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PREVIOUS YEAR PAPER · 2022

OLYMPIAD · STAGE I

NSEB

National Standard Examination in Biology

2022

Question paper with official answer key

60	216	120 min	21
Questions	Maximum marks	Time	Paper code

Question paper and official answer key: Indian Association of Physics Teachers (IAPT), NSEB 2022, paper code 21.
Solutions and notes: Zigyan. This booklet is not an IAPT publication.

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Sulokya Bibhuty

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- Hardik Sharma — 3 Years Classroom
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- Sulokya Bibhuty — 3 Years Classroom
- Saksham Bishnoi — 4 Years Classroom

ASTRONOMY

- Sulokya Bibhuty — 3 Years Classroom

MATHEMATICS (IOQM)

- Priyanshi — 4 Years Classroom

Saksham Bishnoi qualified the Chemistry Olympiad twice and was selected for the Orientation-cum-Selection Camp at HBCSE, Mumbai.

16 selections	16 of 35	AIR 168
in JEE Advanced 2026	students of the batch selected	best JEE Advanced rank

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PART A-1 · ONE CORRECT OPTION

Q. 1 – 48 · +3 for a correct answer, –1 for a wrong one

1. Compare adults of the animals listed below and find out which animal has both higher annual energy expenditure and higher energy expenditure per unit body weight per day?

(A) Python (B) Frog (C) Man (D) Penguin

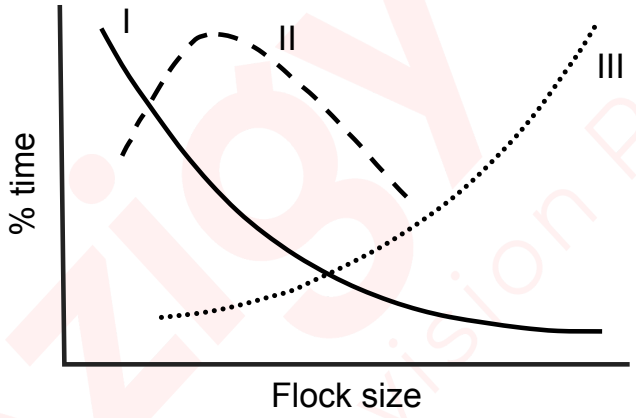
2. The correct sequence of arrangement in the decreasing order of size for Hemoglobin, *E.coli* ribosome and Tobacco mosaic virus (T.M.V.) is;

(A) *E.coli* ribosome > T.M.V. > hemoglobin
(B) Hemoglobin > T.M.V. > *E.coli* ribosome
(C) T.M.V. > hemoglobin > *E.coli* ribosome
(D) Hemoglobin > *E.coli* ribosome > T.M.V.

3. Which of the following animals is triploblastic, acoelomate and with ciliated body surface?

(A) Obelia (B) Taenia (C) Planaria (D) Fasciola

4. Several factors can influence optimal flock size in birds. The following graph indicates % time spent in three major lifestyle habits by birds of different flock size.



The three habits I, II and III respectively are:

(A) feeding, scanning, fighting
(B) fighting, feeding, scanning
(C) scanning, feeding, fighting
(D) feeding fighting, scanning

5. Predatory insects with two pairs of functional wings with an incomplete metamorphosis are:

(A) Dragonflies (B) Wasps (C) Caddisflies (D) Moths

6. Which of the following tools is used to determine the 3D structure of protein ?

(A) X- rays
(B) Mass spectrometry
(C) Liquid chromatography
(D) 2D gel electrophoresis

7. Among the following amino acids, arginine could have an ionic interaction with:

(A) Lysine (B) Glutamic acid (C) Valine (D) Methionine

8. Embryos of reptiles, birds and mammals have extraembryonic membranes. They perform essential functions for the developing embryo.

Match the predominant function with each type of membrane.

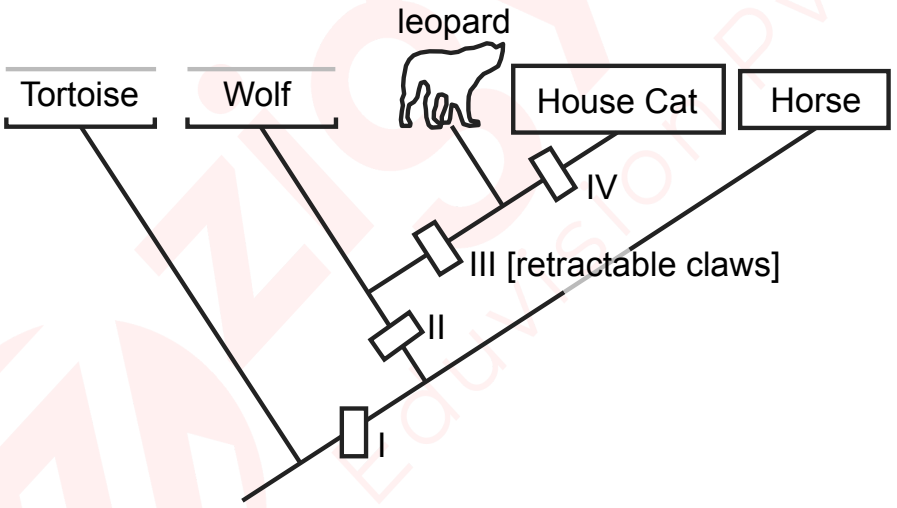
	Membrane		Function
i.	Yolk sac	P.	Storing metabolic waste
ii.	Chorion	Q.	Source of food
iii.	Allantois	R.	Gas exchange
iv.	Amnion	S.	Fluid enclosing and protecting embryo

(A) i – Q, ii – S, iii – P, iv – S
(B) i – S, ii – P, iii – Q, iv – R
(C) i – Q, ii – R, iii – P, iv – S
(D) i – S, ii – Q, iii – R, iv – P

9. Consider the following five animals:

horse, house cat, leopard, tortoise and wolf.

If they have to be correctly classified cladistically using the following scheme, what will be the characters at I, II, and IV respectively?



(A) I: carnivory II: hair IV: purring
(B) I: hair II: purring IV: carnivory
(C) I: purring II: hair IV: carnivory
(D) I: hair II: carnivory IV: purring

10. Birds show an adaptive cross-connection between blood vessels that increases the flexibility of their neck. The anastomosis between blood vessels of left and right side, allowing blood to flow freely even when the head twists and one of the vessels is pinched, is:

(A) Carotid anastomosis
(B) Cranial anastomosis
(C) Jugular anastomosis
(D) Branchial anastomosis

11. An animal who is known to be a marsupial shows the following body features:

- Almost hairless big ears
- Forelimbs with sharp claws
- Grey coat color
- Long sticky snout

What can be deduced about the animal's habits/habitat?

i. The animal is likely to be diurnal.

ii. The animal is likely to dig deep burrows.

iii. The habitat is likely to be sandy deserts.

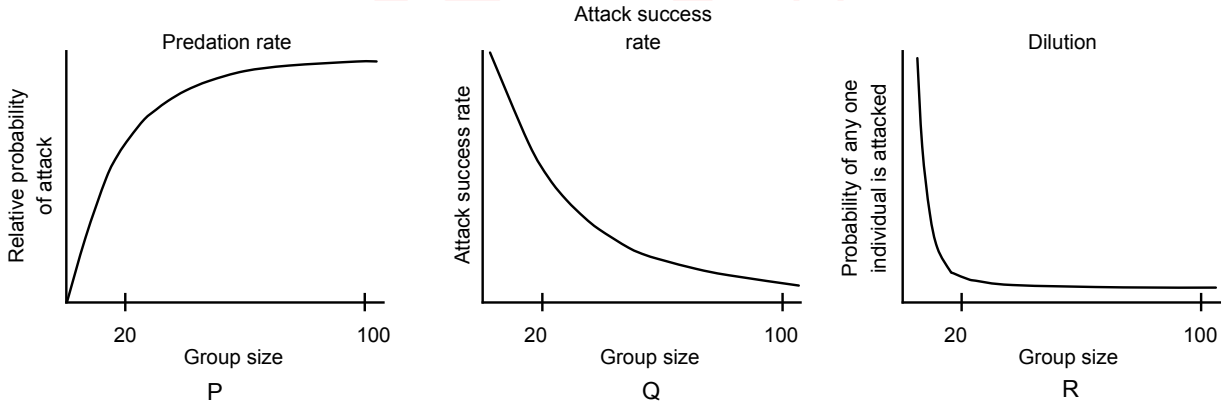
iv. The animal is likely to be insectivorous.

(A) i and ii only
(B) ii, iii and iv only
(C) ii and iii only
(D) all the four

12. MHC-I is expressed by almost all normal cells but not abnormal and infected cells. Cells of which of the following lymphoid lineages recognize tumor cells and virus-infected abnormal cells by the absence of MHC-I ?

(A) Th Cells.
(B) Tc Cells.
(C) NK Cell.
(D) B Cell

13. Empirical data suggests that optimal group size of animals is determined by costs and benefits associated with it. When predation risk and success rate were studied in prey-predator relationships, following graphs were obtained. Four possible factors that influence the group sizes of prey populations are given below.



I. Conspicuousness of group

II. Shared vigilance

III. Confusion effect

IV. Every individual with equal chance of being attacked

Match these against the correct graphs marked P, Q, and R:

(A) P: I; Q: II, III; R: IV
(B) P: IV; Q: II; R: III, IV
(C) P: IV; Q: II, III; R: I
(D) P: I; Q: II, III; R: IV

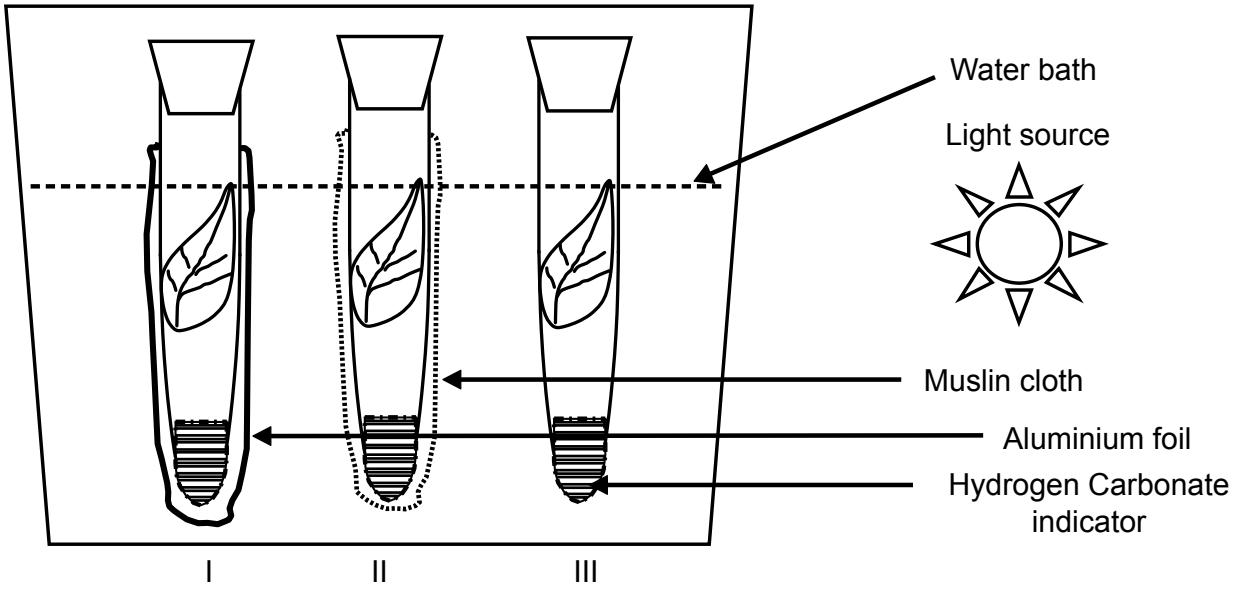
14. In a protein structure, α-helix hairpin, β-hairpin and β-α-β unit are the examples of:

(A) Secondary structure
(B) Super secondary structure
(C) Tertiary structure
(D) Quaternary structure

15. The immunoglobin (X) is present on mast cells and basophils. When bound to an antigen, it triggers the release of (Y) that causes (Z). Here X,Y and Z respectively refers to:

(A) IgA, Histamine and inflammation
(B) IgM, Interleukin and allergy.
(C) IgE, Histamine and allergy.
(D) IgD, Histamine and Interleukin.

