

UNEB U A C E P530/1 BIOLOGY THEORY PAPER ONE 2023

SECTION A

1. During indirect flight in insects, the elevator muscles contract and the

A. roof of the thorax is pulled downwards. C I B S.3 page 149 (So, when the dorso-ventral muscles contract, the longitudinal muscles relax, pulls the roof of the thorax down causing the wings to go up and so causes an upstroke.)

B. roof of the thorax curves upwards.

C. wings move 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 a butterfly is to

A. increase 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 cell 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 periods particular stimulus is permanently associated with particular response.

B. the organisms at young age survive by trial and error learning.

C. at young age animals display exploratory behavior patterns.

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 5 kg to 8 kg is higher than for heavier or lighter babies is due to

A. disruptive selection.

B. directional selection.

C. *stabilizing selection*. **C I B S.4 page 274** (This type of selection favours members in a natural habitat who have average traits i.e. traits in between the extremes and will select against both members with extreme traits.)

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 the asexual stage.

D. *spores are produced by mitosis*. **C I B S.3 page 301** (The sexual phase, called the gametophyte generation, produces gametes, or sex cells, and the asexual phase, called sporophyte generation, produces spores asexually.)

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% CO₂ at 20°C.

B. 0.03% CO₂ at 20°C.

C. *0.03% CO₂ at 28°C*. **C I B S.2 page 9** (This is because temperature influences the rate of enzyme controlled reactions and yes...photosynthesis is controlled by enzymes, which are sensitive to temperature. At low temperature, enzymes are inactivated and as the temperature increases, they become activated hence, the rate increases up to a maximum at optimum temperature with carbon dioxide concentration being at a standard i.e. 0.03% by volume).

D. 0.10% CO₂ at 28°C.

8. What is the percentage net primary production if the gross primary production of decomposers is 20,000 kJ m⁻²yr⁻¹ and respiration is 18,000 kJ m⁻²yr⁻¹?

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 catalyze the reactions is low.*

B. a very unstable compound forms in one stage and splits 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 0.5m² was randomly thrown different times in an area and each time the number of plants obtained were recorded as 2, 5, 8 and 7. What is the population density of the area?

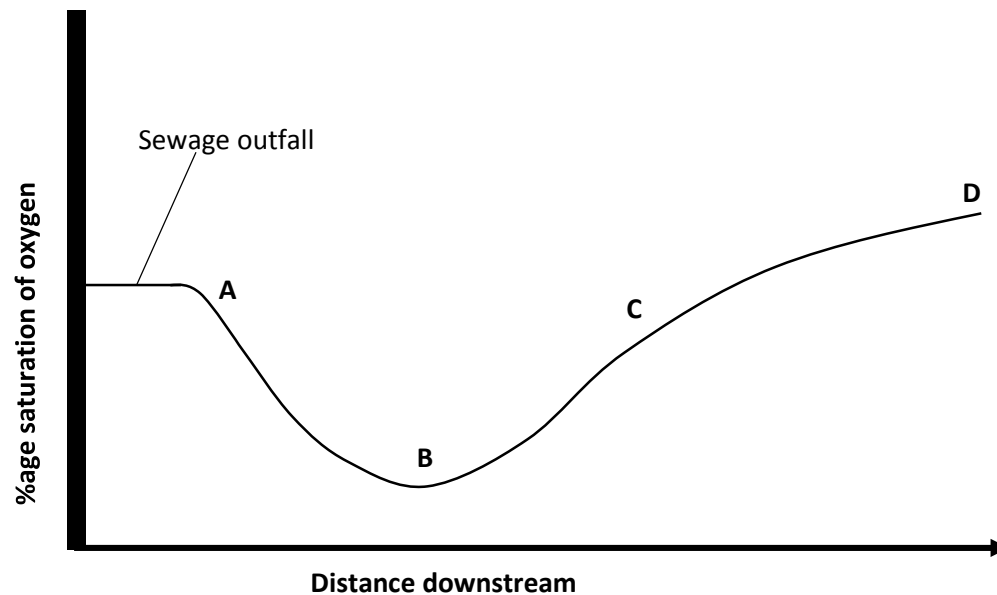
A. 5.25

B. 11.00

C. 44.00

D. 88.00

11. The illustration below shows changes in oxygen concentration downstream of a river. At what point of the curve is the BOD highest?



