NAME……..INDEX NO……DATE……

231/2

BIOLOGY FORM 4

PAPER 2 THEORY

JULY 2024

2 HOURS

This paper consist of two sections A and B

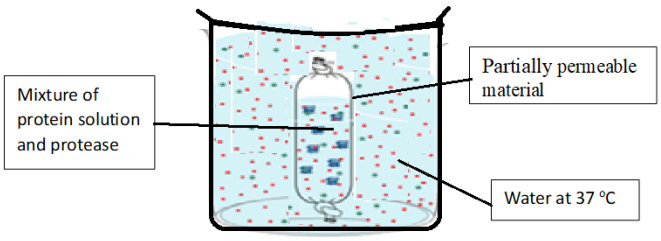
Answer all questions in section A in the spaces provided.

In section B,answer question 6 (compulsory) and either question 7 or 8 in the space provided after question 8.

SECTION A 40 MKS

MARKING

1. Form 2 students set up an experiment on diffusion as shown below. The set up was left to stand for 15 minutes.



a) What does the partially permeable material represent in a cell. (1mark)

Cell membrane;

b) Give a reason for keeping the water at 37 °C. (2marks)

To provide optimum/ favourable/ suitable temperature; for enzyme/protease action;

c) The students carried out a test for proteins using the **contents of the partially permeable material** after the 15 minutes. Suggest the conclusions made. (1 mark)

Proteins absent;

Explain your answer in c) above. (1mark)

Proteins were broken down / hydrolysed/ digested to amino acids by the action protease;

d) Amino acids were found to be present in the water. Explain its source and presence there. (3 marks)

Proteins broken down into amino acids; diffused to the water through the partially permeable material; because they are small in size;

2.The diagram below shows the base sequence of part of a nucleic acid strand. Observe it and answer the question that follows

G T T A C G C A

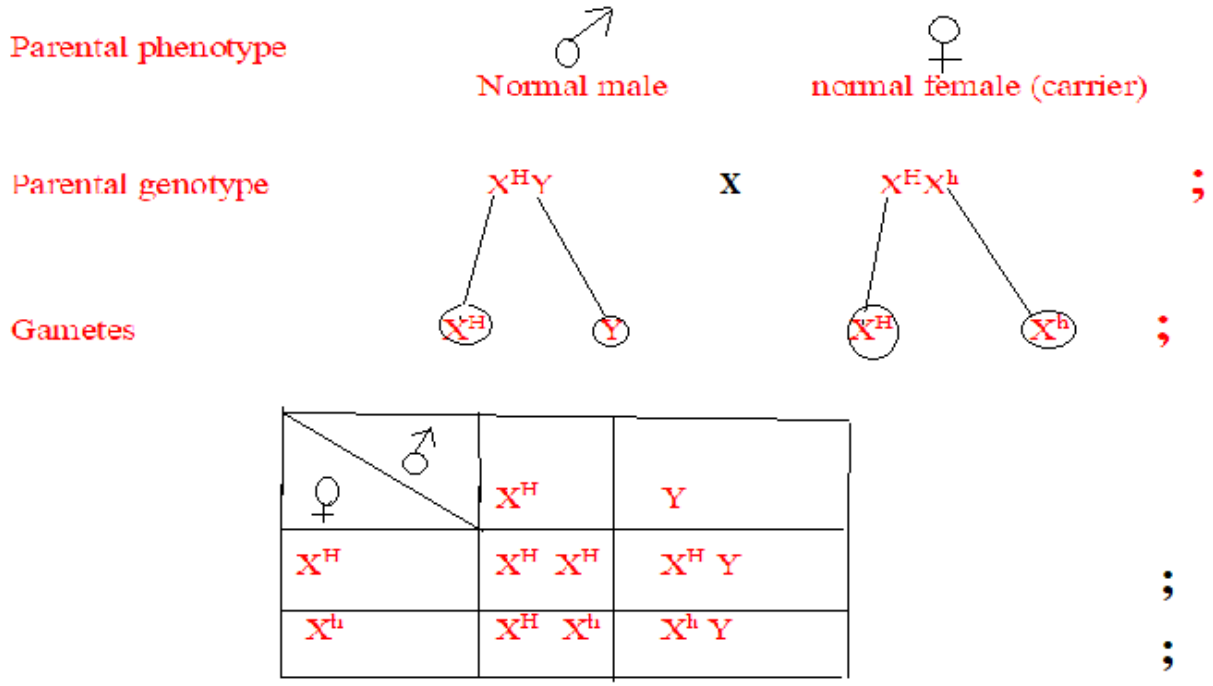
a) Giving the reason, identify the type of nucleic acid (2 mks)

