



Dr. Bbosa Science

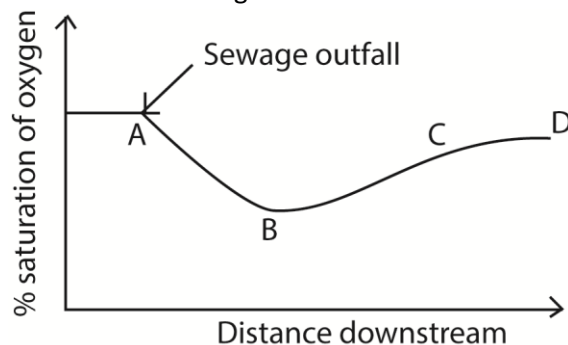
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### UACE Biology 2023 paper 1

1. During indirect flight in insects, the elevator muscle contract and the
  - A. roof of the thorax is pulled downwards
  - B. roof of the thorax curves upwards
  - C. wings moves downwards
  - D. wings provide lift for movement
2. The evolutionary significance of mandibular mouth parts in larval form different from proboscis in adult form of butterfly is to
  - A. increases competitive advantage of the larval form
  - B. reduce interspecific competition for available food
  - C. reduce intraspecific competition for available food
  - D. increase selection pressure on the adult form
3. The cell organelle important for cell wall formation in plant is
  - A. Chloroplast
  - B. Ribosome
  - C. Golgi apparatus
  - D. Endoplasmic reticulum
4. Newly hatched chicks are seen to follow and move around the first object they see after hatching because
  - A. at critical period particular stimulus is permanently associated with particular response
  - B. the organism at young age survive by trial and error learning
  - C. at young age animal display exploratory behaviour pattern
  - D. the chicks use their insight to solve the immediate problems
5. A situation where the survival rate of babies of the same age weighing between 5kg and kg is higher than that for heavier babies is due to
  - A. disruptive selection
  - B. directional selection
  - C. stabilising selection
  - D. adaptive radiation
6. In alternation of generation, the
  - A. Spores are produced from haploid cells
  - B. Gametes are produced by mitosis
  - C. Gametophyte is a sexual stage
  - D. Spores are produced by mitosis
7. Which **one** of the following factors would promote the highest rate of photosynthesis in a plant where light is **not** a limiting factor?
  - A. 0.10% CO<sub>2</sub> at 20°C

- B. 0.03%CO<sub>2</sub> at 20°C
- C. 0.03%CO<sub>2</sub> at 28°C
- D. 0.10% CO<sub>2</sub> at 28°C

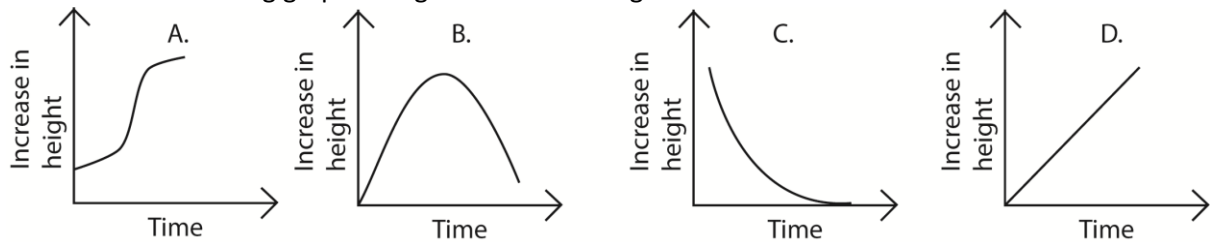
8. What is the percentage net primary production if the gross primary production of decomposers is 20,000 kJm<sup>-2</sup>yr<sup>-1</sup> and respiration is 18,000 kJm<sup>-2</sup>yr<sup>-1</sup>?
- A. 10.0
  - B. 11.1
  - C. 20.0
  - D. 90.0
9. The amount of glucose produced in one Calvin cycle is less than expected because
- A. the concentration of enzymes that catalyse the reaction is low
  - B. a very unstable compound forms in one stage and split immediately
  - C. some of the 3 carbon sugar formed is used for regeneration of the carbon dioxide acceptor
  - D. the energy required to form glucose has to be obtained from other reactions
10. A quadrat of 0.5m<sup>2</sup> was randomly thrown different times in an area and each time the number of plants obtained recorded as 2, 5, 8 and 7. What is the population density of the area?
- A. 5.25
  - B. 11.0
  - C. 44.0
  - D. 88.0
11. Figure 1 shows changes in oxygen concentration downstream of a river. At what point of the curve is the BOD highest?



