Candidate's Name: ……*Proposed Marking Guide*……

Student Number: …… Signature: ……...

P530/1
BIOLOGY
Paper 1
June 2023
2 ½ hours

Department of Biology

Uganda Advanced Certificate of Education

PRE-MOCK EXAMINATIONS 2023

BIOLOGY

Principal Subject

Paper 1

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

- *This paper consists of two sections A and B. Answer ALL questions in both sections.*
- *Write the letter corresponding to the most correct alternative in the box drawn against each question in section A.*
- *In section B, write the short essay answers in the spaces provided.*

FOR EXAMINERS' USE ONLY		
	Marks Scored	Comments
SECTION A (1-40)	*40*	
41	*1o*	
42	*1o*	
43	*1o*	
44	*1o*	
45	*1o*	
46	*1o*	
Total	*1oo*	

SECTION A (40 marks)

1. Rotation of the fish about its longitudinal axis during swimming is counteracted by;
   A. Dorsal and ventral fins
   B. Ventral and pectoral fins
   C. Pectoral and pelvic fins
   D. Pectoral and ventral fins

   A

2. Which one of the following may not be an effect of overcrowding in intraspecific competition?
   A. Failure to copulate
   B. Increased abortions
   C. Eating the young
   D. Territorial behavior

   D

3. The initial barrel shaped structure which forms during cytokinesis in plant cells is called a: ……..
   A. Cell plate
   B. Cell wall
   C. Phragmoplast
   D. Middle lamella

   C

4. Which one of the following protein channels remain open; with a net effect of increasing the value of negative charge inside the neuron?
   A. Sodium gates
   B. Potassium gates
   C. Anionic gates
   D. Chloride gates

   B

5. Which one of the following animal groups has a partially obliterated mesoderm?
   A. Annelida
   B. Platyhelminthes
   C. Nematoda
   D. Trematoda

   C

6. When root cells continue to actively transport ions into cell sap; whilst the stomata are closed due to low light intensity, the resulting loss of water from the plant will occur by;
   A. Cuticular transpiration
   B. Oozing
   C. Guttation

   C

D. Root pressure

7. Which one of the following hormones is abundant in plant cells when stomata close?
   A. Ethylene
   B. Abscisic acid
   C. Auxin
   D. Cytokinin

B

8. Inhibition of cytokinesis in cells may result in;
   A. Prevention of mitosis
   B. A large cell with a diploid nucleus
   C. A large cell with a tetraploid nucleus
   D. A large cell with a haploid nucleus

C

9. Which one of the following secretions is released together with portions of cytoplasm?
   A. Colostrum
   B. Sebum
   C. Sweat
   D. Thyroxine

A

10. In *Drosophila*, grey body is dominant over black body while long wing is dominant over vestigial wing. The genes are linked. What would be the ratio of the phenotypes of the offspring when two heterozygous grey body long winged *Drosophila* were mated?
   A. 9:3:3:1
   B. 9:3:4
   C. 3:1
   D. 9:7

C

11. A column of non-secretory cells in the sebaceous gland is chiefly made up of;
   A. Squamous epithelium
   B. Cuboidal epithelium
   C. Columnar epithelium
   D. Pseudostratified epithelium

B

12. Membranes remain fluid even if cells are subjected to temperatures approximating to freezing because membranes contain;
   A. cholesterol and saturated fatty acids
   B. cholesterol and unsaturated fatty acids
   C. cholesterol and proteins
   D. cholesterol and alkyl chains.

B

13. Which one of the following secretions is produced by the crypts of Lieberkühn?
A. Pancreatic juice
B. Gastric lipase
C. Succus intericus
D. Bile

C

14. Carotenoids and xanthophylls are common photosynthetic pigments found in plastids of terrestrial plants. Which one of the following functions is exclusive to carotenoids?
A. Absorption of extra sunlight
B. Uptake of free radicals in order to stabilize chlorophylls.
C. Increasing absorptive efficiency of chlorophylls
D. Reflection of non-usable wavelengths of light.

