**Candidates' Name: ……..……..**

**Signature: …….....……..……**

| *Random No.* | | | | | *Personal No.* | | |
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***(Do not write your school / Center name or Number anywhere on this booklet)***

**P530/1**
**BIOLOGY**
**Paper 1**
**July / Aug, 2023**
2 ½ hours


**EDUCAN EXAMINATIONS BOARD**
**Uganda Advanced Certificate of Education**
BIOLOGY
(THEORY)

Paper 1

**2 Hours 30 Minutes**

**INSTRUCTIONS TO CANDIDATES:**

*This paper consists of Sections **A** and **B***
*Answer **all** questions in both Sections.*
Write answers to section **A** in the boxes provided and answers to section **B** in the spaces provided

*No additional sheets of paper should be attached or inserted.*

| **For Examiners' Use Only** | | | |
|---|---|---|---|
| **Section** | **Question** | **Marks** | **Examiner's signature and No.** |
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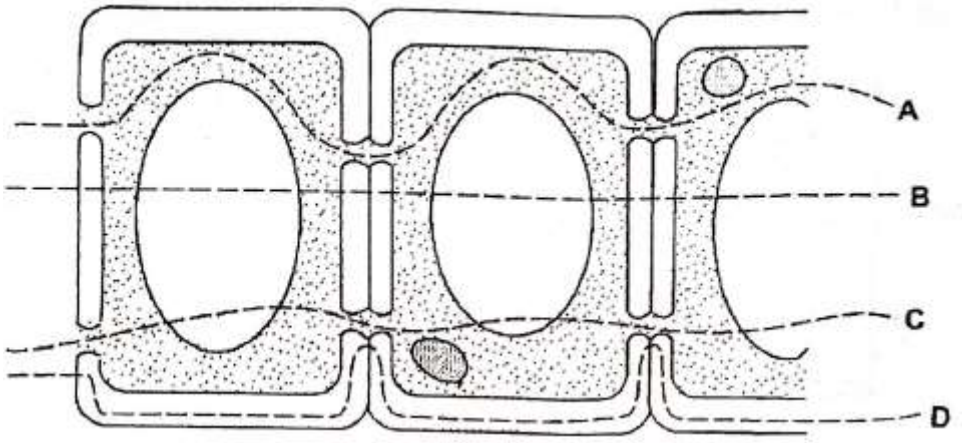
## SECTION A: (40 MARKS)

*Write the letter to the correct answer in the boxes provided. Each question in this section carries **one** mark.*

**1.** The diagram below shows some adjacent cells from the root of a plant. Which one of the following is the apoplast pathway of water movement?




**2.** Which one of the following is the significance of a long refractory period to cardiac muscles?

A. Reduces energy consumption
B. Reduces fatigue
C. Causes synchronous contraction of the muscle.
D. Increases force of contraction

**3.** Antibodies can act in a number of ways to protect the body from pathogenic bacteria. Which event will not occur following antigen-antibody binding?

A. agglutination of bacteria to reduce their spread
B. increased susceptibility to phagocytosis
C. neutralisation of toxins to make them harmless D. secretion of histamine to produce an allergic reaction

**4.** Which of the following is a class under phylum Platyhelminthes?

A. Tubellaria
B. Turbellaria
C. Tubellaria
D. Turbelaria

**5.** Which of the statements about polysaccharides can be used to describe both amylopectin and cellulose?

1. adjacent glucose molecules are rotated by 180°
2. contains 1,4 glycosidic bonds
3. polymer of α–glucose

A. 2 only
B. 3 only
C. 1 and 2
D. 1 and 3

**6.** Which level of protein structure maintains the globular shapes of enzymes?

A. primary
C. tertiary

B. secondary
D. quaternary

**7.** A length of double-stranded DNA contains 120 nucleotides and codes for polypeptide X. What is the maximum length of polypeptide X?