16. Carefully observe the experimental setup given below. Hydrogen carbonate indicator is a cherry red coloured pH indicator which turns yellow in acidic conditions and purple in alkaline conditions. At the start of the experiment, equal quantities of this indicator (cherry red in colour) were added to each tube. A healthy green leaf of the same size was enclosed in each tube. The tubes were then kept for 15 min in a water bath to avoid heating due to the light source.



After incubation for a certain period of time, what would be the colour of the indicator in tubes I, II and III respectively?

(A) Cherry red, Cherry red, Yellow
(B) Yellow, Cherry red, Purple
(C) Purple, Yellow, Cherry red
(D) Yellow, Purple, Cherry red

17. Cyanogen bromide (CNBr) is a very selective agent that splits peptide bonds on the carbonyl side of every methionine residue in a protein. The number of polypeptides that will result from cutting of given protein by CNBr is:

NH_3^+ ~~~~~ Met . Met ~~~~~~ Met ~~~ Met ~~~~~ COO^-

(A) 3 (B) 4 (C) 5 (D) 6

18. A hypothetical population had alleles "A" and "a" with frequencies 0.9 and 0.1respectively. The genotypic frequencies of "AA", "Aa" and "aa" were 0.81, 0.18 and 0.01 respectively. Suppose a negative selection pressure acts against the dominant phenotype resulting in the reduction of the frequency of A in the present generation from 0.9 to 0.8, then the genotypic frequencies of the zygotes formed would be respectively

(A) 0.81; 0.18 and 0.01
(B) 0.64; 0.32 and 0.04
(C) 0.8; 0.1 and 0.1
(D) 0.54; 0.44 and 0.02

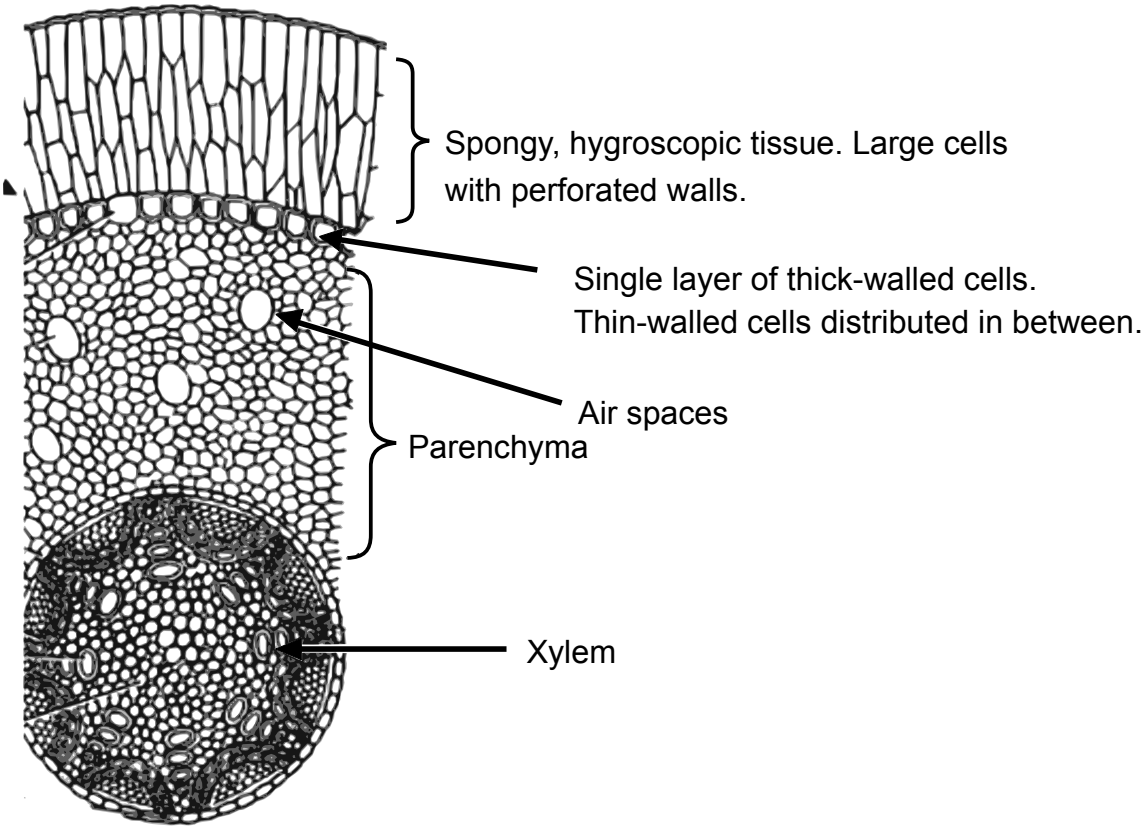
19. While studying the effect of two plant growth regulators; IAA and Cytokinin, five different sets of culture tubes with varying concentrations of the hormones were prepared as given in the following table. Explants of parenchyma tissue derived from the stem of tobacco plant were transferred on culture medium of all sets. After a particular period of time, the **set V** showed undifferentiated large mass of tissue.

Sets	**Conc. of IAA (mg dm^{-3})**	**Conc. of Cytokinin (mg dm^{-3})**
I	-	0.2
II	2.0	-
III	2.0	0.02
IV	0.02	1.0
V	2.0	0.2

What would be the expected result of culturing in set I to IV respectively?

(A) Shoot formation, Root formation, No growth, Cell enlargement
(B) No growth, Cell enlargement, Root formation, Shoot formation
(C) Cell enlargement, No growth, Shoot formation, Root formation
(D) Root formation, Shoot formation , Cell enlargement, No growth

20. Veena found a preserved root specimen in her college laboratory. The specimen jar label was half torn so she could not read the full name of the sample. She took a cross section and observed it under the microscope. She was not aware of the exact tissue types so she drew the diagram and labeled it as per her understanding. Looking at the features she mentioned, it could most likely be:

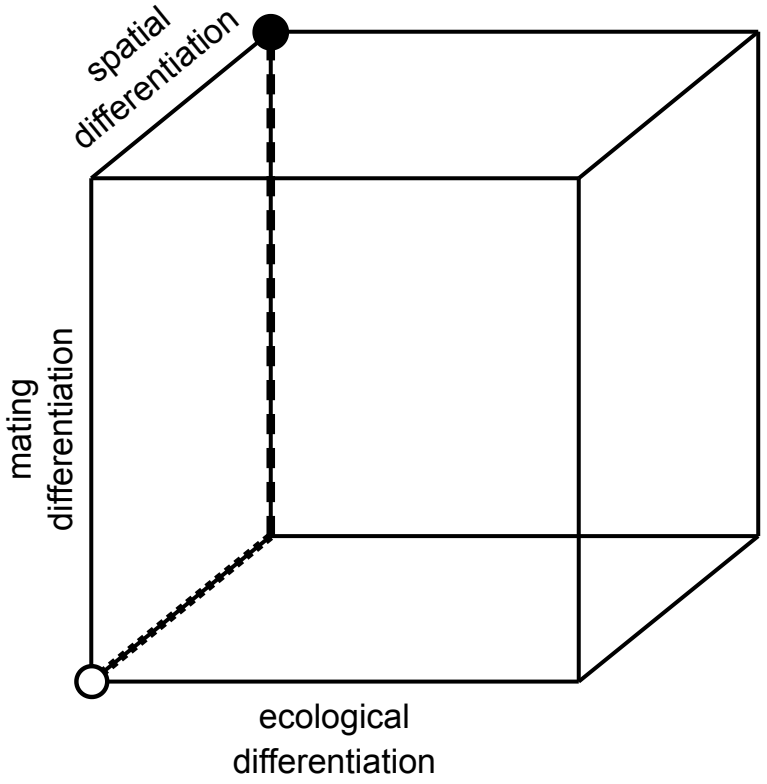


(A) Stilt root of maize plant
(B) Hanging root of an orchid
(C) Pneumatophore of halophyte
(D) Root of a Pteridophyte

21. During denaturation, globular protein becomes :

(A) Insoluble and inactive
(B) Inactive but soluble
(C) Unfolded and more soluble
(D) Soluble

22. The process of speciation is depicted in the adjoining figure with three factors that influence speciation. Identify the type of speciation that would explain the evolution of new species (marked with dark circle) from the original species (marked with white circle).

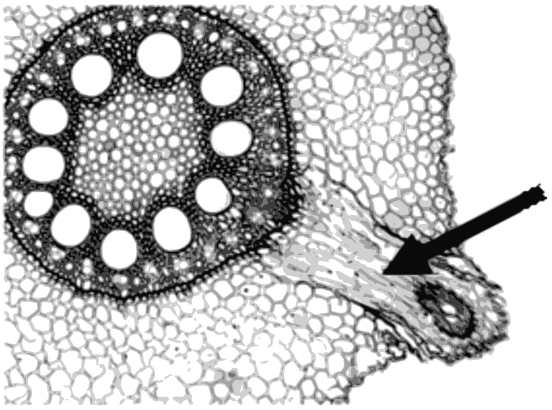


(A) Sympatric speciation
(B) Reproductive isolation
(C) Allopatric speciation
(D) Parapatric speciation

23. Erythrocyte sedimentation rate (ESR) is a common hematology test performed using blood containing anticoagulant. It measures the rate at which the red blood cells (RBCs), in a sample of whole blood, fall to the bottom inside a specific tube, under gravity. This sedimentation is due to rouleau formation where RBCs form a stack because of their discoid shape. Which of the following statements about ESR is correct ?

