MARKING SCHEME

231/2 Candidate's signature:..... Date: .....

Random Number:

THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education

231/2

BIOLOGY (Theory)

Nov. 2025 — 2 hours

Paper 2

Candidate's signature: ..... Date: 02/12/2025

Instructions to candidates

(a) Confirm that this question paper has your name and the correct index number.
(b) Sign and write the date of examination in the spaces provided above.
(c) This paper consists of **two** sections; **A** and **B**.
(d) Answer **all** the questions in section **A** in the spaces provided.
(e) In section **B** answer question **6 (compulsory)** and either question **7** or **8** in the spaces provided after question **8**.
(f) This paper consists of 12 printed pages.
(g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
(h) Candidates should answer the questions in English.

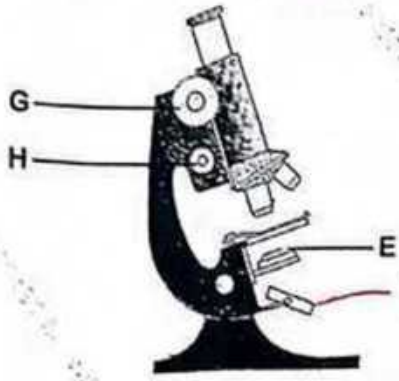
For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A	1	8	
	2	8	
	3	8	
	4	8	
	5	8	
B	6	20	
		20	
	Total Score	80	

SECTION A (40 marks)

Answer all the questions in this section in the spaces provided.

1. The following diagram illustrates a light microscope.



Acc: Condenser; / Mirror;

(a) Name the part labelled E. (1 mark)

Condenser; 1

(b) Label on the diagram with a letter, F, the part that reflects light to the specimen. (1 mark) 1

(c) State the function of the part labelled H. (1 mark) 1

Moves the body tube (through short distances) for sharper/finer/clearer focus;

(d) Explain the precautions that should be taken while using the part labelled G. (2 marks)

It should not be used while focusing with high power objective lens; since it can damage the objective lens/break the slide/cover slip/damage the specimen; 2

OR

Should only be used when focusing with low/medium power objective lens; to avoid breaking high power objective lens/glass slide/cover slip/destroy the specimen;

(e) Describe how one can determine the magnification of a specimen viewed under the microscope. (2 marks)

Acc. Lens power for Mg

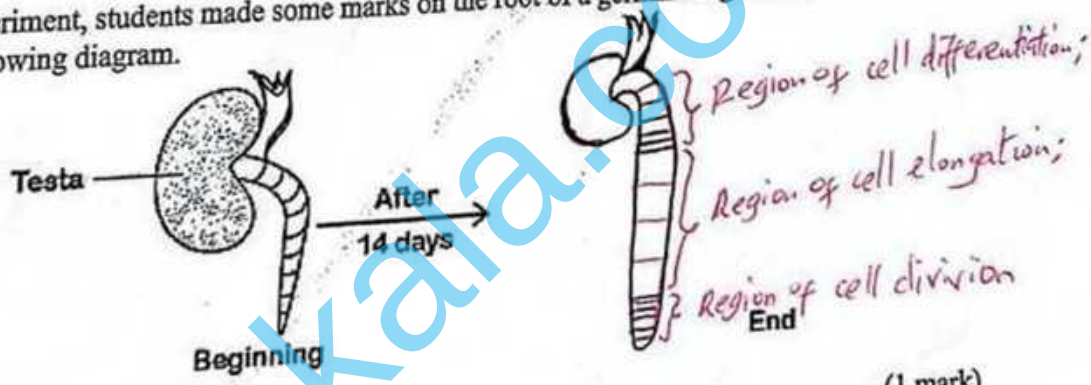
Multiply the eyepiece(lens) Magnification; by objective(lens) magnification;

Acc: Magnification = eyepiece(lens) Mg; X Objective(lens) Mg;

(f) During a microscopy lesson, two groups of students observed different numbers of cells from the same slide using identical microscopes. Suggest the likely cause of the difference. (1 mark)

Difference in Objective lens ~~size~~ used / difference in diameter / Location of the field of view;

2 In an experiment, students made some marks on the root of a germinating bean plant as shown in the following diagram.



(a) State the aim of the experiment. (1 mark)

To determine the region of (primary) growth (in a root); 1

Acc: Radicle for root.

