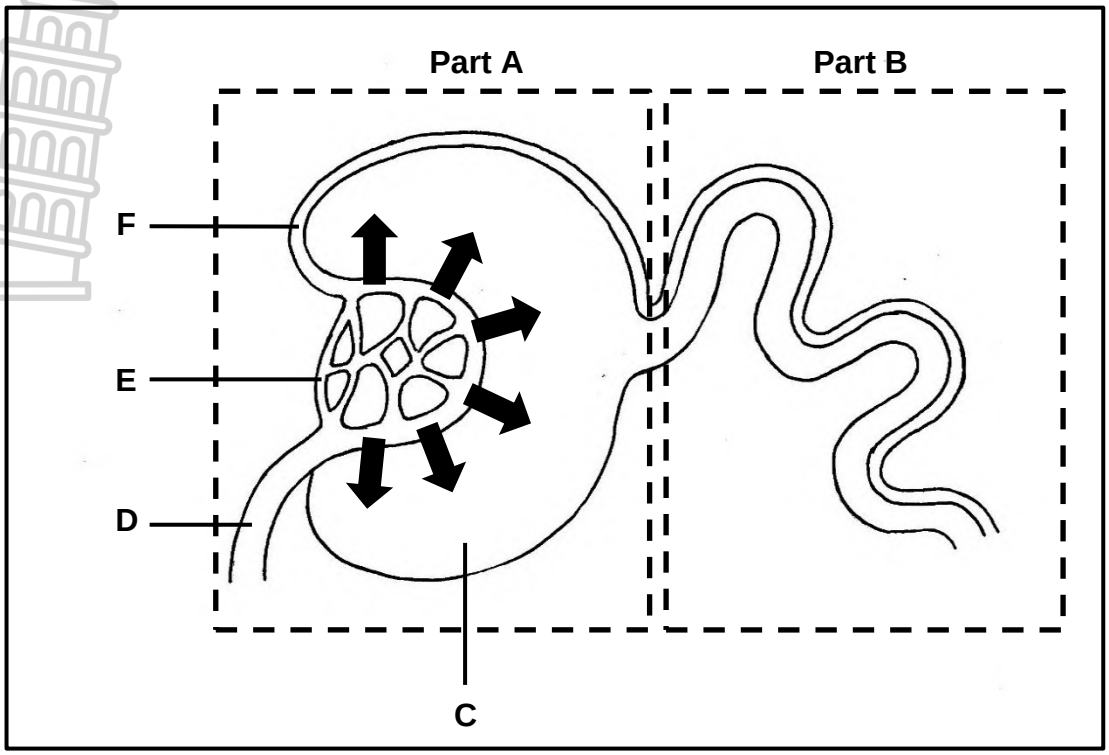
2.1.2 Give THREE general functions of gland **F**. (3)

2.1.3 The acid produced in part **B** does not destroy its walls. Explain why is this possible. (2)

2.1.4 Explain why the blockage in part **D** will disrupt the digestive process in the small intestine. (5)

2.1.5 State, with reasons, why is part **E** is regarded as an endocrine as well as an exocrine gland. (4)

2.2 The diagram below represents a certain portion of a nephron.



2.2.1 Identify part:

(a) **A** (1)

(b) **B** (1)

2.2.2 Name the process that takes place at:

(a) **A** (1)

