

Candidate's Name: .....

Signature: .....

Random No.	Personal No.

(Do not write your School/Centre Name or Number anywhere on this booklet.)

P530/1

**BIOLOGY**

Paper 1

(Theory)

Nov./Dec. 2024

2 ½ hours



**UGANDA NATIONAL EXAMINATIONS BOARD**

**Uganda Advanced Certificate of Education**

**BIOLOGY**

**Paper 1**

**(Theory)**

2 hours 30 minutes

**INSTRUCTIONS TO CANDIDATES:**

This paper consists of two Sections; **A** and **B**.

All questions are **compulsory**.

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 inserted in this booklet.

For Examiners' Use Only			
Section	Question	Marks	Examiner's Signature & No.
A	1 - 40		
B	41		
	42		
	43		
	44		
	45		
	46		
<b>Total</b>			

## SECTION A (40 MARKS)

Write the letter corresponding to the right answer in the box provided. Each question in this section carries **one** mark.

1. The epithelium with elongated cells arranged at right angle to the basement is

- A. glandular.                      B. cuboidal.  
C. squamous.                      D. columnar.

2. Which one of the following makes conifers better adapted to life on land than ferns?

- A. Having vascular tissues.  
B. Producing pollen grains.  
C. Possessing waxy cuticle surfaces.  
D. Developing true roots.

3. The following structures contain elastin protein **except**

- A. cartilage.                      B. tendon.  
C. ligament.                      D. aorta.

4. In the cell membrane, the phosphate group of the phospholipid

- A. forms ionic bonds with water.  
B. contains covalent bonds.  
C. is non-polar.  
D. is both saturated and unsaturated.

5. Which one of the following pathways taken by water from the soil involves use of plasmodesmata?

- A. Apoplast.                      B. Symplast.  
C. Cell to cell.                   D. Vacuolar.

6. Secondary productivity is lower than primary productivity because

- A. plants have poor energy containing organic molecules.  
B. the rate of assimilation of organic matter in plants is low.  
C. most of the food is used to produce energy in plants.  
D. digestion of plant materials occurs very slowly.

7. The selection pressure that could have favoured the evolution of long neck giraffe in its habitat is

- A. stabilising.                      B. disruptive.  
C. directional.                      D. artificial.

8. Biochemical analysis of a sample of DNA showed that 33 % of the nitrogenous base was guanine. What would be the percentage of adenine in the DNA sample?

- A. 16.5  
C. 49.5

- B. 33  
D. 66

9. In which of the following processes is osmosis involved?

- A. Movement of water through the xylem.  
B. Passage of water across a cell of endodermis.  
C. Movement of water from leaf epidermal cells.  
D. Oozing out of water through the stomata.

10. Figure 1 shows the effect of carbon dioxide on the oxygen dissociation curves of human blood.

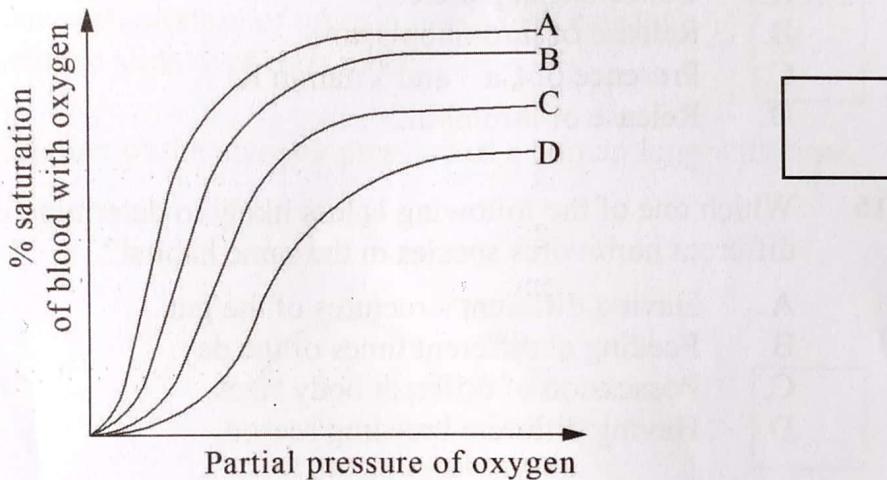


Fig. 1

Which one of the curves in figure 1 shows condition of low pH?

11. CAM plants are physiologically suited to minimise excessive water loss by

- A. reducing the number of stomata on their leaves.  
B. reversing the normal stomatal rhythm.  
C. possessing shallow roots for maximum absorption of surface water.  
D. reducing their leaf size into spines.

12. According to competitive exclusion principle,

- A. the successful species can attain full population growth in presence of the outcompeted species.  
B. full population growth of the successful species is attained much slower than when grown alone.  
C. the population of the outcompeted species show no growth.  
D. there is cyclical fluctuations of population of the two species with time.