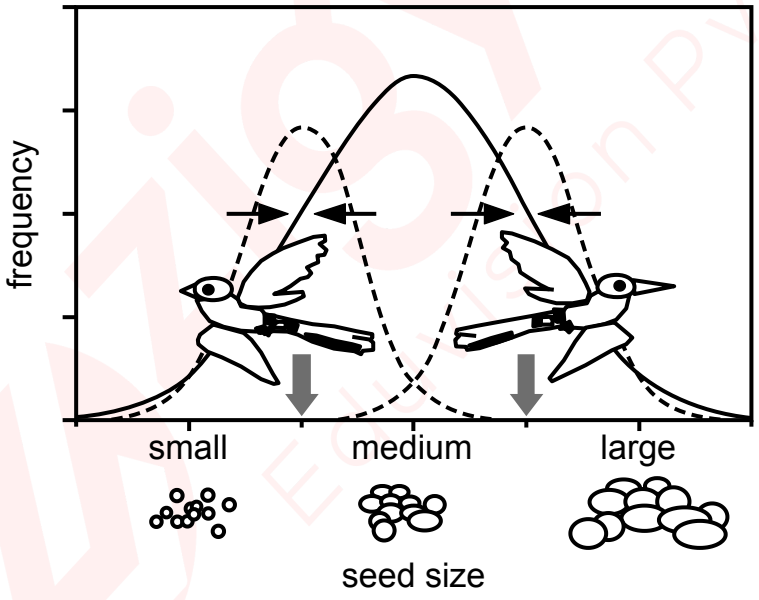
(A) Inflammatory conditions cause increase in “Acute Phase Proteins” in plasma, that cause the RBCs to repel from each other to form stacks.
(B) Increase in positively charged plasma proteins, increases neutralization of the negative charges on the surface of the RBCs, which allows the formation of the rouleaux.
(C) Bacterial endotoxins in plasma inhibit platelet aggregation causing RBC to clump.
(D) Anticoagulants in the blood increase the negative ions in plasma which increases charges on RBC membranes causing them to stack and form the rouleaux.

24. The adjoining figure is a transverse section of root of a monocot plant showing the stele. Identify the part pointed by arrow.



(A) Adventitious root
(B) Lateral root
(C) Tap root
(D) Adventitious bud

25. Evolutionary branching in a bird population is depicted in the figure below. Based on their phenotype (Bill size), the individuals compete for resources (seeds of different sizes). An individual can utilize only a limited fraction (indicated by the dashed curve) of the total available resources (solid curve).



Which of the following statements most appropriately describes the current status of the bird population, as shown in the figure?

(A) The mean bill size in the population does not match the most abundant resource, and therefore selection pushes the bill size to an intermediate value.
(B) The resources in the middle of the distribution curve are unutilized providing a new ecological niche to evolve in future.
(C) Since resources in the tails of the distribution curve are left unexploited, selection establishes individuals with either small or large beak sizes.
(D) Selection pressure splits the population into two ecological specialists that evolve an optimal compromise of foraging on the most abundant seeds and avoid competition.

26. A student in a biochemistry lab found three solutions in unlabelled beakers on his working table. He marked the beakers as P, Q and R and found that the H^+ concentration (moles per litre) of the three solutions was 10^{-4}, 10^{-7} and 10^{-10} respectively. The solutions P, Q, and R respectively could be:

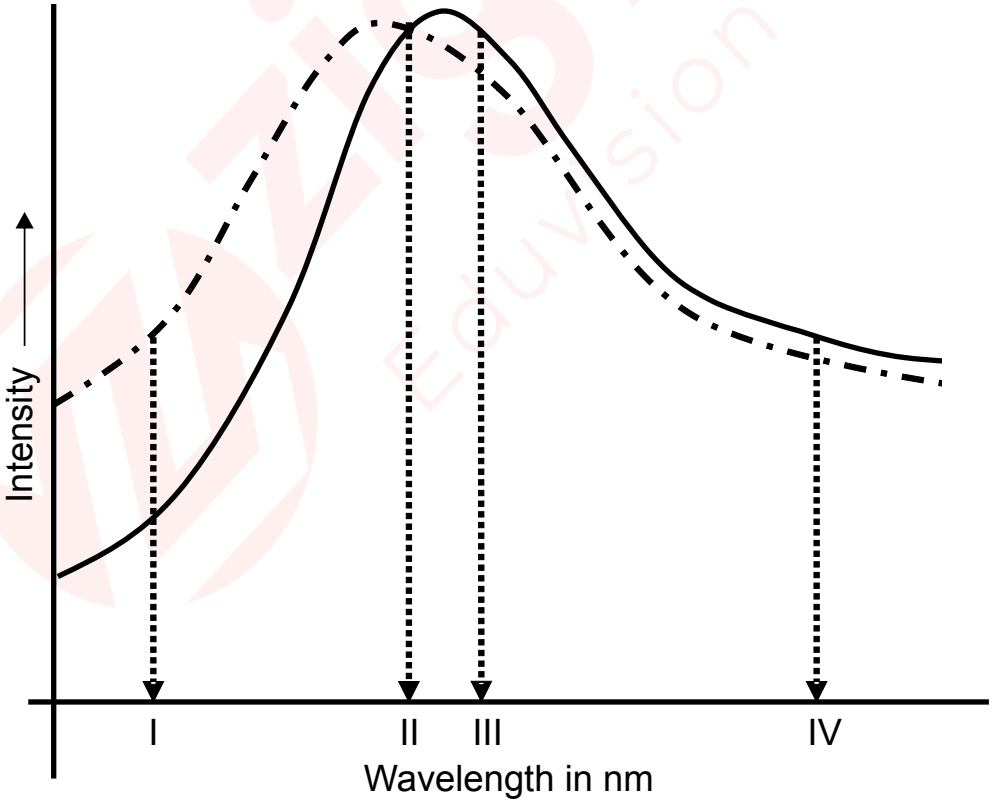
(A) Baking soda; sea water and beer
(B) Stomach acid; household ammonia and detergent
(C) Tomato juice; human blood and milk of magnesia
(D) Beer; human urine and vinegar

27. Most ants, bees and wasps exhibit haplodiploidy wherein males are haploid and develop from unfertilized eggs while females are diploid and develop from fertilized eggs. Which of the following would be true if the genetic relatedness between two daughters from the same mother in humans and ants are compared?

The genetic relatedness will be:

(A) less by a factor of 0.5 in ants.
(B) same in both cases.
(C) greater by a factor of 0.25 in ants.
(D) greater by a factor of 0.5 in ants.

28. Urea is used to produce conformational changes in protein and these changes can be studied using fluorescence emission spectroscopy. In the adjoining figure changes in fluorescence emission is shown for different excitation wavelengths for a protein both in the absence (dotted line) and in the presence (solid line) of urea Which of the excitation wavelengths marked as I, II, III and IV will be the best one to study the conformational changes ?



(A) I (B) II (C) III (D) IV

29. In a classic experiment, scientists selected fruit flies with many bristles (stiff, hairlike structures) on their abdomen. At the start of the experiment, the average number of bristles was 9.5. In each of the successive generations, scientists picked out 20% of the population with the greatest number of bristles and allowed them to reproduce. After 86 generations of such selection, the average number of bristles had quadrupled, to nearly 40.

This is an example of:

(A) Disruptive selection
(B) Natural selection
(C) Stabilizing selection
(D) Directional selection.

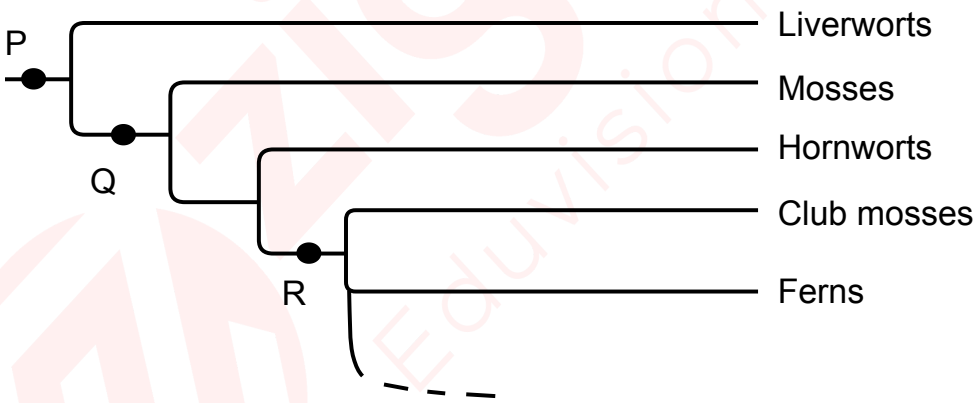
30. Warm blooded animals have mechanisms evolved for insulating their bodies. Choose the option that correctly depicts the increasing order of relative insulation that these body parts/components provide.

(A) Fat; Muscle; dry fur
(B) Muscle; fat; dry fur
(C) Muscle; dry fur; fat
(D) Dry fur; muscle; fat

31. Which of the following is NOT TRUE about DNA polymerase-I ?

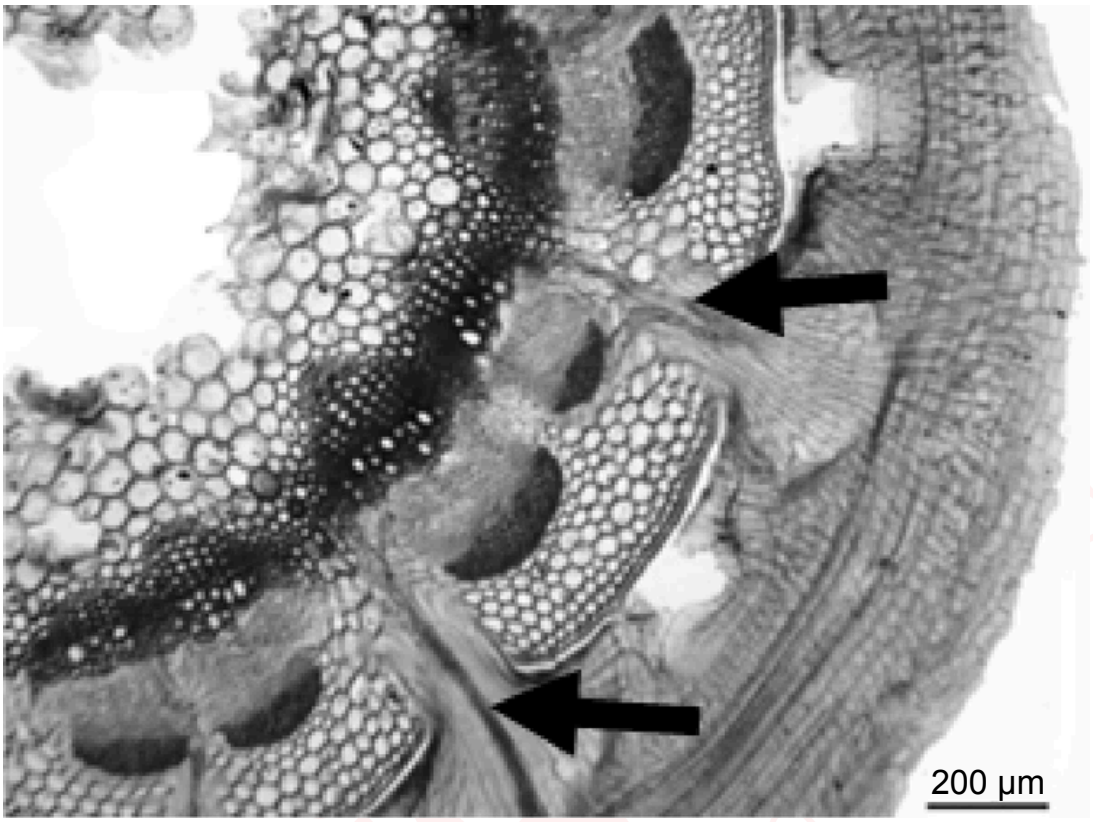
(A) It helps in the removal of primer and subsequent gap filling.
(B) It has both 5' to 3' and 3' to 5' exonuclease activity.
(C) It has low processivity and polymerization rate.
(D) It has only 5' to 3' exonuclease activity

32. The key characteristics that emerged during plant evolution are shown. P, Q and R respectively indicate:



(A) P: Persistent green sporophyte, Q: Protected embryos, R: Stomata
(B) P: Stomata, Q: Microphylls, R: Tracheids
(C) P: Microphylls, Q: Persistent green sporophyte, R: Stomata
(D) P: Protected embryos, Q: Stomata, R: Tracheids

33. The given figure is transverse section of a stem of *Trifolium repens* (White Clover), a flowering plant, with *Cuscuta epithymum* growing on its stem. Identify the part pointed by arrows.

