



BIOLOGY
HIGHER LEVEL
PAPER 1

Monday 5 November 2001 (afternoon)

1 hour

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. What happens as a cell grows larger?
 - A. The surface area to volume ratio increases.
 - B. The metabolic rate of the cell increases.
 - C. Heat exchange becomes more efficient.
 - D. Materials are not absorbed quickly enough for the cell's needs.

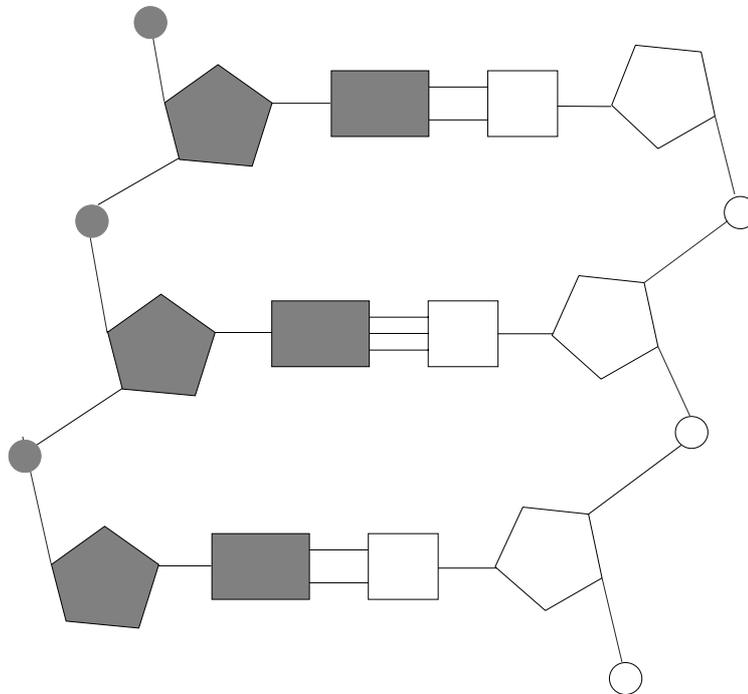
2. Which statement correctly describes the Golgi apparatus?
 - A. It is found in prokaryotic and eukaryotic cells.
 - B. It is composed of a stack of disc-shaped structures.
 - C. It is only found in plant cells.
 - D. It is situated within the endoplasmic reticulum.

3. What happens during the process of mitosis?
 - A. The chromosome number is halved.
 - B. Identical DNA molecules are separated.
 - C. The cell grows until its volume has doubled.
 - D. All of the DNA in the nucleus is replicated.

4. If an enzyme was extracted from *Sulfolobus acidocaldarius* (a bacterium found in acidic hot springs with temperatures up to 90 °C), what is likely to cause the fastest denaturation of the enzyme?
 - A. Dissolving the enzyme in a solution with a very high pH
 - B. Placing the enzyme in a very high substrate concentration
 - C. Storing the enzyme in a refrigerator at 4 °C
 - D. Storing the enzyme in oxygen-free (anaerobic) conditions

5. What are the components of a DNA nucleotide?
- A. A pair of complementary bases
 - B. A double helix held together by hydrogen bonds
 - C. A deoxyribose sugar, a base and a phosphate
 - D. A triplet of bases that form a codon

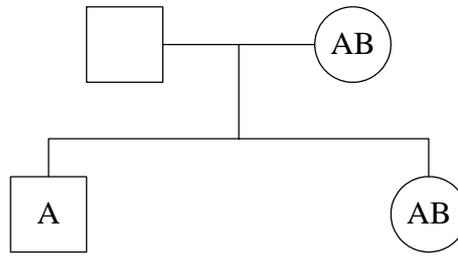
6. The diagram shows part of a molecule produced by replication of DNA. What is the significance of the shaded and the unshaded regions?



