

KAMSSA 2022 SECTION A: (40 MARKS)

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

- Which one of the following statements is not true of a torus?

A. Is made up of lignified materials

B. Is attached to the secondary cell wall

C. It acts as a valve in some plants

D. Is absent in animals

B
- In a human with a non-functional pancreas digestion of starch in the ileum would;

A. Be possible because of suitable pH due to bile.

B. Not occur for absence of enzymes.

C. Would be possible because small intestine mucosa contains the necessary enzymes.

D. Would not occur because of acidic pH in chyme.

B
- Which of the following is true about sex-linked characters in humans?

A. Females never suffer from the traits.

B. Fathers do not pass on the traits to their sons.

C. Males are either carriers or sufferers.

D. Females are either normal or carriers.

B

- The similarities of the skeletal structures of moles, monkeys and whales lead to the conclusion that they:

A. Descend from a common ancestor

B. Belong to the same class

C. Evolved by convergent evolution

D. Originate from the same environment

A

- Table 1 shows changes in the heart rate and volume of blood pumped per beat of an adult man while resting and during vigorous exercise.

Table 1

Adult man	Heart beat in beats per minute	Volume of blood pumped per beat in cm ³
Resting	50	50
Exercising	200	75

By how many times was the volume of blood passing through the heart per minute increased during exercise?

- A. 1.5 times

B. 3 times

C. 6 times

D. 4 times

A
- An absolute limit imposed by the environment on population increase is called

A. Biotic potential

B. Mortality

C. Carrying capacity

D. Environmental resistance

C
 - Which one of the following can be described as instinctive behavior?

A. A bird building a nest

B. A man shouting after electric shock

C. A dog responding to a routine meal bell

D. A dragon fly capturing prey.

D

8. During heat of the day, control of stomatal movements to reduce excessive water loss is due to

- A. Active accumulation of mineral ions in the guard cells.
- B. Synthesis of abscisic acid.
- C. Inter-conversion of glucose to starch in the guard cells.
- D. Synthesis of glucose during photosynthesis

- C. Cilia
- D. Columnar epithelium

- C. Dorsal hollow nerve tube
- D. Post anal tail

B

9. The actual diameter of a cell organelle which measures 0.4mm at magnification of X400 is

- A. 0.1µm
- B. 0.01 µm
- C. 1.0 µm
- D. 0.001 µm

C

10. The goblet cells are normally supported by:

- A. Squamous epithelium
- B. Stratified epithelium

D

11. Chordates have the following characteristics except:

- A. Dorsal notochord extending into the head
- B. Gill clefts

A

12. Some bacteria when infected with microphages, may make a particular amino acid they could not make before. This is due to

- A. Transformation
- B. Mutation
- C. Transduction
- D. Conversion

C

13. Centrioles are short cylinders with a pattern of microtubule triplet. The pattern may be described as:

- A. 9+3
- B. 9+2
- C. 9+0
- D. 9+4

C

14. Which one of the following pairs of characteristics are both for cnidarians?

- A. Body is radially symmetrical and triploblastic
- B. Body is bilaterally symmetrical and has stinging cells
- C. Body is bilaterally symmetrical and they exhibit polymorphism as polyp and medusa
- D. Body lacks mesoderm and is diploblastic.

D

15. Which one of the following is not a characteristic of an epiphyte?

- A. Its roots collect nutrients from dripping water
- B. Its roots are on the outside the body of the supporting tree.

D

- C. It competes for light
- D. It cannot produce its own food

16. Into which one of the following is pyruvate produced in glycolysis converted, before entering the tricarboxylic acid cycle?

- A. Acetyl coenzyme A
- B. Coenzyme A
- C. Ethanol
- D. NADH

A

17. A desert mammal's lower lethal temperature is higher than that of a mammal living in cold regions because a desert mammal has:

- A. Small extremities
- B. Poor insulation mechanisms
- C. Thick fur
- D. A small surface area to volume ratio

B

18. The table below shows a system of two cells separated by a semi-permeable membrane.

Cell X	Cell Y
$\Psi_s = -700 \text{ kPa}$ $\Psi_p = 500 \text{ kPa}$ a	$\Psi_s = -900 \text{ kPa}$ $\Psi_p = 400 \text{ kPa}$ a

Which one of the following statements is correct about the movement of water in the system?