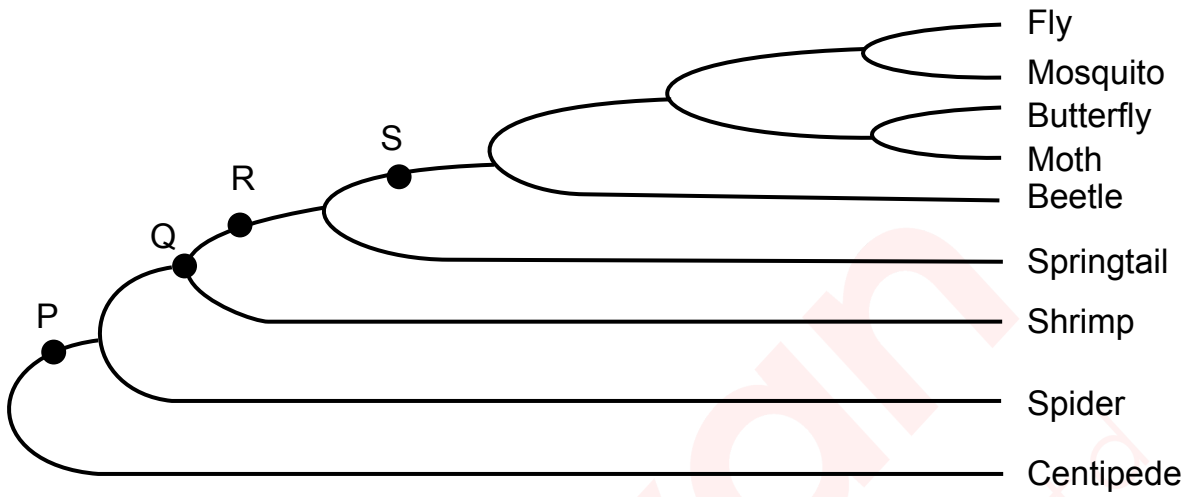


(A) Cork cambium
(B) Haustorium of parasite
(C) Secondary phloem
(D) Vascular cambium

34. Na^+-K^+ATPase is essential for maintaining various cellular functions and its inhibition could result in diverse pathologic states. Ca^{2+} transport in cardiac muscles is also linked to Na^+-K^+ ATPase. Cardiac glycosides such as digoxin directly inhibit the Na^+-K^+ATPase. With respect to cardiac muscles, which of the following statements are correct events after digoxin inhibition of Na^+-K^+ATPase?

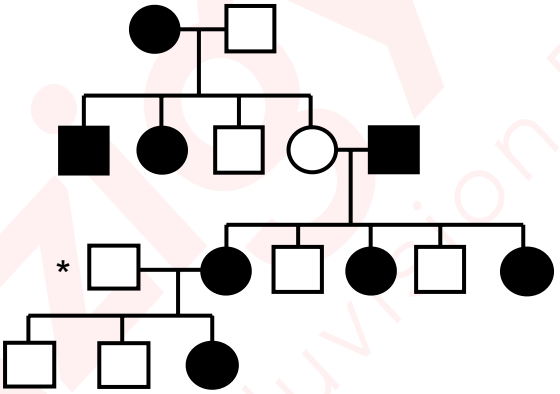
(A) Build-up of excessive K^+ extracellularly, and depletion of intracellular Na^+.
(B) Build-up of Ca^{2+} intracellularly leading to increased cardiac contractility.
(C) Inhibition Na^+-K^+ATPase stimulates the vagus nerve, causing an increase in heart rate.
(D) Changes in Na^+ ion concentration increases conduction of atrioventricular node causing stimulation of the sinoatrial node.

35. In insects, it has been found that change in the Ubx gene resulted in modifying a protein that blocks the development of legs in the abdominal region. Among the positions indicated as P, Q, R, and S in the cladogram, where the Ubx gene seems to have mutated?



(A) P (B) Q (C) R (D) S

36. What type of gene is involved in the inheritance pattern depicted in the adjoining human pedigree?



* Note: the person from outside the family does not carry a defective allele.

(A) X linked recessive
(B) Y linked recessive
(C) X linked dominant
(D) Autosomal recessive

37. The concentration of four components of air during respiration is provided in the table;

Gas (Pressure in Hg mm)	Air in inhalation	Air in exhalation	Air in Alveolus	Arterial blood	Venous Blood
1	158.25	116	100	95	37
2	5.0	47	47	47	47
3	596	568	573	573	573
4	0.3	28	40	40	46

Match the gases 1, 2, 3, and 4 with their names.

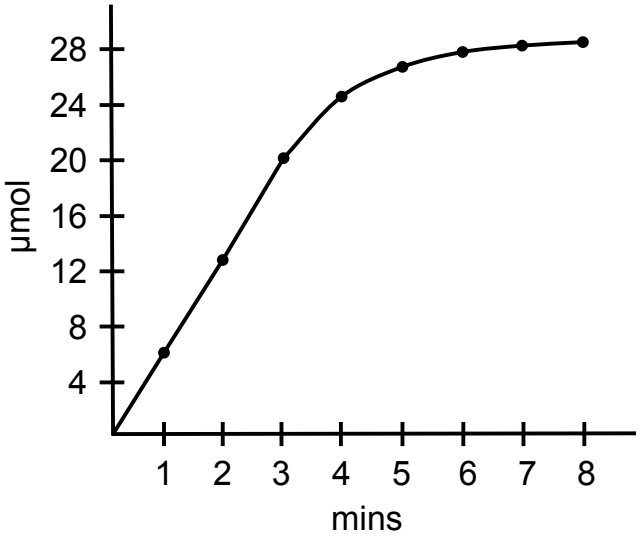
(A) 1 – Carbon dioxide, 2 – Water vapour, 3 – Nitrogen, 4 – Oxygen.

(B) 1 – Oxygen, 2 – Carbon dioxide, 3 – Nitrogen, 4 – Water vapour.

(C) 1 – Oxygen, 2 – Water vapour, 3 – Nitrogen, 4 – Carbon dioxide.

(D) 1 – Nitrogen, 2 – Water vapour, 3 – Oxygen, 4 – Carbon dioxide.

38. A student was following an enzyme catalyzed reaction. As the reaction progressed, she obtained the following graph showing the conversion of the substrate into the product.



Which of the following is the correct method to calculate product formed per minute?

(A) $[(\mu moles)_{3\ min} - (\mu moles)_{1min}]/2$

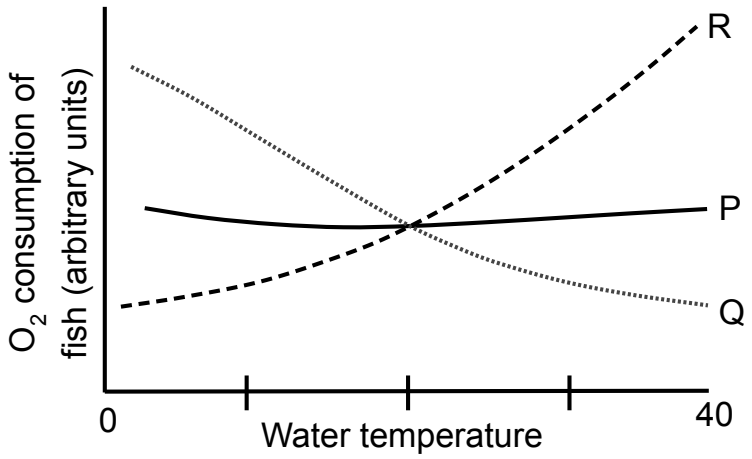
(B) $[(\mu moles)_{8min} - (\mu moles)_{7min}]$

(C) $[(\mu moles)_{8min} - (\mu moles)_{1min}]/7$

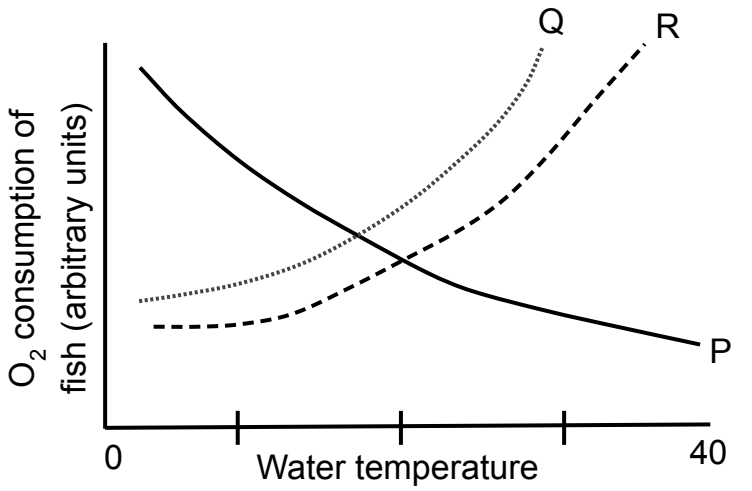
(D) $[(\mu moles)_{5min} - (\mu moles)_{0min}]/5$

39. Which of the following figures (marked A, B, C, and D) appropriately depict the relationship of (P) oxygen content of water, (Q) oxygen consumption of resting fish and (R) oxygen consumption of active fish with respect to water temperature?

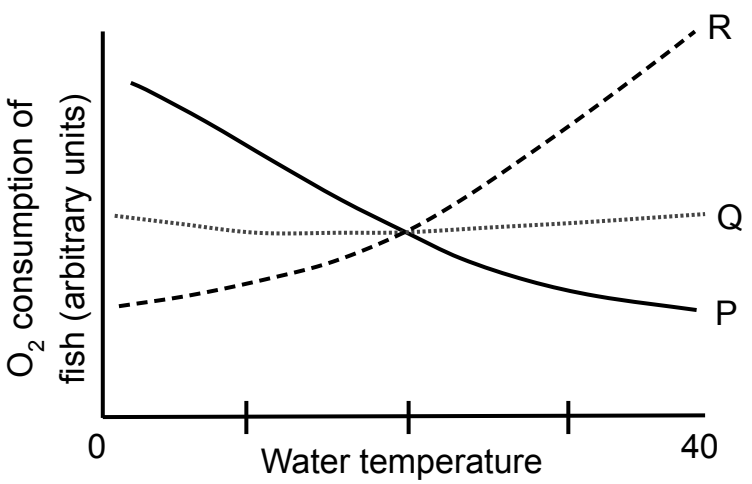
(A)



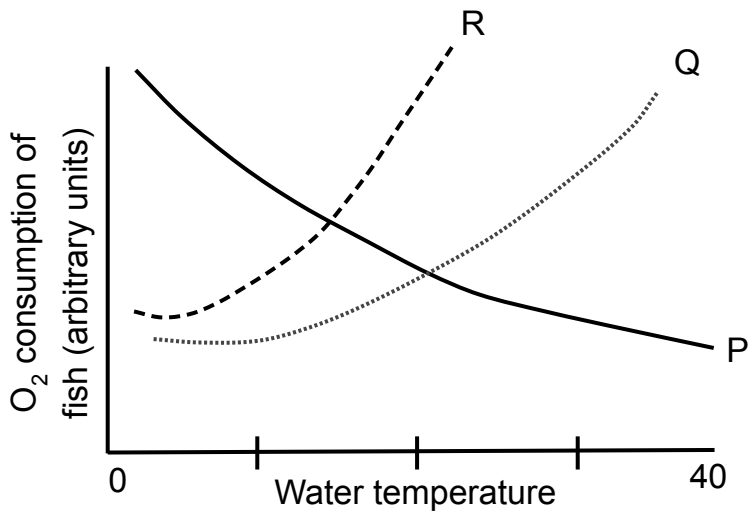
(B)



(C)



(D)



40. Colonisation of drier terrestrial habitats became possible in birds and mammals due to development of the renal system to manage osmotic concentration of urine. Which of the following adaptation is the most crucial for this development ?