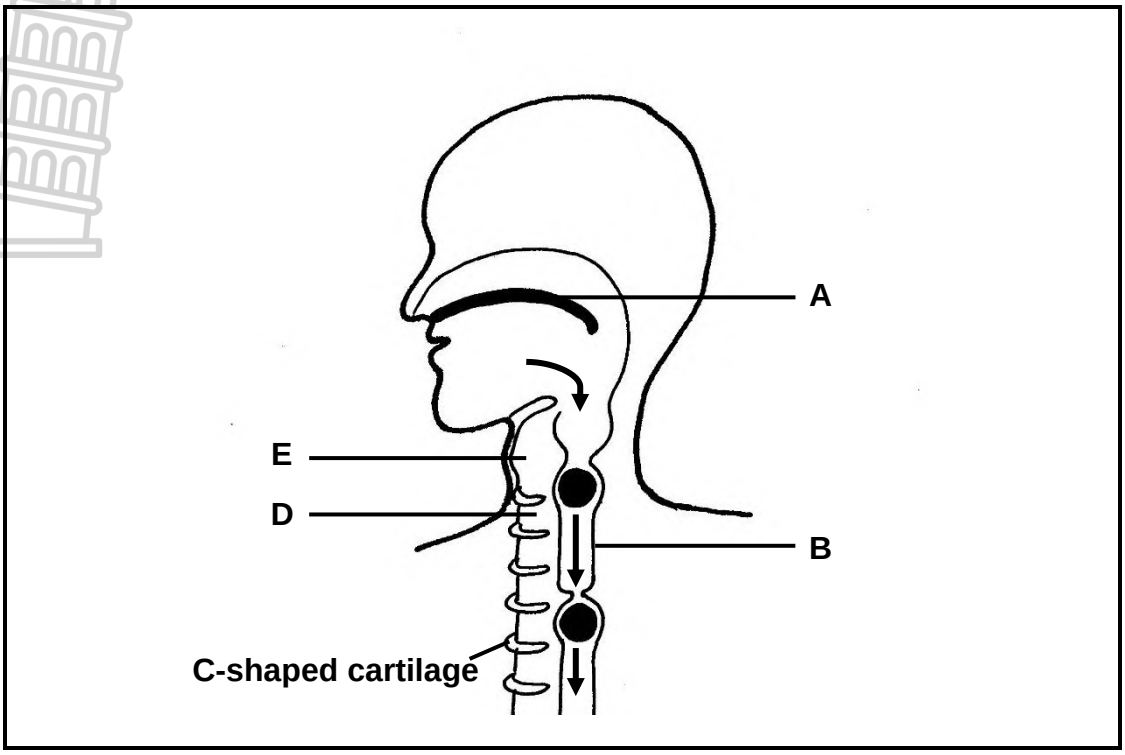
(b) **B** (1)

2.2.3 Explain why blood vessels **D** and **F** are structurally different in size. (4)

2.2.4 What components of blood in part **E** are absent from the fluid in part **C**? (2)

2.2.5 Explain how the structure labelled part **B** is structurally suited for its function. (4)

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



2.3.1 Name the:

(a) Part that separates the nasal cavity from the mouth cavity (1)

(b) Process that facilitates the movement of food through part **B** (1)

(c) TWO muscles that are involved in the process mentioned in QUESTION 2.3.1(b) (2)