Rej: seed, seedling

(b) (i) On the space provided on the right side of the diagram, sketch the appearance of the marks on the root after 14 days. (1 mark)

(ii) Account for the appearance of the marks on the sketch made in (b)(i). (3 marks)

Markings at the base and tip remained the same, while the tip markings become more spaced; OWTTE

Acc. wider/longer for more

The tip is the region of cell division; behind the tip is the region of cell elongation; at the base, is the region of cell differentiation/specialization; 4

Water | Cork; Pin; Moist cotton wool;

(c) State two materials the students would require to undertake the experiment. (2 marks)

Ruler/Tape measure; - Blotting paper/filter paper;
piece of thread; - Beaker; Acc. conical flask
Marker pen/indelible ink/permanent ink/Indian ink/waterproof ink;
Bent wire;

(d) State the role of the testa during germination. (1 mark)

Provides protection to the embryo/plumule/cotyledon/inner parts (of the seed); Rej protection of the seed

1/08

3 (a) In a certain variety of pea plants, the allele for smooth seed coat is dominant over the allele for wrinkled seed coat. Using letter **R** to represent the allele for smooth seed coat, determine:

(i) the genotypic ratio of the F_1 generation if two heterozygous pea plants were crossed; (5 marks)

Rr x Rr;
(R)(r) (R)(r);
RR Rr Rr rr;
1RR: 2Rr: 1rr;

Acc:
Punnets square

	R	r
R	RR	Rr
r	Rr	rr

Rr x Rr;
1RR: 2Rr: 1rr;

(ii) the total number of seeds with wrinkled seed coats if the total number of all the F_1 seeds was 12,000. (2 marks)

$\frac{1}{4} \times 12000$;
3000 (seeds);

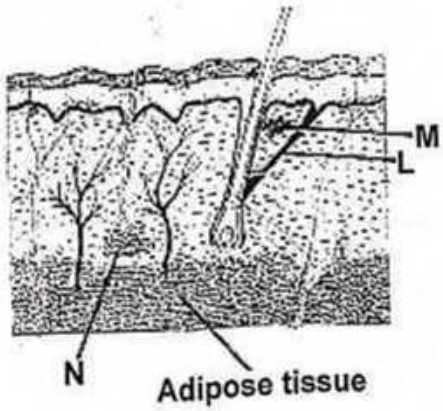
7

(b) State the advantage of using pea plants over eucalyptus plants in genetic studies. (1 mark)

- Pea plants have shorter generational time/mature faster/shorter time
- pea plants do not occupy as much space as eucalyptus
- pea plants exhibit distinct traits/contrasting characteristics/discontinous traits/variations;
- can self or cross-pollinate/easy to breed;
- Pea plants are easy to grow/simple to cultivate;
- yields/produce numerous offsprings;

acc shorter life cycle

4 The following diagram represents a section of the mammalian skin.



(a) Name the part labelled **M**. (1 mark)

Sebaceous gland;

(b) Explain the roles played by the parts labelled **N** and **L** in thermoregulation during hot weather conditions. (3 marks)

(i) **N**

Produces sweat; which moves through the sweat duct to the skin surface where it vaporizes; to bring about cooling effect; (Acc: absorbs latent heat of vaporization for vaporizes)

(3 marks)

(ii) **L** (Erector pili muscles)

Relaxes; causing the hair to lie flat; thus no/less air is trapped hence less/no insulation; the body loses heat encouraging heat loss;

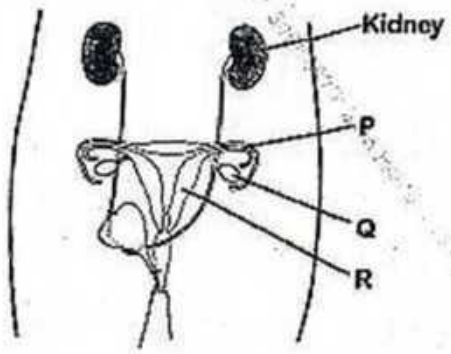
(1 mark)

(c) Explain why aquatic animals have a thicker adipose tissue.

