MARKING SCHEME
SULIMO JET- July 2025

Kenya Certificate of Secondary Education

231/2

BIOLOGY

Paper 2

TIME: 2HRS

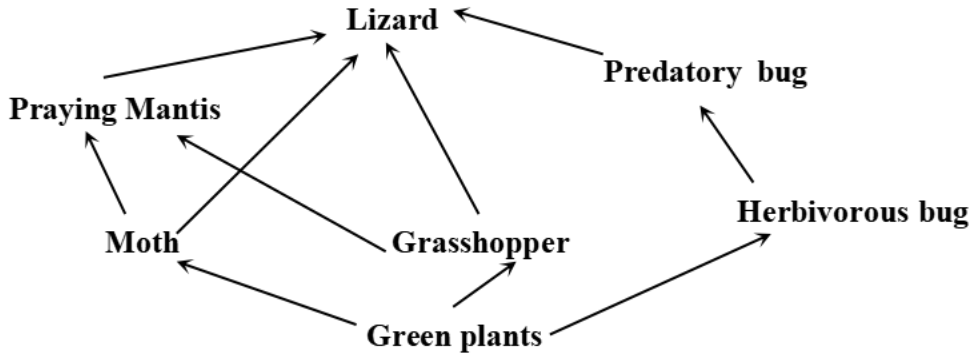
INSTRUCTIONS TO CANDIDATES

- *Write your **name, Admission number** and **name of your school** in the spaces provided above*
- *Answer **all** the questions in section A in the spaces provided a question **6** (COMPULSORY) in the spaces provided and either question 7 or 8 in the spaces provided after question 8.*
- *Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.*

For Examiners Use Only

Question	Maximum score	Candidate's score
1	8	
2	8	
3	8	
4	8	
5	8	
6	20	
7/8	20	
Total Score	80	

1) The figure below represents a feeding relationship



(a) What is the difference between a food chain and a food web? (2marks)

A food chain shows a single, linear path of energy flow from one organism to another, while a food web is a complex network of interconnected food chains, showing multiple pathways and relationships

(b) Construct **two** food chains ending with a tertiary consumer. (2marks)

Green plants ------ moth ---------- praying mantis ------ lizard

Green plants --------- herbivorous bug --------- predatory bag -------- lizard

Green plants ---------- grasshopper ---------- praying mantis----------lizard

(c) Name **one** secondary consumer in the food web. (1mark)

Praying mantis /predatory bug/lizard

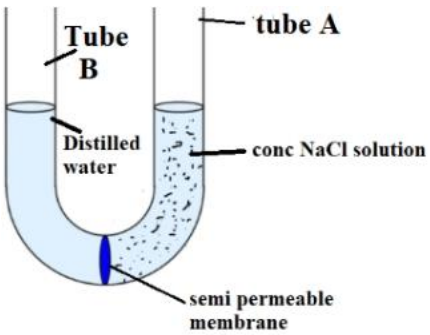
(d) Name **one** organism through which energy from the sun enters the food web. (1mark)

Green plants

(e) Suggest **two** ways in which the ecosystem would be affected if there was prolonged drought. (2marks)

Green plants, moth and herbivorous bug reduces in population

2) An experiment to investigate a certain physiological process was set up as shown in the diagram below



a) Name the physiological process that was being investigated (1mark)

Osmosis

b) What are the expected observation after 30minutes of the experiment (1mark)

Rise in the level of NaCl solution in tube A/drop in level of distilled water

c) Account for your observation in 1(c) above . (2marks)

Distilled water is hypotonic to the concentrated sodium chloride solution;water moves across the semi-permeable visking tubing by osmosis leading to a rise in level of the liquid

d) State the significance of the process you have named in 1(a) above (2marks)