12. Which one of the following pairs of hormones promote cell enlargement in leaves?
- A. IAA and gibberellic acid
  - B. Cytokinins and ethane
  - C. Gibberellic acid and cytokinins
  - D. IAA and ethene
13. The amount of DDT in zooplankton was measured as 0.04ppm and that of small fish as 0.5ppm. the DDT bioaccumulation is small fish by
- A. 0.02
  - B. 0.054
  - C. 0.08
  - D. 12.50
14. Counter flow system is more efficient that parallel flow system because in counter flow the
- A. gill expose a greater surface area for diffusion
  - B. distance across the gases diffuse is reduced
  - C. speed of water is increased
  - D. concentration gradient is maintained

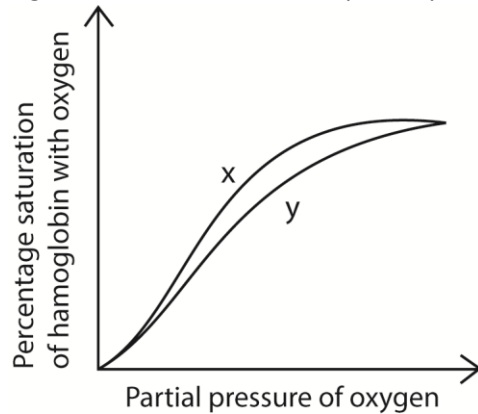
15. The success of angiosperm on land is greater than that of conifers due to
  - A. possession of seed
  - B. possession of flowers
  - C. development of true roots
  - D. presence of mechanical tissues
16. What is the pressure potential of a cell whose solute potential is  $-4900\text{kPa}$  and water potential is  $-4400\text{kPa}$ ?
  - A.  $9300\text{kPa}$
  - B.  $-9300\text{kPa}$
  - C.  $500\text{kPa}$
  - D.  $-500\text{kPa}$
17. Which of the following structures give rise to lateral roots in higher plants
  - A. cambium
  - B. endosperm
  - C. pericycle
  - D. epidermis
18. The significance of retaining urea in cartilaginous fish is to
  - A. prevent loss of water by osmosis from the tissue
  - B. make their blood isotonic to the environment
  - C. enable them to extract nitrogen from urea
  - D. allow for conversion of urea to ammonia
19. A rise in the osmotic pressure of blood leads to
  - A. Inhibition of ADH production
  - B. A decrease in blood volume
  - C. An increase in the volume of water absorbed
  - D. An increase in production of ADH
20. Which one of the following conditions would result into **RQ greater** than 1.0?
  - A. Aerobic respiration
  - B. Release of energy from seeds submerged in water
  - C. Respiration during prolonged starvation
  - D. Feeding on fat rich food
21. Which one of the following cells produces structures that give strength and toughness to areolar tissue in animals?
  - A. Fibroblasts
  - B. Mast cells
  - C. Fat cells
  - D. macrophages
22. The tidal volume of a person whose ventilation rate is  $200\text{ dm}^3$  per minute and who breathes 40 times in the same period is
  - A.  $5\text{ dm}^3$
  - B.  $160\text{ dm}^3$
  - C.  $240\text{ dm}^3$
  - D.  $8000\text{ dm}^3$
23. The quantity of mineral salt in the soils of tropical rain forests are low because the
  - A. Standing crop biomass is small
  - B. High temperatures destroy nutrients
  - C. Abundance of decomposers is decreased
  - D. Nutrients are rapidly taken up by many plants

