UGANDA NATIONAL EXAMINATION BOARD

UGANDA ADVANCED CERTIFICATE OF EDUCATION

2003

BIOLOGY PAPER 1

SECTION A

1. Which one of the following is a fibrous soluble protein?
a. Myosin
b. Collagen
c. Myoglobin
d. Fibrinogen

2. A muscle cell of an animal was found to contain 24 chromosomes. How many chromosomes would a germinal epithelium cell within the ovary of the animal contain?
a. 24
b. 12
c. 48
d. 36

3. A plant tissue which is tubular, open-ended, with lignified and thickened walls is
a. Tracheid
b. Xylem vessel
c. Parenchyma
d. Sieve tube

4. The following are physiological conditions of living cells:
1. High concentration of ADP and Pi
2. High concentration of ATP
3. High concentrations of hydrogenase
4. High concentration of ATPase

Which of them will increase the rate of sugar break down in a cell?
a. 1 and 2
b. 2 and 3
c. 1 only
d. 4 only

5. Which one of the following characteristics in an insect is list suitable for use in identification keys?
a. Body colour
b. Number of hair on the body
c. Shape of abdomen
d. Length of wings

6. Which one of the following is not a form of inbreeding?
a. Cross-breeding offsprings of same parents.
b. Self-fertilization
c. Back crossing
d. Test crossing

7. A coffee plant known to be heterozygous for a recessive defect which makes the plant fail to produce viable seeds was self-pollinated and gave rise to 600 seedlings. How many of the seedlings were heterozygous?
a. 150
b. 200
c. 300
d. 400

8. Which of the following does not play part in regulating the salt concentration of a mammalian blood?
a. Kidney
b. Skin
c. Liver
d. Pituitary gland

9. Which of the following conditions in the human blood would stimulate the highest rates of ventilation and heart beat?
a. Little carbon dioxide
b. Little oxygen
c. Much carbon dioxide
d. Much oxygen

10. Which of the following hereditary characteristics is known to be sex limited?
a. Haemophilia
b. Baldness
c. Albinism
d. Colour-blindness

11. Which one of the following shows the correct coding sequence during protein synthesis?
a. DNA -> mRNA -> tRNA -> rRNA -> amino acids
b. rRNA -> tRNA -> mRNA -> polypeptide
c. RNA -> mRNA -> tRNA -> protein
d. DNA -> mRNA -> rRNA -> amino acids

12. Which one of the following adaptations would not assist animals living in a desert?
a. Use of metabolic water
b. Possession of a large number of glomeruli
c. Possession of long loop of Henle
d. Production of non-toxic nitrogenous waste

13. During an action potential in a neuron,
a. Potassium ions diffuse into the axon
b. Sodium ions diffuse out of the axon
c. Sodium ions diffuse into the axon
d. Both the sodium and potassium ions diffuse into the axon

14. Which one of the following statements is true only of sympathetic nervous system?
a. Nerve endings produce nor-adrenaline
b. Preganglionic fibres are short
c. Nerve endings produce acetylcholine
d. Preganglionic fibres are long

15. Which one of the following is a method halophytes use to survive physiological drought?
a. Reducing the number of stomata on their leaves.
b. Reversing the normal stomatal rhythm
c. Storing water
d. Having wax cuticle

16. Which one of the following is true of diploid parthenogenesis? The eggs are formed by
a. Meiosis and develop without fertilization
b. Mitosis and develop after fertilization
c. Meiosis and develop after fertilization
d. Mitosis and develop without fertilization.

17. In the mammalian menstrual cycle, the decline in the level of progesterone is due to
a. Successful conception
b. Formation of corpus luteum
c. Degeneration of corpus luteum
d. Maturation of garafian follicle

18. In a plant species, the allele for tallness (T) N and blue flowers (B) is dominant to that for shortness (t) and white flowers (b). A tall plant with blue flowers was crossed with a short plant with white flowers.
1 Tall blue: 1 Tall white: 1 Short white
The genotype of the tall blue flowered parent was
a. TtBb
b. ttBB
c. TTBb
d. Ttbb

19. Excellence in detection of movement at the lateral edges of the visual field is attributed to
a. Rods and cones
b. Rods only
c. Cones only
d. Compound eyes

