Candidate's Name: .....

Signature: .....

Center No.					Personal No.		

P530/1
BIOLOGY
Paper 1
JULY/AUG 2024

2 ½ hours

ASSHU ANKOLE JOINT MOCK EXAMINATIONS 2024

Uganda Advanced Certificate of Education

BIOLOGY

(THEORY)

Paper 1

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

This paper consists of sections; **A** and **B**.

Answer **all** questions in **both** sections.

Write answers to this section **A** in the boxes provided and answers to section **B** in the spaces provided.

No additional sheets of paper(s) should be inserted in this booklet.

For Examiners' Use Only			
Section		**Marks**	**Examiner's Initials**
A	1 – 14		
B	41		
	42		
	43		
	44		
	45		
	46		
Total			

SECTION A (40 marks)

1. Which event in the mitotic cell cycle ensures that daughter cells are genetically identical?
   A. During anaphase, the paired chromatids separate.
   B. After telophase, the two daughter cells contain the diploid number of chromosomes.
   C. DNA replicates to form sister chromatids.
   D. A spindle is formed.

2. The term physiological drought in plants refers to;
   A. Plants losing more water through transpiration than what they absorb through the roots
   B. Drooping of plants due to plants losing excess water by transpiration
   C. Plants growing in water – deficient soils
   D. Presence of water in a form that plants cannot readily access.

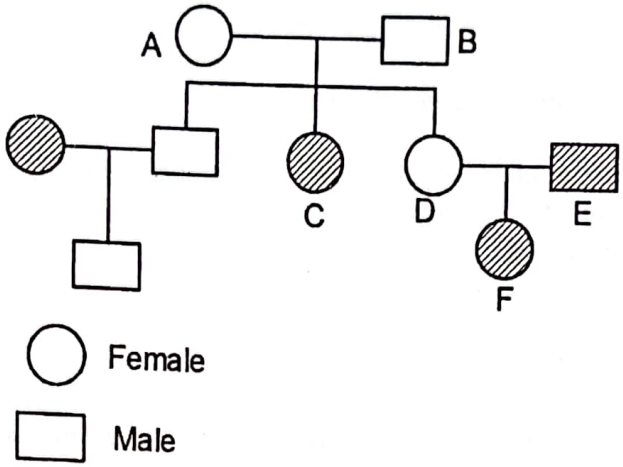
3. Which one of the following is responsible for salutatory conduction in myelinated neurons?
   A. Axon membranes
   B. Nodes of Ranvier
   C. Schwann cells
   D. Voltage – gated channel proteins

4. In dim light, rod cells in the human eye are.
   A. Depolarized
   B. Polarized
   C. Hyperpolarised
   D. Repolarised

5. A metabolic pathway that involves movement of substances between two kinds of cells is
   A. Photolysis
   B. Calvin – Benson cycle
   C. Non – cyclic photophosphorylation
   D. C4 – photosynthesis

6. A severe storm forms a new river that divides a population of mice. After many years, a drought causes the river to dry up, allowing the two populations of mice to mix. Mating between mice from the two populations does not yield any offspring. This is an example of;
   A. Hybridization
   B. Balanced polymorphism
   C. Sympatric speciation
   D. Allopatric speciation

7. The figure below is a diagram illustrating pedigree. Filled boxes or circles indicate inheritance of a biochemical disorder.



The best explanation for the inheritance of the disorder in individual F is that she received

A. Two alleles for the disorder from her father
B. Alleles for the disorder from both parents
C. An allele for the disorder only from her father
D. An allele for the disorder only from her mother.

8. Which of the following are the components found in the thin filaments of skeletal muscles?

i) Actin molecules
ii) Myosin molecules
iii) Troponin molecules
iv) Tropomyosin molecules

A. (i), (ii) and (iii)
B. (i), (ii) and (iv)
C. (i), (iii) and (iv)
D. (ii), (iii) and (iv)

9. A function of the allantois is to.

A. Fuse with the endomentrium and forms the placenta
B. Develop into the nervous system
C. Store food for use by the developing embryo
D. Store or dispose of wastes from the developing embryo.

