Candidate's Name: ..TR. SSENTAMU ...MAYIN1 (BIOSCOPE)

Signature: .....

Random No.					Personal No.			
0	7	4	6	4	6	0	8	26

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

0768293277 100%

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**	40	
B	**41**	10	
	42	10	
	43	10	
	44	10	
	45	10	
	46	10	
Total		100	

Turn Over

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 B. 33
C. 49.5 D. 66

None

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.

B

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

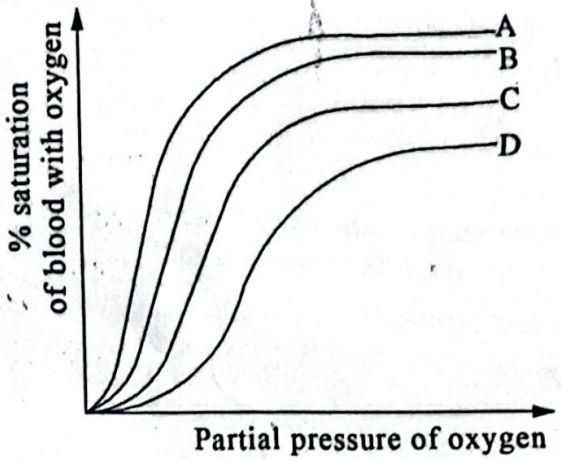

Fig. 1

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

D

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.

B

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.

B

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 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.

D

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.

B

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

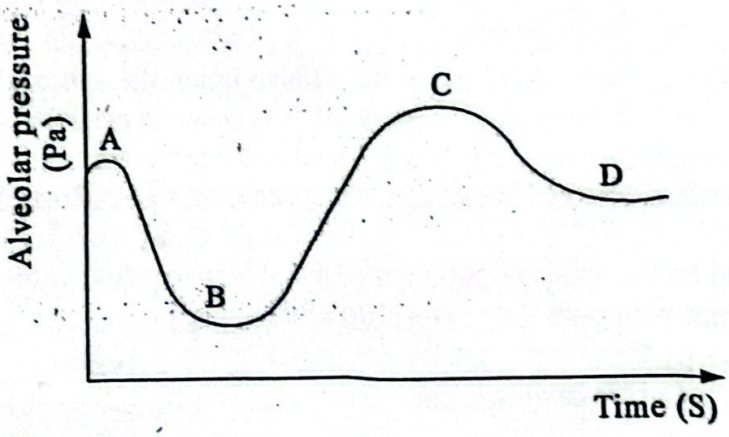

Fig. 2

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

C

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.

B

23. Figure 3 illustrates the Calvin cycle.

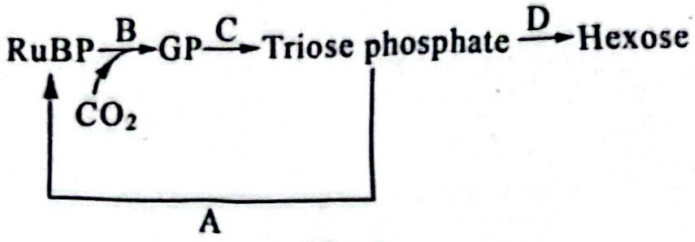

Fig. 3

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 locomotary 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.

B

29. The rate of photosynthesis in C_3 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.

C

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.

D

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.

C

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.

None

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.

C

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.

D

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*)

It is a dyanmic structure with freely moving phospholipids in which proteins are randomly scattered. 02

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

It acts as an intracellular transport system.
Isolate different chemical reactions.
It acts as an intracellular transport system.
Isolate enzyme that may change other organelles.
Allow different reactions to occur simultaneously.
Control movement into and out of organelles.
Bring enzymes of related metabolic pathway in close proximity.