- A. The shaded parts are DNA and the unshaded parts are mRNA.
- B. The shaded parts contain adenine and thymine and the unshaded parts contain guanine and cytosine.
- C. Helicase cannot bind to both the shaded and the unshaded parts at the same time.
- D. One of the parts has been newly synthesised and the other was part of a pre-existing DNA molecule.

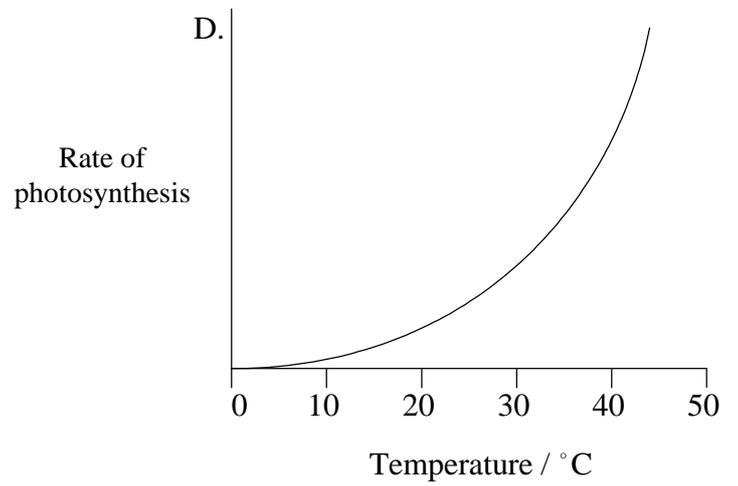
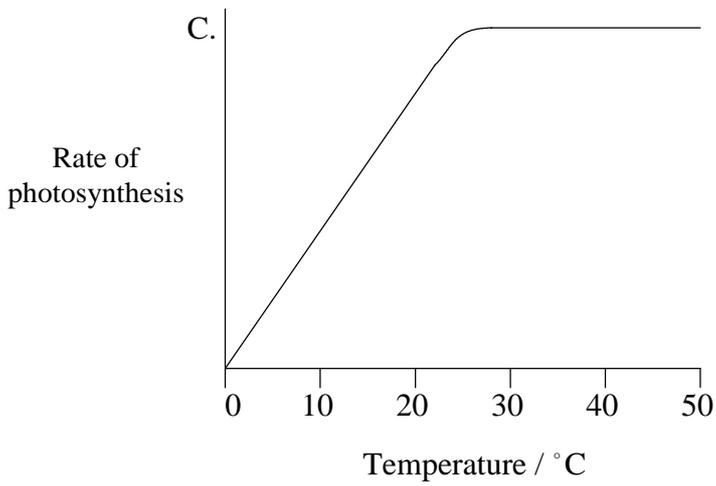
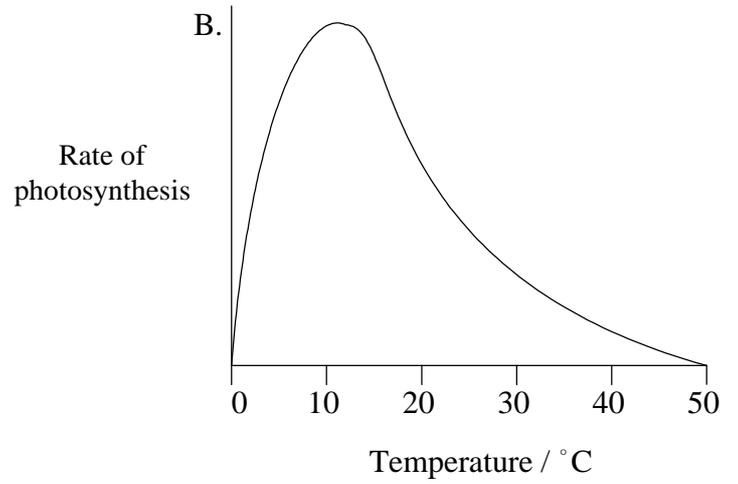
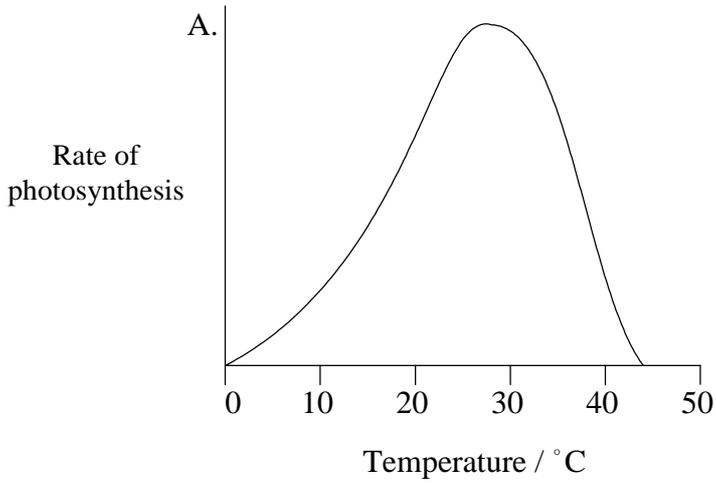
7. What is the result of gel electrophoresis?
- A. Molecules with a different size or charge become separated.
 - B. DNA is broken up into fragments of different size.
 - C. Many copies of a DNA molecule are made.
 - D. Genes are spliced together to form recombinant DNA.
8. Down's syndrome in humans is due to an abnormal chromosome number. What is the cause of this?
- A. Polyploidy
 - B. Triploidy
 - C. Disjunction
 - D. Non-disjunction
9. Duchenne muscular dystrophy in humans is caused by a recessive allele of a gene. This gene is located on the X chromosome and not on the Y chromosome. How frequently will Duchenne muscular dystrophy occur in females?
- A. No females will have Duchenne muscular dystrophy.
 - B. Fewer females will have Duchenne muscular dystrophy than males.
 - C. Equal proportions of females and males will have Duchenne muscular dystrophy.
 - D. More females than males will have Duchenne muscular dystrophy.