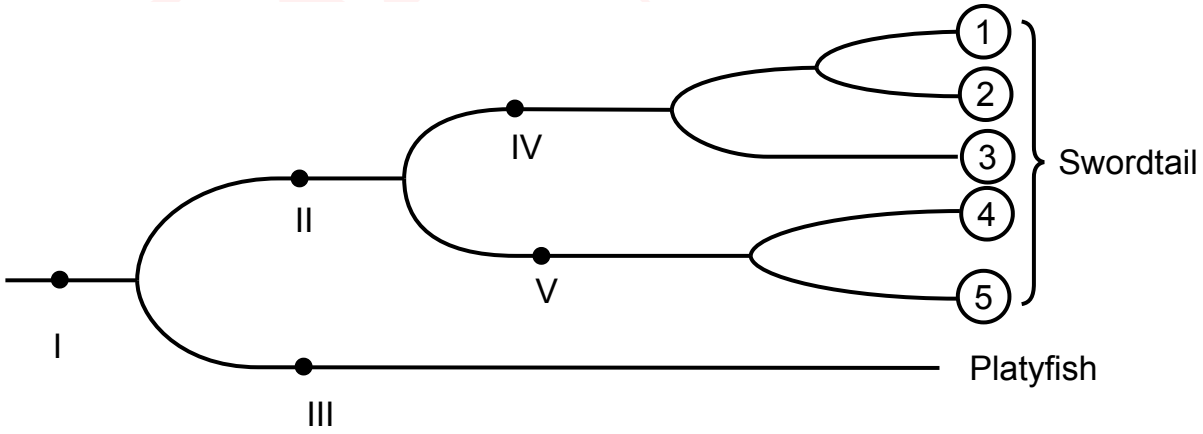
(A) Insertion of aquaporins into the luminal plasma membrane.

(B) Differentiation of the kidney into the cortex and medulla

(C) Appearance of Henle's loops.

(D) Increase in renal circulation.

41. Swordtail fishes belong to genus Xiphophorus. Males of these fishes have a long, colorful tail extension called Sword Males with short swords are less likely to be chosen by the female. In order to find whether female behavior of choosing longer sword evolved before or after the evolution of long sword, scientists used the closest relative of this fish, the platyfish, which lacks sword When they attached artificial long tail to male platyfish, females preferred the fish with long tails. Indicate in the diagram showing evolutionary relationship where these traits most likely have evolved.



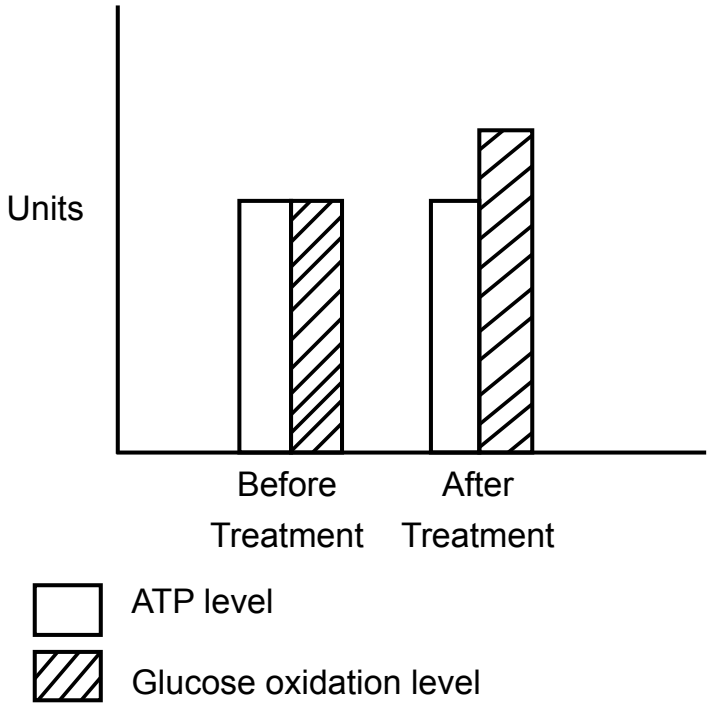
(A) Female sensory bias : I Sword: II

(B) Female choice : I Sword: IV, V

(C) Female choice : II, III Sword: IV, V

(D) Female choice : IV, V Sword: IV, V

42. After making several unsuccessful attempts to qualify in the final wrestling team, a person went to take the advice of a physical trainer. After he explained the case to him, the trainer advised him to take a blood test and then start a regime of drug. He also advised blood test post regime. The results of both tests are given.



The most likely use of the drug is:

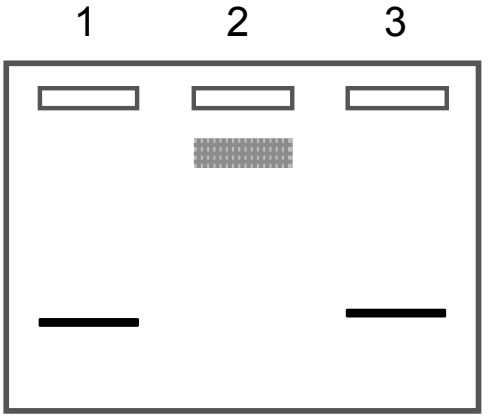
(A) to increase strength of skeletal mass.

(B) to reduce anaerobic respiration by the tissues.

(C) to reduce body weight by increasing body respiration.

(D) to get trained for endurance exercise to maintain low levels of ATP over long period

43. Electrophoresis was carried out to test the efficacy of an anticancer drug. In lane 1- circular DNA sample alone, in lane 2 - DNA mixed with topoisomerase, and in lane 3 - DNA+ topoisomerase mixed with the anticancer drug were loaded in the wells of an agarose gel and electrophoresed The result was as follows.



What can be the possible mechanism of action of the drug?

(A) The drug is likely to act by protecting the cells from damage.

(B) The drug is likely to affect topoisomerase I and helping DNA repair mechanism.

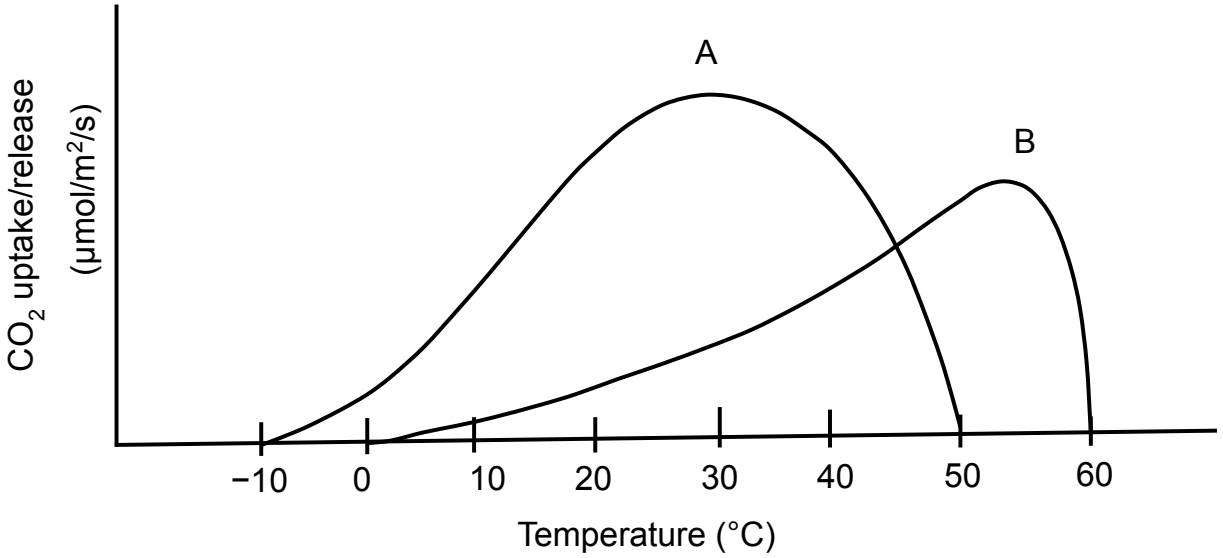
(C) The lane I and III represent intact supercoiled DNA thus indicating no effect of the drug.

(D) The drug is likely to be effective by inhibiting topoisomerase I enzyme that helps in DNA repair at multiple check points.

44. The blood in the capillaries has both a greater hydrostatic and greater osmotic pressure than the surrounding tissue fluid The difference in hydrostatic pressure tends to force water and dissolved materials out of the capillaries into the tissue fluid while the difference in the osmotic pressure has the opposite effect, causing the capillaries to take up water and the dissolved materials from the tissue fluid. If the osmotic pressure differential at the arteriole and the venule ends are 25mm Hg each; then what would be the expected hydrostatic pressure differentials at the arteriole and venule ends respectively to result in 11mm Hg net outward pressure and 10 mmHg net inward pressure respectively?

(A) 36 and 35 (B) 16 and 15 (C) 16 and 35 (D) 36 and 15

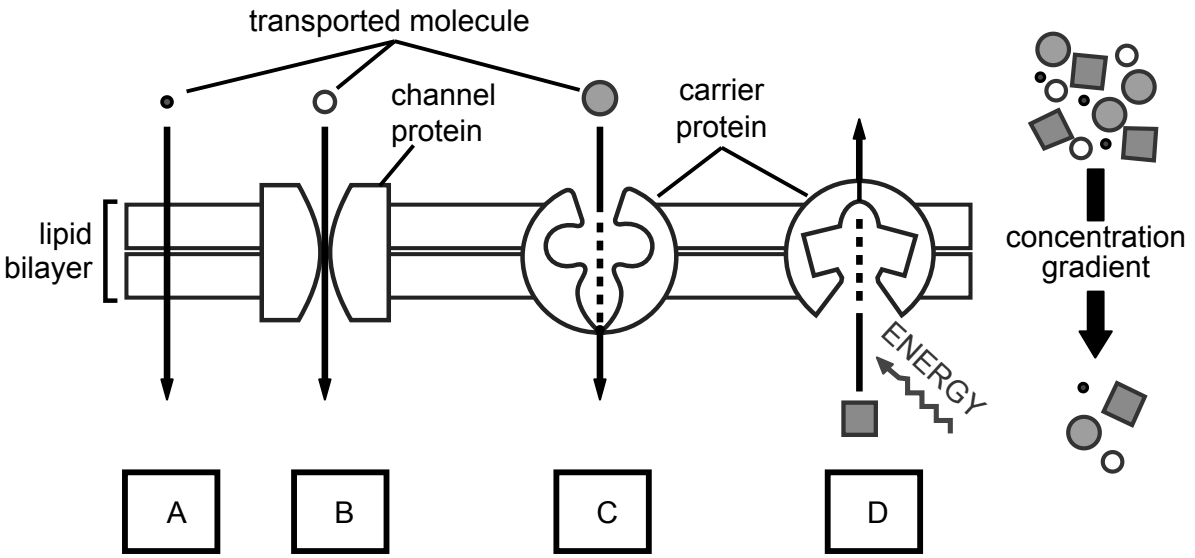
45. The response of the rates of photosynthesis (curve A) and respiration (curve B) to temperature is depicted in the graph.