13. Which one the following characteristics is correct for all members of kingdom fungi? All
- A. are saprotrophs.      B. have crosswalls.  
C. produce spores asexually.      D. are eukaryotic.
14. Blood from the placenta and fetal gut bypasses the fetal liver because
- A. the liver is non-functional.  
B. the liver has no regulatory function.  
C. of the presence of the ductus arteriosus.  
D. the fetus has no excretory products.
15. What initiates the process of blood clotting at the site of a damaged tissue?
- A. Collection of platelets.  
B. Release of thromboplastin.  
C. Presence of  $\text{Ca}^{2+}$  and Vitamin K.  
D. Release of thrombin.
16. Which one of the following is less likely to determine the existence of different herbivores species in the same habitat?
- A. Having different structures of the gut.  
B. Feeding at different times of the day.  
C. Possession of different body sizes.  
D. Having different breeding season.
17. What is the final electron acceptor in lactic acid fermentation?
- A. Pyruvate.  
B. NAD.  
C. Acetyl CoA.  
D. Oxygen.
18. A cross between two *Drosophila*, one with a black body and purple eyes and the other with a grey body and red eyes gave the following numbers of offspring.
- 47 black bodied with purple eyes.  
3 black bodied with red eyes.  
3 grey bodied with purple eyes.  
47 grey bodied with red eyes.

The recombination frequency of the two genes is

- A. 0.096      B. 0.09  
C. 0.06      D. 0.03

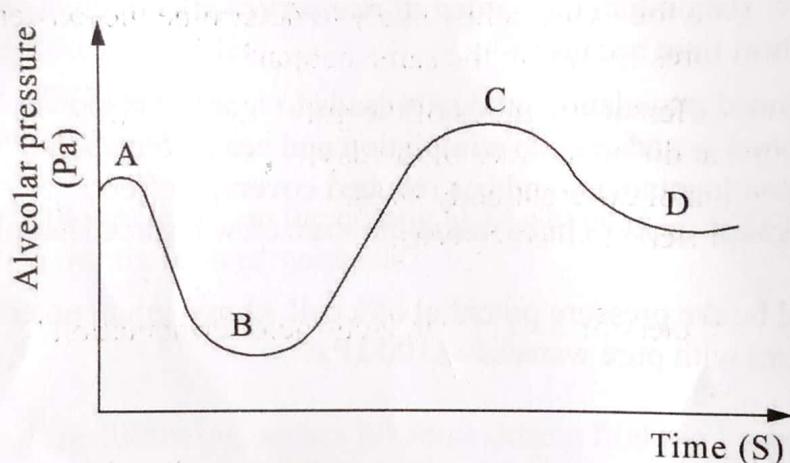
19. Which one of the following organelles is associated with the functioning of neutrophils?

- A. Mitochondria.
- B. Ribosomes.
- C. Microbodies.
- D. Lysosomes.

20. Which one of the following is the role of calcium ions in the process of muscle contraction?

- A. Causing depolarisation of the transverse tubule system.
- B. Changing the configuration of troponin thus exposing myosin binding sites.
- C. Binding to tropomyosin and breaking actin-myosin cross bridges.
- D. Changing the configuration of myosin heads thus causing microfilaments to slide over each other.

21. Figure 2 shows variation of the alveolar pressure of a human lung with time.



**Fig. 2**

Which part of the curve in figure 2 shows the stage of deepest exhalation?

22. Which one of the following best explains why prolonged pesticide application in controlling pest populations causes pest resurgence?

- A. Pesticide changes the colour of the pest and become invisible to predators.
- B. Pests get used to surviving in pesticide environment.
- C. Pesticide loses effectiveness in combating the pests.
- D. Resistant mutants multiply.

23. Figure 3 illustrates the Calvin cycle.

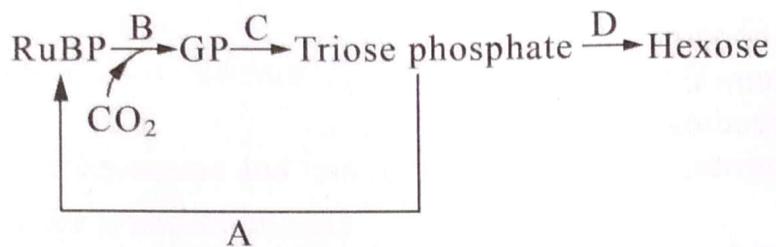


Fig. 3

Which one of the stages in figure 3 would be slowed down due to the presence of high levels of oxygen in a plant?

24. In haploid parthenogenesis, eggs are produced by
- A. meiosis and develop without being fertilised.
  - B. meiosis and develop after being fertilised.
  - C. mitosis and develop without being fertilised.
  - D. mitosis and develop after being fertilised.

25. A scare crow standing in the garden of rice serves effectively against birds only for a short time because
- A. continued stimulation gradually leads to ignored response.
  - B. receptors get adapted to stimulation and cease to respond.
  - C. it is non locomotory and has reduced coverage effect.
  - D. high visual acuity of birds makes the scare crow regarded harmless.

26. What would be the pressure potential of a cell whose solute potential when in equilibrium with pure water is -1100 kPa?
- A. 1100 kPa.
  - B. 1000 kPa.
  - C. -1000 kPa.
  - D. -1100 kPa.

27. Which one of the following adaptations of Xerophytes does not minimise water loss?
- A. Reduced numbers of stomata.
  - B. Thickened lamina.
  - C. Sunken stomata.
  - D. Short life cycle.

28. Which one of the following stimulus distorts receptor hair cells in the organ of corti in the human ear?

- A. Displacement of the fluid in tympanic canal.
- B. Movement of the basilar membrane.
- C. Movement of the fluid in vestibular canal.
- D. Movement of the Reissner's membrane.