B

15. The following are functions of the ray initials apart from;
A. Deposition of tannins
B. Radial transport of water and food
C. Formation of new vascular tissue
D. Formation of new xylem parenchyma

C

16. The hardening of blood vessels resulting in malfunctioning of the circulatory system is due to accumulation of;
A. cholesterol
B. Smoke and tar
C. Clots
D. Toxins

A

17. Which one of the following features of sponges makes them fit neatly into the animal kingdom?
A. Multi cellularity
B. Ability to recognize self and non-self-cells
C. Powers of locomotion
D. Tissues

B

18. Which one of the following is the ultimate effect of cultivating invasive species?
A. Rapid growth of aliens
B. Outcompeting the indigenous species
C. Modifying the ecological set up
D. Production of toxins

B

19. The following can be used to explain why sexual reproduction causes variation except;
A. Crossing over
B. Independent assortment
C. Random fusion of gametes
D. Segregation of alleles

D

20. At which stage of meiosis does the formation of chiasma take place?
A. Leptotene
B. Zygotene
C. Pachytene
D. Diakinesis

C

21. Impulses leading to contraction of the bronchial tree during inspiration are transmitted via the;
A. Vagus nerve
B. Intercostal nerve
C. Carotid bodies
D. Phrenic nerve

B

22. Dilation of superficial blood vessels of the skin is an adaptation to;
A. Increase heat loss by conduction and evaporation
B. Increase heat loss by conduction and radiation
C. Increase heat gain by conduction and evaporation
D. Reduce heat loss by conduction and radiation

B

23. In the lifecycle of a flowering plant, gametes are produced by;
A. Mitosis in the gametophytes
B. Meiosis in the sporophyte
C. Mitosis in the sporophyte
D. Meiosis in the gametophyte

A

24. The secondary immune response consists of a higher population of lymphocytes. This is mainly because;
A. The rate of activation of T4 cells is higher
B. More cytokines are released into the blood stream
C. Memory cells are released during the primary response
D. More antigens are usually introduced during the second invasion.

C

25. Figure 1 shows a cell obtained from a plant tissue. Suggest a plant organ from which the cell may have been obtained.

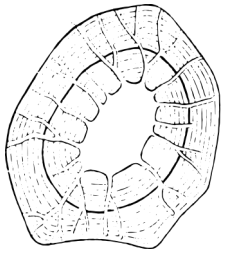


Figure 1

A. Endosperm of seeds
B. Leaf petiole
C. Testa of seeds
D. Pericyle

C

26. The following are patterns of lignification in metaxylem except;
A. Scalariform
B. Pitted
C. Reticulate
D. Annular

D

27. The following are all secondary proteins apart from;
A. Myoglobin
B. Tropocollagen
C. Fibroin
D. Keratin

A

28. The best explanation for the abundance of C3 plants in high altitude areas is to;
A. Maximize photosynthesis
B. Reduce water loss
C. Minimize photorespiration
D. Regenerate carbon dioxide

C

29. The motor proteins used to move cilia and flagella in cells are;
A. Tubulin and fibrin
B. Dynein and kinesin
C. Kinesin and motorin
D. Elastin and collagen

B

30. The micronucleus of a typical protozoan is exclusively for;
A. Sexual reproduction
B. Asexual reproduction
C. Controlling cell division
D. Storing DNA

C

31. Which one of the following would be the phenotypes of the offspring produced from a mating between a woman of blood group O and a man homozygous for blood group A.
A. A only
B. O only
C. A and O
D. A and AB

A

32. The best explanation for the increased sensitivity of a cat than a frog is difference in;
A. Diameter of axons
B. Myelinated axons
C. Body temperature
D. Size of the brain

C

33. Which one of the following best describes the off position of actin protein?
A. Troponin dwells at the myosin binding site of F-actin
B. Tropomyosin dwells at the myosin binding site of G- actin
C. Troponin dwells at the myosin binding site of G-actin
D. Tropomyosin dwells at the myosin binding site of F-actin

D

34. The choroid layer of the eye is important for;
A. Maintaining shape of the eye ball
B. Attachment of rectus and oblique muscles of the eye sockets
C. Minimizing back reflection of light in the eye
D. Minimizing back refraction of in the eye.