10. The pedigree chart below shows the blood groups of two children and their mother. What could be the blood group of the father?

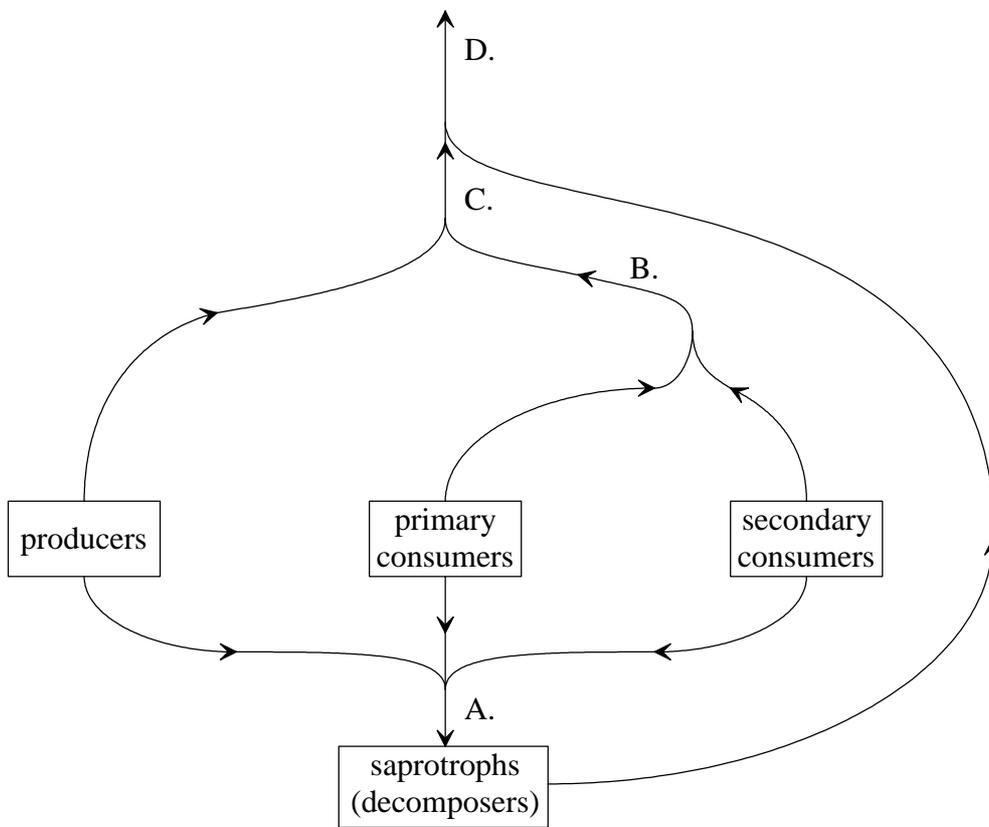


- A. A only
 - B. A or B only
 - C. A, B or AB only
 - D. A, B, AB or O
11. What are the members of one species in a particular area at a particular time called?
- A. A community
 - B. An ecosystem
 - C. A population
 - D. A habitat

12. Which graph represents the relationship between temperature and the rate of photosynthesis?



13. Which arrow in the energy flow chart below represents the heat produced by all respiring organisms in a habitat?



14. Which factor could cause a population to fall below the carrying capacity of the environment?