29. The rate of photosynthesis in C<sub>3</sub> plants decreases when the oxygen concentration is high because

- A. organic acids accumulate in the cells lowering the pH.
- B. carbon dioxide concentration decreases with increase in oxygen concentration.
- C. oxygen competes with carbon dioxide for RuBP carboxylase.
- D. PEP carboxylase is more efficient at high oxygen concentration.

30. Which one of the following is a major cause of increased metabolic rate during a sprint? Increased

- A. movement of limbs.
- B. blood flow to muscles.
- C. body temperature.
- D. demand for ATP.

31. What is the triplet of bases on the coding DNA strand if the anticodon on tRNA is AUG during protein synthesis?

- |         |         |
|---------|---------|
| A. ATG. | B. UAC. |
| C. TAC. | D. UCG. |

32. Which one of the following causes lift force during flight in birds?

- A. Faster flow of air below the lower surface of the wing.
- B. Greater turbulence above the upper surface of the wing.
- C. Increased pressure on the wing.
- D. Reduced angle of attack below the wing.

33. Digested food is absorbed over the body surface in tapeworms because they

- A. posses no gut.
- B. lack the anus.
- C. have flattened body.
- D. have a scolex with suckers.

34. Which one of the following maintains a resting potential across the membrane of a neurone?

- A. Active transport of sodium ions outside the membrane.
- B. Active transport of potassium ions inside the membrane.
- C. Rapid diffusion of sodium ions inside the membrane.
- D. Rapid diffusion of potassium ions outside the membrane.

35. Which one of the following is true about the cardiac muscle? The fibres
- A. are connected by intercalated discs.
  - B. are voluntary.
  - C. are spindle shaped.
  - D. have no nucleus.
36. Secretin is secreted in the duodenum in response to the
- A. stimulation by the vagus nerve.
  - B. presence of partially digested fats.
  - C. presence of partially digested proteins.
  - D. presence of acidified chyme.
37. Which one of the following is the best ecological reason for metamorphosis in insects?
- A. Allows full differentiation of body tissues.
  - B. Enables the larvae and adult to have different body shapes.
  - C. Allows larvae to camouflage from predators.
  - D. Reduces competition between adults and juveniles.
38. In which one of the following plants will the apical bud grow more vigorously than the lateral buds below it?
- A. Tall unbranched plant.
  - B. Short branched plant.
  - C. Decapitated plant.
  - D. A plant treated with ABA.
39. Which of the following increases the precision of cones?
- A. Ability to rapidly resynthesise the photochemical pigment.
  - B. Many cones converging into one bipolar neurone.
  - C. Many cones are widely distributed on the retina.
  - D. One to one relationship with the optic nerve fibres.
40. The onset of lactation is initiated by
- A. secretion of oxytocin.
  - B. secretion of prolactin.
  - C. increase in levels of oestrogen.
  - D. decrease in levels of progesterone.

## **SECTION B (60 MARKS)**

*Write your answers in the spaces provided.*

41. (a) Why is a cell membrane described as **fluid – mosaic**? (02 marks)

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- (b) Outline **three** functions of the membranes within cells. (03 marks)

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- (c) How are the following cell organelles involved in enzyme secretion?

- (i) Rough endoplasmic reticulum. (02 marks)

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- (ii) Golgi apparatus. (03 marks)

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42. (a) State how respiratory surfaces enable organisms maintain a maximum possible rate of gaseous exchange. (04 marks)

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- (b) Explain the short term physiological adjustments that take place in the following systems when a person moves from a low altitude to a high altitude.

- (i) Respiratory system. (03 marks)

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- (ii) Circulatory system. (03 marks)

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43. (a) What is parthenogenesis?

(01 mark)

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(b) The life cycle of a bean aphid involves both parthenogenesis and sexual reproduction. Of what advantage is each type of reproduction to the population of aphids?

(i) Parthenogenesis.

(02 marks)

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(ii) Sexual reproduction.

(02 marks)

(c) Explain the role of parthenogenesis in the life cycle of bees.

(03 marks)

- (d) State **two** sources of variation that arise between parents and offspring as a result of sexual reproduction. (02 marks)
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44. Figure 4 shows the rate of glucose reabsorption in, and excretion from the human kidney in relation to the glucose concentration per  $100 \text{ cm}^3$  of plasma.