- A. No water moves out of both cells X and Y
- B. There is net movement of water from cell Y to cell X
- C. There is no net movement of water between the cells.
- D. There is net movement of water from cell X to cell Y

D

19. The primary meristematic tissue in plants that gives rise to the cortex is the

- A. Protoxylem
- B. Protoderm
- C. Procambium
- D. Ground meristem

D

20. Tension in skeletal muscles does not normally change immediately on receiving a stimulus mainly because

- A. Action potential delays to be formed
- B. Some time is taken for calcium ions to be released
- C. ATP has to first be synthesized from ADP
- D. Actin filaments have to first be moved apart.

B

21. A young plant cell whose middle lamella and cell wall were observed to be malformed lacks some materials most likely has malfunctioning:

- A. Chloroplasts
- B. Golgi body
- C. Ribosomes
- D. Endoplasmic reticulum

B

22. An individual whose heart beat remained at 71 beats per minute during a strenuous exercise collapsed: It can be concluded that such an individual had a malfunctioning:

- A. Sinoatrial node
- B. Hindbrain
- C. Atrio-ventricular node
- D. Intercalated discs

B

23. The reason that contributes to the survival of organisms which live at the bottom of fresh water lakes is;

- A. Cooling water below a certain temperature increases its volume
- B. Freezing water increases metabolism of bottom living organisms
- C. Ice is denser than water
- D. Water has high latent heat of vapourisation

A

24. The following results were obtained from selfing of F₁ generation of pure breeding round, yellow seeded plants with that of, pure breeding wrinkled, and green seeded plants.

Dominant traits	Recessive traits	Total number of F ₂ offspring
Round seeds Yellow seeds	Wrinkled seed Green seeds	937

C

What would be the actual number of F₂ offspring with wrinkled yellow seeds? A. 527 B. 234 C. 176 D. 703

25. Curare is known to block nicotine receptors on neuromuscular junction. Which one of the following explains the fact that it is applied during surgical operations? It

- A. Reduces blood flow in the body
- B. Relaxes the muscles
- C. Causes muscle contraction
- D. Enhances effects of acetyl choline

B

26. In the gastric glands, the digestive enzymes and hydrochloric acid are produced by the following cells respectively

- A. Kupffer cells and Oxyntic cells
- B. Kupffer cells and Peptic cells

- C. Oxyntic cells and Peptic cells
- D. Peptic cells and Oxyntic cells

D

27. In estimating the population of an area of 1000m^2 a 1m^2 quadrat was thrown 50 times and the total number of weeds counted were 60. What was the estimated population of the weed?

- A. 20
- B. 300

- C. 833
- D. 1,200

D

28. Young human babies tend to grasp any solid or rod-like object presented into palms of their hands. This behavior is caused by:

- A. Imprinting
- B. Operant conditioning

- C. Classical conditioning
- D. Fixed action patterns

D

29. Nitrogen is often a limiting nutrient in many ecosystems because:

- A. There is much less nitrogen in the atmosphere than carbon
- B. Elementary nitrogen is rapidly used by most organism
- C. Nitrogen availability is being reduced by pollution due to fertilizer use
- D. Most organisms cannot use nitrogen in its elemental form

D

30. Which of the following terms best describes the resting condition produced across a cell membrane of Giant axon?

- A. Polarized
- B. Depolarized
- C. Neutral
- D. Discharged

A

31. Which one of the following cells is the most valuable to HIV?

- A. T- Killer cells
- B. T-Suppressor cells
- C. T- Helper cells
- D. Memory cells

C

32. Bryophytes and pteridophytes cannot fully exploit the terrestrials habitats because they

- A. Lack roots
- B. Are covered by a thick cuticle
- C. Lack well developed vascular system
- D. Depend on water for fertilization

D

33. Which one of the following does not contribute to the short reaction time in an insect?

- A. Large coverage of the head by the compound eyes
- B. Rapid impulse transmission
- C. High flicker fusion frequency
- D. Many closely packed ommatidia

D

34. The volume and surface area of four animals A, B, C and D are shown in the following table: Which of the organisms would most need a specialized respiratory system?