2.3.2 Explain why food normally flows into part **B** instead of part **D**. (2)

2.3.3 How do the C-shaped cartilage rings on part **D** provide a functional advantage to part **B**? (2)

2.3.4 Explain the possible consequence of a bacterial infection at part **E**. (2)

2.3.5 Explain why an obstruction/blockage in part **D** for more than 20 minutes may lead to death. (4)

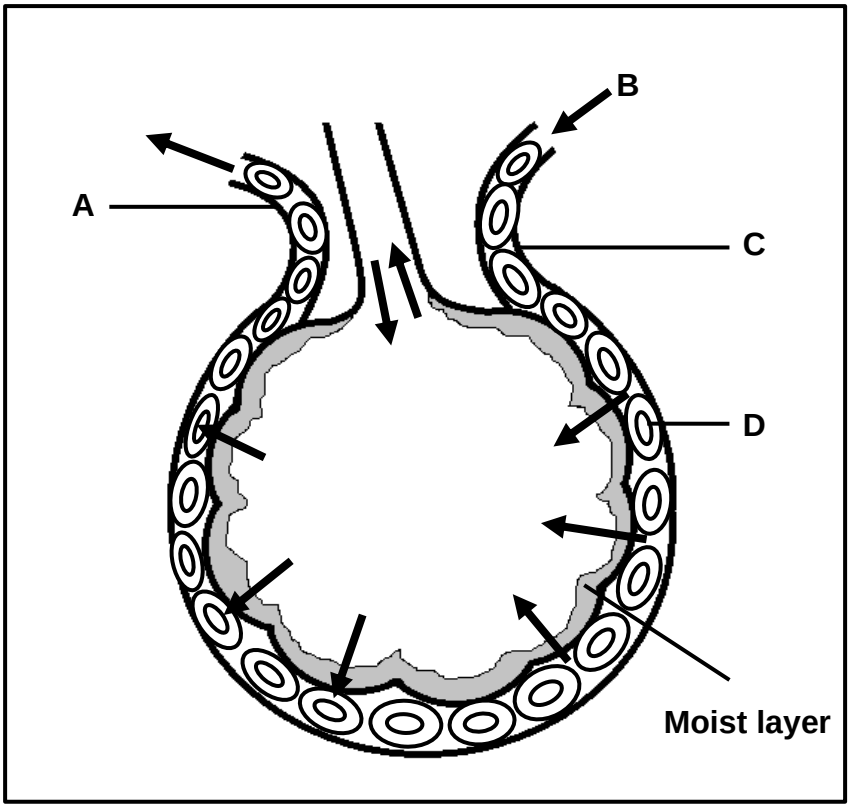
2.4 Consumption of food items such as pickles, chips and salty crackers may change the salt concentration in the blood.

Describe how the correct salt concentration in the blood is normalised by the homeostatic process in these circumstances. (6)

[50]

QUESTION 3

3.1 The diagram below represents an alveolus.



3.1.1 Identify the gas which is at high concentration in blood vessel **B**. (1)

3.1.2 State TWO ways in which this gas in **B** is transported in the blood. (2)

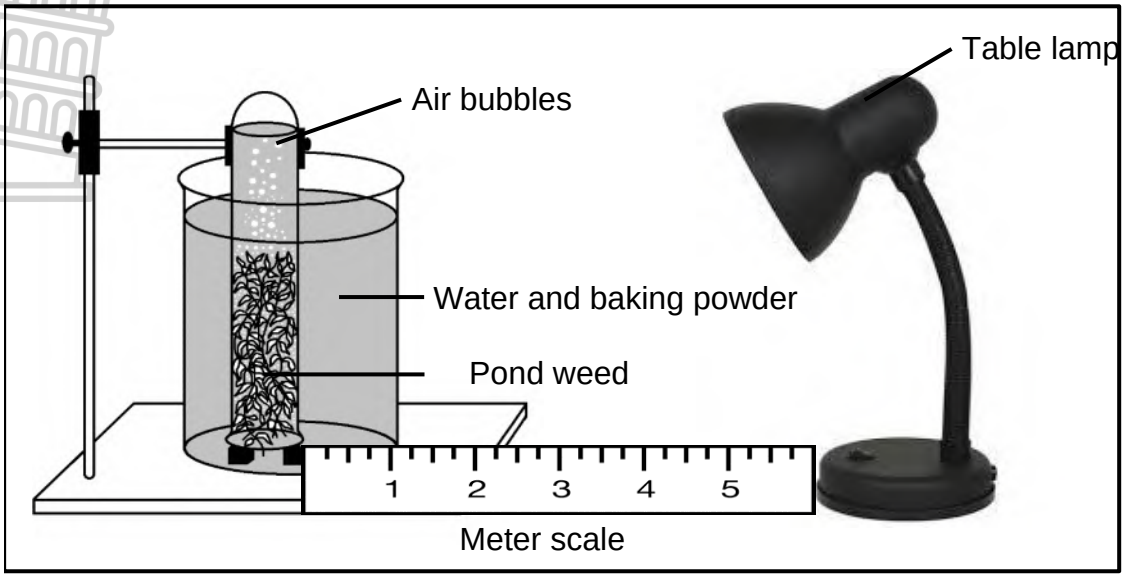
3.1.3 Which large blood vessel receives blood from **A**? (1)