11. Which one of the following pairs of hormones promote cell enlargement in leaves?

Both

A. *IAA and gibberellic acid. C I B S.3 page 84 and 85 respectively* (page 84: Stimulates cell elongation, cell division, differentiation of phloem and xylem, root initiation on stem cuttings, lateral root development, growth of flower parts, and production of ethylene. page 85: Gibberellins stimulate hyper-elongation of dwarfed stems *as shown below*. Actually it was the excessive stem elongation in infected rice plants that led to the discovery of gibberellins, and hyper-elongation of stem tissue remains one of the more dramatic effects of gibberellins on higher plants.)

B. cytokinins and ethane.

C. gibberellic acid and cytokinin.

D. IAA and ethane.

13. The amount of DDT in zooplankton was measured as 0.04 ppm and that of small fish as 0.5 ppm. The DDT bioaccumulation in small fish by

A. 0.02

B. 0.054

C. 0.08

D. 12.50

14. Counter current flow system is more efficient than parallel flow system because in counter current flow the

A. gills expose a greater surface area for simple **diffusion**.

B. distance across which gases simple **diffuse** is reduced.

C. speed of water is increased.

D. concentration gradient is maintained. C I B S.2 page 271 (Hence, countercurrent flow ensures that a concentration gradient remains between blood and water throughout the flow. *See the illustration on the left.*)

15. The success of angiosperms on land is greater than that of the conifers due to the

A. possession of seeds.

possession of flowers. **MARVEL BIOLOGY page 165** (Flowering plants, or angiosperms, are the most diverse land plants living today. About 250,000 species have been described, and more are discovered each year. Their success in terms of geographical distribution, number of individuals, and number of species revolves around a reproductive organ called the *flower*.)

B. development of true roots.

C. presence of mechanical tissues.

16. What is the pressure potential of a cell whose solute potential is -4900 kPa and water potential is 4400 kPa?

- A. 9300 kPa.
- B. -9300 kPa.
- C. 500 kPa.
- D. -500 kPa

17. Which one of the following structures gives rise to lateral roots in higher plants?

- A. Cambium.
- B. Endodermis.
- C. Pericycle.

D. Epidermis. C I B S.1 page 112 (This is because in this region, epidermal cells produce outgrowths called root hairs, which greatly increase the surface area of the dermal tissue for the purpose of absorbing water by osmosis and then absorption of dissolved mineral salts by simple diffusion at the beginning then later by active transport.)

18. The significance of retaining urea in cartilaginous fish is to

A. prevent loss of water by osmosis from the tissues. C I B S.2 page 331 (Rather than ingesting sea water in order to change their internal salinity, sharks are able to absorb sea water directly. This is due to the high concentration of urea kept inside their bodies. This high concentration of urea creates a simple diffusion gradient which permits the shark to absorb water in order to equalize the concentration difference.)

- B. make their blood isotonic to the environment.
- C. enable them to extract nitrogen from urea.
- D. allow for the conversion of urea to ammonia.

19. A rise in the osmotic pressure of blood leads to

A. inhibition of ADH production. C I B S.2 page 323 (The hypothalamus then stops the pituitary gland from releasing a hormone called antidiuretic hormone (ADH) also known as vasopressin. The absence of the antidiuretic hormone (ADH) causes the kidneys to bring about the actual decrease in the amount of water in the blood by increasing the impermeability of distal convoluted tubules and collecting ducts to water.)

- 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 oxidation of carbohydrates. **C I B S.2 page 274. Warning:** This is not the correct answer but just related to the correct answer. This is because the aerobic oxidation of carbohydrates has a maximum RQ of 1, **NOT GREATER THAN 1.** (With this formula, the RQ values for fats is 0.7, proteins is 0.8 and for carbohydrates is 1.0. An RQ of greater than 1 may be due to excessive carbs.)

