NAME: _____ ADM NO. _____ CLASS: _____

231/2

BIOLOGY (THEORY)

PAPER 2

END OF TERM 3 2024

TIME: 2 HOURS FORM 3

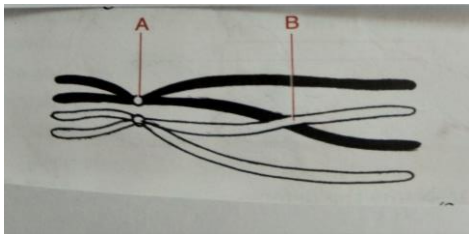
MARKING SCHEME

INSTRUCTIONS TO CANDIDATES:

- Write your name and index number in the spaces provided above.
- Sign and write the date of examination in the spaces provided above.
- **This paper consists of two sections, A and B.**
- **Answer all the questions in sections A in the spaces provided.**
- **In section B, answer question 6 (compulsory) and either question 7 or 8 in the spaces provided after question 8.**
- **Candidates should answer the questions in English.**

SECTIONS A: (40 marks)
Answer All the Questions in this section in the spaces proved.

1. The diagram below shows a phenomenon which occurs during cell division.



a) Name the parts labelled A and B. (2 mks)
A Centromere;
B Chiasma; deny chiasmata

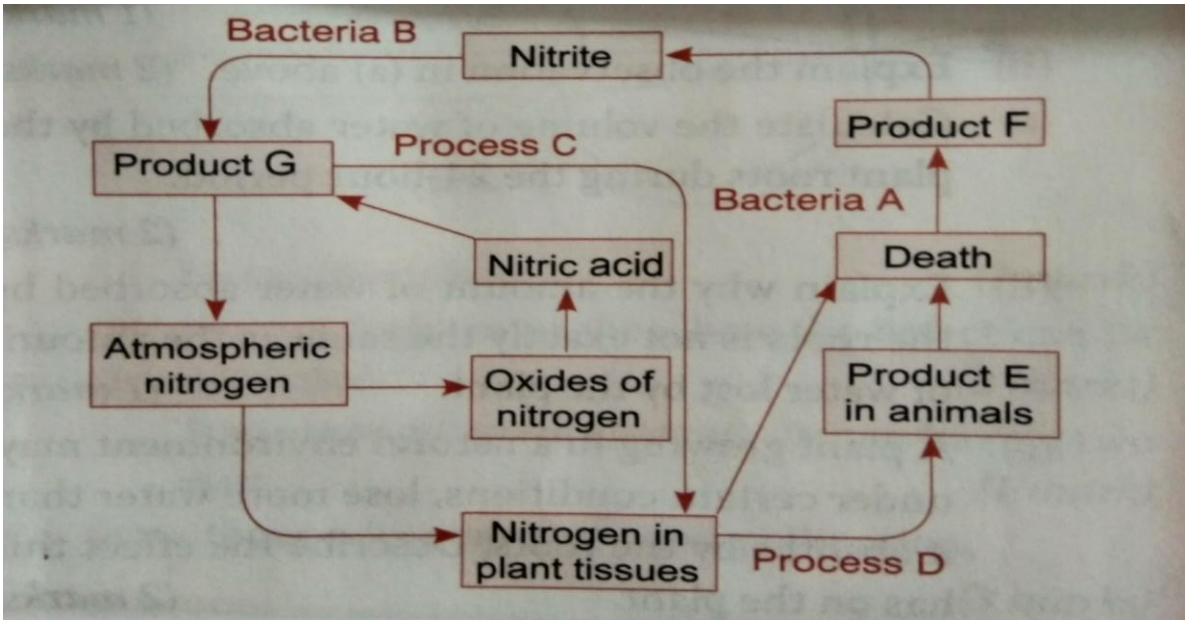
b) State the biological importance of the parts labelled A and B. (2 mks)
A = Joins/links the (sister) chromatids of a chromosome; acc point of attachment of spindle fibres
B = Allow exchange of genetic materials (between the homologous chromosomes) / Between non sister chromatids;

c) Identify the type of cell division in which this phenomenon occurs. (1 mk)
Meiosis;

d) Name the organs in human beings in which the phenomenon occurs. (2 mks)
Testis/Testes;
Ovary/Ovaries;

e) How many daughter cells are formed during this cell division? (1 mk)
4/four;

