SECTION A: (40 MARKS)

1. The table gives the tRNA anticodons for three amino acids.

Amino acid	Base sequence anticodon on tRNA
Mchionine	UAC
Valine	CAA
Arginine	GCU

What is the base sequence on part of a DNA strand which could code for the tripeptide Methionine –Valine-Arginine?

A. ATG GTT CGA
B. AUG GUU CGA
C. TAC CAA GUT
D. UAC CAA GCU

2. The competitive exclusion principle implies that co-existing species

A. cannot feed on the same food.
B. cannot be closely related
C. cannot be of same size
D. may not occupy the same niche.

3. The diagram below show two adjacent cells and the values of the value of their φ_s and φ_p are given in Kpa

Cell A	Cell B
φ_S = 1600 φ_P = 800	φ_S = 2200 φ_P = 1000

Which cell is hypertonic in terms of water potential?

A. Cell A $\varphi_w = 2400kp$
B. Cell B $\varphi_w = 3200kpa$
C. Cell A $\varphi_w = -800kpa$
D. Cell B $\varphi_w = -1200kpa$

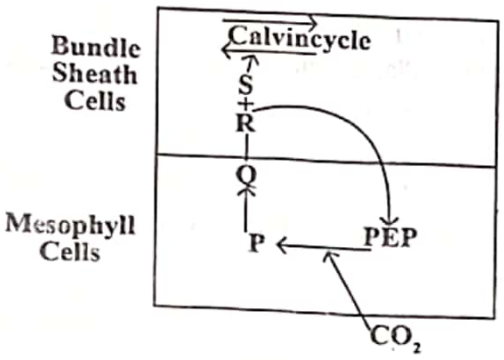
4. A quadrant measuring 25cm × 25cm was used to measure the population abundance of barnacles on a rock shore. Data was collected from 10 randomly placed quadrants.

Quadrant	1	2	3	4	5	6	7	8	9	10
No of barnacles	0	4	5	2	9	0	10	8	2	10

Calculate the population size of barnacles in a study area of $1m^2$.

A. 20.4
B. 40
C. 200
D. 80

5. The diagram below shows photosynthesis in C_4 plants.



What do products ***P, Q, R*** and ***S*** represent?

A. OAA, Malate, Pyruvate, Co_2.
B. OAA, Co_2, Pyruvate, Malate.
C. Malate, Co_2, Pyruvate, OAA.
D. OAA, Malate Co_2, Pyruvate.

6. Which of the following statements are true about the casparian strip?

(i) It covers the whole endodermic cell
(ii) It consists of suberin which is impermeable to water
(iii) It is a thickening strip of the endodermis cell.
(iv) It ensures that water crosses the root through the apoplast only to xylem.

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

7. The population of rodents in an ecosystem was estimated to be 400 using Lincoln index. In the time between the first and second captures, large numbers of rodents were born and view few died. How might this have affected the population estimate?

A. The population estimate was wrong because the method used is unsuitable for motile rodents.
B. The population estimate is correct because the newly- born rodents are incapable of reproducing.
C. The population is less than 400 because the birth rate exceeds the death rate.
D. The population is more than 400 because birth rate exceeds death rate.

8. The relationship between gross primary productivity (GPP), net primary productivity (NPP) and heat loss through respiration (R) can be represented by the equation:

A. GPP = NPP × R
B. GPP = NPP – R
C. NPP = GPP + R
D. NPP = GPP – R

9. Which phylum comprises of acoelomate, bilaterally symmetrical, triploblastic organisms?

A. Annelid
B. Nematoda
C. Cnidaria
D. Platyhelminthes

10. The quaternary structure of a protein is the

A. linear sequence of amino acids in a polypeptide chain.
B. linkage of two or more polypeptide chains to form a single function molecule
C. folding and coiling of a polypeptide chain.
D. regular arrangement of a polypeptide chain.

11. Which of the following is **not** true about both the blood circulatory system and lymphatic systems in mammals?

A. Excretory products
B. Plasma proteins
C. Leucocytes
D. Digested food

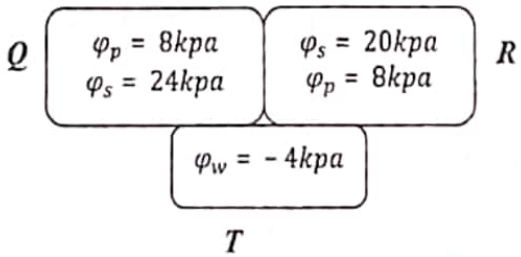
12. Which one of the following may **not** always form part of a bacterial cell?