Animals	Volume cm ³	Surface Area cm ²
A	1	6
B	8	24
C	64	96
D	64	28

A

35. Which one of the following ecological effects may not be caused by deforestation?

- A. Species extinction

D

- B. Reduction in soil fertility
- C. Flooding and landslides
- D. Acid rain

36. A plant has 12 chromosomes in each of its pollen grains. What would be the number of chromosomes in leaves of its offspring formed by autopolyploidy?

- A. 24
- B. 96
- C. 48
- D. 36

C

37. Which one of the following events is both true and correctly matched with the effect it causes in the process of skeletal muscle contraction?

	Event	Effect
A	Actin filaments slide past myosin	H zone elongates
B	Tropomyosin combines with calcium ions	Binding sites are exposed
C	Actin filaments overlap each other	Light band shortens
D	Troponin combines with calcium ions	Tropomyosin changes shape

38. Marine cartilaginous fish solve their osmoregulatory problems by:

- A. Swallowing sea water
- B. Actively extruding salts
- C. Retaining urea in their bodies
- D. Excreting trimethylamine

C

C

SECTION B (60 MARKS)

41.(a) What is meant by **crossing over**? (03marks)

- This refers to a process by which the non-sister chromatids of homologous chromosomes break and exchange their genetic material. it occurs at the chiasma during pachytene of prophase I and brings about genetic variation in gametes
- (b) What is the effect of crossing over in sexually reproducing populations? (02marks)
- Exchange of genetic material between non-sister chromatids of the maternal and paternal homologous chromosomes brings about genetic variations among gametes and off springs of the subsequent generation

(c) Explain why a cross between a horse of 64 chromosomes and a donkey of 62 chromosomes is sterile. (05 marks)

- The gametes of the horse contain 32 chromosomes while the gametes of the donkey contain 31 chromosomes after meiosis. On fertilization, all chromosomes move into one cell since they are non-homologous and due to non-disjunction during meiosis, resulting into a sterile off spring, the mule with an odd number of chromosomes, 63.

42. Doctors measured the thickness of the walls of three blood vessels in a large group of people.

The doctors also observed great variations in the thickness of the aorta during each cardiac cycle. Their results are given in the table below.

Name of vessel	Mean wall thickness
Aorta	5.7
Pulmonary artery	1.0
Pulmonary vein	0.5

(a) Explain the difference in thickness between the pulmonary artery and pulmonary vein. (03 marks)

- The pulmonary artery carries blood at a higher pressure and pulse rate due to the pumping action of the heart and narrower lumen. This requires a thicker wall to sustain such pressure while the pulmonary vein carries blood at a lower pressure from the lungs and has a wider lumen that does not resist pressure; instead, it contains valves at regular intervals to prevent back flow of blood

(b) Explain the great variations in the thickness of the aorta during each cardiac cycle. (04 marks)

- The aorta is the largest artery in the body that transports blood to other arteries from the heart.
- During ventricular systole, blood at high pressure is pumped into the aorta through the aortic valve which then closes at the end of this systolic phase. This high pressure tends to increase the diameter of the lumen and hence the wall; during ventricular diastole, pressure in the aorta tends to reduce thereby reducing the diameter of the lumen and wall

(c) List three ways by which pressure gradients that aid blood flow in human blood vessels are produced. (03 marks)

- hydrostatic pressure of the blood against the walls of the blood vessels especially in arteries
 - cardiac output
 - heart rate
 - blood volume
 - diameter of blood vessel
 - elasticity of blood vessels
- (any three)

43. (a) What is meant by respiratory quotient? (02 marks)

- This is the ratio of the volume of carbon dioxide produced to the volume of oxygen used in respiration during the same period of time.
- It is given by volume of carbon dioxide produced / volume of oxygen taken in

(b) For each of the following respiratory quotient values in a green plant, state the type of respiratory substrate being used and the condition in which the process occurs. (06 marks)

Respiratory quotient	Respiratory substrate	Condition in which it occurs
1.0	Carbohydrate such as glucose	During Aerobic respiration
0.7	lipids	During long period of starvation (lipogenolysis)
0.5	proteins	Short periods of starvation when glucose is depleted (gluconeogenesis)

(d) Under what circumstances would you expect a respiratory quotient higher than 1.4. (02 marks)

- Occurs in germinating seeds when the testa is removed due to rapid entry of oxygen into the seed but when some anaerobic respiration still occurs

44. (a) Explain how the following adaptations might assist in homeostasis.