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 produce structures that give strength and toughness to areolar tissue in animals?

A. Fibroblasts. **MAVERL BIOLOGY page 71 (Fibroblasts: These are spindle shaped flattened cells with an oval nucleus. They produce collagen, elastin and ground substances which provide strength and flexibility.)**

B. Mast cells.

C. Fat cells.

D. Macrophages.

22. The tidal volume of a person whose ventilation rate is 200 dm^3 per minute and whose breathes 40 times in the same period is

A. 5 dm^3 .

B. 160 dm^3 .

C. 240 dm^3 .

D. 8000 dm^3 .

23. The quantity of mineral salts 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?

Both species

A. evolved at the same time. **C I B S.4 page 272** (*Comparative bio-chemistry*: In the modern organisms, they have similarities in the chemicals involved. For example all organisms are made up of cells and all cells have DNA as the carrier for genetic information; all use RNA, ribosomes to translate genetic information into proteins; all use roughly the same set of 20 amino acids. Therefore the universal occurrence of the above chemicals in organisms suggests that they all have a common ancestor.)

B. show divergent evolution.

C. show convergent evolution.

D. evolved at different time.

25. Water soluble compounds enter cells less rapidly than lipid soluble molecules because

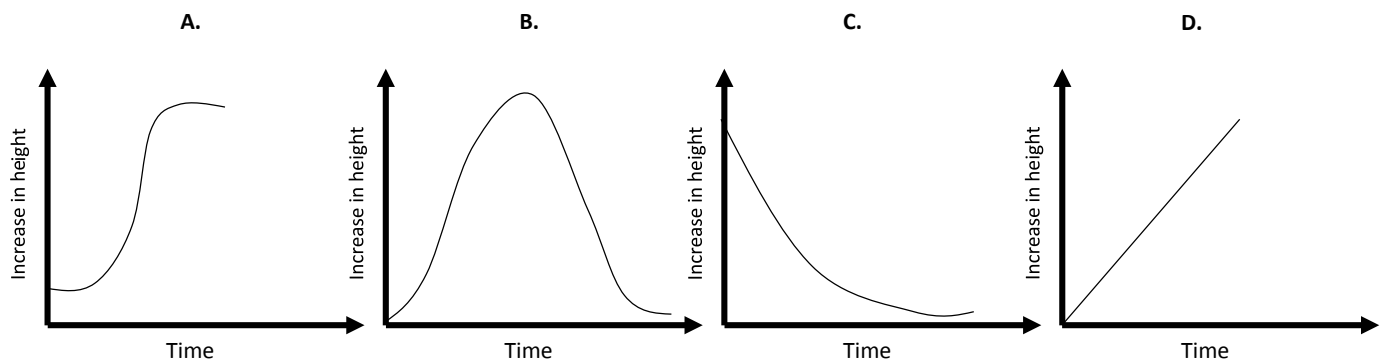
A. cell membranes contain more phosphate heads projecting outwards.

B. components of the membrane are polar to allow limited entry of water.

C. of a large hydrocarbon tail component of the cell membrane.

D. cell membranes contain channel proteins that are impermeable to water.

26. Which one of the following graphs in the illustration below shows a growth rate?



27. The following are adaptations of fresh water fish to conserve water except

A. possession of numerous large glomeruli.

B. extensive reabsorption of salts back into blood.

C. excretion of trimethylamine oxide.

D. active uptake of salts by gills.

28. Which of the following pairs of hormones reach their highest peak of secretion at the point of ovulation? Both

- A. LH and progesterone.
- B. FSH and oestrogen.
- C. FSH and LH.

D. LH and oestrogen. C I B S.3 page 275 (see [Hormonal and physical changes in the ovary and uterine wall](#))

29. Recombination of linked genes during gamete formation occurs by

A. independent assortment. C I B S.3 page 176 (Each bivalent moves to the metaphase plate independently of the other bivalents (a condition known as independent assortment of chromosomes),)

- B. crossing over.
- C. thickening of chromatids.
- D. non-disjunction.