- A. Disease
- B. Immigration
- C. A decrease in mortality
- D. Over-production of offspring

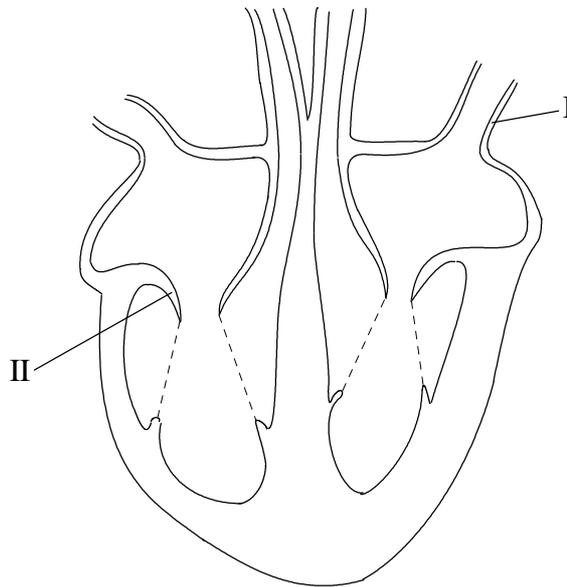
15. What is a cause and a result of the increased greenhouse effect?

	Cause of the increased greenhouse effect	Result of the increased greenhouse effect
A.	release of CFCs	skin cancer
B.	burning of fossil fuels	acid rain
C.	burning of fossil fuels	climate change
D.	release of CFCs	urban pollution

16. Which statement correctly describes the absorption of glucose in the digestive system?

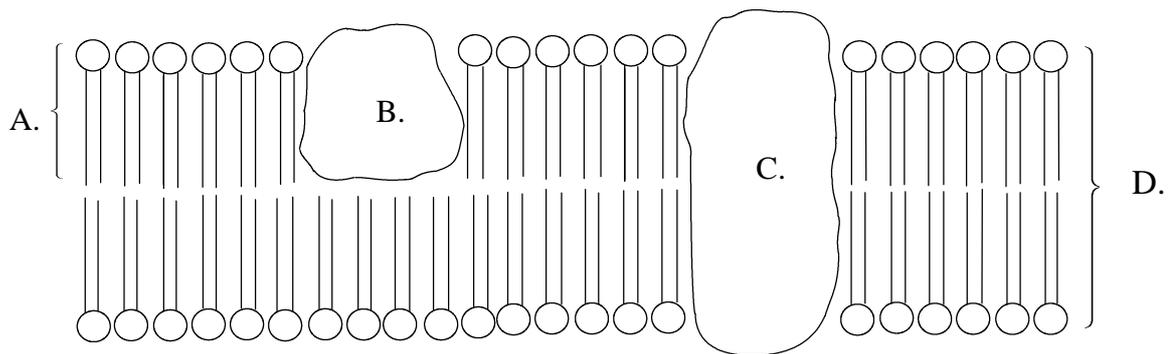
- A. It is stimulated by the hormone insulin.
- B. It occurs in the large intestine.
- C. It occurs in the small intestine.
- D. It is stimulated by the hormone glucagon.