10. Which of the following best expresses the concept of the word 'allele'?

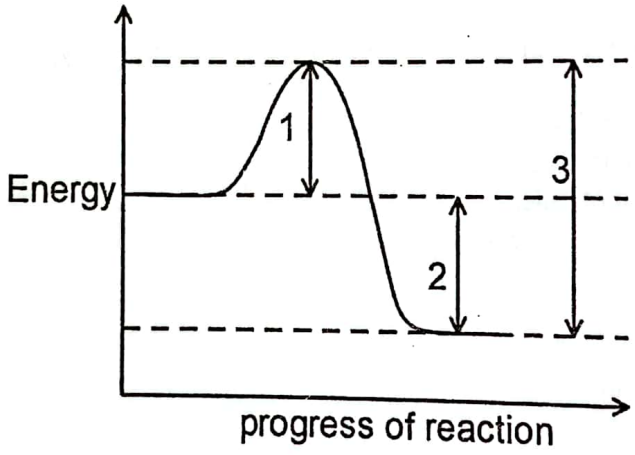
A. Genes for wrinkled and yellow
B. The expression of agene
C. Genes for wrinkled and round
D. Phenotypes

11. Induction of development of a giant larval instar in an insect is done through
    A. Injecting it with large doses of juvenile hormone
    B. Injecting it with large doses of ecdysone
    C. Decapitating the insect
    D. Surgical removal of corpus allatum gland

12. Which one of the following pairs of hormones would be most active during periods of physiological stress in plants?
    A. Ethane and auxins
    B. Cytokinins and ethene
    C. Ethene and abscisic acid
    D. Abscisic acid and gibberettins

13. The behavioral response in adult animals that enables them to recognize their own offspring shortly after giving birth is known as
    A. Insight
    B. Pavlovian conditioning
    C. Instinct
    D. Imprinting

14. The figure shows the energy changes during the progress of a chemical reaction.



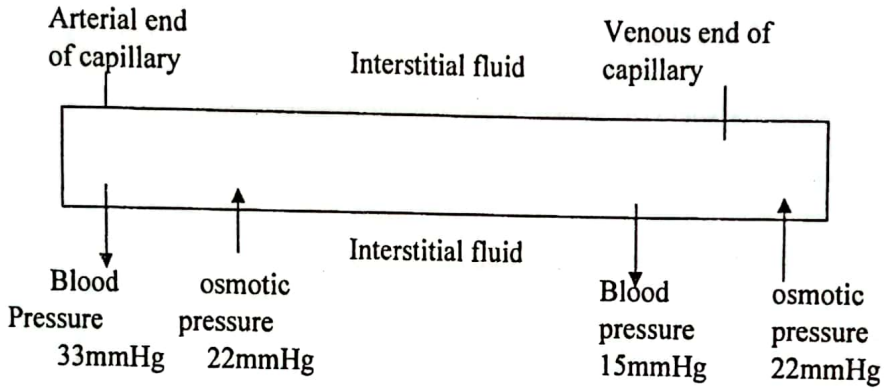
Which of the energy changes could be decreased by adding an enzyme.
    A. 1, 2 and 3
    B. 1, and 3 only
    C. 1 and 2 only
    D. 2 and 3 only

15. A characteristic common to all chordates that is lacking in all other animal groups is;
    A. The presence of three germ layers
    B. A true coelom
    C. The presence of vertebrae
    D. The appearance of pharyngeal gill slits

16. Which effect of natural selection is likely to lead to speciation?
    A. Differences between populations are increased
    B. The range of genetic variation is reduced
    C. The range of phenotypic variation is reduced
    D. Favourable alleles are maintained in the population

17. Assuming that the population is in genetic equilibrium, what are the frequencies of G and g alleles in a population in which the heterozygous (Gg) frequency is 0.50?
    A. G = 0.94; g = 0.06
    B. G = 0.25, g = 0.25
    C. G = 0.50, g = 0.50
    D. G = 0.75, g = 0.25

18. The diagram shows the movement of fluid between a capillary and the interstitial fluid



What is the net pressure that forces the fluid across the capillary wall into the interstitial fluid?
    A. 4mmHg
    B. 11mmHg
    C. 18mmHg
    D. 33mmHg

19. The primary function of progesterone in the menstrual cycle is to;
    A. Stimulate development of follicle
    B. Stimulate development of endometrium
    C. Stimulate development of corpus luteum
    D. Trigger ovulation.