3.1.4 Give an observable reason for your answer to QUESTION 3.1.3. (1)

3.1.5 Explain TWO ways in which the blood cell labelled **D** is structurally suited for its function. (4)

3.1.6 Explain why it is not advisable to sleep in an unventilated room where a heater is switched on. (3)

3.2 A student set up an experiment as shown in the diagram below, to determine the effect of carbon dioxide concentration on the rate of photosynthesis of a pond weed.



The procedure was as follows:

- The student used five similar pieces of pond weed and five different concentrations of baking powder (Sodium hydrogen carbonate) solution, which produces carbon dioxide
- A control experiment was set up using a similar piece of pond weed
- The student counted the number of bubbles produced by the pond weed over a period of five minutes
- The student repeated the investigation three times at each concentration of baking powder solution and calculated the average rate of photosynthesis

Carbon dioxide concentration %	**Number of bubbles per minute**			
	1st	2nd	3rd	Average
0	3	2	4	3
0,1	6	4	5	5
0,2	12	7	11	10
0,3	14	15	16	15
0,4	18	22	21	20
0,5	19	23	21	21

3.2.1 Identify the:

(a) Dependent variable (1)

(b) Independent variable (1)

3.2.2 How was the rate of photosynthesis measured? (1)

3.2.3 Identify THREE variables that should have been kept constant. (3)

3.2.4 How did the student increase the reliability of this investigation? (1)

3.2.5 Give a reason for setting up a control for this experiment. (2)

3.2.6 Plot a bar graph to represent the average number of bubbles released at different concentration of carbon dioxide by the pond weed. (6)

3.2.7 What conclusion can be drawn from the results? (2)

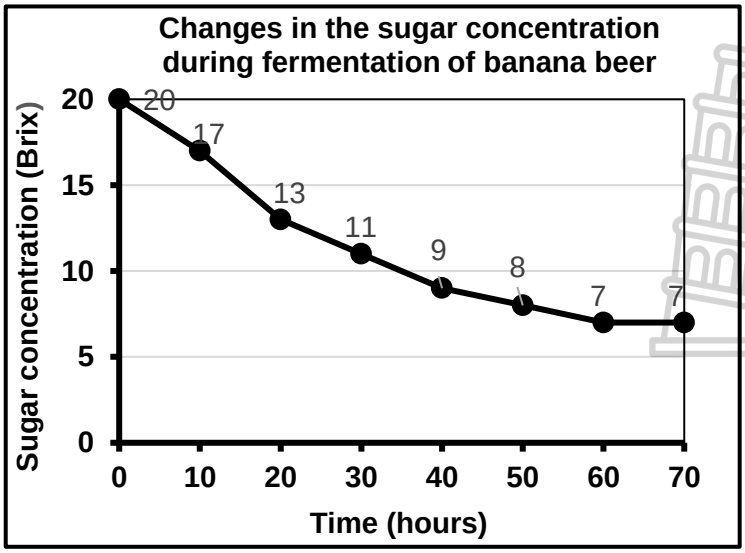
3.3 The extract below describes the microbial activities that occur during the production of banana beer.