Support in harbeceous plants

Absorption of water from the soil

Osmoregulation

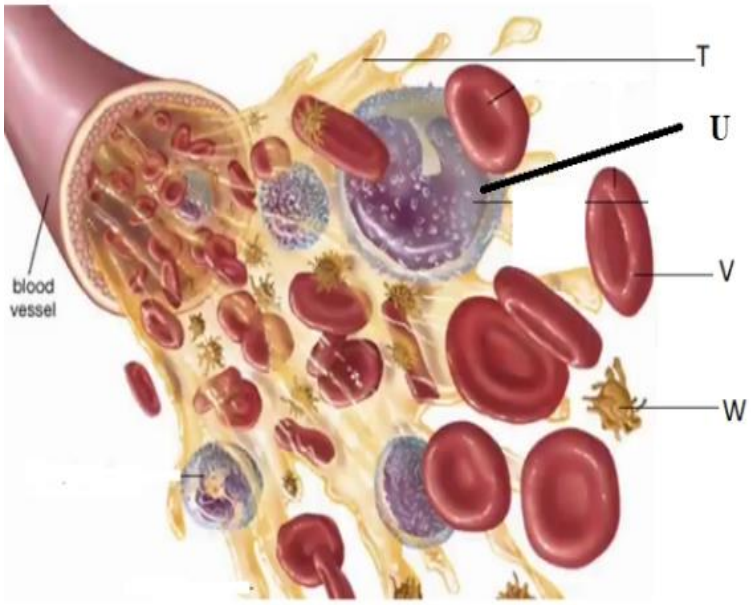
Feeding in insectivorous plants

Closing and opening of stomata

e) Suggest what would be the effect if the experiment was set up and placed on a fridge.Explain? (2marks)

The rise in the level of NaCl solution will be lower; lower temperatures reduce the kinetic energy of water molecules, causing them to move slower and collide less frequently with the semipermeable membrane, thus decreasing the rate of water movement across the membrane

3) The photograph below shows components of blood from a ruptured blood vessel. Study it and answer the questions tha



(a)Suggest the identity of the above blood vessel if a lot of digested food substances were found dissolved in part T. (1mark)

✓ **Hepatic portal vein;**

(b) Identify cell U and suggest its function. (2marks)

Identity

- ✓ .**Granulocyte/polymorph/phagocyte;White blood cell**

Function

- ✓ **Protection of body against infection;**

(c)(i) Name three types of antigens that are likely to be present on the surface of the membrane of cell V (3marks)

- ✓ **Antigen A; antigen B and antigen D// rhesus factor antigen;**

(ii)Where in the human body is cell V produced? (1mark)

- ✓ **Bone marrow{of short bones}**

(d)What role does structure W play in blood clotting? (1mark)

- ✓ **Produces thromboplastin//thrombokinase that initiates blood clotting process;**

4. Albinism is a genetic disorder that is carried by a recessive gene on autosomal chromosomes. Jacky is normal for albinism and her mother is an albino while the father is normal.Jacky is married to Shady who is heterozygote for the disorder

a. What is the probable genotype for Jacky and Shady (2marks)

Jacky Aa; Shady Aa both must be stated to score

b. Using a punnet square work the phenotypic ratio of the offspring of Jacky and shady (3marks)

Parental genotype : ***Aa x Aa***

Gamates;	***A***	***a***
A	***AA***	***Aa***
a	***Aa***	***aa***

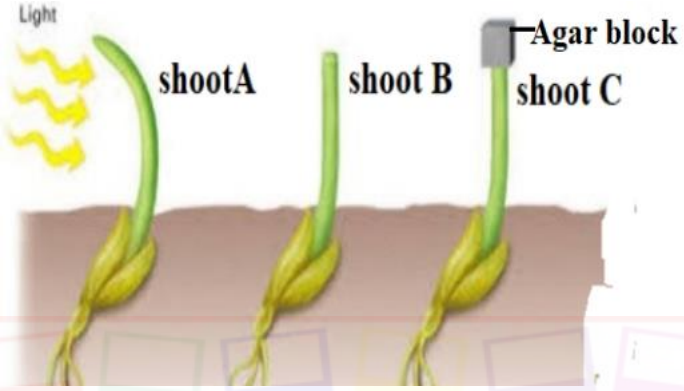
Phenotypic ratio: 3 Normal skin colour: 1 albino;

c) State the differences between normal haemoglobin and abnormal haemoglobin. (3marks)

Normal haemoglobin	Abnormal haemoglobin

Polypetide chain is occupied by glutamic acid	***Polypetide chain is occupied by valine***
Does not crystalise in low oxygen concentration	***Easily crystalise in low oxygen concentration***
Haemoglobin efficient in loading and transportation of oxygen	***Haemoglobin is inefficient in loading and transportation of oxygen***
Rbcs carrying it have normal Biconcave shape	***Rbcs carrying it crescent /sickle shaped***