20. When a lipid is combined with a phosphate group, it becomes
    A. Saturated
    B. Water soluble
    C. Amphipathic
    D. Amphoteric

21. Which one of the following is the major role of T-helper cells in cell mediated response?
A. Gradually destroy transplanted organs.
B. Helps to kill body cells infected by viruses.
C. Suppress activity of other T-cells.
D. Stimulation of B-cells to make antibodies.

22. Skin colour is an example of inheritance through.
A. Sex linkage
B. Multiple alleles
C. Polygenes
D. Epistasis.

23. Why does the absorption spectrum for chlorophyll and the action spectrum for photosynthesis coincide?
A. Photosystems I and II are activated by different wave lengths of light.
B. Wave lengths of light that are absorbed by chlorophyll trigger light capturing reactions.
C. Energy from wavelengths absorbed by carotenoids is passed down into chlorophyll.
D. The rate of photosynthesis depends on the amount of light received.

24. Production of hypertonic urine is mainly due to high levels of
A. Aldosterone
B. Vasopressin
C. Adrenaline
D. Insulin

25. The association of white egrets with herds of cattle can be described as
A. Mutualism
B. Commensalism
C. Parasitism
D. Co-evolution

26. In which of the following responses do auxins and gibberellins show synergism in their roles?
A. Fruit growth.
B. Apical dominance
C. Root growth
D. Stomatal opening

27. Which of the following is a test cross?
A. AABB x AABB
B. AaBb x AaBb
C. AaBb x AABB
D. Aabb x AaBb

28. Why are certain exotic species considered 'invasive'? They
    A. Are found in areas where they are not native
    B. Were introduced by humans often accidentally
    C. Spread aggressively and displace native species
    D. Benefit from being in a new environment.

29. Which of the following would be a result of increased carbondioxide concentration in the tissues?
    A. Increase in affinity for oxygen by haemoglobin
    B. Increase in the loading tendency of haemoglobin
    C. Lowering of affinity for oxygen by haemoglobin
    D. Shifting of oxygen dissociation curve to the left

30. The function of the acrosome in the sperm head is to
    A. Provide ATP for flagellar movements
    B. Control DNA replication in the sperm
    C. Enclose genetic material
    D. Store enzymes used for penetrating the egg during fertilization.

31. Which of the following are re-absorbed into the malpighian tubules during excretion in insects.
    A. KHU, carbondioxide and water.
    B. K^+ and Na^+ ions.
    C. $KHCO_3$, water and carbondioxide
    D. KHU, water and $KHCO_3$

32. A zygote with three copies of chromosome 21 is known to manifest symptoms of
    A. Sickle cell anaemia
    B. Klinefelter syndrome
    C. Turner's syndrome
    D. Down's syndrome.

33. Which of the following carries the code that determines the sequence of monomers in a protein?
    A. rRNA
    B. tRNA
    C. mRNA
    D. DNA polymerase

34. The main function of water in photophosphorybition is to
    A. Supply the energy required for photosynthesis
    B. Provide the necessary oxygen for the photosynthetic process.
    C. Provide electrons which are energized by light energy.
    D. Maintain the integrity of chloroplast membranes.

35. Which of the following is an anabolic reaction
    A. $CO_2 + H_2O \longrightarrow C_6H_{12}O_6 + O_2$
    B. Starch + $n(H_2O) \longrightarrow n(C_6H_{12}O_6)$
    C. $ATP + H_2O \longrightarrow ADP + Pi$
    D. Glycolysis

36. Which of the following best describes a notochord?
    A. Develop into gills in fishes
    B. Is dorsal, tubular nerve cord
    C. Extends posterior to the anus
    D. Is a flexible, supporting structure

37. An example of auto immune disease in humans is
    A. Type 1 diabetes
    B. Asthma
    C. Allergy to pollen
    D. AIDS

38. Small, nocturnal primates with large eyes adapted to seeing in the dark belong to the primate group called
    A. Prosimians
    B. Hominoids
    C. Anthropoids
    D. Marsupials

39. The outer layer of the cerebrum that is the centre of thinking is the
    A. Cerebellum
    B. Medulla oblongata
    C. Cerebral cortex.
    D. Thalamus

40. The situation in which atmospheric gases trap the son's heat and keep Earth's surface warm is called
    A. Radio active pollution
    B. Precipitation and temperature
    C. Green house effect.
    D. Ozone depletion

SECTION B (60 MARKS)

41. The table below gives some figures for metabolism of carbohydrate and lipid in a mammal.

Energy source	Metabolic energy produced/Kjg^{-1} food	Metabolic water produced/gg^{-1} food	Oxygen consumed/dm^{3}g^{-1} food
Carbohydrate	17.2	0.56	0.83
Lipid	38.9	1.07	2.02

a) (i) Using the information given in the table, state two advantages to mammals, of storing lipids rather than carbohydrates *(2 marks)*

.....