DNA; presence of Thymine

b) Show the complimentary RNA strand (1mk)

C A A U G C G U

c) Haemophilia is a genetic disorder which is transmitted through recessive gene linked to X-Chromosome. A woman who is a carrier to haemophilia married a normal man. Using the punnet square, work out the genotype of F1 Offspring (4 mks)



3. The equation below shows the chemical reaction that takes place in plants.

Carbon (IV) oxide + water $\longrightarrow$ Glucose +A

i) Identify substance A (1mk)

Oxygen;

ii) Other than the reactants, state two conditions necessary for this reaction (2mks)

Sunlight, energy , chlorophyll, optimum temperature first two

iii) Name the process represented by the equation above (1 mk)

Photosynthesis;

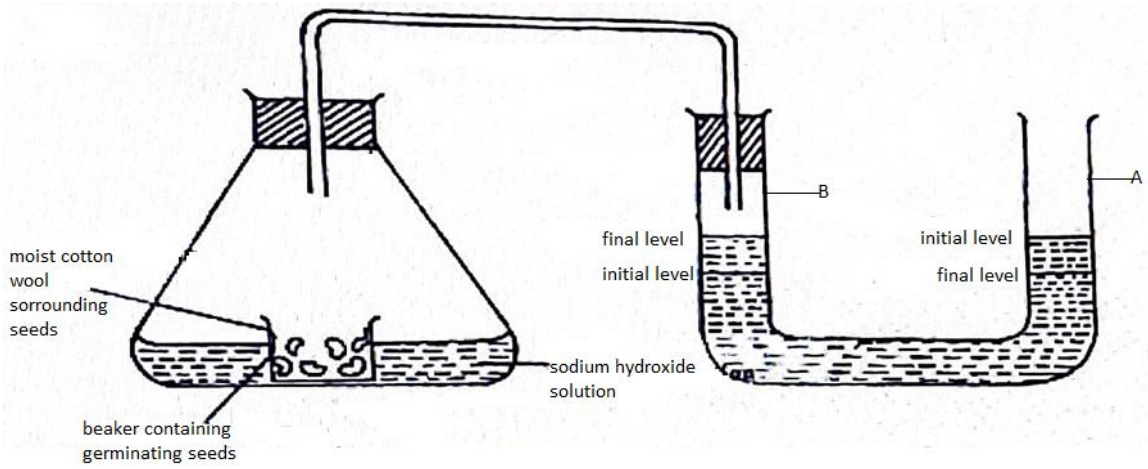
iv) Give two types of cell where this process occurs (2mks)

Palisade cell, guard cell, mesophyll cell

v) How would the process named in (C) above be affected by age of leaves in plants (2mks)

As the leaf ages the amount of chlorophyll, reduces ; leading to the rate of photosynthesis decreasing (reducing);

4. The apparatus below was set up by a student to find out the changes in gases during germination



a) After 48 hours the level of water in the U-tube at **A** and **B** was as shown. Explain the observation (3mks)

Germinating seed respired aerobically;oxygen was used up and carbon(IV)oxide produced was absorbed by sodium hydroxide solution; partial pressure was created hence atmospheric pressure pushed water down at A and level raised at B;

b) Calculate the respiratory quotient (**RQ**) from the equation below:- (2mks)

$$2C_{51}H_{98}O_6 + 145O_2 \longrightarrow 102\ CO_2 + 98H_2O + \text{Energy}$$

respiratory quotient=carbon (IV) oxide produced

oxygen consumed

$=\frac{102}{145}$

$=0.7$

c) Identify the substrate being respired in the above equation (1mk)