2. The figure below represents the nitrogen cycle.



a) Identify bacteria A and B. (2 mks)
A = Saprophytic (bacteria/Putrefying/Decomposer;
B = Nitrifying/nitrococcus/nitrobacter;

b) Name processes C and D. (2 mks)
C = Absorption/assimilation;
D = Feeding/Eating/Consumption/assimilation;

c) Name products E and F. (2 mks)
E = Proteins/Amino acids in Animals;
F = Ammonium compounds/Ammonia;

d) State two (in bold) ways in which free Nitrogen in the air is made available for plant use.
1. **By Rhozobium bacteria in root nodules;**
2. **By Azolobacter/Chlostridium;**
3. **Action of lightening;**
4. **Industrial fixation/Haber process;**
5. **Chlorella/Nostoc/ ;**

3. An organism was exposed to different temperatures but the body temperature remained constant at $36.7^{o}C$.
a) What type of organism is it in terms of thermoregulation? (1 mk)
Homoiotherm/Endotherm;

b) Describe one (bold) advantage of this condition to the organism. (1 mk)

It ensures metabolism occurs without being affected by external factors; the organisms can live in all types of habitats; Body functions efficiently since body temperature is constant all the time; any one correct.

c) List two (bold) ways by which the body of a human being loses heat. (2 mks)
- **Sweating/evaporation/convection;**
- **Excretion;**
- **Breathing/Breath;**
- **Respiration;**
- **Radiation;**
- **Conduction;**

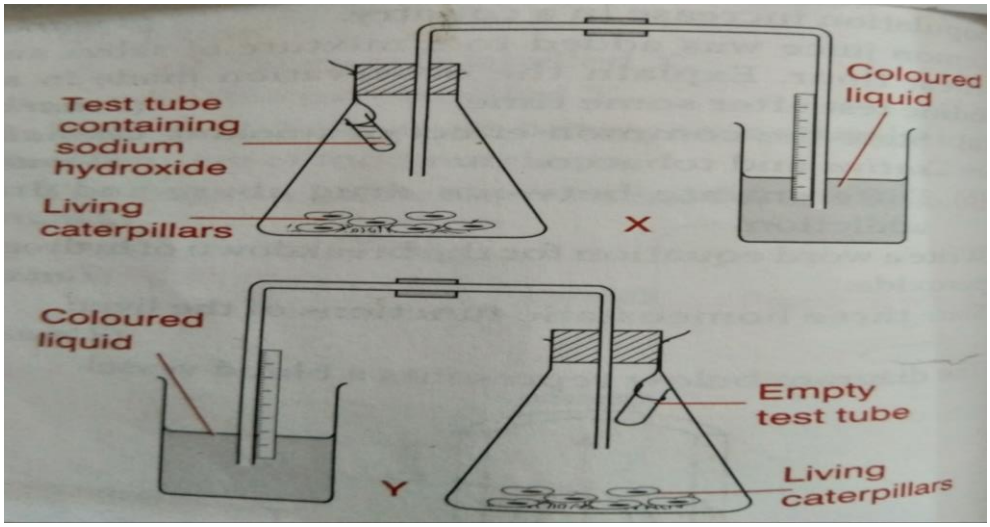
d) What changes occur in the skin at a room with temperature of $40^{o}C$. (3 mks)

The erector pilli muscles relax; thus the hair on the body lies flat; decreasing insulation and increasing heat loss;/
Vasodilation occurs; which increases blood flow in the superficial blood vessels; hence increasing heat loss by convection and radiation;/
The sweat glands secrete <u>more</u> sweat; which evaporates; increasing loss of heat through latent heat of vaperization;
(score marks only in one area to max of 3)

e) Explain why it is important to reduce heat production in the body from $40^{o}C$ to $36.7^{o}C$? (1 mk)

To prevent overheating in the body, which can cause heat stroke/To provide optimum temperature for enzyme action;