20. The differences between a green plant and the iron bacteria in the synthesis or organic compound is that the
a. Bacteria drive their energy for the synthesis from oxidation of inorganic compounds.
b. Source of hydrogen for the bacteria is not water
c. Bacteria have a different kind of chlorophyll
d. Bacteria luck enzymes for fixation of carbon dioxide

21. Viruses cannot reproduce outside a living cell because
a. Not all of them contain DNA
b. They are too small to reproduce
c. They are unable to synthesize their own DNA
d. They are unable to absorb raw materials from the surroundings

22. Which part of an Amoeba is concerned with active intake of water?
a. Ectoplasm
b. Contractile vacuole
c. Pseudopodia
d. Cell membrane

23. Which one of the following statements is true of first division of meiosis but untrue of mitosis?
a. The chromosome number is maintained in the daughter cells
b. Four daughter cells are formed
c. The chromosome number is doubled in the daughter cell
d. Homologous chromosomes come together at the equator

24. The products of light reaction in photosynthesis are
a. NADH2 ATP and O2
b. NADP, ATP and O2
c. NAPH2, ADP and O2
d. NAPH 2, ATP and O2

25. Injection of thyroxine into a laboratory mammal would cause
a. Oxygen consumption to increase
b. metabolic rate to decrease
c. Conversion of glucose into glycogen to increase
d. Thyroid gland to become more active

26. Figure one represents a tail of a fish in water

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Which arrow represents the force applied against the water by the tail of the fish as the muscles in the shaded side contract?

27. Which one of the following water relations is not true about a plasmolysed plant cell?
a. Turgor pressure is zero
b. Pressure potential is equal to osmotic potential for sap
c. Pressure potential is zero
d. Water potencial of cell is equal to osmotic potential of sap

28. Rapid transport of materials within the cytoplasm of a cell is associated with the pressure of
a. Spindle fibres in the diving cell
b. An extensive endoplasmic reticulum
c. Many plasma membrane pores
d. Extensive golgi apparatus

29. Which one of the following show divergent evolution?
a. Wings of a cockroach and a bat
b. Skeletons of a mouse and cray fish
c. Fore limbs of a pigeon and a monkey
d. Eyes of a locust and a kite

30. Which one of the following ecological effects may not be caused by deforestation?
a. Species extinction
b. Reduction in soil fertility

c. Acid rain
d. Flooding and landslides

31. Under which of the following conditions would transpiration be most rapid?
a. Dark and windy
b. Light and windy
c. Dark and still
d. Light and still

32. A green plant develops yellow leaves as a result of being deficient in
a. Magnesium
b. Manganese
c. Nitrogen
d. Calcium

33. Which one of the following stages of photosynthesis uses light energy directly?
a. Regeneration of ribulose diphosphate
b. Production of energy in the form of ATP
c. Reduction of carbon dioxide
d. Formation of phosphoglyceric acid

34. Which one of the following types of epithelia lines the walls of the mammalian alveoli?
a. Columnar epithelium
b. Cuboidal epithelium
c. Stratified epithelium
d. Squamous epithelium

35. Which one of the following mineral elements is not required by plants?
a. Copper
b. Iodine
c. Zinc
d. Iron

36. Which one of the following would speed up the process of diffusion?
a. Reducing the concentration gradient
b. Swallows water and absorbs salt
c. Swallows water and extrudes salts
d. Gains water by osmosis and extrudes salts

37. In order to survive in the sea, a marine bony fish
a. Loses water by osmosis and absorbs salts
b. Swallows water and absorbs salts
c. Swallows water and extrudes salts
d. Gains water by osmosis and extrudes salts.

38. Figure 2 shows growth and curves of a rat provided with milk diet at different times.

The most appropriate conclusion of the results is that
a. In rats, normal growth occurs if the milk contains essential vitamins
b. Milk stimulates growth while lack of it retards growth in rats
c. If milk is added to a milk deficient diet, then the body weight of the rats decreases further.
d. Lack of milk in the diet has no effect on the growth of rats.

39. Which of the following does not always form part of a bacterium cell?
a. Cell wall
b. Flagellum
c. Cytoplasm
d. Ribosomes

40. Which one of the following characteristics of a parasite would increase its chances of survival?
a. Being highly specific
b. Inflicting severe effects on host
c. Parasiting more than one type of host
d. Employing no vectors.