Lipids/fats

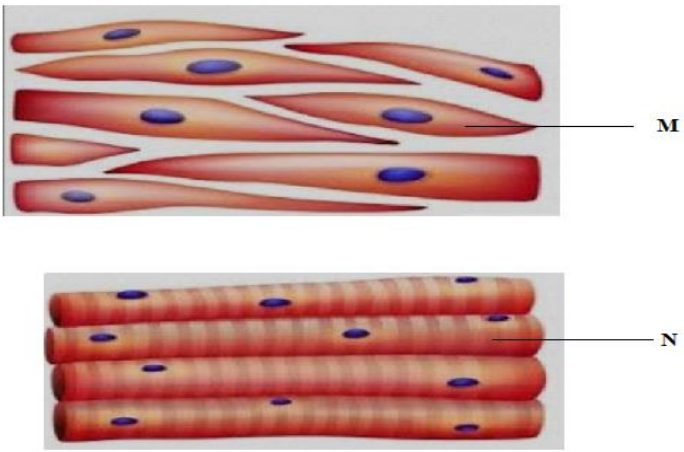
d) (i)where in the cell does glycolysis take place? (1mks)

cytoplasm

ii) what is oxygen debt? (1mks)

extra amount of oxygen required to get rid of lactic acid that accumulate in the tissue when oxygen demand is less than supply.

5.The figures below illustrate specialised cells in animal's body



i)Identify cells M and N **(2mks)**

M smooth muscle;.

N Striated muscle/skeletal muscle;

ii) State two structural differences between M and N **(2mks)**

M	N
Lacks striations	Has striation;
Uninucleated	Multinucleated;

iii) Which of the above specialized cells is found in the gut or human intestines **(1mk)**

M/smooth muscle;

iii) Which organelles are found in large numbers in N (1mks)

mitochondria;

iv) Name a carbohydrate and form of energy stored in cell N(2mks)

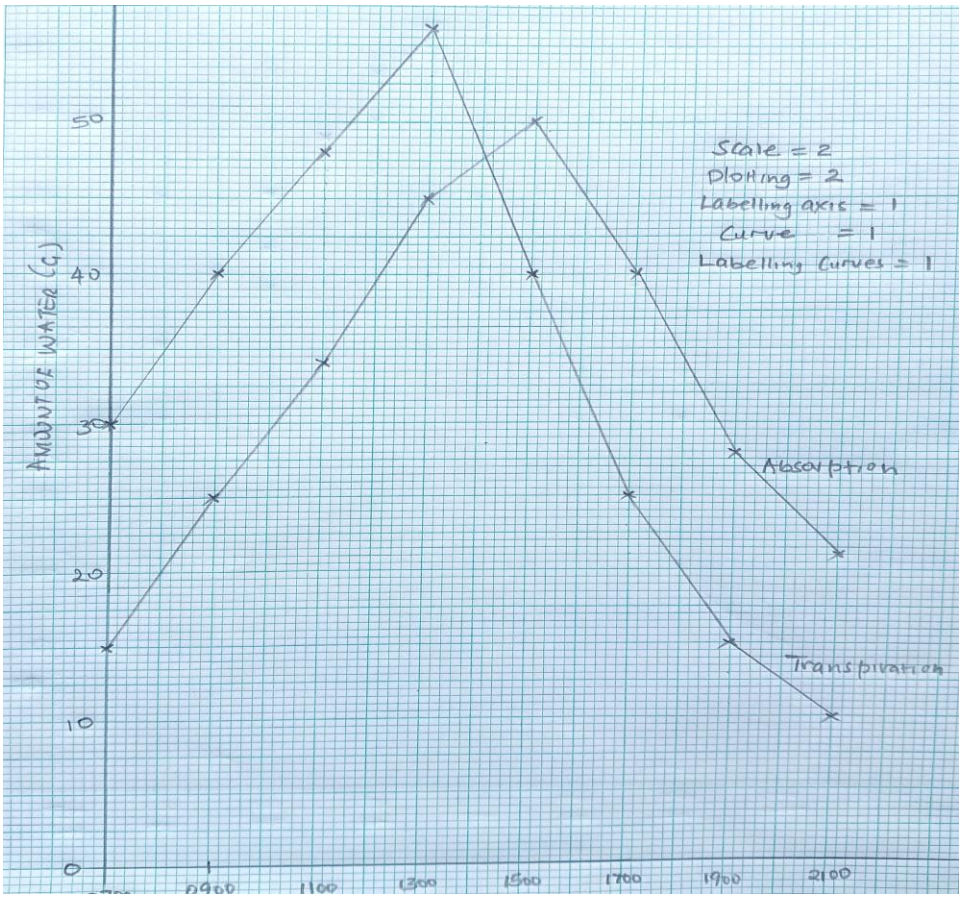
carbohydrate-glycogen

form of energy-adenosine triphosphate

6. An experiment was carried out to investigate transpiration and absorption of water in a certain plant species. The plants were potted and supplied with adequate water. The amount of water lost and absorbed was determined. The results are shown in the table below;