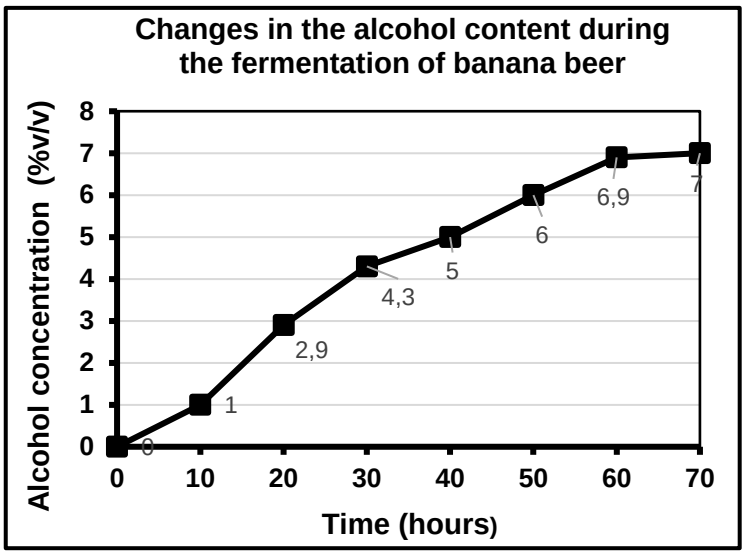
Banana beer, *urwagwa*, is one of the oldest and major alcoholic drinks traditionally made in Rwanda. The banana beer is manufactured from the fermentation of banana juice and roasted red sorghum.

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

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

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





3.3.1 From the graph, indicate the:

(a) Initial sugar level of banana juice (1)

(b) Final alcohol content of the banana beer (1)

3.3.2 Name ONE by-product, other than alcohol, formed during the fermentation process. (1)

3.3.3 Describe the symbiotic relationship between lactic acid bacteria and yeast during the fermentation process. (4)

3.3.4 Calculate the percentage decrease in sugar concentration from the 10^{th} hour to the 70^{th} hour. Show ALL your working. (3)

3.3.5 From the graph, how would you determine the completion of fermentation? (1)

3.3.6 Explain why the sugar level decreased with fermentation time. (3)

3.4 A person has consumed two large bars of chocolate and two cups of soft drink containing a high sugar content during lunch break.

Describe the homeostatic process that restores the correct level of glucose in the blood. (7)

[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

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NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2023

LIFE SCIENCES P1
MARKING GUIDELINE

MARKS: **150**

This marking guideline consists of 10 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 whole process is given when only a part of it is required**
   Read all and credit the relevant part.

4. **If comparisons are asked for, but descriptions are given**
   Accept if the 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 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 sequence and links become correct again, resume credit.

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

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

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

12. **Spelling errors**
    If recognisable, accept the answer, 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 national memo discussion meeting.

14. **If only the letter is asked for, but only the name is given (and vice versa)**
    Do not credit.

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

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

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

18. **Code-switching of official languages (terms and concepts)**
A single word or two that appear(s) in any official language other than the learner's 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 is applicable to all official languages.

SECTION A

QUESTION 1

1.1	1.1.1	B ✓✓		
	1.1.2	C ✓✓		
	1.1.3	C ✓✓		
	1.1.4	B ✓✓		
	1.1.5	B ✓✓		
	1.1.6	A ✓✓		
	1.1.7	B ✓✓		
	1.1.8	A ✓✓		
	1.1.9	B ✓✓		
	1.1.10	B ✓✓	(10 x 2)	(20)
1.2	1.2.1	Squamous epithelium ✓		
	1.2.2	Pleural membrane ✓/ Pleura		
	1.2.3	Medulla oblongata ✓		
	1.2.4	Glucagon ✓		
	1.2.5	Egestion ✓/ Defaecation		
	1.2.6	Amino acid ✓		
	1.2.7	Villi ✓		
	1.2.8	Greenhouse ✓		
	1.2.9	Renal capsule ✓	(9 x 1)	(9)
1.3	1.3.1	A only ✓✓		
	1.3.2	Both A and B ✓✓		
	1.3.3	None ✓✓	(3 x 2)	(6)
1.4	1.4.1	(a) Aorta ✓		(1)
		(b) Inferior vena cava ✓		(1)
	1.4.2	(a) Renal artery ✓		(1)
		(b) Ureter ✓		(1)
		(c) Urinary bladder ✓		(1)
	1.4.3	- Excretion ✓ (of metabolic wastes) - Regulation of salt content of body ✓ - Regulation of blood pH ✓ - Regulation of water content of the body ✓/osmoregulation	(Any 3 x 1)	(3)
	1.4.4	Blood vessel **A** / aorta ✓		(1)