4. The diagrams below show two experimental set-ups X and Y, that were placed in the sunlight.



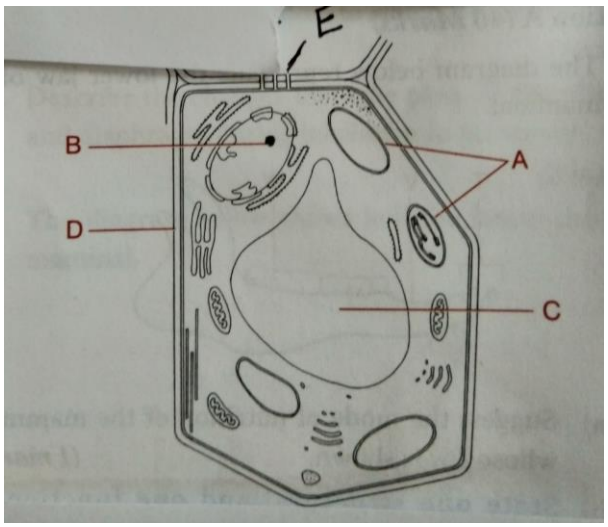
a) After half an hour, the coloured liquid in set-up X had risen to the top of the scale. Explain this observation. (3 mks)
The living caterpillars respired, used up oxygen and produced carbon (IV) oxide; The carbon (IV) Oxide was absorbed by the sodium hydroxide solution creating a space/partial vacuum; the liquid rose to occupy the space created;

b) Suggest the purpose of the set-up Y in the experiment. (1 mk)
It is a control experiment; deny <u>to control</u> the experiment

c) What would be the observation in X if the caterpillars were replaced with fresh green vegetables? (2 mks)
No change; The leaves would use up their carbon (IV) oxide from respiration for photosynthesis and give out oxygen gas;

d) What modifications are required for the green leaves to register the same results as the caterpillars. (2 mks)
Covering the flask with black paper/opaque material/ Aluminium foil; to prevent light form reaching the plants, hence no photosynthesis takes place;

5. The diagram below represents a cell seen under an electron microscope. Study it and answer the questions that follow.



a) i) Suggest the kingdom from which the cell shown in the diagram was obtained. (1 mk)
Plantae;

ii) Give two (bold) reasons for your answer in a(i) above. (2 mks)

- **Has chloroplasts;**
- **Has a cell wall;**
- **Cell has regular shape;**
- **It has a large central vacuole;**
  (1st two max 2)

b) Name the parts labelled A and B. (2 mks)
A = Chloroplasts;
B = Nucleolus;

c) State the functions of the part labelled C. (1 mk)

- **It stores water and mineral salts;**
- **It maintains the shape of the cell;**
- **It supports the cell/Plant;**
- **It creates osmotic pressure which is important for uptake of water;**

d) Name a structure component of the part labelled D. (1 mk)
Cellulose;