Time of the day	**Amount of water in grams**	
	Transpiration	**Absorption**
0700	30	15
0900	40	25
1100	48	34
1300	56	45
1500	40	50
1700	25	40
1900	15	28
2100	10	21

a) Using the same axes, plot graphs to show transpiration and absorption of water in grams against time of the day. (7mks)



b) i)At what time of the day was the amount of water the same for transpiration and absorption; (1mk)

1400 hrs;

ii) how much water was absorbed at 1800 hours? (1mk)

34g;

c) Explain the shape of the graphs of:-

i) Transpiration (4mks)

0700 -1300hrs increase in the rate of transpiration; due to increase in light intensity and Increase in temperature;

1300 – 2100 hrs decrease in the rate of transpiration; due to decreasing light intensity and

Decrease in temperature.;

ii) Absorption (4mks)

0700 – 1500hrs Increase in the rate of absorption of water; to replace water lost through transpiration;

1500 – 2300hrs decrease in the rate of absorption of water; due to decrease in the rate of Transpiration;

d) Suggest what would happen to transpiration and absorption of water if the experiment was continued for another 2 hours; (1mks)

Both transpiration and absorption decreases;(due to darkness and low night temperatures)

e) Name two environmental factors that affect the rate of transpiration (2mks)

Wind

Humidity

Atmospheric pressure

Light

Temperature any two correct

7a) Describe fertilization in flowering plants. (14marks)

The pollen grain contains the generative nucleus and a tube nucleus;

When the pollen grain lands on the stigma; it absorbs nutrient and germinates forming a pollen tube;

This pollen tube grows through the style pushing its way between the cells; as it gets nourishment from these cells;

The tube nucleus occupies the position at the tip of the growing pollen tube; while the generative nucleus follows behind the tube nucleus;the generative nucleus divides by mitosis; to form two male gamete nuclei;

The pollen tube enters the ovule through the micropyle;

When the pollen tube penetrates the ovule, the tube nucleus disintegrates and the pollen tube bursts open leaving a clear way for the male nuclei;

One male nucleus fuse with the egg cell nucleus; to form a diploid zygote; which develops into an embryo;

The other male gamete nucleus fuses with the polar nucleus; to form a triploid nuclei; which forms the primary endosperm;

(17mks max 14mks)

b).Explain ways through which plants hinder self-pollination and encourage cross pollination. (6mks)

a) Heterostyly;
Where the stigma is located in a position higher than the anthers; hence cannot receive pollen grains; reject stigma taller than anther

b) Protogyny and protandry;
Protandry - Stamens ripen early and release their pollen grains before the stigma, mature to receive them; e.g. in sunflower.
Protogyny - The stigma matures earlier and dries before the anthers release the pollen grains;

c) Monoecism and Dioecism;
Dioecism - Where the staminate and pistillate flower are located in different plants;
Monoecism - Where the staminate and pistillate flower are located in the same plant but separate;

d) Self-sterility and incompatibility;
Pollen grains are sterile to the stigma of the same flower, e.g. in maize flower.
(Mark any three)

8(a).Describe the breathing mechanism in human (12mks)

Inhalation

External intercostal muscles contracts;
Internal intercostal muscles relax;
Ribcage moves upward and outwards/ raised;
Diaphragm muscles contracts and it flatten;
Volume of thoracic cavity increases;
(Air) pressure decreases; air is drawn into the lungs from the atmosphere through the nose;
(max 6 mks)

Exhalation

Internal intercostal muscles contracts;
External intercostal muscles relax;
Ribcage moves downwards and inwards;
Diaphragm muscles relax and acquire the dome shape;
Volume of the thoracic cavity decreases;
(Air) pressure inside thoracic cavity increases; air is forced out of the lungs;
(max 6 mks)

(b).**State the structural adaptation of insects tracheal system (8 mks)**

Spiracles are openings through which gases (oxygen and carbon (IV) oxide) enters or exit the tracheal system;
Valves on the spiracle controls the opening and closing of the spiracles;
Hair on the spiracles trap foreign particles and prevent their entry in the tracheal system;
Hair on the spiracles trap moisture reducing water loss;
Trachea is strengthened with rings of chitin to prevent them from collapsing/ keeping trachea open;
Tracheoles are thin walled for faster diffusion;
Tracheoles contain a fluid/ moist lining which absorb oxygen thus facilitating diffusion into the tissues;
Tracheoles are higly branched to increase the surface area for gaseous exchange;
(max 8 mks)