C

35. The final transformation of proteins made by cell occurs in the;
A. Smooth Endoplasmic reticulum
B. Rough endoplasmic reticulum
C. Golgi apparatus
D. Lysosomes

C

36. The following consist of fixed action patterns except;
A. Biological rhythms
B. Courtship
C. Mating
D. Imprinting

D

37. Dehydrogenation of phosphorylated glucose produces;
A. Pyruvic acid and ADP
B. Pyruvic acid and ATP
C. Glycerate-3- phosphate and ATP
D. Glycerate-3- Phosphate and ADP

B

38. Bacteria of the genus *Nitrobacter* have;
A. An organic source of carbon and a chemical source of energy
B. An organic source of carbon and photo source of energy
C. An inorganic source of carbon and photo source of energy
D. An inorganic source of energy and a chemical source of energy.

D

39. The movement of sodium ions into the axoplasm during excitation of a neuron occurs by;
A. Facilitated diffusion
B. Simple diffusion
C. Active transport
D. Endocytosis

B

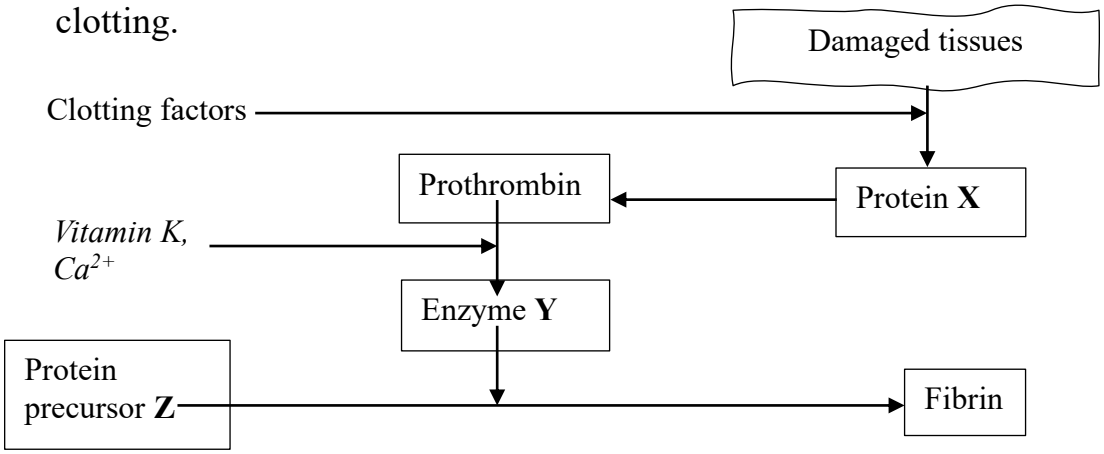
40. A cock deprived of a hen after being aroused sexually will display to a bucket or stone. This is an example of;
A. Releasing stimulus
B. Displacement activity
C. Vacuum activity
D. Motivational stimuli

C

SECTION B (60 marks)

Write the answers to these questions in spaces provided.

41. Figure 1 below shows the scheme summarizing the process of blood clotting.



a. Identify;

i. Protein X: Thromboplastin / thrombokinase ✓ (*1 mark*)

ii. Enzyme Y: Thrombin✓ (*1 mark*)

iii. Protein precursor Z: Fibrinogen✓ (*1 mark*)

b. Describe the effect of the enzyme Y on protein precursor Z. (*2 marks*)

Enzyme Y catalyzes conversion of globular (soluble) fibrinogen✓ into fibers (threads) of insoluble fibrin✓

c. In some individuals, one of the essential blood clotting factors is not synthesized. Explain why this condition is common in human males even if it is recessive. (*5 marks*)

The mutant allele is carried on the X- chromosome hence sex liked✓. In heterogametic sex; ✓ the X chromosomes which carries the allele does not have any homologous portion on✓ the Y- chromosome. ✓ Hence the trait appears in males regardless of its being recessive. ✓

42.

a. Explain the contribution of meiosis to genetic variation (*5 marks*)

Crossing over: During prophase I, homologous chromosomes in a bivalent ✓ exchange portions of genetic material between non-sister chromatids. ✓This accounts for gene reshuffling.