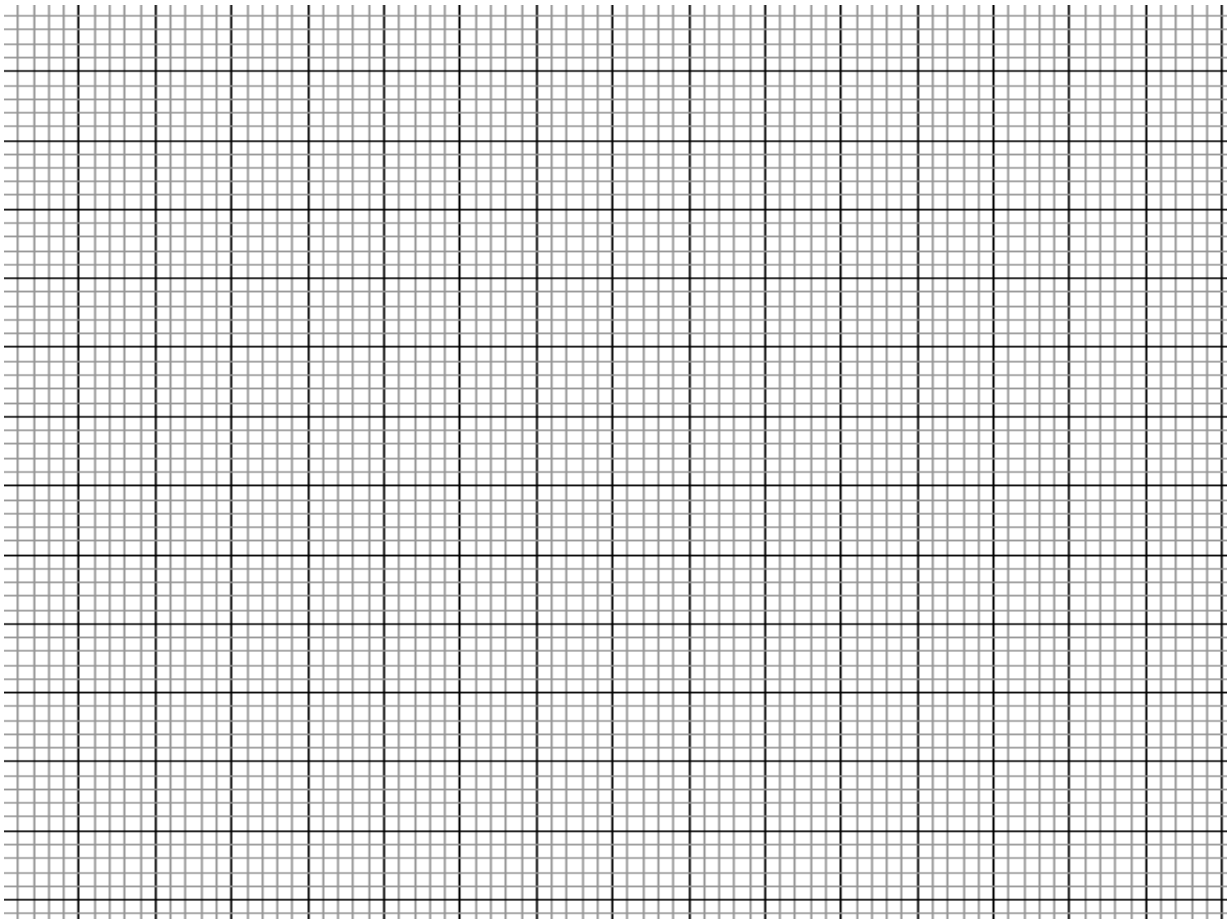
e) Name part labelled E. (1 mk)
Plasmodesma;

SECTIONS B: (40 marks)
Answer Question 6 (compulsory) and either question 7 or 8 in the spaces provided.

6. An experiment was carried out in which red blood cells were put in salt solutions of different concentrations. The table below shows the percentage of cells which were destroyed by haemolysis in different salt concentrations.

Salt concentration (g/dm^3)	% R.B.C destroyed by Haemolysis
0	100
1	100
2	100
2.5	100
3.0	100
3.5	96
3.7	80
4.0	60
4.5	16
4.7	0
5.0	0
6.0	0

a) Draw a graph of percentage of red blood cells haemolysed against salt concentration. (6 mks)



Scale @ 1 = 2 mks)
Label axes @ 1 = 1 mk
Plotting 1 = 1 mk
Curve 1 = 1 mk

b) Explain haemolysis of red blood cells. (4 mks)
Haemolysis of red blood cells occurs when they are placed in a hypotonic solution; they gain water (by osmosis) and swell; and then burst;

c) From the graph, state:
i) The salt concentration at which 50% red blood cells were haemolysed. (1 mk)
4.1g/dm^3; $\pm$ 0.1
(4.0 – 4.2) deny if no units.
Deny range

ii) The highest salt concentration when the largest number of red blood cells were haemolysed. (1 mk)

3.0g/dm^3; $\pm$ 0.1
(2.9 – 3.1) deny if no units.
Deny range

d) i) Suggest the normal salt concentration in the blood of the mammal from which the red blood cells were obtained. (1 mk)

4.7g/dm^3; $\pm$ 0.1

(4.6 – 4.8) **deny range**

ii) Give a reason for your answer in d(i) above. (1 mk)
At 4.7g/dm^3 salt concentration, there is no haemolysis; (It was at 0%).