For buoyancy;
For insulation against heat loss (in the cold aquatic habit);

5 The following diagram represents a section of the human female reproductive system.

F – P
O – O
L – P
P – O



(a) Name the part labelled **P**. (1 mark)

Fallopian tube / oviduct; 1

(b) State **two** functions of the part labelled **R**. (2 marks)

- Holding / protecting the (developing) foetus/embryo;
- Implantation (of the blastocyst);
- Nourishment of foetus (through formation of placenta);
- Pushing out / expulsion of foetus; Acc. Contraction during birth for expulsion of foetus; 2 mark

(c) (i) Name the hormone secreted in the part labelled **Q**.

Oestrogen; Progesterone;

(ii) State the roles of the hormone named in (c)(i). (2 marks)

Oestrogen: → promotes growth of uterine blood vessels in readiness for implantation;
→ stimulates pituitary gland to produce LH;
→ stimulates healing and repair of endometrium; reject uterus
→ Regulates uterine contractions;
→ Development of mammary glands;
→ Makes uterine wall more sensitive to oxytocin;

(d) Explain why a pregnant woman would require more proteins in her diet. (2 marks)

For growth and development of foetus; and mother's body needs (replenish nutrients used by foetus gastn, dev't, repair);

→ Progesterone:
- stimulates thickening of the endometrium (in preparation for implantation);
- Promotes growth of uterine blood vessels in readiness for implantation;
- Maintains the pregnancy;
- Inhibits production of LH and FSH;

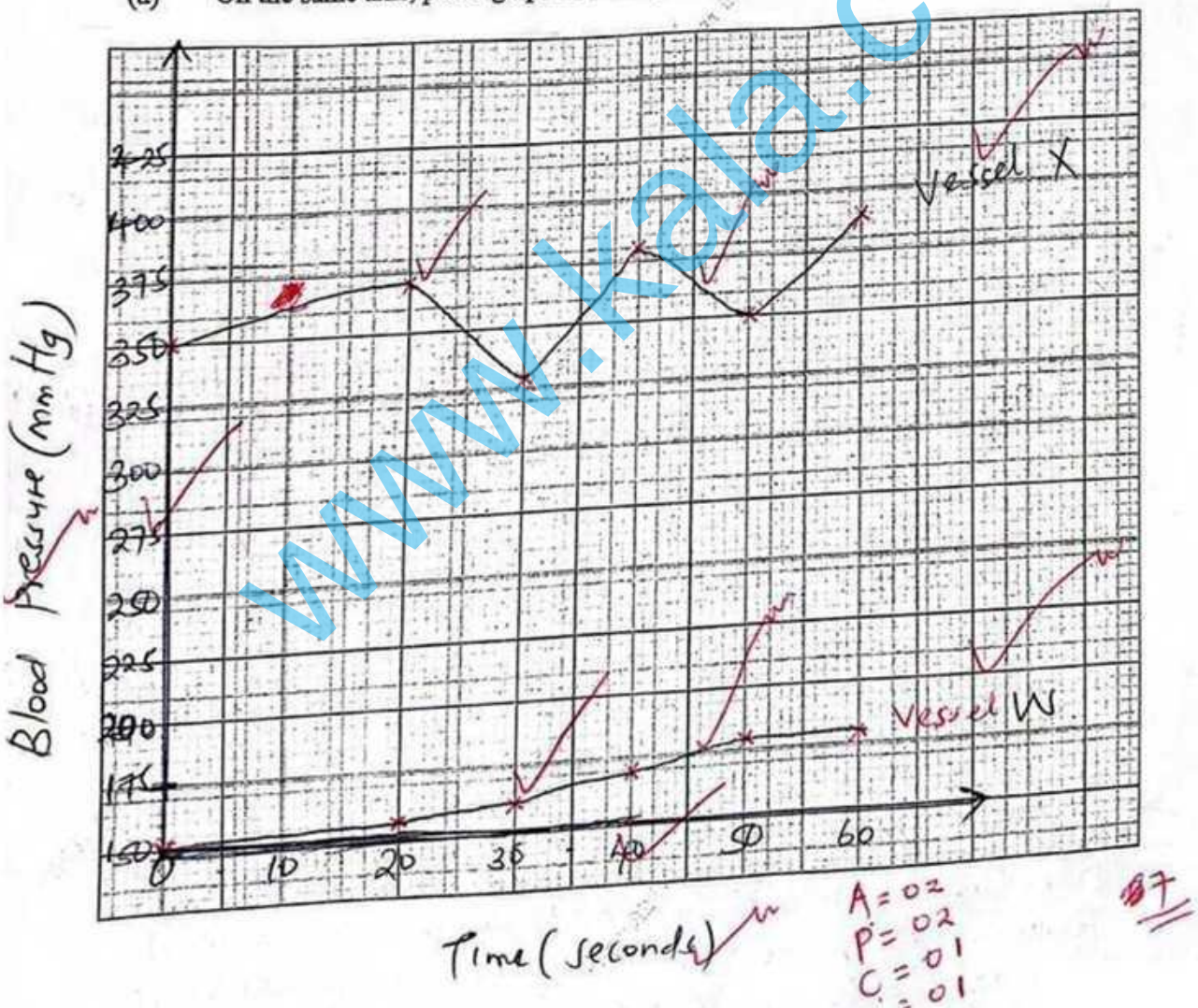
SECTION B (40 marks)