17. What are the structures labelled I and II on the diagram of the heart below?



- A. I is the pulmonary vein and II is the atrio-ventricular valve.
 - B. I is the pulmonary artery and II is the atrio-ventricular valve.
 - C. I is the pulmonary vein and II is the semi-lunar valve.
 - D. I is the pulmonary artery and II is the semi-lunar valve.
18. How do the mucus membranes help to protect the body from infectious disease?
- A. They form a barrier.
 - B. They produce antibodies.
 - C. They release phagocytic leucocytes.
 - D. They absorb mucus.

19. Regular exercise causes changes to the heart both during the exercise and at rest. The stroke volume (amount of blood pumped per heart beat) and the heart rate (number of beats per minute) are both affected. What is the effect of regular exercise on the heart when the body is at rest?
- A. The stroke volume and the heart rate are both increased.
 - B. The stroke volume is increased and the heart rate is decreased.
 - C. The stroke volume is decreased and the heart rate is increased.
 - D. The stroke volume and the heart rate are both decreased.
20. The levels of oestrogen, progesterone, FSH and LH vary during the menstrual cycle in women. Each hormone reaches its maximum level at a different stage in the cycle. In what sequence do the hormones reach their maximum level, if the cycle begins at the start of menstruation?
- A. LH, progesterone, FSH, oestrogen
 - B. FSH, progesterone, LH, oestrogen
 - C. LH, oestrogen, FSH, progesterone
 - D. FSH, oestrogen, LH, progesterone
21. The diagram below shows part of the structure of a cell surface membrane (plasma membrane). Which structure will carry out active transport?



22. What would be transcribed from this DNA base sequence?

3'-C-C-G-A-A-T-G-T-C-5'

- A. 3'-G-G-C-U-U-A-C-A-G-5'
- B. 3'-G-G-C-T-T-A-C-A-G-5'
- C. 5'-G-G-C-U-U-A-C-A-G-3'
- D. 5'-G-G-C-T-T-A-C-A-G-3'

23. Which enzyme is responsible for splitting the DNA double helix during replication in a eukaryote cell?

- A. DNA polymerase I
- B. DNA polymerase III
- C. DNA ligase
- D. Helicase

24. Which bonds are used in the primary structure of proteins?

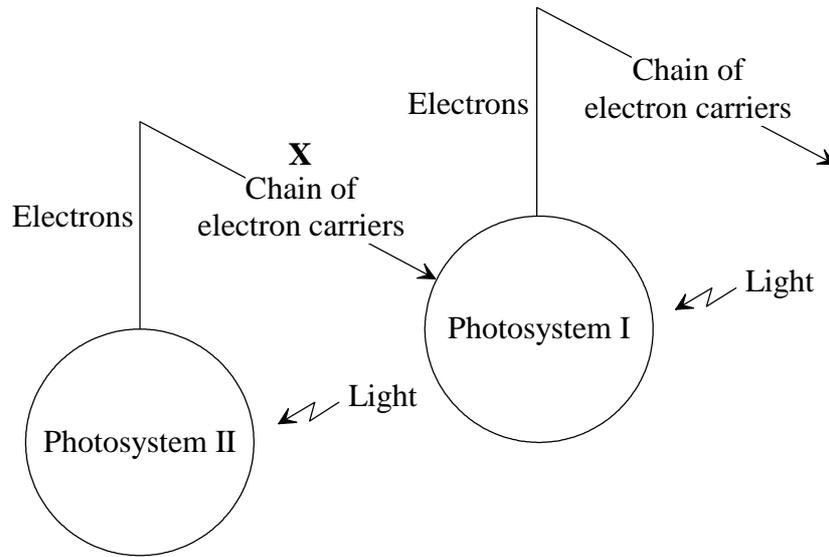
- I. peptide linkages
- II. hydrogen bonds
- III. ionic bonds