24. Which one of the following statements is correct about the presence of a similar structure of cytochrome C in both man and chimpanzee?
- evolved
  - show divergence evolution
  - show convergence evolution
  - evolved at different times.
25. Water soluble compounds enter cells rapidly than lipid soluble molecules because
- cell membranes contain more phosphate heads projecting outwards.
  - components of the membrane are polar to allow limited entry of water.
  - of a large hydrocarbon tail component of the cell membrane
  - cell membrane contain channel proteins that are impermeable to water
26. Which of the following graphs in figure 2 illustrate a growth rate?



27. The following are adaptations of fresh water fish to conserve water **except**
- Possession of numerous larger glomeruli
  - Extensive reabsorption of salts back into blood
  - Excretion of trimethylamine oxide
  - Active uptake of salts by gills
28. Which of the following pairs of hormones reach their highest peak secretion at the point of evolution? Both
- LH and progesterone
  - FSH and oestrogen
  - FSH and LH
  - LH and oestrogen
29. Recombination of linked genes during gamete formation occurs by
- Independent assortment
  - Crossing over
  - Thickening of chromatids
  - Non-disjunction
30. Neo- Darwinism differs from Lamarckism in that in Neo-Darwinism the
- environmental pressure is the source of variation
  - variation arise by chance mutation
  - acquired characteristics are passed onto the offspring
  - genes are modified by the environment
31. Which one of the following is the correct reason why impulse across the synapse is unidirectional?
- Permeability of pre-synaptic membrane to  $\text{Ca}^{2+}$  ions
  - Permeability of post-synaptic membrane to  $\text{Na}^+$  ions
  - Presence of  $\text{Na}^+$  ions in the synaptic cleft
  - Presence of synaptic vesicles on one side of the synapse
32. During the muscle contraction process, the calcium ions
- are necessary to bring the light band and H-Zone together
  - strengthen the muscle fibres to prevent wear during contraction

- C. act as cofactors that activate enzymes responsible for contraction process
  - D. stimulate the hydrolysis of ATP to provide energy for the process
33. Which one of the following organisms exhibits metameric segmentation?
- A. Liver fluke
  - B. Hydra
  - C. Earthworm
  - D. Roundworms
34. Figure 3 shows the effect of partial pressure of oxygen on the oxygen saturation of haemoglobin

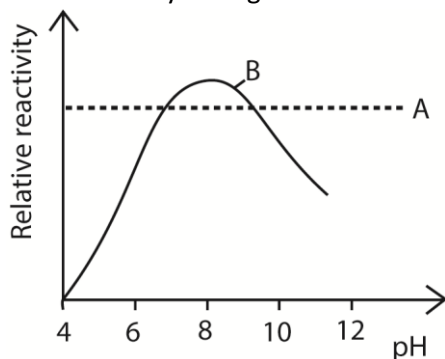


- Which one of the following conditions in a mammal would result into shifting the curve in figure 3 from position y to x?
- A. Increased strenuous exercise
  - B. Increased metabolic rate
  - C. Decreased respiration
  - D. Cold environmental pressure
35. Which one of the following processes in plants would drastically slow down when soil become water logged?
- A. Mineral uptake by roots
  - B. Capillarity
  - C. Root pressure
  - D. Water uptake by root hairs
36. Which One of the following is a characteristic of muscles found in the walls of the alimentary canal? They
- A. Contract powerfully without fatigue
  - B. Contract rapidly with fatigue
  - C. Relax rapidly with fatigue
  - D. Contract slowly without fatigue
37. Which one of the following methods can be used to preserve genetic stock of endangered species
- A. Captive breeding in a zoo.
  - B. Crossing threatened species with other related species
  - C. Ecological study on threatened species
  - D. Removal animals from threatened areas
38. Which form of light triggers early flowering in long day plants. Flashes of
- A. far-red light during the night
  - B. red light during the night
  - C. far-red light during the day