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

6 In an investigation, blood flowing in two blood vessels, **W** and **X** of a healthy adolescent was measured within a minute and recorded as shown below.

Time (seconds)	Blood Pressure (mmHg)	
	Vessel W	Vessel X
0	150	350 ✓
20	155	370 ✓
30	160	330 ✓
40	170	380 ✓
50	180	350 ✓
60	180	390 ✓

(a) On the same axis, plot a graph of blood pressure in both vessels against time. (7 marks)



A = 02
P = 02
C = 01
L = 01
I = 01

07

(b) State the likely identity of the blood vessels, W and X. (2 marks)

W ..... Vein; Acc. Correctly named vein eg pulmonary vein, venacava, etc (1 mark)

X ..... Artery; Acc. Correctly named artery eg Aorta, (1 mark)

(c) Explain your answer in (b). (3 marks)

Blood in vein/W flow at low/lower pressure; smoothly; due to resistance of blood flow in capillaries; and a wide lumen; Blood in arteries/X flow in high pressure; and intermittently/in pulses; due to pumping action of heart/receives blood directly from the heart; and narrow lumen;

(d) (i) Compare the blood pressure in an adolescent boy and a sixty year old man. (1 mark)

The blood pressure of adolescent boy is higher than that of a 60 year old man; Acc. Converse.

(ii) Explain your answer in (d)(i). (3 marks)

The adolescent boy is more active/faster growth/higher BMR than 60 yr old; blood pressure is high to ensure faster supply of nutrients/oxygen (for respiration); to provide energy needed; and for faster removal of metabolic waste products;

(f) Explain the role of blood in:

(i) temperature regulation; (2 marks)

Heat distribution; (carry heat from core body parts to (eg heart, brain, liver, skeletal muscles, spleen) to periphal organs/tissues) Excess heat is lost through radiation/vaporization/sweating; (during vasodilation) (Blood passing through) thermoregulation centre/hypothalamus, triggering responses to cool/warm the body;

(ii) disease control. (2 marks)

- Through clotting, Platelets prevents entry of pathogens;
- White blood cells fight/destroy pathogens;
- Distribution of antibodies (to neutralise pathogens);
- Removal of pathogens (toxins (through filtration);
- Transportation of white blood cells (to site of infection);

18, 16, 34

7 (a) Describe the role of the stomach in digestion. (5 marks)