1.5 1.5.1 (a) Chloroplast ✓ (1)

(b) Photosynthesis ✓ (1)

1.5.2 A ✓– granum ✓ (2)

1.5.3 - Part **A** (granum) contains chlorophyll ✓
- Chlorophyll absorbs light energy ✓ (2)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 2.1.1 (a) Gall bladder ✓ (1)

(b) Pyloric sphincter ✓/pylorus (1)

2.1.2
- Secretes bile ✓
- Converts glucose to glycogen ✓
- Converts excess glucose to fat ✓
- Stores minerals such as iron ✓
- Stores vitamin A, D and B_{12} ✓
- De-amination of excess amino acids ✓
- Detoxifies certain harmful substances and make them harmless ✓

(Mark first THREE only) (Any 3 x 1) (3)

2.1.3
- The mucus glands on the mucosa layer secretes thick mucus ✓
- that acts as a barrier between the acid and the wall of the stomach ✓ (2)

2.1.4
- Bile will not emulsify fat ✓
- therefore, (pancreatic) lipase will not be able to digest fat ✓
- Bile will not neutralise the acid chyme from the stomach ✓
- therefore, enzymes secreted by the pancreas ✓ and
- the intestinal glands ✓
- will not digest proteins and carbohydrates ✓ (Any 5 x 1) (5)

2.1.5
- Part **E** acts as an exocrine gland because it has a duct ✓
- to transport its secretion ✓ to the site of action
- It also acts as an endocrine gland because it secretes hormones ✓
- that are released directly into the blood ✓/ blood transports
- hormones to the target organ. (4)

2.2 2.2.1 (a) Part **A** – Malpighian corpuscle ✓/body (1)

(b) Part **B** – Proximal convoluted tubule ✓ (1)

2.2.2 (a) Ultra-filtration ✓ (1)

(b) Tubular re-absorption ✓ (1)

2.2.3
- Blood vessel **D** is wider than blood vessel **F** ✓
- the small diameter of blood vessel **F** resists the flow of blood ✓
- and causes high blood pressure at Part **E** ✓ that
- leads to the leakage of blood plasma into part **C** ✓ (4)

2.2.4 Blood cells ✓ and (large) protein molecules ✓ (2)

2.2.5 The inner walls of region **B** consists of:
- large number of mitochondria ✓ to generate energy for active transport of nutrients into the blood capillaries ✓
- large number of micro-villi ✓ to increase the area of absorption. ✓ (4)

2.3 2.3.1 (a) Palate ✓ (1)

(b) Peristalsis ✓ (1)

(c) Circular ✓ and longitudinal ✓ muscles (2)

2.3.2
- During swallowing, the bolus is pushed backwards into the pharynx ✓ and
- this stimulates the closure of the glottis by epiglottis blocking the flow of food into part D ✓ (2)

2.3.3
- The incomplete portion of the C-shaped cartilages of the trachea is in contact with the oesophagus ✓
- This allows the oesophagus to stretch and bulge into the trachea preventing the oesophagus from becoming blocked ✓/ prevents choking. (2)

2.3.4
- The bacterial infection causes inflammation of vocal cords ✓
- therefore, vocal cords will not be able to vibrate freely ✓ and
- no sound can be produced ✓ (Any 2 x 1) (2)

2.3.5
- Oxygen will not reach the lungs ✓
- Oxygen concentration drops in the blood ✓
- Oxygen will not be made available for cellular respiration ✓
- The energy production stops ✓
- therefore, all vital organs will stop functioning ✓