SECTION B.

41. Using a structural formula
For glycerol, and molecular $CH_3(CH_2)_nCOOH$ for a fatty acid, show the formation of a triglycide from fatty acids and glycerol.

b. What properties do lipids possess as storage food substance?

c. Outline the structural and physiological functions of lipids in living organisms.
(i) Structural
(ii) Physiological

42. Using an example, give the meaning of adaptive radiation of species.

a. State the ecological importance of adaptive radiation

b. How do adaptive radiation and homologous structures give evidence of evolution?
(i) Adaptive radiation
(ii) Homologous structures

43. Figure 3 shows growth curves of the brain, thymus gland, reproductive organs and the whole body of a human. The size attained is expressed as percentage of total gain between birth and maturity (20 years).

a. Explain the different growth rate of the brain, thymus, gland, reproductive organs and the whole body.
(i) Brain
(ii) Thymus gland
(iii) Reproductive organs
(iv) Whole body

b. What type of growth is exhibited in the figure?

44. What do you understand biological chemical control?
a. What considerations must be made before application of a biological pest control method?

b. State two ways in which chemical pest control method can upset ecosystems
(i) Suggest two reasons why pests may eventually flourish after a period of pesticide application.

c. Suggest three characteristics of a good pesticide.

45. Figure 4 shows the oxygen dissociation curves at 2.7 kpa of carbon dioxide, in three organisms: pigeon, human and lungworm that lives in muddy, water logged burrows.

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a. Explain the position of the curves for the lugworm and pigeon in reference to that for human.
(i) Lugworm
(ii) Pigeon

b. On the same graph sketch oxygen dissociation curves for the lugworm and human if both organisms were subjected to same higher carbon dioxide tension.
(i) Explain the position of each of the curves you have sketched in (b)

46. What is photophosphorylation?
a. Where in the plant cell does cyclic photophosphorylation occur?

b. Describe the process of cyclic photophosphorylation.

c. What is the importance of cyclic photophosphorylation in photosynthesis?

PAPER TWO
1. In an experiment to determine the factors affecting photosynthesis, seedlings of a plant were divided into two groups and grown under different light intensities. One group of seedlings was grown at a constant high light intensity (25 arbitrary units), and another group grown at a constant low light intensity (3 arbitrary units). When the plants were mature, their apparent rates of photosynthesis in milligrams of oxygen released per unit leaf area per hour were measured over a range of different light intensities.

Figure 1 shows the results of the experiment.

In addition, some characteristics of the two groups of plants were recorded as indicated in table 1.

Group of plants	Characteristics
Plants grown at high light intensity	Big, dark green leaves with short internodes
Plants grown at low light intensity	Small, pale yellow leaves with long internodes

a. From the graph, state the
(i) Differences in the effect of light intensity on the two groups of plants.
(ii) Similarities in the effect of light intensity on the two groups of plants.

b. Suggest explanations for the differences you have stated I (i)

c. Explain the pattern of the curve for plants grown in low light intensity

d. Explain the observed characteristics of the two groups of plants as indicated in table 1

e. Suggest why
(i) Seedlings of the same plant were used in the experiment
(ii) The rate of release of oxygen was used to measure the rate of photosynthesis

f. Name two factors that may limit the rate of photosynthesis of plants previously grown in high light intensity, if subjected to light intensity above 25 arbitrary units.

Section B

2. Describe mechanisms which promote out-breeding in monoecious plants.

a. Explain how sexual reproduction may cause variation

3. Describe the structural and the biochemical adaptations of a mammalian red blood cell for its functions

b. How does variation in pH of mammalian blood affect the ability of haemoglobin to associate with oxygen?
(i) What is physiological significance of these effects in (i)

4. What is the role of the apical meristem in root growth?
a. Describe the formation of secondary tissues in cotyledonous plants

5. Describe the trend of succession that would take place on a bare rock.

a. Outline the flow of energy in the climax community described in (5)

6. What are the qualities of a respiratory surface?

b. How is each of the following organisms adapted for efficient gaseous exchange?
(i) An insect
(ii) A terrestrial flowering plant
(iii) An amoeba

END