- D. red light during the night
39. Which one of the following processes will occur in plants if the supply of auxins from leaves exceeds that from stems?
- Fruit abscission will be inhibited
  - Leaf abscission will be inhibited
  - Fruit development will be stimulated
  - Leaf senescence will be delayed
40. Which one of the following are adaptations for conserving oxygen in diving mammals?
- Having small blood vessels to transport oxygen
  - Having a lower proportion of red
  - Maintain a slower heartbeat
  - Having less concentration of myoglobin

SECTION B (60MARKS)

41. (a) Why is the structure of plasma membrane of a cell
- Described as a partially permeable? (02marks)
  - Modelled as fluid-mosaic? (03marks)
- (b) Explain the advantages of the development of membrane-bound organelles in eukaryotic cells. (03marks)
- (c) State **two** organelles in eukaryotic cells which are not membrane bound (02marks)
42. (a) What is **protein denaturation**? (02marks)
- (b) Figure 4 shows the relationship between pH and relative reactivity of two different enzymes; A and B. Study the figure and answer the questions that follow:



- Explain the advantages of enzyme A over enzyme B (02marks)
  - From the figure above, What conclusion can be drawn on the effects of pH on the relative activity of enzyme B (03marks)
  - How do inorganic chemicals cause denaturation of proteins (03marks)
43. (a)(i) State **two** differences between mass flow and cytoplasmic streaming (02marks)
- (ii) Outline three conditions under which mass flow occurs. (03marks)
- (b) How do the following structures perform their roles in the movement of substances in plants? The
- endodermis (03marks)
  - plasmodesmata (02marks)
44. (a) Distinguish between taxis and kinesis types of behaviour in organisms. (01marks)
- (b) Explain the significance of insight learning in animal behaviour. (03marks)
- (c) Giving an example in each case, explain the role of the following organic chemicals in territoriality in animals

- (i) pheromones (03marks)
- (ii) testosterone hormone (03marks)
- 45. (a) Explain the meaning of a **meristem**. (02marks)
- (b) How is dormancy induced in buds of plants growing in areas that experience variation in day lengths? (02marks)
- (c) How does secondary thickening, contributes to increase in strength and support of a growing plant? (04marks)
- (d) Explain the ecological significance of primary growth in plants. (02marks)
- 46. (a) What is the difference between continuous variation and discontinuous variation. (02marks)
- (b) Explain the genetic basis of
  - (i) continuous variation (02marks)
  - (ii) discontinuous variation. (01mark)
- (c) Why do commercial crop varieties have a relatively uniform genotype? (02marks)
- (d) How disadvantageous is growing of crops with relatively uniform genotype? (03marks)

**Suggested answers**

- 1A 4A 7D 10B 13D 16C 19D 22A 25C 28C 31D 34C 37C
- 2C 5C 8A 11A 14D 17C 20B 23D 26C 29B 32A 35D 38B
- 3C 6B 9C 12A 15B 18A 21A 24B 27C 30B 33C 36D 39D

Comments

8. Percentage net production =  $\frac{20,000-18,000}{20,000} \times 100\% = 10.0\%$

9. Bioaccumulation =  $\frac{0.5}{0.04} = 12.5$

11. Biochemical oxygen demand (BOD) is a measure of the amount of dissolved oxygen needed by aerobic biological organisms to breakdown organic material present in a given water sample. It represents the amount of oxygen consumed by bacteria and other microorganisms while they decompose **organic** matter under aerobic conditions at a specified temperature.

**The more organic matter there is (e.g., in sewage and polluted bodies of water), the greater the BOD; and the greater the BOD, the lower the amount of dissolved oxygen available for higher animals such as fishes. The answer is A due to highest concentration of organic matter**

15. The **success** of angiosperms is due to two novel reproductive structures: flowers and fruits. The function of the flower is to ensure pollination, often by arthropods, as well as to protect a developing embryo.