- A. I only
- B. II only
- C. I and II only
- D. I, II and III

25. What is the role of oxygen in aerobic respiration?

- A. To provide the energy for the Krebs cycle
- B. To allow glycolysis of hexose sugars
- C. To accept electrons at the end of the electron transport chain
- D. To accept hydrogen from $\text{NADH} + \text{H}^+$

26. The diagram below summarises the light-dependent reactions in photosynthesis. What is occurring at X?



- A. $\text{ADP} + \text{P}_i \rightarrow \text{ATP}$
 - B. $\text{NADP}^+ \rightarrow \text{NADPH} + \text{H}^+$
 - C. $\text{H}_2\text{O} \rightarrow \text{O}^{2-} + 2\text{H}^+$
 - D. $\text{NADPH} + \text{H}^+ \rightarrow \text{NADP}^+$
27. What is the first identifiable product of carbon dioxide fixation in photosynthesis?
- A. Ribulose biphosphate (RuBP)
 - B. Glycerate 3-phosphate (GP)
 - C. Triose phosphate (TP)
 - D. Acetyl co-enzyme A
28. A diploid cell contains the alleles R and r on one pair of homologous chromosomes and the alleles S and s on another pair of homologous chromosomes. How many combinations of these alleles could appear in the gametes after meiosis?
- A. 1
 - B. 2
 - C. 4
 - D. 16

29. The genes for height and flower colour in peas are unlinked. The allele for tallness (T) is dominant over the allele for dwarfness (t). The allele for red flowers (R) is dominant over the allele for white flowers (r).

If a plant with the genotype TtRr is crossed with a plant which has the genotype ttRr, what proportion of the offspring will be tall white flowered plants?

- A. $\frac{1}{4}$
- B. $\frac{3}{16}$
- C. $\frac{1}{8}$
- D. $\frac{1}{16}$
30. Genes P, Q, R and S are located on the same chromosome. The cross over values between them are:

P–Q 20 %
P–R 30 %
P–S 15 %
Q–R 15 %
Q–S 30 %
R–S 40 %

What is the sequence of genes in the gene map of the chromosome?

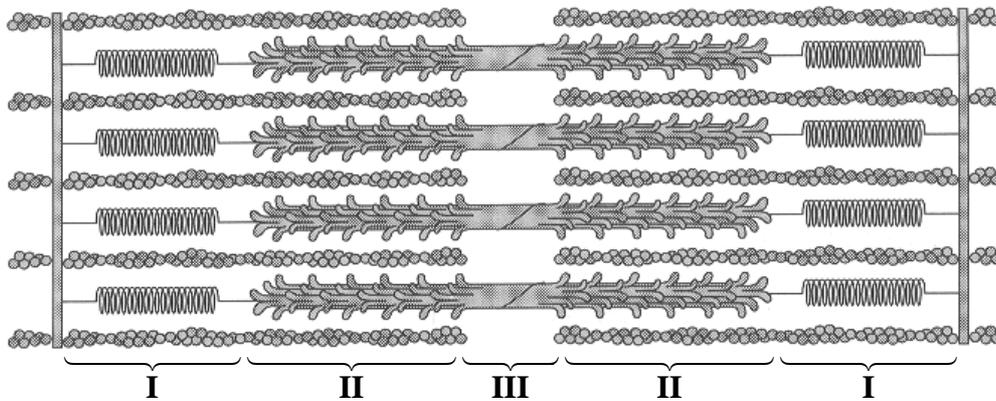
- A. S, P, Q, R
- B. R, P, Q, S
- C. P, R, S, Q
- D. Q, S, R, P
31. Farmers in Argentina often travel to Scotland to buy Aberdeen Angus bulls to mate with their Aberdeen Angus cows. Which term describes this process?
- A. Interspecific hybridisation
- B. Outbreeding
- C. Inbreeding
- D. Polyploidy