A. Cell wall
B. Ribosome
C. Flagellum
D. Cytoplasm

13. A person's blood group is type A if his/ her;

A. red blood cells carry only B antigen
B. blood plasma contains only antibody b
C. blood plasma contains only A antigen
D. blood plasma contains neither antibody a nor b.

14. The φ_w, φ_p and φ_s of three adjacent cells ***T, Q*** and ***R*** are shown in figure below.



The cells that experience the least and the highest influx of water respectively are?

A. ***R*** and ***Q***
B. ***T*** and ***R***
C. ***T*** and ***Q***
D. ***Q*** and ***T***

15. Net primary productivity in C_4 plants is higher than that in C_3 plants because

A. C_4 plants have a higher turn over
B. photorespiration occurs in C_3 plants
C. rate of respiration is higher in C_4 plants
D. energy accumulates quickly in C_4 plants

16. The unwinding of DNA double helix during transcription requires an enzyme

A. DNA Li gase
B. DNA polymerase
C. RNA polymerase
D. DNA Helicase

17. In HIV the role of the enzyme *Reverse transcriptase* is to?

A. make DNA from RNA
B. unite viral DNA with the host DNA
C. release viral RNA to make its own protein
D. transfer DNA from the virus into the host.

18. Which one of the following would decrease the cardiac rate in a mammal?

A. increase in Co_2 content in blood
B. increase in the partial pressure of O_2 in blood
C. accumulation of lactic acid in tissues
D. secretion of adrenaline into blood

19. The most efficient method to determine the commonest plant species in a large habitat can be by;

A. using a quadrant
B. aerial photography
C. using line transect
D. dissect counting

20. Which one of the following does **not** occur during the opening of the stomata?

A. Conversion of sugar into starch
B. Conversion of starch into malic acid
C. Water enters by osmosis into guard cell
D. K^+ ions pumped into guard cells

21. One of the roles of glycoproteins and glycolipids on the cell membrane is to

A. increase the absorption surface area
B. provide receptor site for recognition of stimuli
C. provide sites for varies reaction pathways
D. separate protoplasm from the surroundings

22. The transport of photosynthetic products in a plant from mesophyll cells to adjacent transfer cells (phloem tissue) occurs by?

A. active transport
B. mass flow
C. osmosis
D. cytoplasmic streaming

23. The internal solute concentration of a plant cell is about 0.8m. To demonstrate plasmolysis it would be necessary to suspend the cell in external solution with a solute concentration of;

A. 0.4 m
B. 0.8 m
C. 1.0 m
D. 0.0 m

24. Which of the following is least likely to occur when organisms of related species compete for the same limited source?

A. Range restriction
B. Resource partitioning
C. Extinction
D. Migration

25. Dogs have 78 chromosomes in their diploid cells. If a diploid dog cell enters meiosis, how many chromosomes and chromatids will be present in each of the daughter cells at the end of meiosis 1?

A. 39 chromosomes, 39 chromatids
B. 39 chromosomes, 78 chromatids
C. 78 chromosomes, 78 chromatids
D. 78 chromosomes, 156 chromatids

26. Bacteria that lie in the human intenstines assist digestion and feed on the nutrients the human has consumed. This relationship is described as

A. commensalism
B. mutualism
C. endoparasitism
D. saprophytism

27. Which of the following events would move energy and materials from a detritus food web into a grazing food web?

A. A beetle eating the leaves of a living plant
B. An earth worm eats dead leaves on the forest floor
C. A bird catches and eats an earth worm
D. A marabou stork eats a dead bird.

28. The total dry weight of plant material in a forest is a measure of the forest's

A. GPP
B. N.P.P
C. Respiration
D. Starving crop biomass

29. Components of the inflammatory response include all the following except?

A. Macrophages
B. Neutrophils
C. B-cells
D. Mast cells

30. Oxygen enters blood in the lungs because relative to alveolar air the;

A. Co_2 concentration in blood is high
B. Co_2 concentration in blood is low
C. O_2 concentration in blood is high
D. O_2 concentration in blood is low

31. Which of the following, if increased to an Elodea plants in water at 30°C, would lead to a rise in the number of bubbles released from the plant?