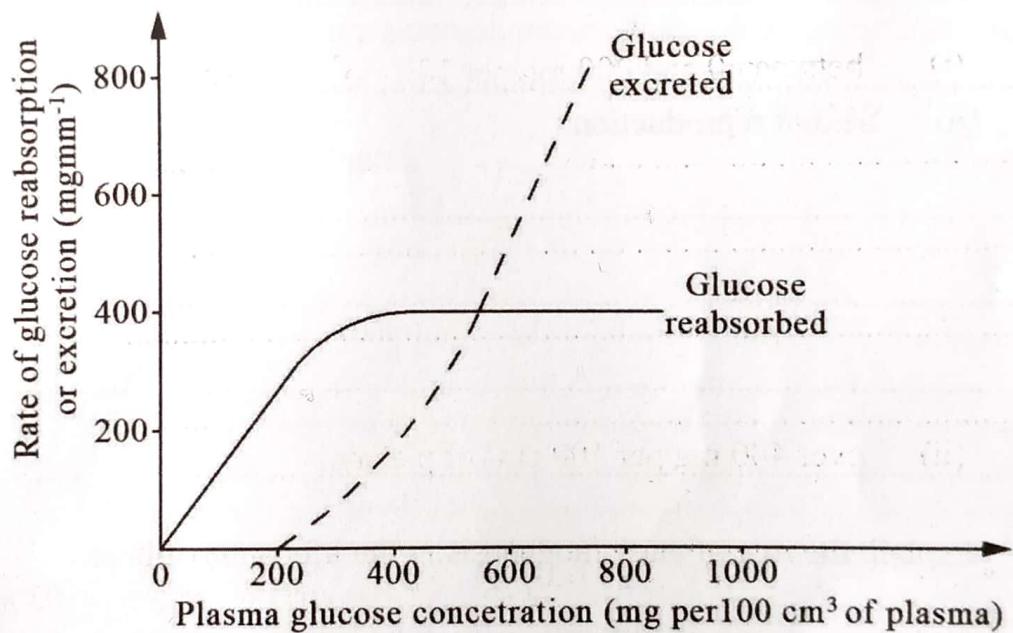


Fig. 4

- (a) Compare the rate of glucose reabsorption with glucose excretion.  
(i) Similarities. (02 marks)
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## (ii) Differences.

(02 marks)

- (b) Explain the changes in the rate of glucose reabsorption when the plasma glucose concentration is;

(i) between 0 and 200 mg per 100 cm<sup>3</sup> of plasma. (02 marks)

(ii) over 400 mg per 100 cm<sup>3</sup> of plasma. (02 marks)

(c) Suggest why glucose may be excreted in urine of a person. (02 marks)

45. (a) State **two** differences between growth in perennial plants and growth in animals. (02 marks)

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- (b) Explain the following observations:

- (i) Increase in girth of stem only occurs in perennial dicotyledonous plants. (02 marks)

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- (ii) Cutting off the apex of a young tree makes it develop more branches. (03 marks)

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- (iii) Terrestrial plants dry up days after flooding of their habitat. (03 marks)

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46. Figure 5 shows the result of an experiment to investigate the effect of oxygen concentration on uptake of potassium ions and consumption of sugar by the cells of an excised (cut off) root of barley seedlings.

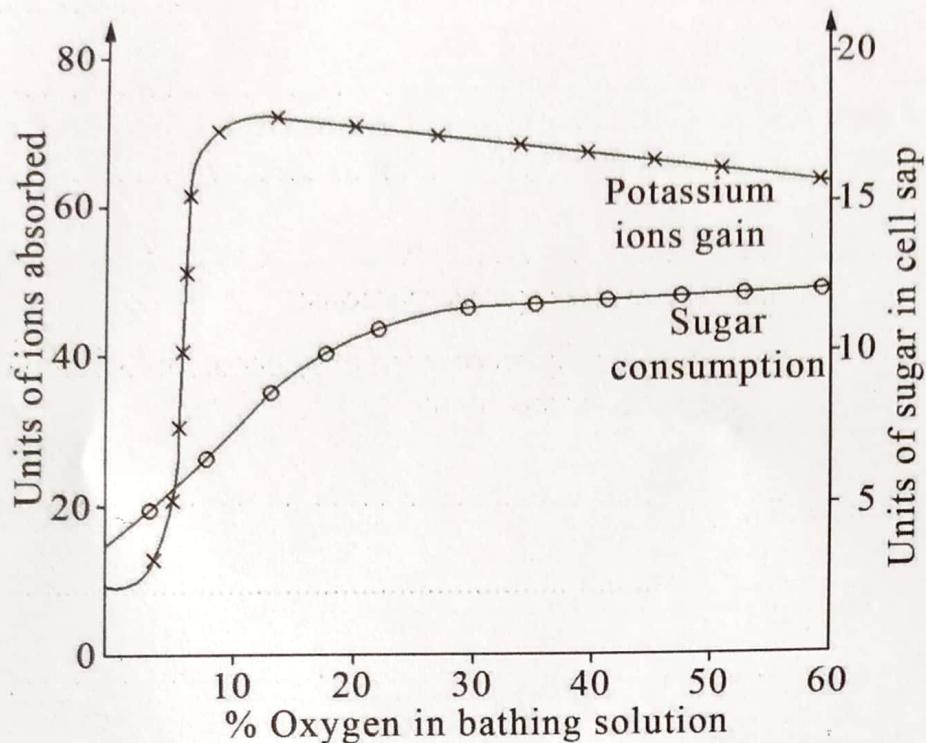


Fig. 5

(a) Explain the;

(i) effect of oxygen concentration on the uptake of potassium ions.  
(03 marks)

(ii) relationship between units of potassium ions absorbed and units of sugar consumption into the cell sap.  
(02 marks)

(b) State **one** factor other than oxygen that affects uptake of mineral ions by plants. (01 mark)

(c) Describe how the absorbed potassium ions reach the xylem vessels through apoplast pathway. (04 marks)