A. 20 amino acids
B. 40 amino acids
C. 60 amino acids
D. 120 amino acids

**8.** The effect of increased body temperature on the oxygen dissociation curve for haemoglobin in mammals is to;

A. Lower haemoglobin's affinity for oxygen
B. Increase haemoglobin's affinity for oxygen
C. Shift the oxygen dissociation curve to the left
D. Increase on the levels of carbon dioxide in the blood

**9.** In the life cycle of bryophytes, which of these is not a haploid structure?

A. Sporophyte
B. Protonema
C. Gametophyte
D. Antheridium

**10.** Which statement explains how mass flow arises in sieve tube elements?

A. Sucrose actively loaded into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.
B. Sucrose actively loaded into sieve tube elements increases the water potential causing the hydrostatic pressure to decrease.
C. Sucrose diffused into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.
D. Sucrose diffused into sieve tube elements increases the water potential causing the hydrostatic pressure to decrease.

**11.** An increase in carbon dioxide in human blood shifts the oxyhaemoglobin dissociation curve to the right.

What is the explanation for this effect?

A. An increase in carbon dioxide concentration increases the ventilation rate.
B. Carbon dioxide is more soluble than oxygen and displaces it.
C. Diffusion of carbon dioxide between the alveoli and the blood is more rapid.
D. Increasing the H+ concentration decreases haemoglobin affinity for oxygen.

**12.** Which one of the following processes do plants lose water during cold humid days?

A. Diffusion
B. Exedution
C. Transpiration
D. Guttation

**13.** Stages of aerobic respiration are shown below.

1. Glycolysis
2. Citric acid cycle
3. Electron transfer chain

Which stage(s) involve(s) **both** phosphorylation of intermediates and generation of ATP?

A. 1 only
C. 1 and 2 only
B. 3 only
D 1 and 3 only

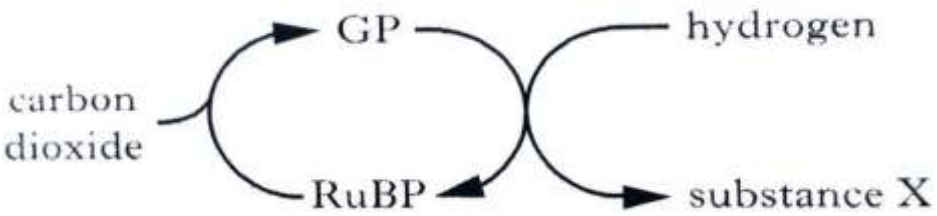
**14.** What is the role of cholesterol in the cell surface membrane?

A. to assist active transport
C. to assist facilitated diffusion
B. to provide hydrophilic channels
D. to regulate fluidity of the membrane

**15.** What is the role of decomposers in the nitrogen cycle?

A. They convert proteins to ammonium compounds.
B. They fix atmospheric nitrogen.
C. They oxidise ammonium compounds to nitrites.
D. They oxidise nitrites to nitrates.

**16.** The diagram below shows an outline of the carbon fixation stage of photosynthesis.




Substance **X** is

A. ATP
C. glucose
B. oxygen
D. water.

**17.** Human males affected by Klinefelter syndrome may have two X chromosomes and a Y chromosome (XXY). This condition arises as a result of

A. Recombination
B. sex-linkage
C. crossing-over
D. non-disjunction.

**18.** Rifampicin is an antibiotic used to treat tuberculosis (TB).
It works by inhibiting RNA polymerase in bacteria. Which processes are directly inhibited by this antibiotic?

1. DNA replication
2. transcription
3. ATP synthesis

A. 1, 2 and 3
B. 1 and 2 only.
C. 1 and 3 only
D. 2 only

**20.** A light microscope is used to observe two structures that are 200nm apart. How far apart are the structures when the magnification is changed from ×40 to ×400?

A. 2 µm
B. 20 µm
C. 200nm
D. 2000nm

**21.** During unexpected periods of drought, the South American lungfish, *Lepidosiren paradoxa*, survives by burying into mud. This type of behaviour is known as

A. predictive dormancy
B. daily torpor
C. aestivation
D. hibernation.

**22.** An experiment was set up to investigate the effect of different respiratory substrates on the rate of respiration in yeast. Methylene blue can be used to measure the rate of respiration as it changes from dark blue to colourless when it accepts hydrogen ions. Four test tubes were set up, each containing yeast, methylene blue and one of the respiratory substrates. The table below shows the results of this investigation.

| *Test tube number* | *Respiratory Substrate* | *Appearance of the methylene blue after 20minutes* |
|---|---|---|
| 1 | Starch | dark blue |
| 2 | Sucrose | light blue |
| 3 | Lactose | dark blue |
| 4 | Glucose | Colourless |

Which of the following conclusions is correct?
The rate of respiration is
A. higher with starch than with glucose
B. lower with sucrose than with lactose
C. higher with glucose than with lactose
D. lower with glucose than with sucrose.