32. Which statement most accurately describes the acrosome reaction in mammals?
- A. The release of enzymes which allow the sperm to reach the egg
 - B. The release of carbohydrate which prevents the entry of sperm into the egg
 - C. The release of carbohydrate which allows the sperm to reach the egg
 - D. The release of enzymes which prevent entry of sperm into the egg
33. What is a pathogen?
- A. A disease
 - B. An organism that causes disease
 - C. A white blood cell that fights disease
 - D. A molecule recognised as foreign by the immune system
34. Two systems of immunity exist: the cell-mediated response and the humoral response. What is the role of the B cells?
- A. To stimulate T cells to divide
 - B. To release antigens into the plasma
 - C. To release antibodies into the plasma
 - D. To engulf antigens
35. What organisms are classified into the kingdom Protocista?
- A. Eukaryotes and prokaryotes
 - B. Some eukaryotes
 - C. All prokaryotes
 - D. All eukaryotes

36. What happens to calcium ions after an impulse has passed across a synapse, between a motor neurone and a muscle fibre?

- A. They are pumped out of the motor neurone into the synaptic gap.
- B. They diffuse into the motor neurone through ion channels.
- C. They diffuse across the synaptic gap and bind to receptors in the post-synaptic membrane.
- D. They bind to the neurotransmitter in the synaptic gap and break it down.

37. What happens to the length of I, II and III during muscle contraction?

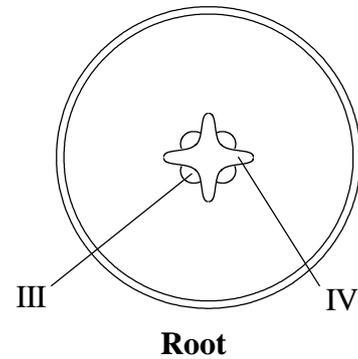
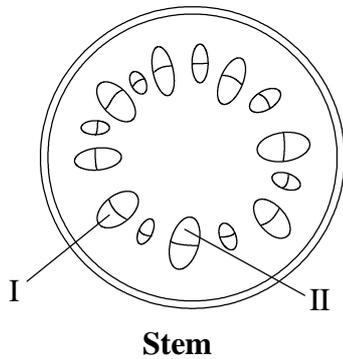


	I	II	III
A.	shortens	shortens	shortens
B.	shortens	no change	shortens
C.	no change	shortens	no change
D.	shortens	lengthens	shortens

38. Ultrafiltration occurs between the capillaries of the glomerulus and the Bowman's capsule of the nephron. What is the reason for the high permeability of these capillaries?

- A. Absence of ADH
- B. The fenestrations of the capillary wall
- C. The high concentration of plasma proteins
- D. Low blood pressure in the capillary

39. The diagrams below show the distribution of tissues in the stem and root of a dicotyledonous plant. Which tissues are xylem?



- A. I and III
B. I and IV
C. II and III
D. II and IV
40. When a plant is transpiring, water rises up in the xylem vessels from the roots to the leaves. This flow of water is called the transpiration stream. What property of water is essential for the transpiration stream to happen?
- A. When water evaporates it removes heat and therefore causes cooling.
B. Water is a good solvent so inorganic particles can be carried up in the transpiration stream.
C. Water rises up narrow tubes by capillary action.
D. Water molecules are cohesive and therefore can be pulled up.
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