Independent assortment: In prophase I, the alignment of bivalents and their subsequent migration during anaphase I are both random. ✓ In metaphase II, the alignment along the equator and separation during anaphase II✓ determines the direction in which they move. This results in a great deal of allele combinations in gametes. ✓

b. In magpie moths, the homogametic sex is homozygous for color of wings. The genes are carried on sex chromosomes. Black color is dominant over yellow color. Determine the heterogametic sex in magpie moths if a cross between black male and a yellow female gives a ratio of **1yellow male**: **1black female**. (*5 marks*)

Let X and Y be the sex chromosomes

Let B represent the allele for black color of wings ✓

Let b represent the allele for yellow color of wings

Parental phenotypes: Black male X Yellow female

Genotypes (2n) X^BY X^bX^b ✓

Meiosis

Gametes (n) ✓ X^B Y X^b X^b

Random fertilization:

Possible Genotypes(n) X^BX^b X^BX^b X^bY. X^bY ✓

Phenotypes: 2 black females: 2 yellow males

Simplified ratio: 1 black female: 1 yellow male ✓

The heterogametic sex is a male

43. Ethologists have categorized animal behavioral patterns into instincts and learning.

a. Distinguish between **instinctive** and **learned** behavior (*3 marks*)

Instinctive behavior	Learned behavior
• Inherited ✓	• Acquired
• Unintelligent ✓	• Intelligent
• Similar throughout the species (species specific) ✓	• Variable among members of a species
• Sequential ✓	• Non sequential

b. Outline the factors which determine the ability of an animal to learn by trial and error. (*3 marks*)

- The speed at which it ceases to make errors ✓
- The length of time it can remember without repeated trials ✓
- The complexity of the situation to which it will respond ✓

c. Explain the role of hormones in animal behavior. (*4 marks*)

- Reproductive hormones such as oestrogen and oestrogen control gamete formation and courtship. ✓
- Adrenalin stimulates a rise in metabolic rate ✓resulting from stress or anxiety hence controlling agonistic behavior. ✓This results in increase in heartbeat, dilation of pupils, erection of hairs in response to stress.
- Serotonin hormone produced in the nervous system stimulates sleep. This withdrawal response is behavioral and accompanies stress. ✓

44. The table below shows the percentage concentrations of a selection of substances in glomerular filtrate and urine of a mammal.

Substance	Percentage concentration in	
	Glomerular filtrate	Urine
Water	90	95
Protein	0	0
Sodium ions	0.3	0.35
Chloride ions	0.37	0.6
Glucose	0.1	0
Urea	0.03	2.0

a. Explain the differences in the percentage concentration of the following substances in glomerular filtrate and urine.

i. Protein (*2 marks*)

Proteins are large molecules. ✓ They are retained in the filtration barrier in the glomerulus. ✓They don't pass into glomerular filtrate hence cannot be found in urine.

ii. Urea

The concentration of urea increased very rapidly✓ in urine because much urea was secreted into the renal fluid in the distal convoluted tubule and collecting ducts✓

(*2 marks*)

b. Describe the role of hormones in the varying the concentration of;

i. Water in urine (*4 marks*)

When the amount of water in blood is too low, ✓ Anti Diuretic Hormone (ADH) is secreted into blood✓. This hormone stimulates reabsorption of water from glomerular filtrate into blood. ✓The hormone is withdrawn from blood circulation when levels of water ae restored to norm. ✓

d. Suggest with reason(s) the likely water potential of the environment of the mammal in question. (*2 marks*)

The animal lives in an environment of low (more negative) water potential. ✓

Reason. It uses urea as an excretory waste whereby it conserves water by dissolving urea in a relatively a smaller amount of water to be excreted. ✓

44. Figure 3 shows results of Engelmann's experiment on the distribution of bacteria of the genus *Pseudomonas* on a filamentous alga *Spirogyra*.