16. From  $\psi = \psi_s + \psi_p$

$$-4400 = -4900 + \psi_p$$

$$\psi_p = 500$$

19. When osmotic pressure of blood increases it implies presence high solute concentration, thus ADH is produced to increase reabsorption of water from the renal tubules in order to dilute blood to normal

20. Respiratory quotient greater than 1.0 is due to anaerobic respiration.
21. Fibroblasts produce both collagen and elastin fibers.
22. Tidal volume is the volume of air moved into or out of the lung in breath =  $\frac{200}{40} = 5$
24. Man and chimpanzee share the same ancestors.
25. of a large hydrocarbon tail component of the cell membrane make the membrane hydrophobic.
26. The rate of growth decreases with time
27. Note that the problem of a fresh water fish is dilution of blood by osmosis and loss of salts in urine.
- 29 Crossing over is the exchange of gene no different chromosomes.
34. Increased respiration reduces affinity of haemoglobin for oxygen i.e. situation A, B and D lead to increased respiration
35. Water logging cause deficiency of oxygen limiting respiration and bsorption of mineral salts by active transport
36. A- refers to heart muscle
38. Pfr promotes flowering in long day plants while Pr inhibits flowering (Pfr is synthesized in presence of red light during day, thus flowering of long day plants require shorter night; red light in night make nights shorter)
39. Auxins promote growth
40. Physiological adaptations of diving animals include increased blood volume and elevated hematocrit (proportion of red blood cells), hemoglobin, and myoglobin, whereas oxygen-use rates are minimized via **regulation of metabolism, heart rate, and peripheral vasoconstriction**

#### SECTION B (60MARKS)

41. (a) Why is the structure of plasma membrane of a cell
- (i) Described as a partially permeable? (02marks)  
Because it allows substances (lipid soluble) to pass through and prevents others (water soluble) to pass through
  - (ii) Modelled as fluid-mosaic? (03marks)  
Contains proteins that are randomly distributed throughout the membrane; some penetrating through while others penetrating to varying depth into the membrane.
- (b) Explain the advantages of the development of membrane-bound organelles in eukaryotic cells. (03marks)
- Cell membrane separates the contents of the cell from the external environment.
  - Cell membrane controls exchange of materials between the cells and external environment
  - Cell membrane separates compartment with specialized functions inside the cell
  - Cell membrane acts as receptor site for recognizing external stimulus such as hormones.
  - Cell membrane allows uptake of materials by phagocytosis and pinocytosis.



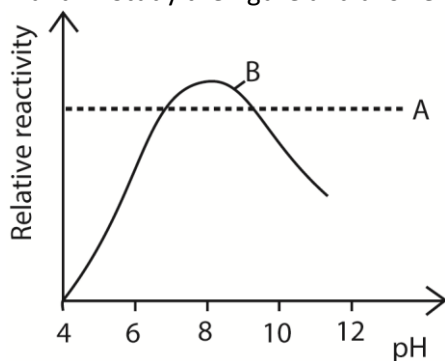
- Cell membrane supports enzymes of complex metabolic pathways in place for close proximity.

(c) State **two** organelles in eukaryotic cells which are not membrane bound (02marks)

- Ribosomes
- Cytoskeleton
- P-bodies
- Germ granules
- Cell water

42. (a) What is **protein denaturation**? (02marks)

(b) Figure 4 shows the relationship between pH and relative reactivity of two different enzymes; A and B. Study the figure and answer the questions that follow:



- Explain the advantages of enzyme A over enzyme B (02marks)  
The relative activity of enzyme A is independent of changes in pH
- From the figure above, What conclusion can be drawn on the effects of pH on the relative activity of enzyme B (03marks)
- How do inorganic chemicals cause denaturation of proteins (03marks)

43. (a)(i) State **two** differences between mass flow and cytoplasmic streaming (02marks)

(ii) Outline three conditions under which mass flow occurs. (03marks)

- The relative reactivity of enzyme B depends of pH
- The optimum reactivity of enzyme B is pH 8
- Below and above pH 8 the reactivity of enzyme B decreases

(b) How do the following structures perform their roles in the movement of substances in plants? The