P530/2  
**BIOLOGY**  
Paper 2  
(Theory)  
**Nov./Dec.2024**  
2½ hours



**UGANDA NATIONAL EXAMINATIONS BOARD**

**Uganda Advanced Certificate of Education**

ALEVEL

**BIOLOGY**

**Paper 2  
(Theory)**

2 hours 30 minutes

**INSTRUCTIONS TO CANDIDATES:**

*This paper consists of **two** Sections; A and B. It has **six** questions.*

*Section A is **compulsory**.*

*Answer any **three** questions from Section B.*

*Answer **four** questions in all.*

*Any additional question(s) answered will **not** be marked.*

*Begin answering each question on a fresh page.*

*You are advised to read the questions carefully, organise your answers and present them precisely and logically, illustrating with well labelled diagrams where necessary.*

## SECTION A (40 MARKS)

1. Figure 1 shows the changes in the concentration of two growth hormones, abscisic acid and gibberellic acid in germinating apple seeds maintained at 25 °C after a period of cold treatment.  
Figure 2 shows the percentage of apple seeds that germinated under the same conditions.

Study the two figures and answer the questions that follow.

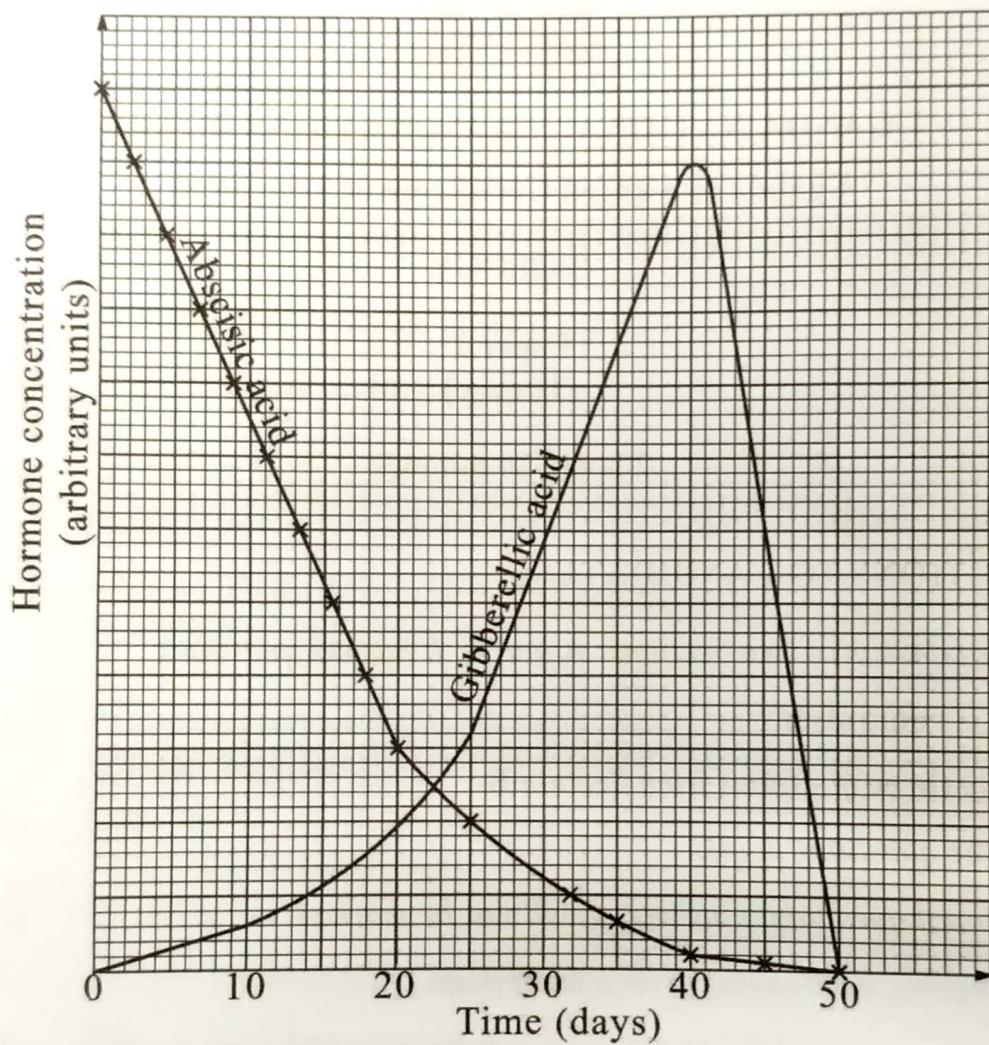
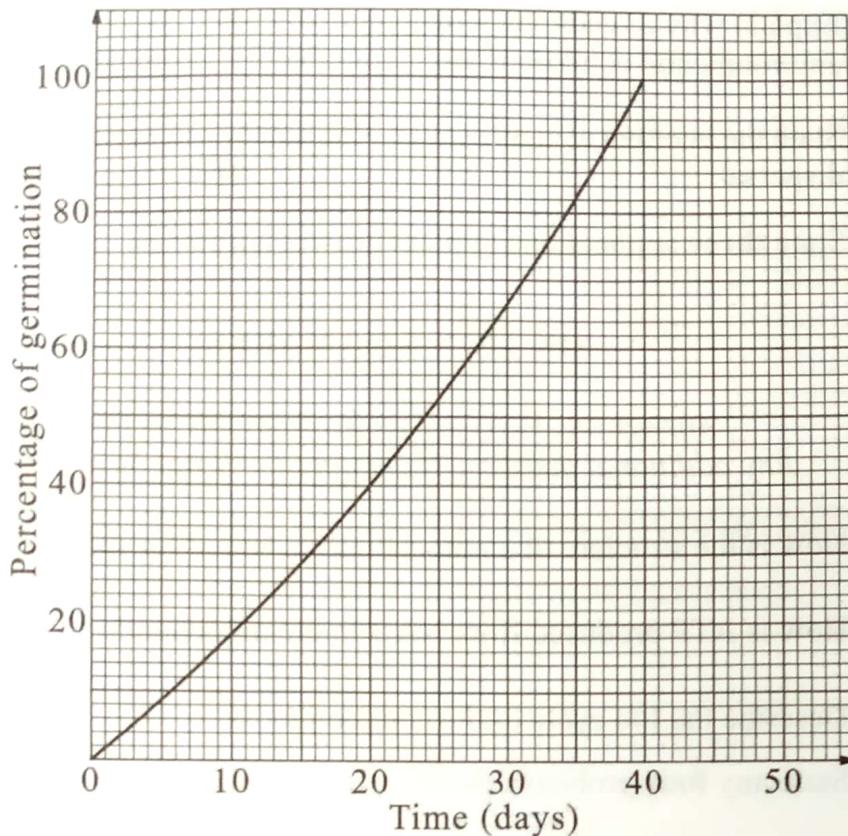