03, Any correct three

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

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

Has ribosomes which synthesize proteins, that are isolated and transported by Rough endoplasmic reticulum. 02

(ii) Golgi apparatus. (*03 marks*)

Receives proteins produced by RER, modifies them and repackages the modified proteins into vesicles for secretion. 03

10

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

large surface area to volume ratio / large surface area
permeable to gases
moist to dissolve respiratory gases
thin to reduce diffusion distance
Efficient system to maintain diffusion gradient

(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)

Reduced partial pressures of oxygen at high altitude is detected by chemoreceptors, which increases the breathing rate

(ii) Circulatory system. (03 marks)

Reduced partial pressures of oxygen at high altitude is detected by chemoreceptors, that stimulate the sympathetic nervous system to increase the heart rate

3. (a) What is parthenogenesis? *(01 mark)*

development of a new individual from unfertilized egg. 01

(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)*

Allows rapid increase in numbers without the need for males, taking advantage of favourable conditions preserve good traits. 02

(ii) Sexual reproduction. *(02 marks)*

Introduces genetic variability which enable species to adapt to new environmental conditions. 02

(c) Explain the role of parthenogenesis in the life cycle of bees. *(03 marks)*

Haploid gametes are formed by meiosis, the unfertilized haploid eggs develop into new fertile drones, this process controls the numbers of each type of bees in the colony. 03

(d) State two sources of variation that arise between parents and offspring as a result of sexual reproduction. (02 marks)

Random fertilization ✓

Independent assortment ✓ 02

Crossing over ✓ Any two.

Mutations during meiosis ✓

44. Figure 4 shows the rate of glucose reabsorption in, and excretion from the human kidney in relation to the glucose concentration per 100 cm³ of plasma.

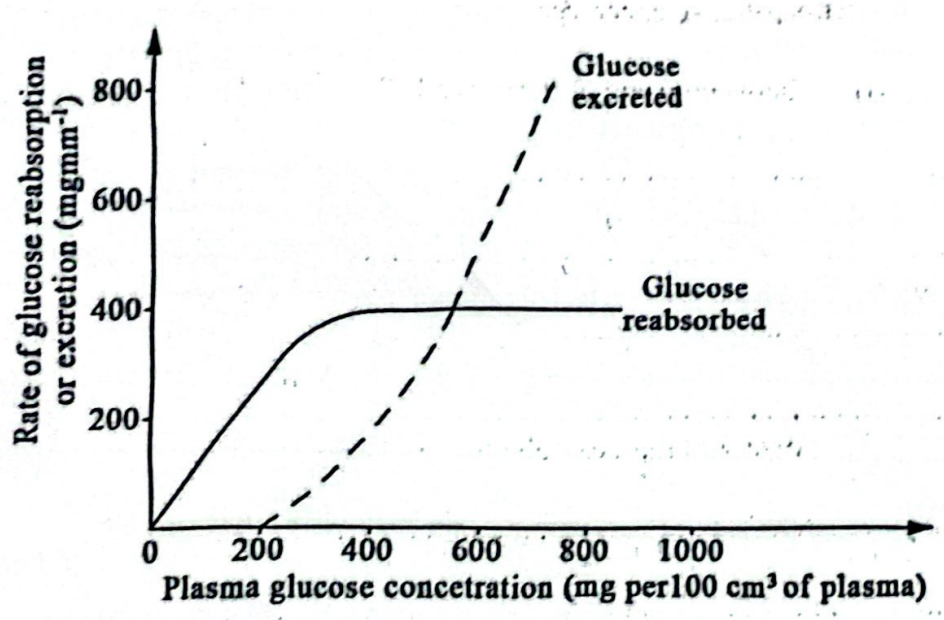

Fig. 4

(a) Compare the rate of glucose reabsorption with glucose excretion.

(i) Similarities. (02 marks)

From 200mg 100cm⁻³ of plasma to 400mg 100cm⁻³ of plasma, there is an increase in both the rate of glucose excreted and glucose reabsorbed. ✓ At 200mg 100cm⁻³ of plasma glucose excreted was equal to glucose reabsorbed. 02

(ii) Differences. (02 marks)

From 0mg 100cm^{-3} to 200mg 100cm^{-3} of plasma glucose reabsorbed increases while there was no glucose excreted.
From 200mg 100cm^{-3} to 550mg 100cm^{-3} of plasma glucose reabsorbed was higher than glucose excreted. 02
From 400mg 100cm^{-3} to 720mg 100cm^{-3} of plasma glucose reabsorbed was constant while glucose excreted increases. Any correct two
From 550 to 720mg 100cm^{-3} of plasma glucose reabsorbed was lower ; glucose excreted is higher

(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^3 of plasma. (02 marks)

Glucose reabsorbed increases rapidly because of a steep concentration gradient between the filtrate and blood plasma. 02

(ii) over 400 mg per 100 cm^3 of plasma. (02 marks)

The rate of glucose reabsorbed remains constant because the glucose level in the filtrate has exceeded the quantity the kidney can reabsorb. 02

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

When insufficient/no insulin is excreted, to cause conversion of excess glucose into glycogen. 02

10

Figure: concentra... cells of an ...