.....

.....

(ii) Suggest three other reasons why mammals might store lipids in preference to carbohydrates. *(3 marks)*

.....

.....

.....

.....

b) Suggest one possible reason why the volume of oxygen consumed varies in the oxidation of the two energy sources *(1 mark)*

.....

.....

.....

c) (i) Explain why the energy value of lipids is more than twice that of a carbohydrate *(2 marks)*

.....

.....

.....

.....

.....

(ii) Outline the biochemical processes which occur in aerobic metabolism of Lipids *(3 marks)*

.....

.....

.....

.....

.....

42. (a)(i) The toxicity of apesticide is determined by the use of an LD_{50} Test (Lethal dose 50). What is meant by the LD_{50} test *(1 mark)*

.....

.....

.....

.....

(ii) What two properties of DDT make it hazardous over the long term *(2 marks)*

.....

.....

(b) The table below shows the amount of DDT measured in parts per million (PPM) found in a variety of organisms associated with a large fresh water lake

Where DDT level was measured	DDT/PPM
Water	0.0003
Phytoplankton	0.006
Zoo plankton	0.04
Herbivorous fish	0.39
Carnivorous fish	1.8
Fish eating birds	14.3

i) Calculate the concentration factor from water herbivorous fish and fish eating birds *(2 marks)*

.....

.....

.....

.....

.....

.....

ii) What principle is illustrated by the data? *(1 mark)*

.....

(c) Briefly explain the reasons for the change in DDT levels in the different organisms *(4 marks)*

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

43. (a) Explain what are meant by the terms Cardiac output and Blood pressure as applied to mammalian circulatory systems. *(2 marks)*

.....

.....

.....

.....

.....

.....

(b) The table below shows the diameter of the lumen and rate of blood flow in a number of human blood vessels.

Vessel	Diameter of lumen	Rate of blood flow/cm^3S^{-1}
Artery	0.4cm	40 – 10
Arteriole	30µm	10 – 0.1
Capillary	8.0µm	Less than 0.1
Venule	20.0µm	Less than 0.3
Vein	0.5cm	0.3 – 5

i) Describe the general relationship between rate of blood flow and diameter of the lumen of the blood vessels. *(2 marks)*

.....

.....

.....

.....

.....

(c) (i) Explain how the diameter of a blood vessel affects blood flowing through it? *(2 marks)*

.....

.....

.....

.....

.....

.....

(ii) How does possession of elastic tissue affect flow through blood vessels?

.....

.....

.....

.....

(d) Describe two factors that control movement of fluid through capillary wall *(2 marks)*

.....

.....

.....

.....

43. (a) Explain what are meant by the terms Cardiac output and Blood pressure as applied to mammalian circulatory systems. *(2 marks)*

.....

.....

.....

.....

.....

.....

(b) The table below shows the diameter of the lumen and rate of blood flow in a number of human blood vessels.

Vessel	Diameter of lumen	Rate of blood flow/cm^3S^{-1}
Artery	0.4cm	40 – 10
Arteriole	30µm	10 – 0.1
Capillary	8.0µm	Less than 0.1
Venule	20.0µm	Less than 0.3
Vein	0.5cm	0.3 – 5

i) Describe the general relationship between rate of blood flow and diameter of the lumen of the blood vessels. *(2 marks)*

.....

.....

.....

.....

.....

(c) (i) Explain how the diameter of a blood vessel affects blood flowing through it? *(2 marks)*

.....

.....

.....

.....

.....

.....

(ii) How does possession of elastic tissue affect flow through blood vessels?

.....

.....

.....

.....