**23.** On returning to their roost after feeding, vampire bats may regurgitate blood to feed an unrelated individual in the same social group.
This is an example of
A. mutualism
B. social hierarchy
C. altruism
D. kin selection.

**24.** Parthenogenesis is most likely to be common in environments with a
A. warm climate and low parasite density
B. warm climate and high parasite density
C. cool climate and low parasite density
D. cool climate and high parasite density.

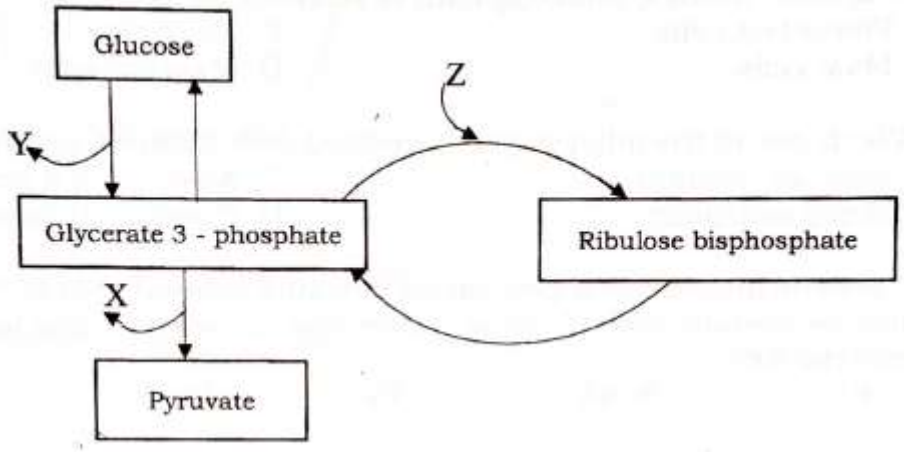
**25.** Which of the following groups of plants has a dependent sporophyte?
A. Filicinophytes
B. Coniferophytes
C. Bryophytes
D. Angiospermophytes

**26.** If the frequency of the recessive allele in a certain population is 0·7, what is the proportion of individuals that would be heterozygous?

A. 0·09 C. 0·21

B. 0·42 D. 0·49

**27.** The diagram below shows chemical pathways in respiration and photosynthesis.




Which one of the following represents the identity of molecules X, Y and Z respectively?

A. ADP, $NAD^+$, $NADP^+$

B. NADPH, NADH, ATP

C. FADH, ATP, $CO_2$

D. ATP, NADH, NADPH

**28.** The similarities of the skeletal structures of mole, monkeys and whales lead to the conclusion that, they.....

A . Belong to the same class

B . Originate from the same environment

C . Evolved convergently

D . Descended from a common ancestor

**29** The hormone thyroxine is

E hydrophobic and unable to pass through the cell membrane

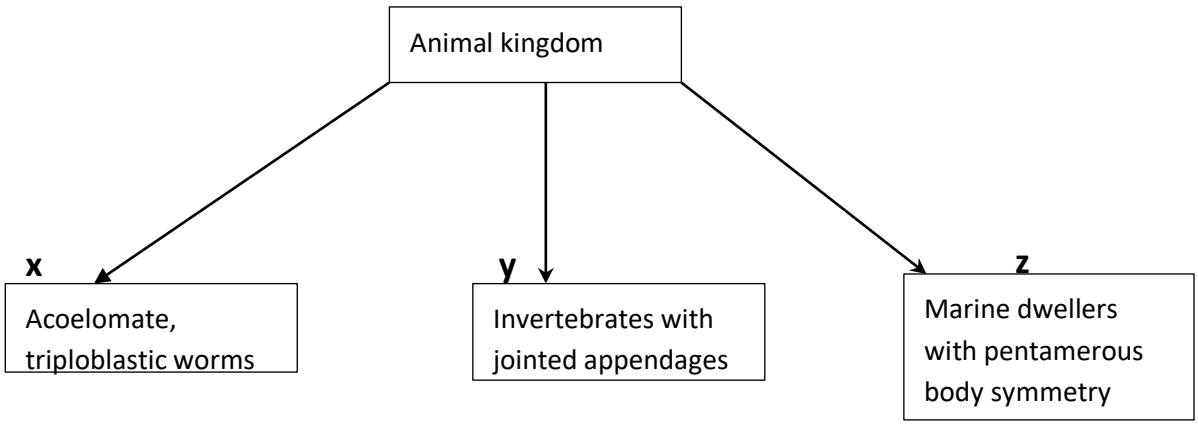
F hydrophilic and unable to pass through the cell membrane