30. Neo-Darwinism differs from Lamarckism in that in Neo-Darwinism the

A. environmental pressure is the source of variation.

B. variation arise by chance mutation. C I B S.4 page 275 (Assuming the longer necked condition to have a genetic connection, they would hand on this beneficial characteristic to their offsprings. This link of Darwin's explanation of natural selection with genetics is known as Neo-Darwinism in the current modern biology.)

- C. acquired characteristics are passed onto the offspring.
- D. genes are modified by environment.

31. Which one of the following is the correct reason why impulse transmission across the synapse is unidirectional?

- A. Permeability of the pre-synaptic membrane to Ca^{2+} ions.**
- B. Permeability of the post-synaptic membrane to Na^+ ions.
- C. Presence of Na^+ ions in the synaptic cleft.
- D. Presence of synaptic vesicles on one side of the synapse.

32. During the muscle contraction process, the calcium ions

- A. *are necessary to bring the light band and H-zone together.*
- B. strengthen the muscle fibers to prevent wear during contraction.
- C. act as co-factors that activate enzymes responsible for the process.
- D. stimulate the hydrolysis of ATP to provide energy for the process.

33. Which one of the following organisms exhibit metameric segmentation?

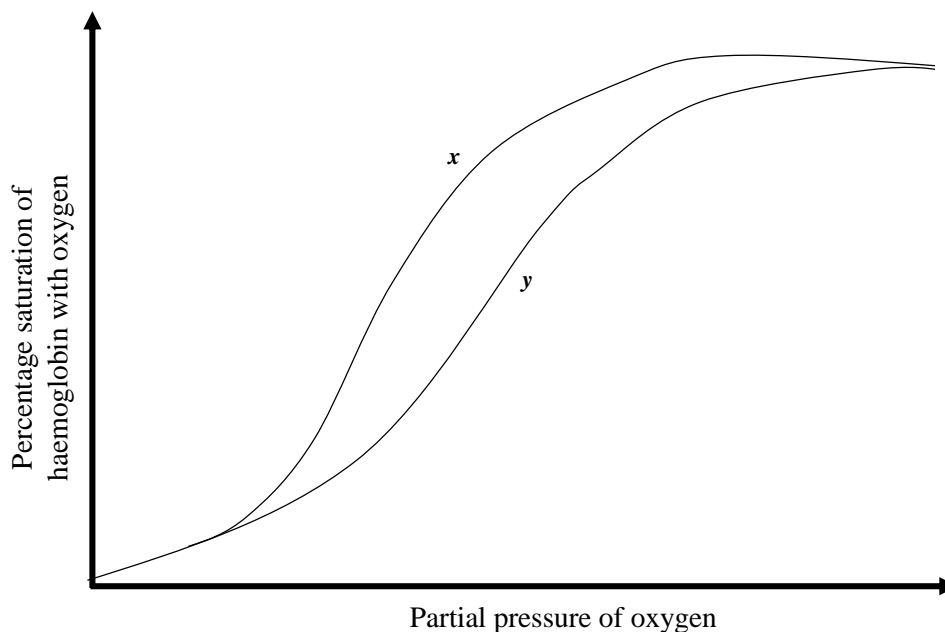
A. Liver fluke.

B. Hydra.

C. *Earthworm. MARVEL BIOLOGY page 252 (In some animals, the body is externally and internally divided into a series of repeated units called segments with a serial repetition of some organs (metamerism). The first segmented animals to evolve were the annelid worms, phylum Annelida. These advanced coelomates are assembled as a chain of nearly identical segments, like the wagons of a train.)*

D. Roundworms.

34. The illustration below 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 of the curve in the illustration above from position y to x?

- A. Increased strenuous exercise.
- B. Increased metabolic rate.
- C. Decreased respiration.
- D. Cold environmental temperature.