OR

- CO_2 will not be removed /exhaled from the lungs ✓
- CO_2 concentration in the blood remains high ✓
- Blood pH drops/ blood becomes very acidic ✓
- Enzymes becomes functionless ✓
- therefore, all vital metabolic processes will stop ✓ (Any 4 x 1) (4)

2.4
- The salt level in the blood increases ✓
- Receptor cells in the afferent and efferent arterioles of the kidney detect the high salt level ✓
- The adrenal gland is stimulated ✓
- to stop secreting aldosterone ✓/ to secrete less aldosterone
- This decreases the re-absorption of sodium ions from the renal tubules ✓ in the kidney
- into the surrounding blood vessels ✓
- The salt level in the blood vessels decreases ✓
- and returns to normal ✓ (Any 6 x 1) (6)

[50]

QUESTION 3

3.1 3.1.1 Carbon dioxide ✓ (1)

3.1.2
- Bicarbonate ions ✓
- In solution in the blood plasma ✓
- Carbaminohemoglobin ✓

(Mark first TWO only) (Any 2 x 1) (2)

3.1.3 Pulmonary vein ✓ (1)

3.1.4 The direction of arrow indicates the outward flow of blood ✓ (1)

3.1.5
- The red blood cells/ erythrocytes contain haemoglobin ✓ for the transportation of oxygen to the tissues and carbon dioxide from the tissues. ✓
- Red blood cells/erythrocytes are biconcave discs ✓ to increase the surface area for the maximum absorption of oxygen ✓

(Mark first TWO only) (2 x 2) (4)

3.1.6
- The heater warms the air and removes the moisture from the air ✓/ humidity in the room
- The person sleeping in the room will continuously inhale dry air ✓
- causing the lungs (the moist lining of alveoli) to become dry ✓ and
- this prevents diffusion of gases between the atmospheric air and the blood in the alveolar capillaries ✓
- the low concentration of oxygen / high concentration of carbon dioxide in the blood stops metabolic processes in the cell/tissues causing possible death ✓

(Any 3 x 1) (3)

3.2 3.2.1 (a) Rate of photosynthesis ✓ (1)

(b) Concentration of carbon dioxide ✓ (1)

3.2.2 By counting the number of bubbles in unit time ✓ (in one minute) (1)

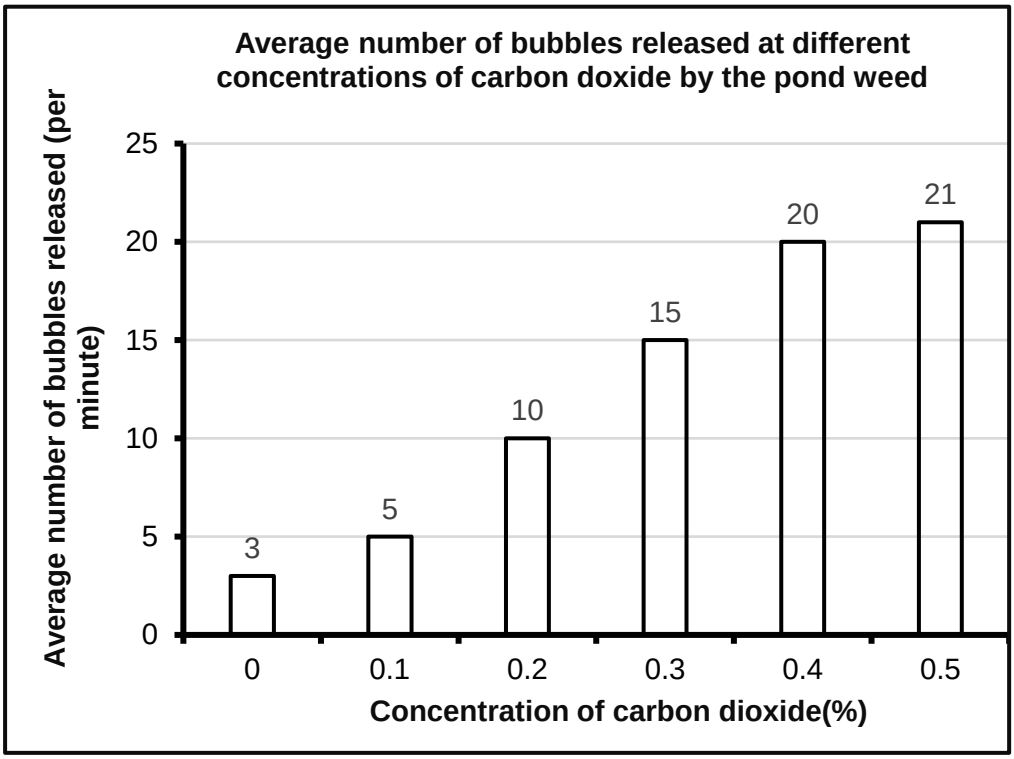
3.2.3
- Water temperature ✓
- Plant species ✓
- Person counting the bubbles ✓
- Age of plants ✓
- Light intensity ✓
- Number of leaves ✓
- Length of light exposure ✓
- Quality of baking powder ✓