G hydrophobic and able to pass through the cell membrane

H hydrophilic and able to pass through the cell membrane.

**30.** The diagram below shows features of some phyla in the animal kingdom.




Which row in the table identifies the phyla **X, Y** and **Z**?

| | Phylum | | |
|---|---|---|---|
| | **X** | **Y** | **Z** |
| A | Nematoda | Mollusca | Chordata |
| B | Annelida | Arthropoda | Cnidaria |
| C | Platyhelminthes | Arthropoda | Echinodermata |
| D | Arthropoda | Annelida | Mollusca |

**31.** In tomato plants, the genes for stem colour and presence of epidermal hairs are found on different chromosomes. The allele for purple stem **P** is dominant to the allele for green stem **p** and the allele for hairy stem **H** is dominant to the allele for smooth stem **h**. The following cross was carried out.

PpHh × pphh;

32 offspring were produced from this cross. How many of these offspring would be expected to have purple, smooth stems?

A. 24
B. 16
C. 8
D. 4

**32.** Which one of the following is true about carnivores?

A. Lateral movement of the lower jaw is possible
B. May have stomach divided into chambers
C. Have shorter gut
D. Have elongated caecum

**33.** Shags and cormorants both belong to the genus *Phalacrocorax,* but different species. They look very similar and nest near each other on the same cliffs. The table below shows the main components of each bird's diet.

| ***Prey*** | ***Percentage composition of diet*** | |
|---|---|---|
| | ***Shag*** | ***Cormorant*** |
| sand eels | 33 | 0 |
| Sprats | 49 | 1 |

| | | |
|---|---|---|
| Flatfish | 1 | 26 |
| Shrimps | 2 | 33 |
| Gobies | 4 | 17 |
| other fish | 4 | 18 |

The data in the table shows;

A. competitive exclusion
B. resource partitioning
C. competition within each species
D. the fundamental niche of each species.

**34.** If ten percent of the bases in a molecule of DNA are adenine, what is the ratio of adenine to guanine in the same molecule?

A. 1:1
B. 1:2
C. 1:3
D. 1:4

**35.** Ulcer patients sometimes are advised to take milk. Milk intake may stimulate production of;

A. Enterogastrone hormone
B. Secretin hormone
C. Cholecystokinin hormone
D. Gastrin hormone

**36.** Mating frequency was observed in sheep exposed to different periods of light and darkness. The results are shown in the table below.

| *Light period* (hours) | *Dark period* (hours) | *Mating frequency* (0 = no mating) + = occasional ++ = frequent) |
|---|---|---|
| 6 | 18 | ++ |
| 8 | 16 | ++ |
| 10 | 14 | ++ |
| 12 | 12 | + |
| 13 | 11 | 0 |

From information in the table, what is the critical factor required for mating to take place?

A. A minimum light period of 6 hours.
B. A maximum light period of 10 hours.
C. A minimum dark period of 12 hours.
D. A maximum dark period of 12 hours.

**37.** The list below shows processes which affect plants.

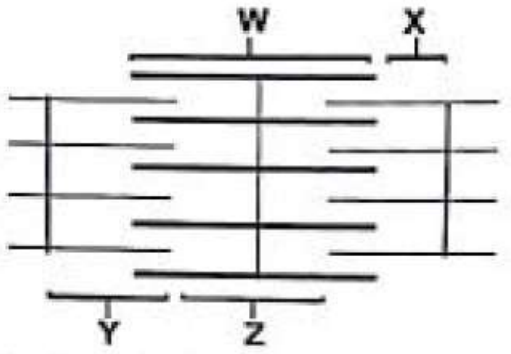
1. Leaf abscission inhibition

2. Fruit formation
3. Photoperiodism
4. Apical dominance

Which processes involve indole acetic acid (IAA)?