Fig. 1



**Fig. 2**

- (a) From figure 1, describe the changes in the concentration of;
  - (i) abscisic acid. (03 marks)
  - (ii) gibberellic acid. (05 marks)
  
- (b) From figure 1, explain the changes in the concentration of;
  - (i) abscisic acid. (05 marks)
  - (ii) gibberellic acid. (05 marks)
  
- (c) Explain how the concentration of;
  - (i) abscisic acid in figure 1 relates to the percentage of seeds that germinated in figure 2. (05 marks)
  - (ii) gibberellic acid in figure 1 relates to the percentage of seeds that germinated in figure 2. (05 marks)
  
- (d) Explain the significance of cold treatment of seeds before planting. (03 marks)

- (e) Explain why a seed may remain dormant after dispersal even when the environmental conditions are favourable for germination. (04 marks)
- (f) State the ecological significance of dormancy in seeds soon after dispersal. (02 marks)
- (g) State **three** applications of plant growth hormones. (03 marks)

## SECTION B (60 MARKS)

*Answer any **three** questions from this section.*

*Any additional question(s) answered will **not** be marked.*

2. (a) How is the structure of a mitochondrion suited for its function? (12 marks)
- (b) How is ATP produced from NAD in the mitochondrion? (08 marks)
- BIO2
3. (a) Describe the life cycle of the common moss. (16 marks)
- (b) State any **four** problems faced by terrestrial plants. (04 marks)
4. (a) How is the structure of the retina of a mammalian eye suited for its function? (11 marks)
- (b) Outline the differences between the structure and function of the mammalian rods and cones. (09 marks)
5. (a) Compare gaseous exchange and ventilation mechanism in bony fish and cartilaginous fish. (12 marks)
- (b) Describe the control of breathing in mammals. (08 marks)
6. (a) Describe the structure of a chloroplast. (07 marks)
- (b) Outline the process of sucrose synthesis in C<sub>4</sub> plants. (07 marks)
- (c) Explain how temperature and altitude influence the distribution of C<sub>3</sub> and C<sub>4</sub> plants. (06 marks)

**Each candidate should be provided with the following:**

A freshly killed rat, labelled **X**.

15 maize seedlings germinated for 24 hours, labelled **C**.

15 maize seedlings germinated for 72 hours, labelled **B**.

15 maize seedlings germinated for 48 hours, labelled **A**.

15 maize seedlings germinated for 12 hours, labelled **E**.

15 maize seedlings germinated for 108 hours, labelled **D**.

*(Each of the maize seed lots are first soaked in water for 12 hours then planted on moist cotton wool. Begin counting the germination time when the seeds are planted on the cotton wool.)*

10 cm<sup>3</sup> of 1 % amylase solution, labelled **F**.

30 cm<sup>3</sup> of distilled water, labelled **G**.

8 cm<sup>3</sup> of 6 % hydrogen peroxide solution, labelled **Q**.

A complete mature plant of *Bidens pilosa* (black jack) but not yet flowering, labelled **U**.

A complete mature plant of *Commelina benghalensis* (wandering jew) but not yet flowering, labelled **V**.

An onion bulb, labelled **W**.

An Irish potato tuber, labelled **Y**.

A light microscope, glass slides and cover slips.

2 droppers and razor blade/scarpel.

Dissecting kit, board, pins and cotton wool.

A thermometer and glass rod.

A plastic mug/beaker and labelling tape.

8 test tubes of the same make and size.

5 boiling tubes.

5 ml and 20 ml or 25 ml measuring cylinders.

5 petri dishes.

A thread (20 cm long).

A cork borer (5 mm diameter).

A mortar and a pestle.

A stop clock.

**Access to:**

Reagents for carrying out food tests.

Distilled water.

Source of heat.

Filter papers and printing paper.

Candidate's Name: .....

Signature: .....

Random No.					Personal No.		

(Do not write your School/Centre Name or Number anywhere on this booklet.)