(i) The thick fur in an arctic mammal (02 marks)

- Thick fur traps air within it. This convective current trap heat lost from the body and prevents formation of temperature gradient between the body and the surrounding cold environment
- Thick fur prevents direct contact of snow and the skin which could accelerate heat transfer from the body to the surrounding

(ii) Elongated loop of Henle in a desert mammal (02 marks)

- Long loop of Henle creates a large surface area for reabsorption of water from glomerular filtrate in the renal medulla hence preventing excessive deviation in tonicity of blood
- From the ascending limb of loop of Henle, NaCl prevents excessive loss of these salts through urine thereby maintaining a relatively constant

(b) Giving an example in each case; describe how organisms other than mammals adapt to daily and seasonal changes in temperature.

(i) Daily changes (03 marks)

- Reptiles such as lizards bask under the sun to warm up during colder temperatures
- Reptiles such as crocodiles switch between water and land as temperature fluctuates
- Feeding during morning hours and evening hours when temperatures are relatively lower.
- Plants carry out transpiration during hot temperatures for evaporative cooling
- Thermal gaping when temperatures are higher
- Salivation over the neck in turtles

(ii) Seasonal changes (03 marks)

- Plants easily lose old leaves during winter period to minimize loss of heat
- Production of spores in bacteria and seeds in plants that are resistant to extreme coldness
- Aestivation in organisms such as lung fish during extreme coldness to minimize heat loss

45.(a) State two locations of the ciliated epithelium in the body of mammals and the function it plays there. (04 marks)

Location	Function
----------	----------

Columnar cells of trachea	Propel mucus containing foreign particles towards the pharynx
Lining of fallopian tubes in	Propel the ovum towards the site of fertilization

(b) Give three structural differences between epidermis of the leaf of a dicotyledonous plant and the epidermis of a mammal. **(03 marks)**

Leaf epidermis	Epidermis of a mammal
Cells surrounded by cellulose cell wall	No cellulose cell wall material
Intercellular spaces may be present	No intercellular air spaces
Epidermal cells are usually rectangular in shape	Epidermal cells are usually flattened towards the surface

(c) How is aerenchyma tissue related to its major function? **(03 marks)**

- Presence of large air spaces to provide buoyancy
- Presence of air spaces also facilitates oxygen transport in submerged roots
- Contains lacunae that may extend long distance between endodermal cell of roots or root cells and stem cells
- Thin walled to facilitate gaseous exchange

46. The growth rate of aerobic heterotrophic bacteria was measured after inoculating some cells

into a sterile nutrient broth at 26°C. 1 cm³ samples were withdrawn with a pasture pipette at various times to determine the number of living cells in the samples. The results are shown in the table below.

Time in minutes	Number of cells in millions per cm ³
0	11
5	11
10	60
15	422
20	470
25	480
30	260
35	70

(a) Calculate the maximum rate of :

(i) Decrease in the population

(02 marks)

Using change in population / change in time

$$(260-480)/(30-25) = -44$$

(ii) Increase in population **(02 marks)**

$$(60-11)/(10-5) = 72.4$$

(b) Explain how the results would have varied if:

(i) The culture had been maintained in pure nitrogen instead of atmospheric air. **(01**

mark)

The bacterial cells would die or sporulate and become dormant. This because, the bacterial strain is aerobic and there fore can not survive without oxygen-rich environment

(ii) The culture had been maintained at 5⁰C instead of 26⁰C (02 marks)

- The population of the bacteria would increase but at a gradual rate. This is due to the low enzyme activity since temperatures below the optimum inactivate enzymes**

(iii) Another micro-organism having the same nutrient requirement had also been introduced in the medium. (03 marks)

- There would be competition for the available nutrients in the medium between the bacteria and the introduced.**
- This would result in a sharp decrease in the population of the species that cannot compete favourably.**
- Also the there would be production of more metabolic wastes in which situation, the species that can not tolerate high toxicity of these wastes will be out competed.**

END