(b) Describe the mechanisms that lead to the opening of the stomata during the day. (15 marks)

8 (a) Explain the forces involved in the uptake of water in terrestrial plants. (5 marks)

(b) While playing, a student was pricked by a thorn on the hand. The student screamed and quickly withdrew the hand from the thorn. Describe the activities that led to the withdrawal of the hand from the thorn. (15 marks)

7(a) Produces HCl; that provides a favourable pH/acidic medium for digestion/destroys pathogens/activates (stomach) enzyme/pepsinogen/provasin;
Produces digestive enzymes/Rennin/Pepsin; for digestion of proteins;
Has muscles on its walls that contracts and relaxes; Mixes food with digestive enzymes/churning of food; Acc. longitudinal and circular muscles for muscles;
Produces hormone gastrin; that stimulate production of gastric juice; Acc. produces gastric juice; which contains digestive juice/mucus/HCl/pepsin/Rennin;
Produces Mucus; that protects the stomach walls from corrosion by HCl/digestive enzymes;
Stores food (temporarily); for long time waiting for chemical digestion;

7(b) Photosynthetic theory; the chloroplasts; in the guard cells trap light for photosynthesis; leading to accumulation of glucose/sugars; increasing the Osmotic potential/pressure; water (Molecules from neighbouring epidermal cells) are drawn into the guard cells; by osmosis; the guard cells become turgid; the inner wall is thicker/less elastic than the outer wall; the outer wall stretches more; pulling the inner wall; opening the stomata.
(Acc. guard cell bulge outwards)

7b.... Potassium ion theory; ~~plate~~ during the day ATp energy is formed; potassium ions move into the guard cells; due to active pumping of potassium ions | by active transport; this increases solutes Concentration | osmotic potential | pressure; ~~in the guard cells~~; so water molecules move into the guard cells; by osmosis; making the guard cells turgid; opening the stomata.

The pH Theory | starch-sugar interconversion theory; photosynthesis takes place in the chloroplasts of the guard cells using carbon (IV) oxide; this raises the pH | reduces acidity; favouring the conversion of starch to sugar | glucose; which is osmotically active; causing water to be drawn into the guard cells by Osmosis; becoming turgid; and causing the stomata to open.

Total 26mks. Max. 15mks

8a) Forces involved in the uptake of water in terrestrial plants.

Transpiration pull; involves the vaporization of water from the spongy mesophyll cells; into the substomatal air spaces; making their cell sap more concentrated than that of its adjacent cells; This increases the osmotic pressure of the spongy mesophyll cells; promoting the flow of water into the cells from the surrounding cells; This in turn takes in water from xylem vessels within leaf veins; the events create a force ~~of~~ ~~pull~~ that pulls a stream of water from the xylem vessels in the stem and root;

(Capillary action) Capillarity; water rises in the xylem vessel until the weight of the water column balances the attractive forces operating between the water and the walls of the xylem vessel; in addition, water rises within the xylem vessels because they are narrow;

Cohesion and adhesion forces; ~~and~~ Cohesion is the force of attraction of water molecules to one other while adhesion is the ~~force~~ attraction between water molecules and walls of xylem vessel; the two forces are very high in thin columns such as the xylem vessel and are not easily broken; hence a continuous flow of water/transpiration stream is maintained;

Root pressure; which is attributed to the active/continous/ pumping of salts across endoderm into xylem (vessels/tracheids)/ ~~water~~ and water moves into xylem (by osmosis);

Total: 17 Max 05 Mks.

Simple Reflex Action.

8 b) This is an automatic response / a simple reflex action; the pathway of this response is reflex arc; the pain receptor cells in the skin; were stimulated; nerve impulses are triggered / generated; and transmitted; via sensory neurones; via dorsal root; to the grey matter; of the spinal cord; the impulse then transmitted to relay neurones; via a synapse; then to motor neurone; through another synapse; and eventually through the ventral root; to the effector muscles / biceps; via a synapse; which (biceps / effector) contract; and withdrawing the forearm.

Total 18mks. Max 15mks.