35. Which one of the following processes in plants would drastically slow down when soil becomes water logged?

- A. Mineral uptake by roots.
- B. Root pressure.

C. Capillarity. C I B S.1 page 197 (The level of water is highest in clay soil because capillarity is supported naturally by the presence of very tiny spaces which are experienced in clay soil since they have very tiny particles creating very tiny spaces that facilitated the great rise of water in the glass tube with clay soils.)

- 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. C I B S.1 page 26 (Smooth muscle is also found in the digestive system, urinary tract and in the trachea. It is responsible for involuntary rhythmic contractions slowly without fatigue for peristalsis, required for moving food down the alimentary canal, and for the dilation and contraction of blood vessels to control blood pressure.)

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 of animals from threatened area.

38. Which form of light would trigger early flowering in long day plants? Flashes of A. far-red light during the night.

- B. red light during the day.

C. far-red light during the day.

D. red light during the day.

39. Which one of the following processes will occur in plants if the supply of auxins from leaves exceed that from the stem?

A. Fruit abscission will be inhibited.

B. Leaf abscission will be inhibited.

C. Fruit development will be stimulated.

D. Leaf senescence will be delayed.

40. Which one of the following is an adaptation of conserving oxygen in diving mammals?

A. Having small blood vessels to transport oxygen.

B. Having a lower proportion of red blood cells.

C. Maintaining a slower heartbeat.

D. Having less concentration of myoglobin.

SECTION B

41. (a) Why is the structure of the plasma membrane of a cell

(i) described as a **partially permeable**?

(02 marks)

C I B S.1 page 22 (The cytoplasmic membrane shows selective permeability to organic molecules and ions. It controls in and out movement of substances in the cells, hence it allows entry of only some substances but preventing the movement of other materials.)

(ii) modelled as a **fluid-mosaic**?

(03 marks)

MARVEL BIOLOGY page 38 Fluid because the individual phospholipid and protein molecules can move laterally, giving the membrane a flexible structure that is constantly changing in shape. Mosaic because the proteins that are embedded in the phospholipid bilayer vary in size, shape and pattern of arrangement.

(b) Explain the advantages of the development of membrane-bound organelles in eukaryotic cells.

(03 marks)

MARVEL BIOLOGY page 122 (According to the current thinking, the evolution of the nuclear envelope was advantageous because it separated transcription and translation. Remember that RNA transcripts are processed inside the nucleus but translated outside the nucleus. However, in bacteria and archaea, transcription (Synthesis of RNA under the direction of DNA) and translation (Assembling of amino acids into proteins using RNA called mRNA) occur together.)

(c) State two organelles in eukaryotic cells which are not membrane-bound.

(02 marks)

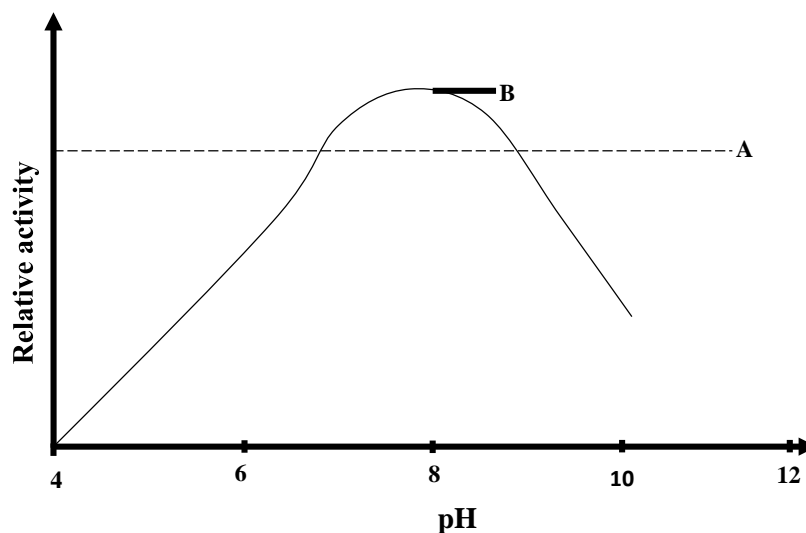
MARVEL BIOLOGY page 34 and page 37 (*The Ribosomes: These are very small organelles that either float freely in the cytoplasm or is attached to the rough endoplasmic reticulum. It is made up of proteins and RNA. It's not surrounded by a membrane.*). (*Structure: Centrioles are non-membrane bound organelles made of nine sets of microtubules, each in groups of three known as triplet microtubules.*)

42 (a) What is **protein denaturation**?