5. An experiment was set up as shown below,shoot B has is decapitated. Shoot **C** decapitated and a gar block containing auxin placed.



a) Name the type of plant response being investigated (1 mark)

Positive phototropism

b) What are the expected observation of shoot B and shoot C after 4 days of the experiment 6marks)

Shoot	Observation	Reason
B	***Shoot Remains intact***	***Part producing auxin removed; hence no growth***
C	***Shoot/bendCurves towards light stimulus***	***agar block, placed on a decapitated shoot, acts as a carrier for auxin,.Light causes auxin to redistribute, accumulating more on the shaded side of the shoot stimulating faster cell elongation on the dark side than lited side thus curvature***

c) Why shoot A included in the experiment A (1mark)

control experiment

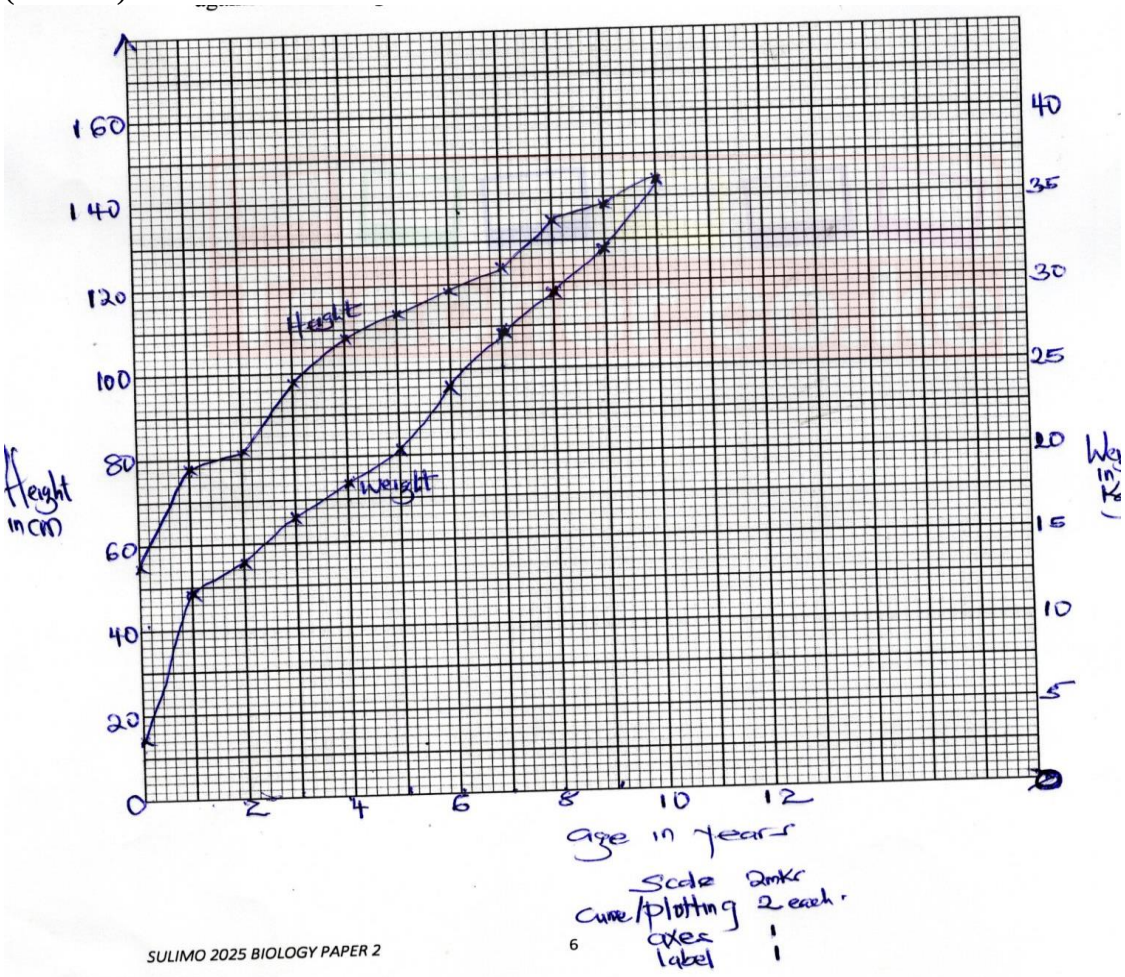
SECTION B (40 MARKS)

Answer any 6 (COMPULSORY) in the spaces provided and either question 7 or 8 in the spaces provided after question 8.