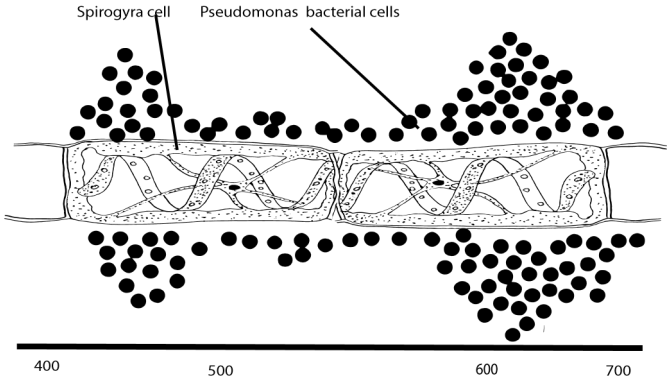


Figure 3

a. Identify the factor in the bacterial environment which determines their distribution. (*1 mark*)

Concentration of oxygen ✓

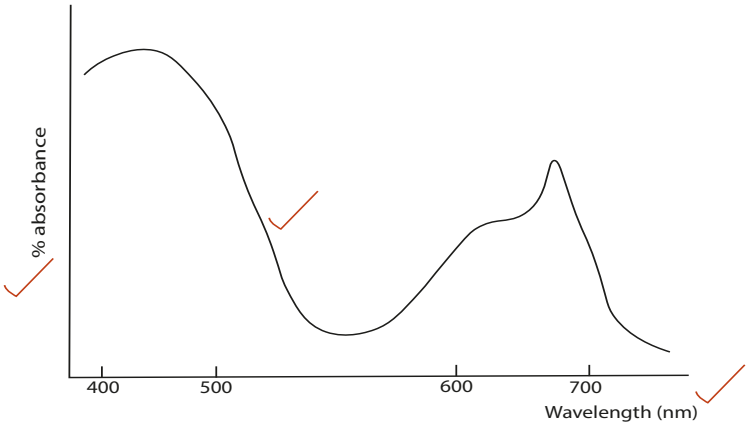
b. Suggest why the light used was made to pass through the prism. (*2 marks*)

The prism disperses light; ✓ splitting white light into specific colors according to wavelength. ✓

c. Explain the differences in distribution of Pseudomonas bacteria along the filament of Spirogyra. (*4 marks*)

Many of the bacterial cells were clumped in the region which received light of wavelength 400-500nm and 600-700nm✓ whereas few bacteria were found in the region of the filament receiving 500-600nm of light. ✓ The regions with the greatest population of aerobic *Pseudomonas* correspond to parts of the visible spectrum where red and blue light✓ are found. These are the most effective wavelengths for photosynthesis. ✓ Much oxygen was produced there hence attracting many aerobic bacteria. Regions with less bacteria received light of wavelength which aren't absorbed but reflected by photosynthetic pigments in bacteria. ✓

d. From figure 3, sketch a graph to show the absorption spectrum of the photosynthetic pigment found in Spirogyra. (*3 marks*)



45. Immune systems in mammals can be either humoral or cell mediated.

a. Distinguish between **cell mediated** and **humoral** immune responses.

Cell mediated responses		Humoral responses
Involves T lymphocytes	√	Involves B- lymphocytes
Graft rejection occurs	√	Not involved
Main destruction pathway is phagocytosis	√	Main destruction pathway uses body fluids
No antibodies produced	√	Antibodies are produced
Mitosis produces T4, T8 lymphocytes	√	Mitosis produces B memory and plasma (effector) cells

(*3 marks*)

b. What do you understand by the following statements?

i. the adaptive immune system is self-regulating (*4 marks*)

Plasma cells destroy antigens by agglutination, opsonization, lysis and neutralization. √ While this occurs, cytotoxic T-lymphocytes destroy cells affected by viruses. √The rate at which these events occur can be down or upregulated by Chemokines, √and T-suppressor cells. √

ii. the immune system is highly specific. (*3 marks*)

A specific antibody is synthesized in response to a particular antigen in plasma. √

The antibody binding site only attach antigen particles which have shapes complementary to the binding site. √ Therefore, there is a considerable timelapse between exposure and attack√ because antigen particles are processed first before they are destroyed.

END

Never Give Up