P530/3  
**BIOLOGY**  
Paper 3  
(Practical)  
Nov./Dec. 2024  
3½ hours



**UGANDA NATIONAL EXAMINATIONS BOARD**

**Uganda Advanced Certificate of Education**

**BIOLOGY**

**Paper 3  
(Practical)**

3 hours 15 minutes

### **INSTRUCTIONS TO CANDIDATES:**

*This paper consists of three questions.*

**All questions are compulsory.**

*Write the answers in the spaces provided. No additional sheets of paper should be inserted in this booklet.*

*You are not allowed to start working within the first 15 minutes. You are advised to use this time to read through the paper and ensure that you have all the apparatus, chemicals and specimens you require.*

For Examiners' Use Only		
Question	Marks	Examiner's Signature & No.
1		
2		
3		
<b>Total</b>		

1. You are provided with specimen X which is freshly killed.

- (a) Examine the head of specimen X and describe the structure and location of the following:

- (i) Vibrissae (whiskers). (03 marks)

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- (ii) Eyes. (1½ marks)

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- (iii) Pinnae. (03 marks)

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- (b) How significant is the location of the following structures in the life of specimen X?

- (i) Vibrissae. (02 marks)

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(ii) Eyes. (1½ marks)

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- (c) Dissect the abdominal cavity of specimen X to expose the structures in the viscera. Displace the liver lobes anteriorly to expose the underlying structures without displacing the stomach. Cut the rectum at the base, pull it upwards and pin it to the right side of the specimen. Locate the duodenum, caecum and ileum. Displace the duodenum and caecum to the right side of the specimen and the ileum to the left side of the specimen. Draw and label the displayed structures of the alimentary canal of the abdominal cavity up to the pinned rectum including the mesenteric structures attached to the small intestine.

(17 marks)

- (d) With the stomach displaced to the right side of the specimen, draw and label the organs lying between the anteriorly displaced liver lobes and the posterior end of the duodenum. Include the blood vessels that supply the structures displayed. (12 marks)



2. You are provided with seedlings/seeds of five different lots labelled **A**, **B**, **C**, **D** and **E**, which have been grown for different lengths of time. You are required to investigate the effect of growth activities on the chemical components of the seed/seedlings using the following procedures:
- (a) (i) Label 5 petri dishes **A**, **B**, **C**, **D** and **E**.  
(ii) Obtain 10 seedlings/seeds from each lot and place them in the respective petri dishes labelled **A**, **B**, **C**, **D** and **E**.

- (iii) Using a clean mortar and pestle, thoroughly pound the seedlings from petri dish A. Add 15 cm<sup>3</sup> of distilled water, stir well and decant into a clean boiling tube and label it extract A<sub>1</sub>. Pour the residue into the plastic mug / beaker provided.
- (iv) Repeat the procedures (a)(i) – (iii) using the remaining seed/seedling lots to make corresponding extracts B<sub>1</sub>, C<sub>1</sub>, D<sub>1</sub> and E<sub>1</sub>.
- (b) (i) Carry out tests in table 1 to determine the food nutrients in extracts C<sub>1</sub> and D<sub>1</sub>. Record your test procedures, observations and deductions in the table.

**Table 1** (14 marks)

Test procedure		Observations	Deductions
<u>Iodine test</u>	C <sub>1</sub>		
	D <sub>1</sub>		
<u>Benedict's test</u>	C <sub>1</sub>		
	D <sub>1</sub>		
<u>Biuret test</u>	C <sub>1</sub>		
	D <sub>1</sub>		

- (ii) Basing on your results in table 1, name the extract which was obtained from the seedling that had grown for a longer time. (01 mark)

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- (iii) Explain your observations in table 1. (02 marks)