6. Form three students of Sulimobu academy were investigating the rate of growth in individuals at different ages. They tabulated their findings showing height and weight measurements in the table below

Ages in years	**Height in cm**	**Weight in Kg**
Birth	55.5	3.8
1	78	12.3
2	80.1	14.6
3	98.0	16.5
4	108.0	18.8
5	113.0	20.4
6	118.5	24.0
7	124	27.0
8	135	29.4
9	138.5	32.0
10	144	36.0

(i) Draw **two** graphs using the same axes to show height and weight against different ages. (8marks)



i. Calculate the percentage growth in height between

a) Year 1 and 2 (2marks)

$$\frac{80.1-78}{78} \times 100 = 2.69\%$$

b) Year 2 and 3 (2marks)

$$\frac{98-80.1}{80.1} \text{ x } 100 = 22.35\%$$

ii. In which period was there the highest percentage (1 mark)

period from birth to 1 year

iii. What are the factors that affects the rate of growth (2marks)

Number of cells dividing

External factors like disease/competition, temperature

Emotional factors such parental care ,companionship

Availability of food

iv. Name a hormone that influences growth in human beings (1 mark)

Somatotrophin

v. Growth in plants occurs in meristematic tissues.State **two** characteristics of a mersistematic tissue. (2marks)

Thin cell wall

Prominent nucleus

Dense cytoplasm

Vacuole absent

vi. Name **two** factors that induce seed dormancy (2 marks)

Immature embryo;

presence of germination inhibitors

low concentration of stimulators

hard impermeable seed coat

external environmental factors

7(a) **Explain how various photosynthetic cells are adapted to their function (6 marks)**

i. ***Guard cells****; are special epidermal cells, mostly found on the lower surface of a leaf. Contains chloroplast hence photosynthesizes.*

Guard cells are also bean shaped creating stoma to allow diffusion of Carbon (IV) Oxide into chloroplasts for photosynthesis;

ii. ***Palisade cell**s; are located below the upper epidermis; with numerous chloroplasts; to trap maximum sunlight to photosynthesize.*

iii. ***Spongy mesophyll cells**; is found between palisade and lower epidermis. Cells are irregular in shape and loosely packed; creating air spaces through which CO_2 gases diffuse. They also contain chloroplasts for photosynthesis.*

iv. ***Chlorenchyma contains chlorenchyma cells** ;that has chlorophyll to trap sunlight used photosynthesis;*

7(b).Explain how human skin is adapted to perform its functions? (16marks)

Cornified layer:** is made up of flattened dead cells**;** that become filled with a tough flexible substance called keratin; to offer Protection against mechanical damage and invasion by bacteria **;

- ✓ ***Malpighian layer;** cells have a dark pigment called melanin**;** that gives color to the skin and also gives protection to the underlying tissues against harmful ultraviolet rays from the sun.*
- ✓
- ✓ ***Sebaceous gland;** produce **sebum;** which is **antiseptic; and protects the skin** against the invasion by pathogenic micro-organisms.*

- ✓ ***Blood vessels** contribute to thermoregulation i.e.*
- ✓ *On hot day/high temperatures; blood capillaries vasodilate; conducting more blood to the skin surface; increase heat lose through conduction; lowering the body temperature back to normal.*
- ✓ *On humid/cold day/ low temperatures; blood capillaries vasoconstrict; conducting less blood to the skin surface; lowering heat lose through conduction; hence maintains heat that keep's body warm.*

- ✓ ***Sweat glands**; produces sweat that evaporates from the skin surface using up latent heat of vaporization; hence cooling the body; and the skin achieves thermoregulation.*