A. 1 and 3 only
B. 2 and 3 only
C. 1, 2 and 4 only
D. 3 and 4 only

**38.** The figure below shows a longitudinal section of part of a striated myofibril in a skeletal muscle.

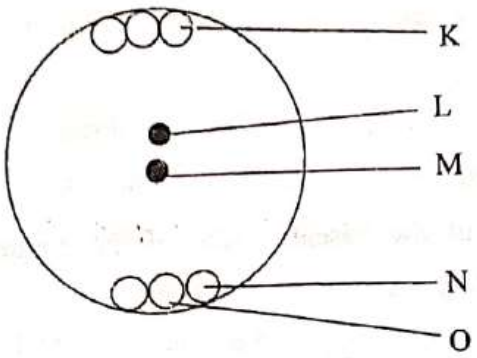



A. W
B. X
C. Y
D. Z

**39.** During secondary growth in plants, the cork cambium forms;

A. Medullary rays
B. Secondary cortex
C. Secondary xylem
D. Annual rings

**40.** The figure below represents an ovule of a flowering plant.



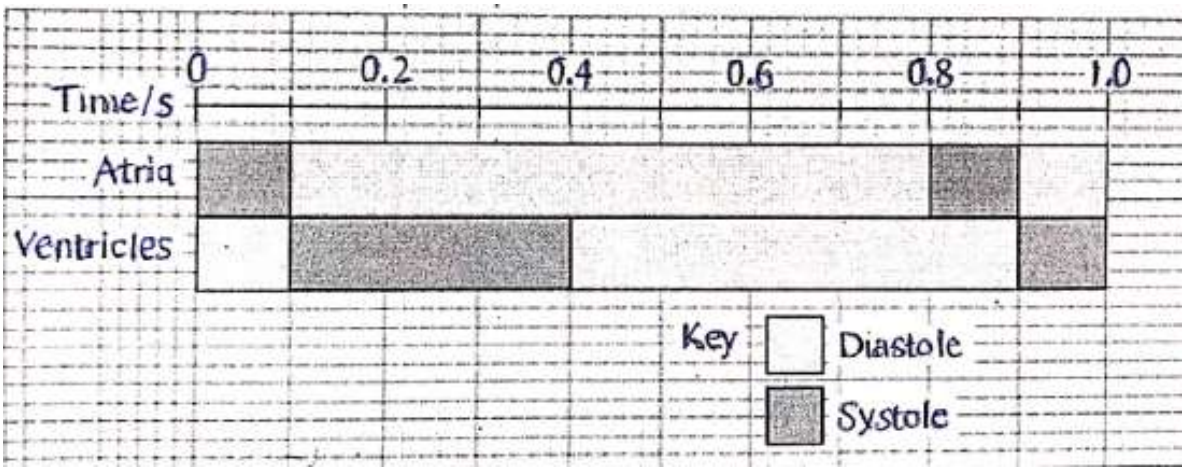

A triploid nucleus is formed by the fusion of a male nucleus with;

A. N and M
B. L and M
C. K and L
D. N and O

## SECTION B (60 MARKS)

*Write answers in the spaces provided.*

41. The relaxation of heart muscles is called diastole. Contraction is called systole. The diagram below shows periods of diastole and systole when the heart is beating.




(a) At what time is the volume of blood in the ventricle at a maximum? ***(01 mark)***

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(b) Calculate the heart rate in beats per minute. Show your working. ***(01 mark)***

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(c) The valves between the atria and ventricles are closed between 0.1s and 0.4s.