The optimal temperature for net photosynthesis is:

(A) Between 10°C–20°C
(B) Between 20°C–30°C
(C) 32°C
(D) Between 40°C–50°C

46. In the figure given below identify the type of transport across membrane (marked A, B, C, and D) that needs maximum energy.



(A) A
(B) B
(C) C
(D) D

47. Hydronephrosis is a condition in which kidneys become swollen due to incomplete emptying of the urinary tract. Given below are the values of water content and some major electrolytes in four different tissue samples. One of them is normal kidney. Identify the other three and match the right alphabet with the respective number.

Values per Kg fat free tissue	Water (gm)	K (mM)	Na (mM)	Cℓ (mM)
Normal Kidney	802.2	58.3	82.6	67.7
1.	765	82.1	32.4	21.5
2.	922	3.72	142.0	109.0
3.	830.1	56.4	77.3	53.0

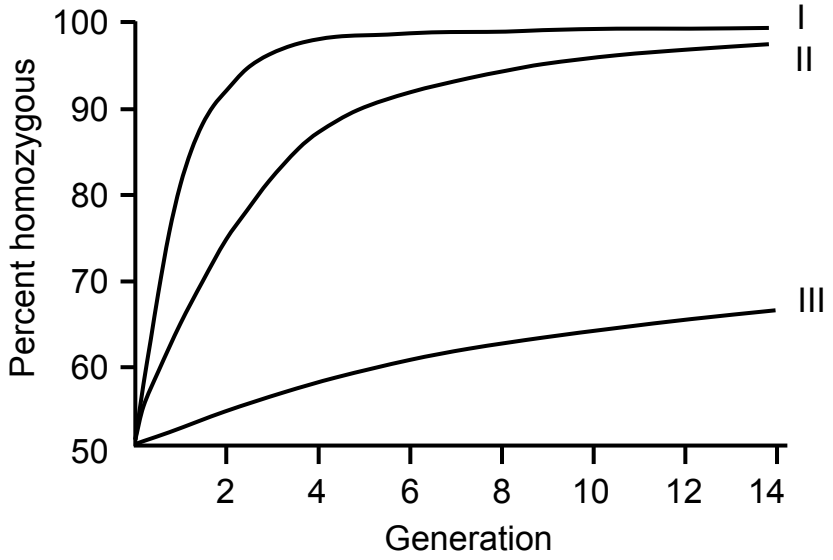
i. Hydronephrotic Kidney

ii. Muscle

iii. Serum

(A) 1. – ii, 2. – iii, 3. – i.
(B) 1. – i, 2. – ii, 3. – iii.
(C) 1. – iii, 2. – ii, 3. – i.
(D) 1. – iii, 2. – i, 3. – ii.

48. Curves I, II and III in the graph represent the impact of inbreeding on the percentage of homozygotes in the successive generations.



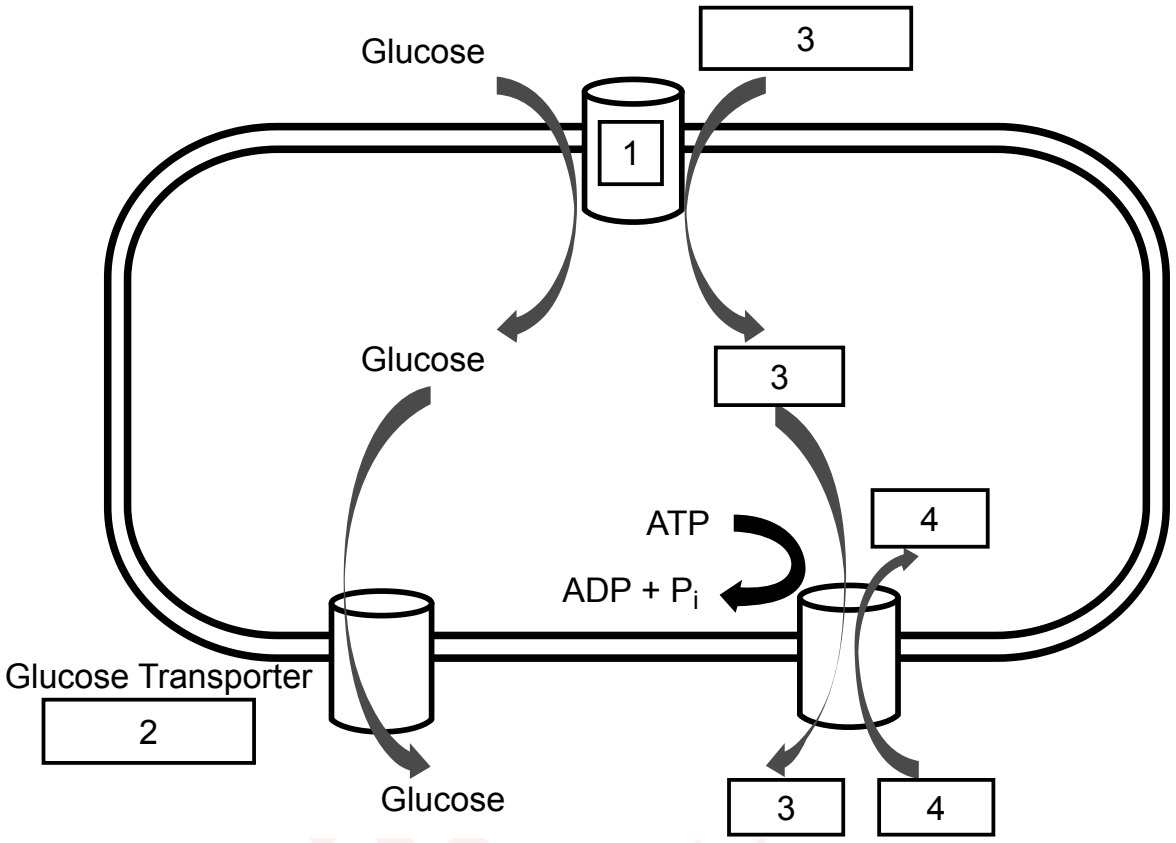
The types of breeding represented by the curves I, II and III respectively are:

(A) Brother –sister mating; mating of first cousins; self-fertilization
(B) Mating of first cousins; brother-sister mating; self-fertilization
(C) Self-fertilization; brother-sister mating; mating of first cousins
(D) Self-fertilization; mating of first cousins; brother-sister mating

PART A-2 · ONE OR MORE CORRECT OPTIONS

Q. 49 – 60 · 6 marks only if all correct options are marked · no negative marking

49. The figure below depicts glucose transport into intestinal cells. Study the figure carefully and identify the correct statements.



(A) 1 is a Uniport Transporter while 2 is a Symport Transporter

(B) 1 is a Symport Transporter while 2 is a Uniport Transporter

(C) 3 is Na+ ions While 4 is K+ ions.

(D) 3 is K+ ions and 4 is Na+ ions.

50. Since the characters fundamental to land plants first appeared in bryophytes, the key to understand transition of plants from aquatic to terrestrial habitats can be found in bryophytes. Which of the following Statements are in consonance with this hypothesis?

(A) Stomata are seen originally as a sporangial specialization, but in some bryophytes it is also expressed in the sporophyte vegetative body.

(B) In most of the bryophytes, rhizoid formation is restricted to the gametophyte.

(C) The cell walls of bryophytes contain lignin-related polyphenolic compounds as protection against UV irradiation and attack by micro-organisms.

(D) The mature gametophyte is a thallus or a leafy shoot in liverworts, a leafy shoot in mosses and a thallus in hornworts.

51. Renal portal system in reptiles drains the posterior part of the body into the kidney. In this context, with respect to reptilian body, which of the following statements are correct?

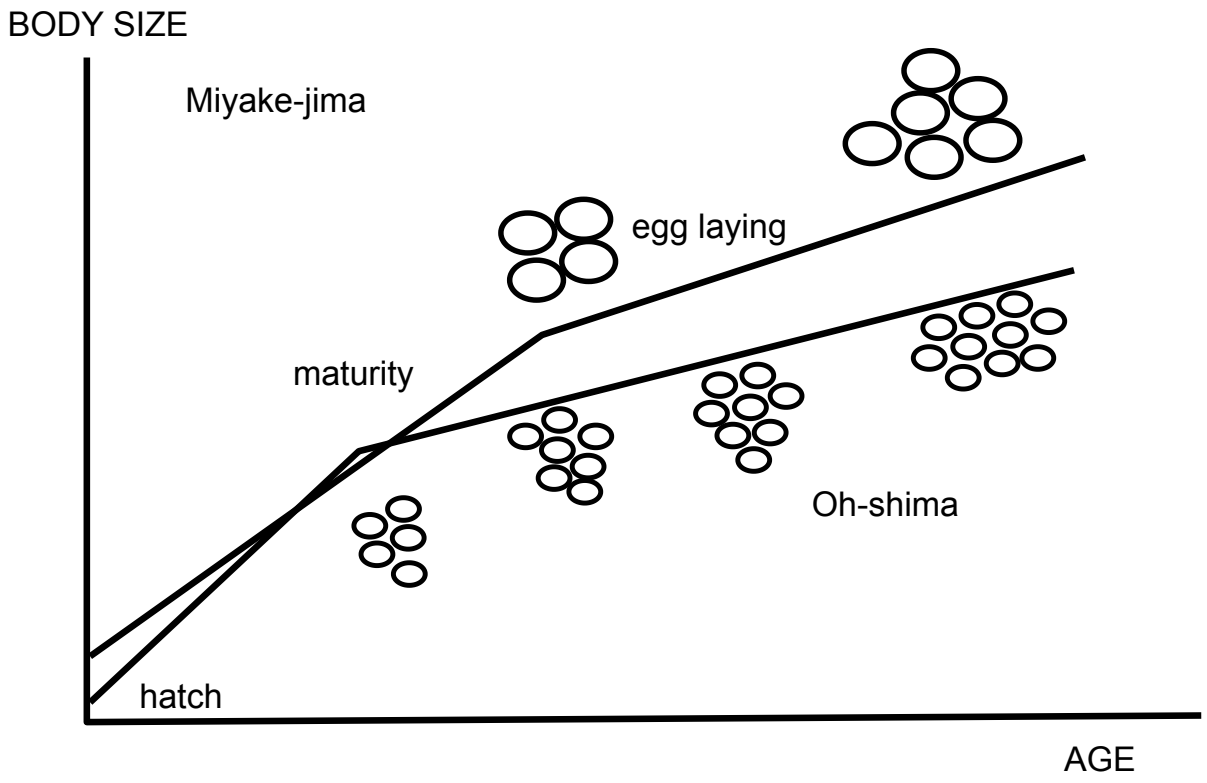
(A) Drug molecule injected in muscles of the front legs and the same drug molecule injected in muscles of hind legs can show different concentrations in circulating blood.