A. Light
B. Temperature
C. Wind velocity
D. Humidity

32. Animals *A, B, C* and *D* have their body volume and surface area shown below.

Animal	Volume *(cm^3)*	Surface area *(cm^2)*
A.	32.0	61.1
B.	1.2	3.0
C.	3.3	8.2
D.	7.5	49.8

Which one of them would have the greatest need for the transport system?

33. One day an ecologist caught and marked 90 butterflies in a population. A week later, the ecologist returned to the population and caught 80 butterflies 16 of which had a mark. What is the size of the butterfly population?

A. 170.
B. 450
C. 154
D. 186

34. The high heat capacity of water has the biological importance of;

A. minimizing temperature change in animal fluids
B. cooling animals
C. preventing freezing of cell contents
D. controlling heat loss in animals

35. Which one of the following statements is correct about base pairing in nucleic acids?

A. Purines only pair with pyrimidines
B. Guanine is paired with Adenine
C. Hydrogen bonds occur only in Purines
D. Pyrimidines only pair with pyrimidines

36. Which one of the following is the first step during protein synthesis?

A. Translation
B. Transcription
C. DNA Replication
D. Amino acid activation

37. The old DNA strand which serves as a guide to a new strand is called.

A. a gene
B. polymerase
C. an anticodon
D. a template

38. In single circulation, the blood pressure is low because;

A. animals that have single circulation have single- chambered hearts.
B. the blood passes through two capillary systems.
C. single circulation systems lack vaives.
D. blood passes through the heart once.

39. Conversion of glycogen to glucose during stress would be stimulated by;

A. insulin
B. glucagon
C. adrenaline
D. thyroxine

40. During stable environment conditions the rate of evolution change

A. slows down
B. remains constant
C. increases rapidly
D. increases slowly

SECTION B:

41. (a) Define the term **hybrid**. *(02 marks)*

.....

.....

(b) Spartina maritima is a grass species with 56 chromosomes while spartina alterniflora has 70 chromosomes. The two grass species can be crossed to produce hybrids.

(i) What will be the chromosome number of the hybrids? *(01 mark)*

.....

.....

(ii) Explain what would happen if the hybrids are crossed. *(03 marks)*

.....

.....

.....

.....

.....

(c) If the hybrids undergo polyploidy, tetrapliod would result

(i) What would be the chromosome number of the tetraploid? *(01 mark)*

.....

.....

(ii) Suggest **three** advantages the tetraploid spartina would have over spartina maritima. *(03 marks)*

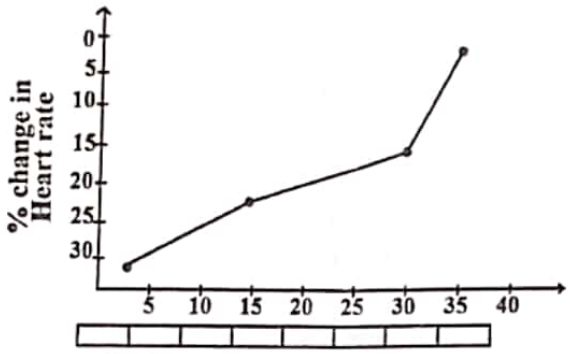
.....

.....

.....

.....

42. Twenty healthy students were monitored as they immersed their faces in water from 3°C to 37°C. The results are shown in the graph below.



(a) (i) What is the effect of facial immersion on heart rate over the range of water temperature shown? *(01 mark)*

.....

.....

(ii) Suggest reasons for the relationship between facial immersion and heart rate. *(04 marks)*

.....

.....

.....

.....

.....

.....

(b) What is the effect of temperature on heart rate? *(01 mark)*

.....

.....

.....

(c) Outline the events which occur leading to the rapture of red blood cells in hypotonic solution. *(04 marks)*

.....

.....

.....

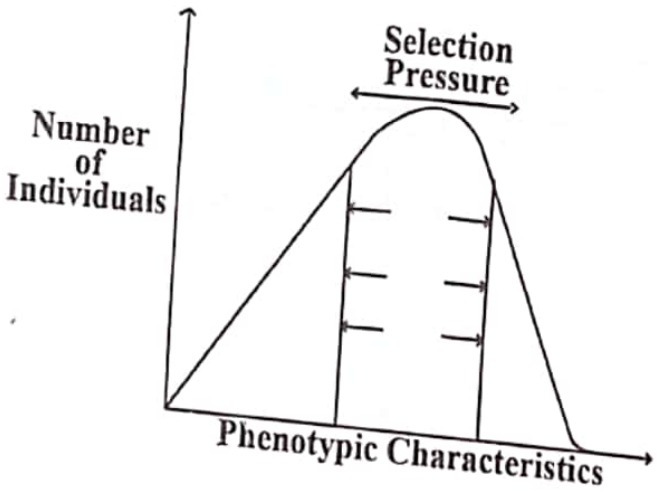
.....