(**Mark first THREE only)** (Any 3 x 1) (3)

3.2.4 - The student repeated the investigation three times at each concentration ✓ (1)

3.2.5 - To act as a baseline ✓
- to see if the concentration of CO_2 causes the change in rate of photosynthesis ✓ (2)

3.2.6



Criteria for marking graph:

Criteria	Mark allocation
Bar graph is drawn **(T)**	1
Caption of the graph includes both variables **(C)**	1
Correct labels on *x*-axis and *y*-axis **(L)**	1
Correct scale for *y*-axis Equal spaces between bars and equal width of bars for *x*-axis **(S)**	1
Plotting: **(P)** 1 – 5 co-ordinates are plotted correctly All 6 co-ordinates are plotted correctly	1 2

Histogram or **line graph** drawn:
- Lose marks for type of graph and for scale

Transposed axes:
- Can get full credit if axes labels are also swapped and bars are horizontal
- if labels are not corresponding, then lose marks for labels and scale
- Check that the plotting is correct for the given labels (6)

3.2.7 As concentration of carbon dioxide increases the rate of photosynthesis increases ✓✓ (2)

3.3 3.3.1 (a) 20 ✓ Brix (1)

(b) 7% ✓v/v (1)

3.3.2 Carbon dioxide ✓ (1)

3.3.3
- During fermentation process, the lactic acid bacteria creates an acid medium ✓ (produce lactic acid while breaking down sugar)
- favourable for the multiplication/ breeding of yeast cells ✓
- The yeast produces vitamins and increase other nutritional components such as amino acids ✓
- for the growth of lactic acid bacteria ✓ (4 x 1) (4)

3.3.4 $17 - 7 = 10$ ✓

$\frac{10}{17} \times 100$ ✓ $= 58,82$ ✓% (3)

3.3.5 The completion of fermentation is indicated by the levelling of the sugar concentration ✓ (Brix level) (1)

3.3.6
- The micro-organisms/lactic acid bacteria and yeast derive energy ✓
- from the decomposition of sugar ✓ in the banana juice and sorghum mix
- As fermentation progresses, more sugar will be broken down ✓ and this will lead to the decrease in the sugar content (3)

3.4
- Glucose levels in the blood increase above the normal levels ✓
- the pancreas is stimulated ✓
- to secrete insulin into the blood
- insulin travels in the blood to the liver ✓
- where it stimulates the conversion of excess glucose to glycogen ✓
- which is then stored ✓
- the glucose level in the blood now decreases ✓
- and returns to normal ✓ (Any 7 x 1) (7)

[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150