(B) Pharmacokinetics of a drug molecule will be same when administered in the vein of front legs or the tail vein.

(C) All drug molecules injected through the tail vein will show first site of metabolism in the liver.

(D) Drugs which are nephrotoxic should be injected in the front legs to reduce toxicity.

52. *Eumeces okadae* is an endemic skink of the Izu Islands in Japan. Growth and reproduction of female *Eumeces okadae* living on two islands is shown in the adjoining figure. The island of Oh-shima has richest predator fauna including weasels, snakes, and birds while Miyake-jima has only avian predators.



Choose the correct statement from the following;

(A) Divergence in the life history traits is influenced mainly by the age of maturity of the breeding individual.

(B) Populations in the island of Miyake-jima show a life history with late maturity with low fecundity.

(C) Heavy predation leads to a life history with late maturity and high fecundity.

(D) The divergence in life history traits is influenced by the age specificity and intensity of predation regime.

53. Evolution of marine fishes shows that fish species have abandoned glomeruli to produce urine by tubular mechanisms. Aglomerular kidney lacks not only glomeruli but also the distal tubules. If aglomerular marine toadfish (*Opsanus tau*) is shifted to 10% sea water, it can survive upto several months. Which of the following event(s) could be taking place in the fish during acclimatisation to dilute sea water?

(A) Urine flow rate decreases.

(B) Kidney starts excreting solutes.

(C) The plasma osmotic pressure will increase.

(D) Significant branchial and intestinal solute uptake mechanisms set in.

54. Even in passive diffusion, energy is required for the solute to cross a bilayer membrane. This energy is related to the energy of hydration for the solute. Listed below are some solutes, in the context of which, choose the correct statement(s) from the following;

Solute
Glycol ($HO–CH_2–CH_2–OH$)
Glycerol ($HO–CH_2–CH(OH)–CH_2–OH$)
Erythritol ($HO–CH_2–CH(OH)–CH(OH)–CH_2–OH$)

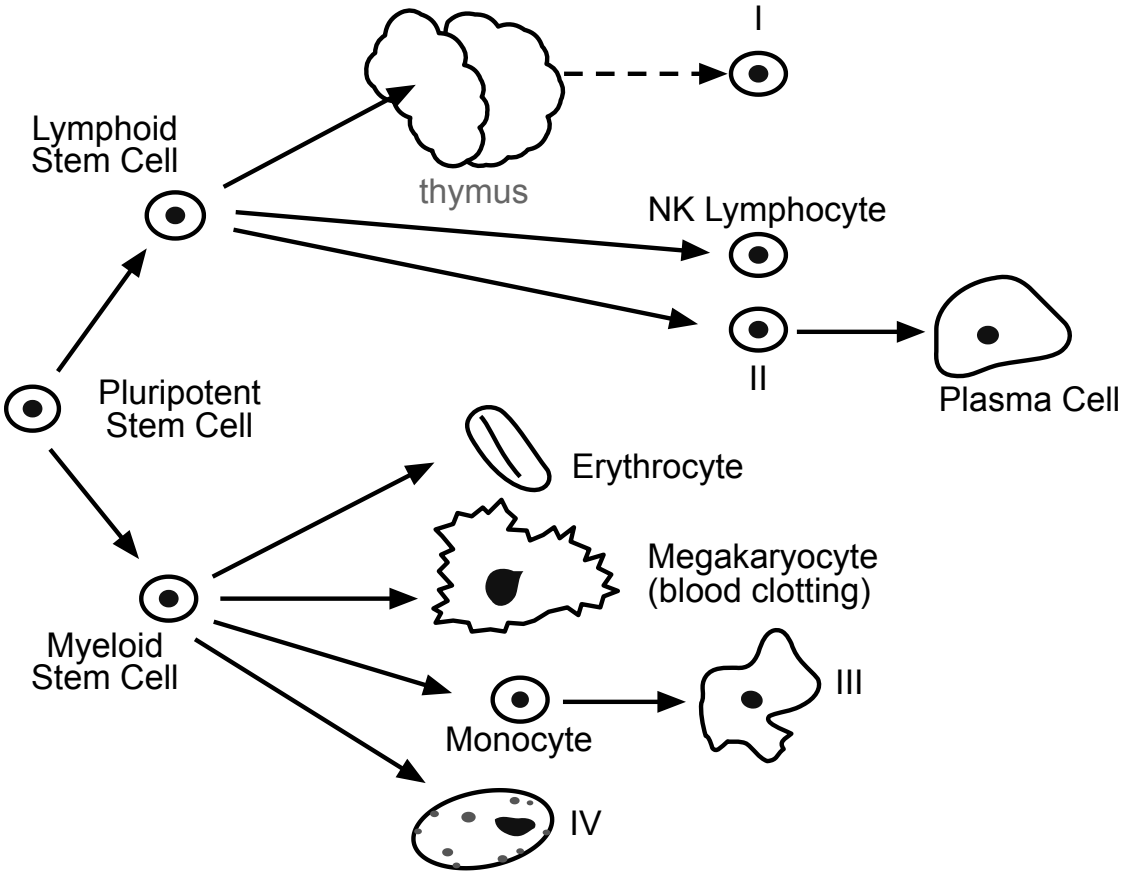
(A) Glycol will diffuse fastest through a bilayer membrane amongst the three solutes listed

(B) Erythritol will diffuse fastest through a bilayer membrane amongst the three solutes listed

(C) The solute must first lose its waters of hydration, diffuse across the bilayer membrane, and then regain its waters on the opposite side.

(D) As the number of waters of hydration increases the activation energy for diffusion decreases.

55. The lineage of cells of immune system are shown below in the figure. Identify the cells marked I, II, III and IV from the statements given.



(A) I is a T Lymphocyte while II is a B Lymphocyte.

(B) I is a B Lymphocyte while II is a T Lymphocyte.

(C) III is a granulocyte while IV is a macrophage.

(D) III is a macrophage while IV is a granulocyte.

56. C4 photosynthesis is a complex physiological adaptation that confers greater productivity than the ancestral C3 photosynthetic type in environments where photorespiration is high. Identify correct statements related to the C4 physiology.

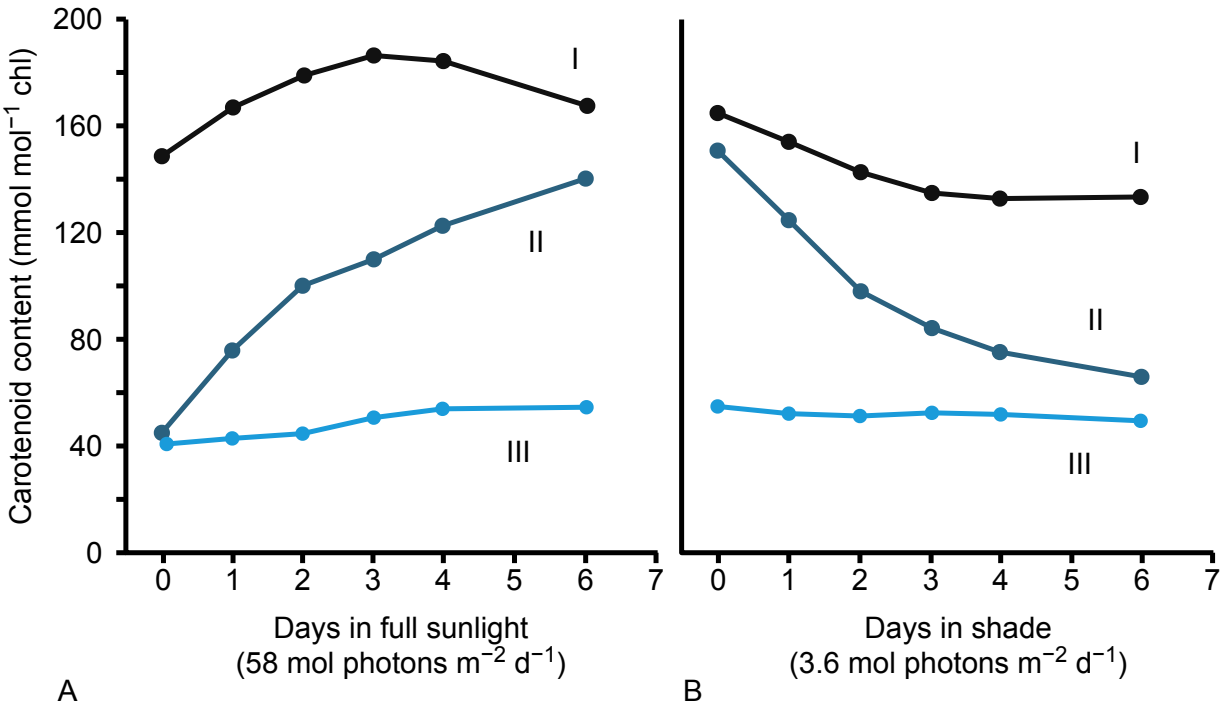
(A) In C4 plants there is a temporal separation of CO_2 fixation and synthesis of glucose.

(B) Leaf has functionally closely connected, discrete compartments, with a relatively large compartment to host the Calvin cycle.

(C) For adapting to arid areas, C4 plants have co-opted same areas of the leaf, for photosynthesis and for water storage cells.

(D) In most C4 plants, the feat of concentrating CO_2 is achieved by confining Rubisco to bundle-sheath cells.

57. A study of the changes in the content of carotenoid pigments of young leaves of cotton in strong and weak light was being carried out. Figure A shows the effects of transferring plants from shade into full sunlight while figure B shows the effects of transfer from sunlight into dark.



Based on the observations, which of the following statements are true ?

(A) II could be violaxanthin, which protects thylakoid membrane lipids from photo-oxidation.

(B) I could be xanthophylls, which contribute to increasing the light-harvesting capacity of the photosystems.

(C) I could be a photoprotector pigment like lutein.

(D) III could be a pigment, which is essential for light-gathering in low light intensities.

58. Animal species use various channels to communicate with each other. The selection of a communication channel depends on the ecology of the species and what kind of message the animal wishes to convey to its receivers. A few features of four such modes of communication (numbered 1 to 4) are tabulated below.

	Information available		**Cost to sender**	
Modes	**Fadeout time**	**Locatability of sender**	**Broadcast expense**	**Risk of being caught**
1	Fast	Fairly easy	High	Medium
2	Fast	Easy	Low	Low
3	Slow	Difficult	Low	Low
4	Fast	Easy	Low-Moderate	High

Choose the appropriate statements:

(A) 1 is Tactile signals while 2 is Auditory signal

(B) 1 is Auditory signals while 2 is Tactile signal

(C) 3 is Chemical signal and 4 is Visual signals.

(D) 3 is visual signals and 4 Chemical signals.