(i) Explain how pressure causes these valves to be shut. ***(02 mark)***

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(ii) State how closure of these valves is essential to the functioning of the heart. ***(01 mark)***

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(d) Explain how blood in a vein in the legs is returned to the heart. ***(05 marks)***

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42. The table below shows the percentages of different membranes in two animal cells.

| **Type of membrane** | **Percentage of total membrane in** | |
|---|---|---|
| | Cell **R** | Cell **S** |
| Plasma membrane surrounding cell | 3 | 5 |
| Rough endoplasmic reticulum | 38 | 60 |
| Outer membrane of mitochondrion | 11 | 4 |
| Inner membrane of mitochondrion | 34 | 17 |
| Lysosome membrane | 3 | 3 |
| Other membranes | 11 | 11 |

(a) The main function of one of these cells is to make enzymes. Suggest which cell has this main function and explain the evidence for your answer. ***(02 Marks)***

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***(b)*** (i) In both cells, the figure for the inner membrane of the mitochondrion is different from the figure for the outer membrane. Explain this difference. ***(02 marks)***

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(ii) The appearance of the mitochondria in in cell **R** is different from the appearance of mitochondrion in cell **S**. Use the figures in the table to suggest how they are different in appearance**.**

***(03 marks)***

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(d) Besides the rough endoplasmic reticulum and cytoplasm, state other two areas in a cell where ribosomes are found. ***(02 marks)***

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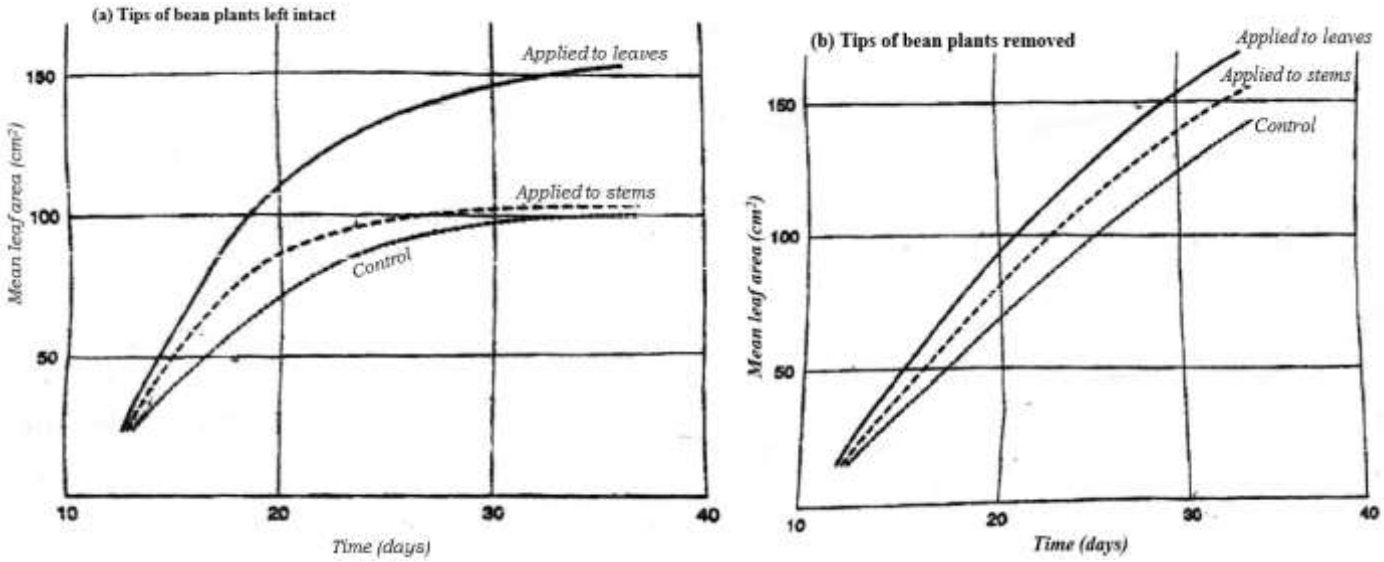
43. In an experiment, the same quantity of the hormone **gibberellin** was applied to either the first leaf or the stem of a dwarf bean plants and the leaf area of the plants was then measured over the following three weeks. The experiment was then repeated under exactly the same conditions except that the tip of each plant was removed at the same time the gibberellins were added. The control experiment in both cases was to use a group of plants to which no gibberellin was added. The results are shown in the graphs in the figure below.