***Erector pili muscle**;*

- ✓ *In hot weather erector pili muscle relax; hair lies flat on the skin surface; creating more space for heat lose; since air is not trapped.*
- ✓ *In cold weather erector pili muscle contracts; hair stands erect on skin surface; trapping more air; which is a poor heat conductor; hence reducing heat lose.*

- ✓ ***Subcutaneous layer/adipose tissue**; is a layer of fat cells below the epidermis; and it stores fat; that acts as an insulator against heat lose; contributing to thermoregulation.*

- ✓ ***Nerve endings**, bundle of fibres in the skin which detects stimuli such as pain ,pressure,touch heat and cold*

8 points 2 marks each

8(a) Explain the functions of the following parts of the brain

Cerebrum

1. *Controls most of the voluntary activities of the body including skeletal muscle movement, eye movement and speech.*

2. *Responsible for conscious awareness of various senses e.g sight, touch, hearing, smell, taste and pain.*
3. *Responsible for memory, learning, reasoning, personality and intelligence*

Medulla oblongata:*Main function-controls involuntary/unconscious responses*

i. *Controls unconscious actions such as breathing , heartbeat rate and peristalsis*
ii. *Controls other involuntary actions e.g swallowing, sneezing, vomiting*
iii. *Controls dilation of blood vessels hence controlling blood pressure.*

Hypothalamus: *maintains a constant internal environment of the body (homeostasis)*

- *controls body temperature*
- *Regulate heartbeat rate*
- *Regulates blood pressure*
- *Regulates osmotic pressure of body fluids*
- *Stimulates hunger, thirst and sleep*
- *Controls the activities of the pituitary gland*

Cerebellum

1. *Controls body balance and posture (balance is condition whereby body is in physical stability (posture is position of body in space i.e sitting , bending)*
2. *Control complex muscular movements e.g standing, swimming , riding and running*
3. *Ensures dexterity/precision in fine movements' e.g sewing, playing the guitar, typing and writing.*
4. *Responsible for instinctive reaction*

*8(b)*Describe the stages of mitosis in living **10 marks**

Interphase

(i) Replication of genetic material or chromosomes in which each chromosome produces an exact copy or replica of itself.

(ii) Formation of new cellular organelles e.g mitochondria, ribosomes e.t.c

(iii) Built – up of energy which is then stored in form of ATP which will be necessary to drive the mitosis process.

Prophase

- *Chromosomes shorten and thicken and become visible as distinct bodies. Each chromosome is seen to consist of two strands lying parallel to one another called sister chromatics and joined together at the centromere (since the chromosomes have already replicated)*
- *The replicated/duplicated centrioles (in animal cell) separate and move to opposite poles of the cell.*
- *Spindle apparatus begin to form. Spindle are extremely thin thread-like strands running from one centriole to the other.*
- *Nucleolus shrinks and disappears.*
- *Nuclear membrane begins to break down.*

Metaphase

- *The nuclear membrane disappears*
- *Spindle formation is complete.*
- *Spindle fibers lengthen and are attached to centrioles which are at both poles.*
- *Chromosomes align themselves at the equator of the cell and are attached to the spindle fibers by their centromeres.*
- *Homologous chromosomes align themselves independently of each other i.e. they do not associate in any way.*

Anaphase

- *For each chromosome, sister chromatids separate at the centromere.*
- *Each of the sister chromatids starts moving away from the other towards the opposite poles. Movement starts at the centromere with the chromatid forming a V-shape. Movement is believed to be brought about by the shortening of the spindle fibers.*
- *As the chromatids reach the poles, the spindle apparatus disappears.*
- *Cell membrane starts to constrict at the equator (in animal cells) as the cytoplasm begins to divide.*

Telophase

- *Spindle fibers completely disappear.*
- *Chromatids collect together at the two opposite sides.*
- *Nuclear membrane reforms around each set of chromatids which are now called chromosomes.*
- *Chromosomes assume their original appearance i.e. they became less distinct as they uncoil / unwind.*
- *The cell membrane constriction is completed as the cytoplasm becomes divided into two.*
- *A Nucleolus reappears in each nucleus of the daughter cells.*
- *Centrioles become less visible.*
- *Chromosomes become extremely thin almost invisible thread like structures. Mitosis is complete. Each daughter cell then enters interphase.*