59. Km values of enzymes provide information about their applications. In this context identify the correct statements from the following;

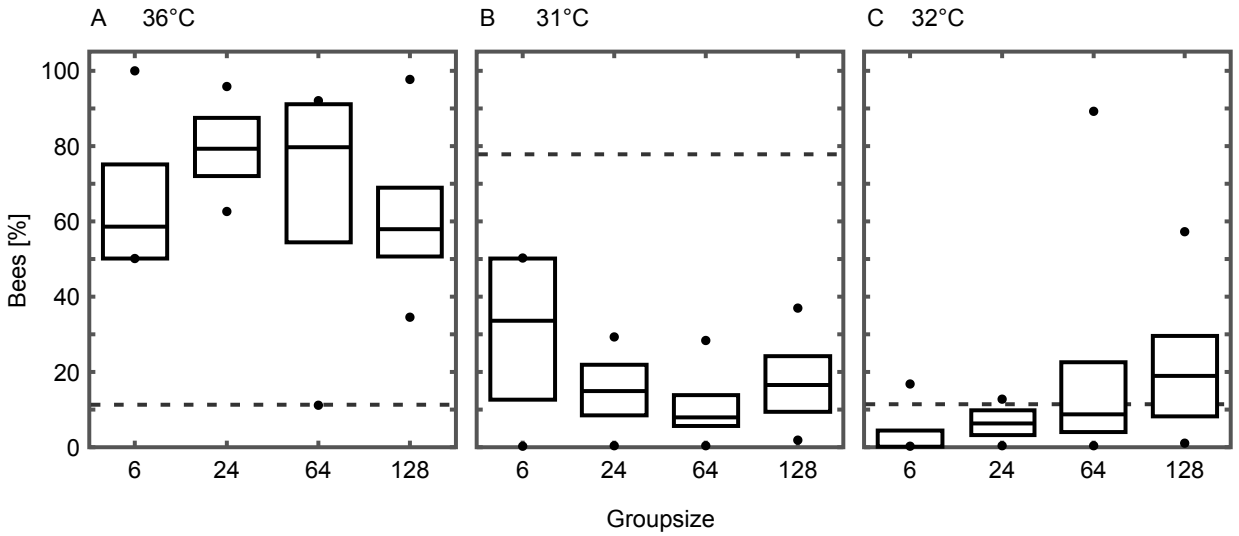
(A) A high Km value indicates the need for high substrate concentrations in order to achieve maximum reaction velocity.

(B) A low Km value indicates the need for high substrate concentrations in order to achieve maximum reaction velocity.

(C) If two enzymes, with similar Vmax in different metabolic pathways compete for the same substrate, then pathway involving enzyme that has the lower Km value is likely to be the 'preferred pathway'.

(D) If two enzymes, with similar Vmax in different metabolic pathways compete for the same substrate, then pathway that has enzyme with the higher Km value is likely to be the 'preferred pathway'.

60. Honey bee (*Apis mellifera*) is able to produce heat endothermically and is one of the main reasons for the wide distribution of this species as it allows the whole colony to survive cold winters. Young bees, however, are ectothermic and tend to position themselves, within the hive, in areas with the appropriate environmental conditions. In an experimental arena, different group sizes of young bees were introduced separately, where they were exposed to three different temperature zones. The bees were allowed to freely position themselves within these temperature zones and their positions were recorded after 30 minutes. The results are depicted below:



Which of the following statements are correct ?

(A) The median percentage of bees at 31°C and 32°C temperature areas decreased with increasing group size.

(B) Irrespective of the group size, 36°C is most likely to be the optimum temperature for the bees.

(C) There is no significant difference in the preference for cooler temperature areas (31°C and 32°C), in all group sizes of bees.

(D) In larger groups a percentage of bees may switch to cooler temperature areas (31°C and 32°C) due to crowding effects.

ANSWER KEY

NSEB 2022 · PAPER CODE 21

60
QUESTIONS · 216 MARKS

IAPT final answer key for paper code 21. ★ marks an answer given as per Zigyan.

1	(D)★	2	—★	3	(C)	4	(C)	5	(A)
6	(A)	7	(B)	8	(C)	9	(D)	10	(C)
11	(C)★	12	(C)	13	(A)★	14	(B)	15	(C)
16	(B)	17	(B)	18	(B)	19	(B)	20	(B)
21	(A)	22	(C)	23	(B)	24	(B)	25	(D)
26	(C)	27	(D)★	28	(A)	29	(D)	30	(B)
31	(D)	32	(D)	33	(B)	34	(B)	35	(D)
36	(C)	37	(C)	38	(A)	39	(D)	40	(C)★
41	(A)	42	(C)	43	(D)	44	(D)	45	(B)★
46	(D)	47	(A)	48	(C)	49	(B), (C)	50	(B), (C), (D)★
51	(A), (D)	52	(B), (D)	53	(B), (D)	54	(A), (C)	55	(A), (D)
56	(B), (D)	57	(A), (C)★	58	(B), (C)	59	(A), (C)	60	(B), (D)

★ Answers as per Zigyan

- **Q1** — As per Zigyan: (D); IAPT key (D).
- **Q2** — As per Zigyan: no option is correct; dropped by IAPT.
- **Q11** — As per Zigyan: (C); IAPT key (C).
- **Q13** — As per Zigyan: (A); IAPT key (A) or (D).
- **Q27** — As per Zigyan: (D); IAPT key (C).
- **Q40** — As per Zigyan: (C); IAPT key (B).
- **Q45** — As per Zigyan: (B); IAPT key (A).
- **Q50** — As per Zigyan: (B), (C), (D); IAPT key (A), (C).
- **Q57** — As per Zigyan: (A), (C); IAPT key (A), (C).

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OLYMPIADS · 2026

Olympiad results



TOP ACHIEVEMENT · CHEMISTRY

Qualified the Chemistry Olympiad twice, and selected for the HBCSE camp.

Saksham Bishnoi reached the national stage of the Chemistry Olympiad in two consecutive years and was selected for the Orientation-cum-Selection Camp at HBCSE, Mumbai. 4 Years Classroom - the same student who took AIR 168 in JEE Advanced 2026.

Qualified twice | HBCSE selection camp | Only student from Faridabad

Above MAS means above the **Minimum Admissible Score**: clearing it puts a student in the national band for their subject. It is a real threshold, not a participation marker.

CHEMISTRY · ABOVE MAS



Sulokya Bibhuty
Class XII
3 Years Classroom
Above MAS



Anay Gupta
Class XI
3 Years Classroom
Above MAS



Akshat Khator
Class XI
3 Years Classroom
Above MAS



Harshit Goyal
Class XII
4 Years Classroom
Above MAS



Hardik Sharma
Class XI
3 Years Classroom
Above MAS



Aarush Kumar
Class XII
1 Year Classroom
Above MAS

PHYSICS · ASTRONOMY · MATHEMATICS

PHYSICS



Sulokya Bibhuty
Class XII
3 Years Classroom
Above MAS

PHYSICS



Saksham Bishnoi
Class XII
4 Years Classroom
Above MAS

ASTRONOMY



Sulokya Bibhuty
Class XI
3 Years Classroom
Above MAS

MATHEMATICS · IOQM



Priyanshi
Class XI
4 Years Classroom
IOQM Qualifier

OLYMPIADS WE PREPARE STUDENTS FOR

NSEP	NSEC	NSEB	NSEA	IOQM	NSEJS
Physics	Chemistry	Biology	Astronomy	Mathematics	Class X and below

The olympiad pathway starts in Class 8.

NSEJS is open to Class 10 and below - the habit of staying with one hard problem is the one JEE Advanced rewards.

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RESULTS · 2021 – 2026

Our toppers, year by year

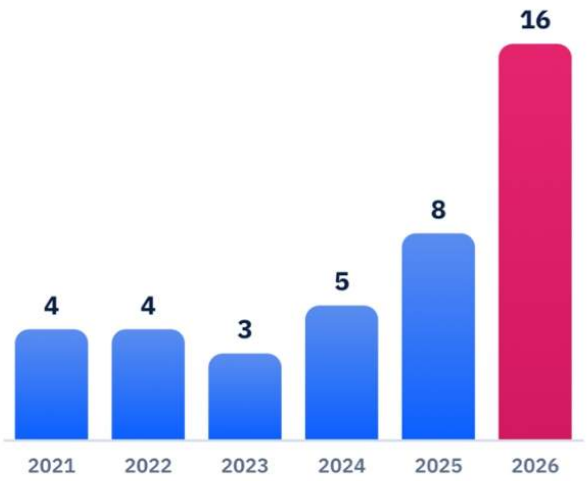
40
JEE Advanced selections in 6 years

AIR 168
best rank — Saksham Bishnoi, 2026

16 of 35
students selected, JEE Advanced 2026

14 of 35
above 98 percentile, JEE Main 2026

JEE ADVANCED SELECTIONS PER YEAR



BEST RANK EACH YEAR

YEAR	JEE ADVANCED	JEE MAIN
2026	**Saksham Bishnoi** AIR 168 · 4 Years Classroom	**Saksham Bishnoi** AIR 811 · 99.95 %ile
2025	**Chakshu** AIR 4,233 · 2 Years Classroom	**Chakshu** AIR 8,538 · 99.44 %ile
2024	**Harshit** AIR 777 · 2 Years Classroom	**Harshit** AIR 1,473 · 99.91 %ile
2023	**Aditya Jain** AIR 2,373 · 2 Years Classroom	**Aditya Jain** AIR 2,503 · 99.79 %ile
2022	**Rachit Sharma** AIR 698 · 1 Year Classroom	**Rachit Sharma** AIR 1,016 · 99.90 %ile
2021	**Sparsh Mittal** AIR 2,237 · 1 Year Classroom	**Sparsh Mittal** AIR 1,562

JEE ADVANCED 2026 — THIRTEEN NAMED SELECTIONS



Saksham Bishnoi
AIR 168
4 Years Classroom



Sulokya Bibhuty
AIR 1,315
3 Years Classroom



Aarush
AIR 2,699
1 Year Classroom



Manishka
AIR 2,869
4 Years Classroom



Oojit Kumar
AIR 5,765
4 Years Classroom



Harshit Goyal
AIR 6,407
4 Years Classroom



Pranab Sharma
AIR 6,750
3 Years Classroom



Aditya Dhar
AIR 15,183
3 Years Classroom



Arpit Anshuman
AIR 19,308
4 Years Classroom



Lokesh
AIR 22,857
3 Years Classroom



Arjun
AIR 24,674
3 Years Classroom



Sanyam Gulyani
AIR 25,123
1 Year Classroom



Saket
AIR 27,628
3 Years Classroom

Sixteen students of the 2026 batch were selected in JEE Advanced; the thirteen above are named with their All India Rank.

JEE MAIN 2026 — TOP SIX, WITH PERCENTILE



Saksham Bishnoi
AIR 811
99.95 %ile
4 Years Classroom



Sulokya Bibhuty
AIR 1,095
99.94 %ile
3 Years Classroom



Harshit Goyal
AIR 2,662
99.83 %ile
4 Years Classroom



Manishka
AIR 4,817
99.70 %ile
4 Years Classroom



Oojit Kumar
AIR 5,040
99.69 %ile
4 Years Classroom



Aarush
AIR 5,276
99.67 %ile
1 Year Classroom

14 of the 35 students in the 2026 batch scored above the 98th percentile in JEE Main.

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