(a) Using evidence from the graphs,

(i) State the effects of the removal of the growing tip on the growth of the leaves in the absence of gibberellin. ***(02 marks)***

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(ii) State the differences that occur when gibberellin is applied to the leaves rather than the stem in intact bean seeds. ***(02 marks)***

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(b) Suggest a reason for the observed effects in a(ii). ***(02 marks)***

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***(c)*** In what ways did the removal of the grown tips influence leaf size when gibberellin was applied?

***(03 marks)***

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(d) At the cellular level, state one way how an increase in leaf area could occur. ***(01 mark)***

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44. $C_4$ – Plants possess a type structure described as the ***Kranz anatomy***.

(a) What is meant by Kranz anatomy of leaf structure? ***(02 marks)***

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(b) In reference to the **Kranz anatomy** leaf structure, state any four differences between mesophyll cells and bundle sheath cells ***(04 marks)***

| **Mesophyll cells** | **Bundle sheath cells** |
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(c) Explain the distribution of $C_4$ – plants at;

(i) Very low altitudes. ***(02 marks)***

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(ii) Very high altitudes. ***(02 marks)***

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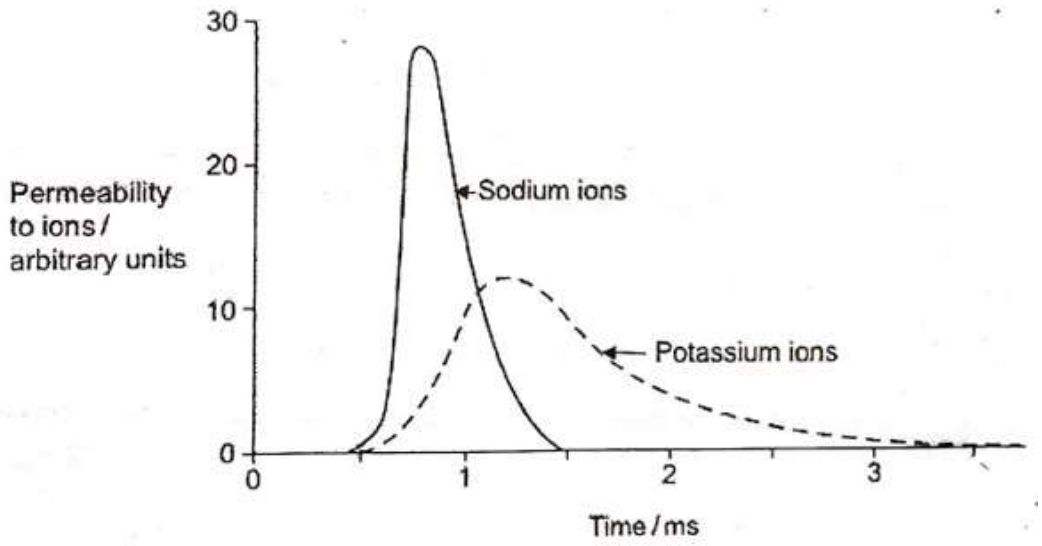
45. (a) The graph in the figure below shows changes in permeability of the membrane to sodium ions (**$Na^+$**) and to potassium ions (**$K^+$**) during a single action potential.




(a) Explain the shape of the curve for sodium ions between **0.5 ms** and **0.7ms**. ***(02 marks)***

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(b) During an action potential, the membrane potential rises to **+40mV** and then decreases. Use information from the graph to explain the decrease in membrane potential. ***(02 marks)***

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(c) If the permeability of the axon membrane to sodium and potassium ions increased simultaneously, what effect would this haver on the action potential? ***(02 marks)***

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(d) After depolarisation, some ATP is used to re-establish the resting potential in axons. Explain how the resting potential is re-established. ***(02 marks)***

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(e) Explain the effect of decrease in axon diameter on transmission of impulse in a nerve cell. ***(02 marks).***

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46. (a) Distinguish between **Rare species** and **Endangered species**. ***(02 marks)***

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(b) If factors that endangering a species are not removed, it can easily become extinct. Outline the factors that can lean to extinction of a species. ***(04 marks)***

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(c) How can extinction of endangered species be prevented? ***(04 marks)***

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**END**

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