iii) What term is used to describe the solution with equal solute concentration as that of the cells? (1 mk)
Isotonic solution;

e) Name the process in human body that ensures that haemolysis of red blood cells is prevented.
Osmoregulation; (1 mk)

f) State the role of osmosis in organisms. (5 mks)
- **Enables movement of water from one cell to the next;**
- **Helps in the opening and closing of stomata in plants;**
- **Leads to turgidity in cells/Provides support to plants;**
- **Enables absorption of water from the soil by the roof hairs;**
- **Feeding in insectivorous plants;**
- **Absorption of water at the kidney tubules;** **(max 5)**

7. Describe what happens to a meal of oily beans and maize from the time of ingestion up to the time of absorption. (20 mks)
In the mouth; the meal is chewed/broken down by teeth/during mastication; The tongue; turns the food for efficient chewing; rolls it into boluses; pushes it to the gullet for swallowing; The salivary glands; secrete saliva; which contains salivary amylase/ptyalin/diastase which digests starch (maize) into maltose; The food is swallowed through peristalsis down the oesophagus; The food enters the stomach; through the candiac splincter; In the stomach, gastric juice containing pepsinogen; that is activated to pepsin; by the hydrochloric and; digest the beans/proteins into peptides; The stomach walls have penstaltic movement that churn the food; The food then moves to the duodenum; via the pylotic splincter; In the duodenum, the bile juice secretin by gall bladder; emulsifies; the oil in beans to increase surface area for enzyme action. Pancreatic juice; secreted by the pancreas; has pancreatic amylase; that digest starch to maltose; pancreatic lipase; digests oil into fatty acid and glycerol; Trypsin; digests proteins into peptides; The food (chime) enters the ileum; where succuss entericus is secreted; it contains maltase enzyme; that digests maltose to glucose; that is absorbed to blood; peptidase; digests peptides into amino acids; lipase digests remaining lipids (oil) into fatty acids and glycerol; which are absorbed into the lacteals of villi;

8. a) What is transpiration?
Process by which plants lose water to the atmosphere; in form of vapour (through lenticels, stomata and cuticle); **(2 mks)**

b) Explain how the various environmental factors affect the rate of transpiration

Temperature; an increase in temperature increase the water vapour holding capacity of air in the spaces between mesophyll cells due to increased evaporation; therefore more water diffuses from the cells increasing the water vapour pressure; this causes an increase in the diffusion gradient between the intercellular spaces and the atmosphere; hence increasing the rate of transpiration; low temperature decreases water vapour pressure and the diffusion gradient hence; lowering the rate of transpiration; Light intensity; high light intensity increases the rate of

photosynthesis in the guard cells; causing the opening of stomata; leading to increased water loss; it also increases the internal temperature of the leaf; that increases the evaporation rate in the intercellular spaces; leading to a higher rate of transpiration; low light intensity; reduces the rate of water loss; Humidity; a humid atmosphere lowers the water vapour diffusion gradient; hence lowering the rate of water loss; in a less humid/dry atmosphere, water diffusion gradient is high/steep; hence the rate of transpiration increases; Availability of water in the soil; more water will diffuse to the atmosphere when there is adequate or excess water; as more will be absorbed; increasing the rate of water loss; the guard cell will also remain turgid; hence stomata are open; leading to more water loss; however, less water in the soil leads to a reduced diffusion gradient between the mesophyll cells and the atmosphere; thereby reducing the rate of transpiration; Wind/air currents; wind blowing over a leaf surface carries pockets of moisture away from the leaf; creating a steep diffusion gradient between the atmosphere and the leaf; increasing the rate of water loss; in still air/on a calm day however, water vapour at the leaf area becomes saturated; and the diffusion gradient is lowered; reducing the rate of transpiration; Atmospheric pressure; low atmospheric pressure leads to a high rate of diffusion of water vapour; since air molecules move at a faster rate; and this increases the rate of water loss; in high atmospheric pressure conditions however, there is low rate of diffusion of water vapour; hence the rate of water loss is lowered; (Max. 18 mks)