.....

.....

.....

43. The figure below shows the type of natural selection acting on a continuous phenotypic variable.



(a) (i) Identify the type of selection acting on the population. *(01 mark)*

.....

.....

.....

.....

(ii) Explain how the selection pressure affects the population. *(03 marks)*

.....

.....

.....

.....

.....

.....

(b) Of what ecological advantage is the above type of selection? *(02 marks)*

.....

.....

.....

(c) Using sickle-cell allele as an example, explain the significance of heterozygous advantages. *(03 marks)*

.....

.....

.....

.....

.....

.....

(d) In a certain population 14% of the babies were born with sickle-cell anaemia. What is the frequency of the carriers? *(02 marks)*

.....

.....

.....

.....

.....

.....

.....

.....

.....

44. (a) (i) What is meant by the term **immunity**? *(01 mark)*

.....

.....

.....

(ii) How does a plasma cell differ from a memory cell? *(02 marks)*

.....

.....

.....

.....

(b) State **three** ways in which helper cells improve efficiency of the immune system. *(03 marks)*

.....

.....

.....

.....

.....

.....

(c) Explain how the body is protected from actions of its own immune system. *(04 marks)*

.....

.....

.....

45. (a) (i) Explain why less glucose is required to maintain cell metabolism in aerobic than anaerobic conditions. *(03 marks)*

.....

.....

.....

.....

.....

.....

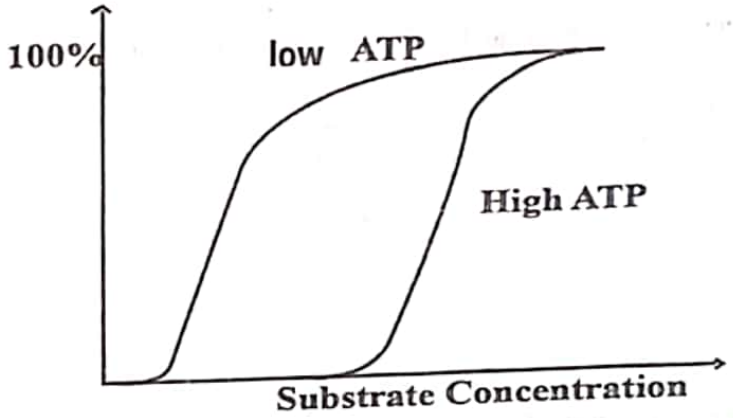
(ii) What is the role of oxygen in oxidative phosphorylation? *(02 marks)*

.....

.....

.....

(b) The graph below shows an activity of an enzyme that controls glycoysis at increasing substrate concentration at two levels of ATP.



(i) Describe how high levels of ATP affect enzyme activity. *(02 marks)*

.....

.....

.....

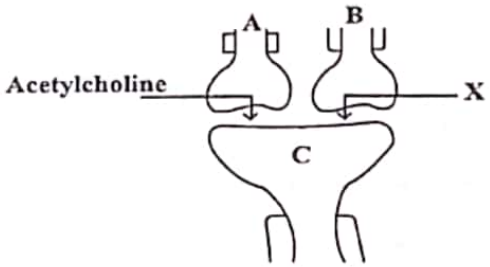
(ii) Explain how glycolysis is regulated by this enzyme.

.....

.....

.....

46. The figure below shows dendrites from neurons *A* and *B* forming synapses with neuron *C*.



(b) Explain what would happen if;

(i) Acetylchlorine increased the permeability of the post-synaptic membrane to Na^+ ions. *(03 marks)*

.....

.....

.....

.....

.....

(ii) X increased the permeability of post-synaptic membrane to Cl^- ions *(02 marks)*

.....

.....

.....

.....

.....

(c) State a benefit of neuron ***C*** forming synapses with two neurons ***A*** and ***B***. *(02 marks)*

.....

.....

.....

(d) State **three** advantages of nerve impulse transmission through synapses. *(03 marks)*

.....

.....

.....

.....

.....

.....

.....

.....

END