(d) Describe two factors that control movement of fluid through capillary wall *(2 marks)*

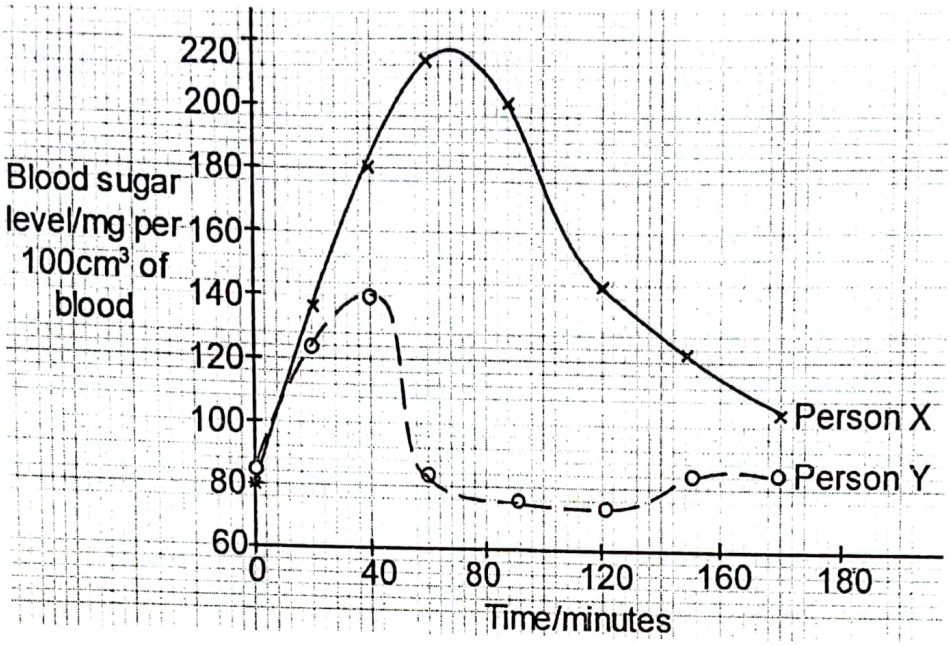
.....

.....

.....

.....

44. Two people drank a solution which contained 100g of glucose. The blood sugar level of each person was measured during, the next 3 hours and the results are shown in the graph below.



a) Comment on the changes in the level of blood sugar during the next 3 hours in person X *(3 marks)*

.....

.....

.....

.....

.....

.....

.....

b) State the differences in the effects of drinking a solution of glucose on the blood sugar levels in person X and person Y. *(3 marks)*

.....

.....

.....

.....

.....

.....

.....

.....

.....

c) Suggest explanations for the changes in blood sugar levels of persons X and Y

(4 marks)

.....

.....

.....

.....

.....

.....

.....

.....

.....

45. (a) When allele frequencies in a population remain constant over long period of time, the population is said to be in genetic equilibrium

State the conditions in order for genetic equilibrium to occur *(2 marks)*

.....

.....

.....

.....

.....

.....

(b) A plant population consists of plants with red flowers and white flowers; of which 84% are red flowered plants. Assume the red allele (R) is dominant and white allele (r) is recessive

Determine

i) Allele frequency of the white flower allele *(1 mark)*

.....

.....

.....

ii) The frequency of individuals with homozygous dominant and heterozygous condition *(2 marks)*

.....

.....

.....

.....

(c) Explain how each of the following causes changes in allele frequencies

i) Genetic drift *(3 marks)*

.....

.....

.....

.....

.....

ii) Non-random mating *(2 marks)*

.....

.....

.....

.....

46. The table below shows the distribution of ions inside and outside the axon of a typical mammalian neuron.

Iron	Concentration/mmol/dm^{-3}	
	In cytoplasm of axon	**In fluid around axon.**
Chloride (Cl^-)	4	120
Organic anions (eg proteins)	163	29
Potassium (K^+)	155	4
Sodium (Na^+)	12	145

a) Compare the distribution of positively charged and negatively charged ions with in the cytoplasm and in fluid around the axon *(3 marks)*

.....

.....

.....

.....

.....

.....

b) (i) Explain the imbalances in the concentration of organic ions and positively charged ions *(3 marks)*

.....

.....

.....

.....

.....

(ii) Explain the results of this ionic imbalances in b(i) **(2 marks)**

.....

.....

.....

.....

.....

.....

c) State two important consequences of the refractory period. *(2 marks)*

.....

.....

.....

.....

.....

.....

END