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

Perennial plants have indefinite growth while animals have definite growth ✓

Perennial plants have growth at meristems only while in animals; growth is all over the whole body ✓ 02

(b) Explain the following observations:

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

This is due to presence of cambium cells ✓ which continue to devide mitotically ✓ giving rise to secondary xylem and phloem ✓ 02

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

This removes the sources of auxins ✓ which may inhibit the growth of lateral buds ✓ promoting growth of side branches ✓ 03

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

There is little or no oxygen in flooded soils ✓ roots respire anaerobically ✓ and therefore have insufficient energy for active absorption of nutrients ✓ Ethanol production is toxic to the cells ✓ 03

10

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.

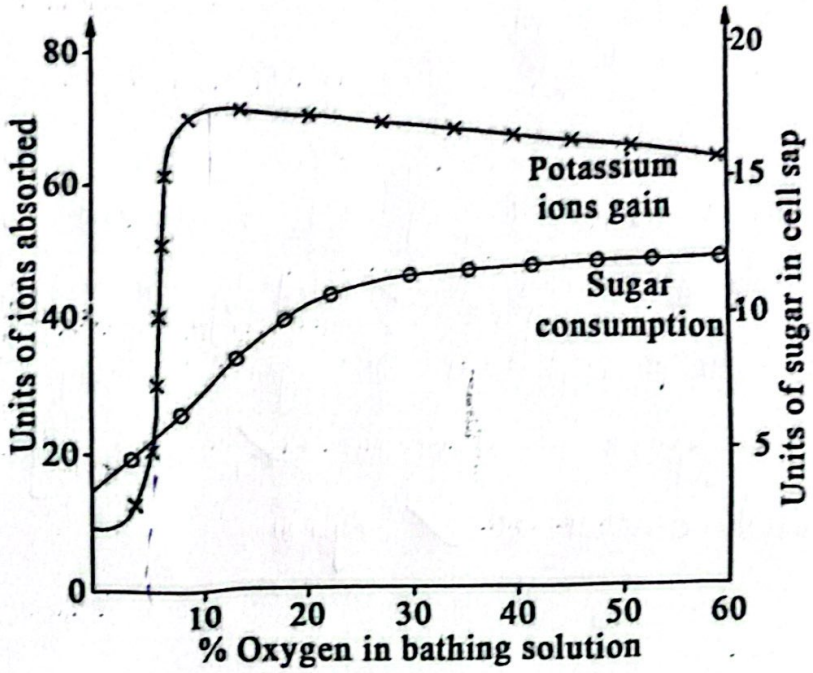

Fig. 5

(a) Explain the;

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

Increase in oxygen concentration, from 0% to 5% oxygen in breathing solution causes potassium ions uptake to increase gradually because of little energy inform of ATP from aerobic respiration for active uptake of potassium ions. Increase in oxygen concentration from 5% to 10% oxygen in breathing solution causes a rapid increase in uptake of potassium ions due to increased ATP from aerobic respiration (03)

Beyond 10% of oxygen concentration the rate of potassium uptake

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

Increase in CO2 to decreases gradually as other factors become limiting

As sugar consumed increases the uptake of potassium ion increases to the peak. this is because sugar is a respiratory substrate that provide energy for active uptake. (02)

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

01

Temperature ✓ pH of the ✓ soil
concentration of ions ✓ Any correct one
presence of respiratory inhibitor

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

Potassium ions move along walls of the root cortex cells by diffusion or mass flow ✓ aided by the transpiration pull, the casparian strip blocks the apoplast pathway ✓ diverting ions into the cytoplasm of endodermal cells ✓ where they are actively pumped or diffuse into the xylem

03