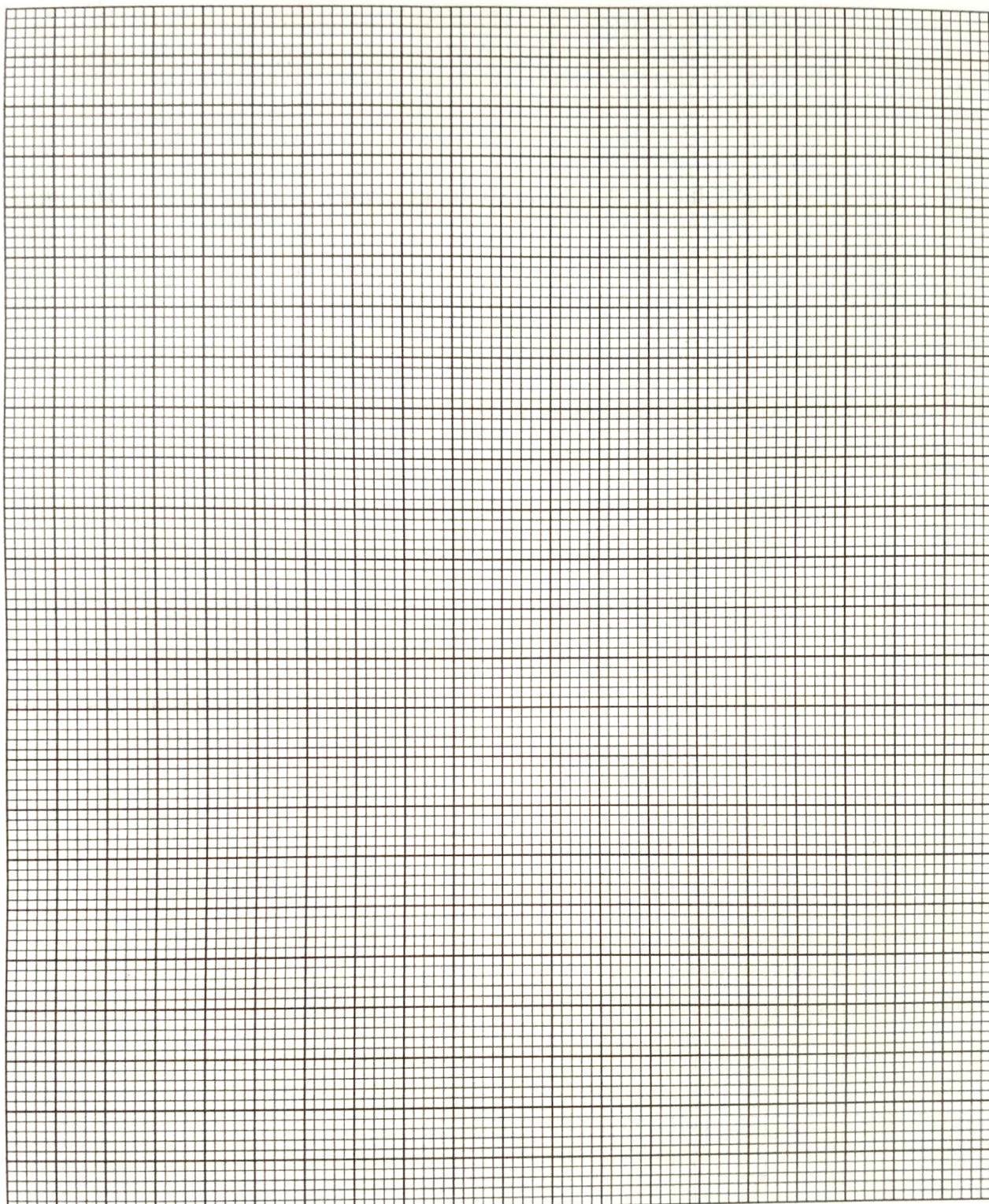
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- (c) (i) Obtain five clean test tubes of the same size, label them **A<sub>2</sub>**, **B<sub>2</sub>**, **C<sub>2</sub>**, **D<sub>2</sub>** and **E<sub>2</sub>** and place them in a test tube rack.
- (ii) To each of the labelled test tubes **A<sub>2</sub>**, **B<sub>2</sub>**, **C<sub>2</sub>**, **D<sub>2</sub>** and **E<sub>2</sub>**, measure and pour 1 cm<sup>3</sup> of solution **Q**.
- (iii) Add 1 cm<sup>3</sup> of **A<sub>1</sub>** into the test tube **A<sub>2</sub>** and immediately start the stop clock.
- (iv) After **30** seconds, using a ruler, measure in centimetres the height of the contents in the test tube **A<sub>2</sub>**.
- (v) Record your measurement in table 2.
- (vi) Repeat procedures (c)(iii) – (v) using extracts **B<sub>1</sub>**, **C<sub>1</sub>**, **D<sub>1</sub>**, **E<sub>1</sub>** and the corresponding contents of test tube **B<sub>2</sub>**, **C<sub>2</sub>**, **D<sub>2</sub>** and **E<sub>2</sub>**.

**Table 2** (05 marks)

Extract	Height of contents after 30 seconds (cm)
<b>A<sub>1</sub></b>	
<b>B<sub>1</sub></b>	
<b>C<sub>1</sub></b>	
<b>D<sub>1</sub></b>	
<b>E<sub>1</sub></b>	

(d) (i) Represent your results in table 2 on a suitable graph. (08 marks)



(ii) Explain the results plotted in (d)(i). (04 marks)

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3. You are provided with specimens V, W, Y and U.

(a) Examine specimens V, W, Y and U.

(i) Identify **two** distinctive features of the leaves and roots of each of the specimens and record your observations in table 3.

**Table 3** (07 marks)

Specimen	Distinctive Features Observed	
	Leaves	Roots
V	..... ..... .....	..... ..... .....
W	..... ..... .....	..... ..... .....
Y	..... ..... .....	..... ..... .....
U	..... ..... .....	..... ..... .....

- (ii) Using the features in table 3, construct a dichotomous key for the identification of specimens **V**, **W**, **Y** and **U**. (03 marks)

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- (b) Explain the significance of any **two** common observable features unique to both specimens **W** and **Y**. (02 marks)

(i)

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(ii)

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- (c) (i) Peel off the lower epidermis of a fleshy leaf of specimen **W**. Place it on a glass slide, add **1 – 2** drops of distilled water and cover with the cover slip. Observe under low power of a light microscope and describe the appearance of the observed structures within the field of view. (03 marks)

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- (ii) Obtain a thin transverse section at the fourth internode towards the apex of specimen **U**. Place it on a glass slide, add **1 – 2** drops of iodine solution and cover it with a cover slip. Allow it to stand for **3** minutes and observe under low or medium power of a light microscope.

Draw and label the observed structures.

*(08 marks)*

- (iii) State how any **three** observed structures in (c)(ii) are suitable for their functions.

*(03 marks)*

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