(02 marks)

C I B S.2 page 115 (A protein (*enzymes inclusive*) is said to be denatured when its structure is altered as a result of the breakdown of the hydrogen and ionic bonds that support them.)

(b) The illustration below shows the relationship between pH and the relative activity of two different enzymes; **A** and **B**. Study the illustration and answer the questions that follow.



(i) Explain the advantages of enzyme **A** over enzyme **B**.

(02 marks)

C I B S.2 page 67 (Enzyme **A** is not affected by changes in pH but enzyme **B** is greatly affected by changes in pH of the medium in which they are working. See the graph illustrated on the right.)

(ii) From the illustration above, what conclusion can be drawn on the effects of pH on the relative activity of enzyme **B**? (03 marks)

C I B S.2 page 67. Enzyme B has an optimum pH of 8. (Changes in the pH of the medium affect the ionization of amino acids. As the ionization of amino acid making up the proteins changes, the shape of the enzymes also changes. Therefore changes beyond certain pH or drops below certain pH, the rate of enzyme activity decreases till it stops.)

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

(02 marks)

C I B S.2 page 175 (The most widely accepted model of how carbohydrates in solution move through the phloem has been called the *bulk flow* hypothesis which is also known as *mass-flow hypothesis* or *pressure flow hypothesis*. The mass flow hypothesis proposes that the movement of

nutrients in the phloem occurs through a pressure gradient, with the high hydrostatic pressure in the source regions (food manufacture place i.e. the leaves) and lower pressure in the sink regions (places where the food is stored or used).)

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

C I B S.2 page 175 (pressure gradient. Concentration gradient of the carbohydrate in solution. Water potential gradient. Transpiration pull (C I B S.2 page 173).

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

(i) endodermis (03 marks)

C I B S.2 page 171 (The endodermis which literally means “inside skin” is a cylindrical layer of cells that forms a boundary between the cortex and the vascular tissue. The function of the endodermis is to control mineral salt uptake and prevent mineral salt leakage from the vascular tissue.)

(ii) plasmodesmata (02 marks)

C I B S.2 page 172 (The symplastic route also known as (*living pathway*) is the movement of absorbed water through the plasma membranes. Therefore, the symplastic route consists of the cytoplasm and the continuous connections through cells that exits via plasmodesmata. All in all, water can flow through tissues in plants by crossing cell membranes through aquaporins, or by passing around cells through the apoplast, and or by passing through the symplast through plasmodesmata.)

44 (a) Distinguish between taxis and kinesis types of behavior in organisms. (01 mark)

C I B S.3 page 83 (Taxis is the nonrandom and directional movement either towards or away among living organisms to a particular stimulus as a response. It is an innate (inborn) behavior just like kinesis. 2. Kinesis is the undirectional and random movement of organisms in response to a stimulus. Since it generates random movements, kinesis is neither positive nor negative.)

(b) Explain the significance of insight learning in animal behavior. (03 marks)

Insight learning is a behavior based on past experience and reasoning among human beings and other animals like chimpanzees and even birds like the crow. Insight learning helps animals to make tools that are used in solving problems. For example chimpanzee have been seen stripping leaves off a twig and then push the twig into a hole in a termite mound. After termites bite and stick onto the twig, the chimpanzee pulls the twig out of the hole and then eats the soldier termites clinging to it.