(i) endodermis (03marks)

- Contains impermeable thickening of suberin called Casparian strip which forces water and solutes to cross the plasma membranes of endodermal cells instead of slipping between the cells, i.e. from apoplast pathway to symplast pathway enabling water to move in one direction
- It ensures that only materials required by the root pass through the endodermis, while toxic substances and pathogens are generally excluded.
- Builds up root pressure in the xylem by actively pumping mineral salts into the xylem which enable water to enter the xylem by osmosis

(ii) plasmodesmata (02marks)

- to allow the movement of molecules and substances (water mineral salts, photosynthetic substance) between cells
  - allow entry of water into the symplast pathways
44. (a) Distinguish between taxis and kinesis types of behaviour in organisms. (01marks)  
Kinesis is a random (non-directional) movement in response to a stimulus while taxis is a directional movement away or towards a stimulus
- (b) Explain the significance of insight learning in animal behaviour. (03marks)  
Enables animals to solve unfamiliar problems using reason, especially to form conclusions, inferences, or judgments.
- (c) Giving an example in each case, explain the role of the following organic chemicals in territoriality in animals
- (i) pheromones (03marks)
- Animals such as dogs, cats, and other animals use pheromones to mark their territories *and establish ownership*.
  - Pheromones help animals to distinguish members of the territory **Attracting mates:** Many insects emit pheromones to attract potential mates into a territory.
  - Pheromones such as injured bee's "ranked smell" solicit defence causing other angry bees to sting
  - **Alarm signals:** animals use pheromones to scare away potential competitors to their territory.
  - **Insects produce pheromones** to tell other female insects to lay their eggs elsewhere
  - **Animals produce pheromones** to strengthen bonds between mother and offspring in a territory.
- (ii) testosterone hormone (03marks)
- Increase in testosterone level in male animals increases physical aggression to defend the territory
  - Increase in testosterone level in male animals increases physical aggression to defend the mates in territory
  - Testosterone promotes muscular build up that increases strength to protect the territory
  - Testosterone promotes mating in primates for the survival of the territory with new members.
45. (a) Explain the meaning of a **meristem**. (02marks)  
A meristem is a region of plant tissue, found chiefly at the growing tips of roots and shoots and in the cambium, consisting of actively dividing cells forming new tissue
- (b) How is dormancy induced in buds of plants growing in areas that experience variation in day lengths? (02marks)  
Bud dormancy is induced by shortened photoperiod as well as reduced temperature due to production of abscisic acid.
- (c) How does secondary thickening contribute to increase in strength and support of a growing plant? (04marks)
- Vascular cambium forms secondary xylem which contains lignin that provides support.
  - Cork cambium forms the tough outermost layer of the stem that provides strength.
  - Increase in girth also increases rigidity of the stem providing strength and support.

(d) Explain the ecological significance of primary growth in plants. (02marks)

- Increases length of stem to reach light
- Increase length of roots to reach water mineral salts
- Increases the length of roots anchor the plant

46. (a) What is the difference between continuous variation and discontinuous variation? (02marks)

Variation is said to be continuous when there is a **gradual change** of character from one individual to another; e.g. skin color, length of leaves, the height of individuals. i.e. it is quantitative while in the discontinuous variation, there is a **clear – cut difference** between the characteristics e.g. blood group tongue-rolling, sex, etc.

(b) Explain the genetic basis of

(i) continuous variation (02marks)

- Multiple genes controlling a character/ polygenic characters
- Environmental factors
- chance

(ii) discontinuous variation. (01mark)

- mutation
- Different alleles at a single gene locus that have a large effect on the phenotype

(c) Why do commercial crop varieties have a relatively uniform genotype? (02marks)

- Are produced from the same genetic stock
- Crops produced by genetic engineering
- Inbreeding
- Genetic erosion

(d) How disadvantageous is growing of crops with relatively uniform genotype? (03marks)

- Planting genetically uniform crops increases the risk of “losing it all” when environmental variables change: for example, if a new pest is introduced or rainfall levels drop.

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