(c) Giving an example in each case, explain the role of the following organic chemicals in territoriality in animals;

(i) Pheromones. (03 marks)

Pheromones can be used by animals to mark territories and serve as warning to members of their own kind. Pheromones are also used by animals to communicate reproductive readiness and so attract mates from several miles away in those in other territories.

IN C I B S.3 PAGE 56 (For the case of detecting mates, the insects such as the blowfly use chemosensory hairs on their antennae to detect pheromones released from abdominal glands in females several kilometers away.)

(ii) Testosterone hormone. (03 marks)

C I B S.3 page 71 (However, the importance of testosterone is not limited to puberty because in adulthood, it is important for functions such as maintaining libido, sperm production, maintaining muscle strength and mass and promoting healthy bone density. Influence aggression and dominance for establishing and defending territories in some animals.)

45. (a) Explain the meaning of a **meristem**. (02 marks)

C I B S.4 page 3 (The meristem is a type of plant tissue that is made up of undifferentiated cells that are capable of dividing continuously. Meristems are found in the tips of stems and roots and in cambium. These meristematic cells are actually the stem cells in plants that are clumped together and can develop into all other types of plant tissues and organs such as leaves, stems, roots, flowers etc.)

(b) How is dormancy induced in buds of plants growing in areas that experience variation in day lengths? (02 marks)

Through photoperiodism which is the physiological response of plants to the length of day and night. Therefore plants growing in areas experiencing day length, the shorter day lengths or longer nights can signal a plant to incoming onset of adverse conditions such as winter, hence inducing dormancy in the buds.

(c) How does secondary thickening contribute to increase in strength and support of a growing plant? (04 marks)

C I B S.4 page 3 (The meristematic cells responsible for secondary thickening are called lateral meristems which are composed of vascular cambium and cork cambium. Vascular cambium is located within the vascular bundle. In dicotyledonous stems, the vascular cambium gives rise to secondary phloem and secondary xylem also known as wood. These secondary xylem besides conducting water and mineral salts also provide mechanical strength and hence support the growing dicot plant.)

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

Primary growth enable plants to compete favorably for resources, reproduce efficiently and adapt to their environment with ease.

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

C I B S.3 page 207 (Continuous variation is variation that has no limit on the value that can occur within a population since they are determined by many genes with environment having effect on the phenotype.). **C I B S.3 page 208** (Discontinuous variation is variation that has distinct groups for organisms to belong to, since they are determined by one or few genes with the environment having not effect on the phenotype.)

(b) Explain the genetic basis of

(i) continuous variation. (02 marks)

Continuous variation phenotypes determined by multiple genes and they can also be influenced by environmental factors. Continuous variation therefore contributes to the diversity of traits (phenotypes) in the population though some of the traits that have been affected by the environment cannot be transmitted to the offspring.

IN C I B S.3 PAGE 207 (Continuous variation is variation that has no limit on the value that can occur within a population since they are determined by many genes with environment having effect on the phenotype. Examples of such characteristics are: height, weight, foot length, intelligence in humans. All these characteristics can be influenced by the environment in which they live. For instance, a plant growing in fertile soil will have leaves longer than those in poor soils.)

(ii) discontinuous variation. (01 mark)

C I B S.3 page 208 (Discontinuous variation is variation that has distinct groups for organisms to belong to, since they are determined by one or few genes. Some examples of discontinuous variation are: tongue rolling, finger prints, eye colour, blood groups, gender, albinism, color blindness. For instance, human blood group is an example of discontinuous variation. There are only 4 types of blood group. There are no other possibilities and there are no values in between and they will never be affected by the environment in which the organism lives.)

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

This is because commercial crop varieties are always bred to have a relatively uniform genotype so as to meet only certain agricultural target. This uniformity in genotype ensures predictable growth pattern, quality of crops hence simplifying farming practices.

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

Relatively uniform genotype can lead to a reduction in genetic diversity hence reducing the resilience of crops to changes in environmental conditions. Besides changes in the environment, relatively uniform genotype can also increase the vulnerability to pests or diseases especially if such a pest has adaptations that can attack a certain genetic trait present in the crop varieties the farmer is growing.

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