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PREVIOUS YEAR PAPER · 2019

OLYMPIAD · STAGE I

NSEB

National Standard Examination in Biology

2019

Question paper, answer key and Zigyan solutions

80	240	120 min	21
Questions	Maximum marks	Time	Paper code

Question paper and official answer key: Indian Association of Physics Teachers (IAPT), NSEB 2019, paper code 21.
Solutions and notes: Zigyan. This booklet is not an IAPT publication.

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PART A-1 · ONE CORRECT OPTION

Q. 1 – 80 · +3 for a correct answer, –1 for a wrong one

1. The function of contractile vacuole is to pump out excess water from the cell. In *Paramecium*, the activity of contractile vacuole was found to increase when transferred from one medium to another. Hence it can be concluded that the transfer was from:

(A) isotonic to hypotonic solution.
(B) hypotonic to isotonic solution.
(C) hypotonic to hypertonic solution.
(D) isotonic to hypertonic solution.

Solution · Q1 **Answer: (A)**

The contractile vacuole throws out the water that enters the cell by osmosis.

It works faster only when more water enters, as on shifting from an isotonic to a hypotonic solution.

IAPT answer: (A) | **Zigyan answer:** (A)

2. Enzyme A has higher km value than enzyme B, although both can achieve the same Vmax. Hence it can be concluded that,

(A) enzyme A requires higher substrate concentration and has lower affinity to substrate than enzyme B.
(B) enzyme A requires lower substrate concentration and has lower affinity to substrate than enzyme B.
(C) enzyme A requires higher substrate concentration and has higher affinity to substrate than enzyme B.
(D) enzyme A requires lower substrate concentration and has higher affinity to substrate than enzyme B.

Solution · Q2 **Answer: (A)**

K_m is the substrate concentration at which the reaction velocity is half of V_{max}.

A higher K_m means a lower affinity for the substrate.

∴ Enzyme A needs more substrate and has the lower affinity.

IAPT answer: (A) | **Zigyan answer:** (A)

3. Average molecular weight of amino acid is considered to be 110 Da.

A homodimeric membrane protein is found to have a molecular weight of 44,000 Da. How many amino acids are present in each monomer of the protein?

(A) 400 (B) 300 (C) 200 (D) 100

Solution · Q3 **Answer: (C)**

A homodimer has two identical monomers. Mass of one monomer:

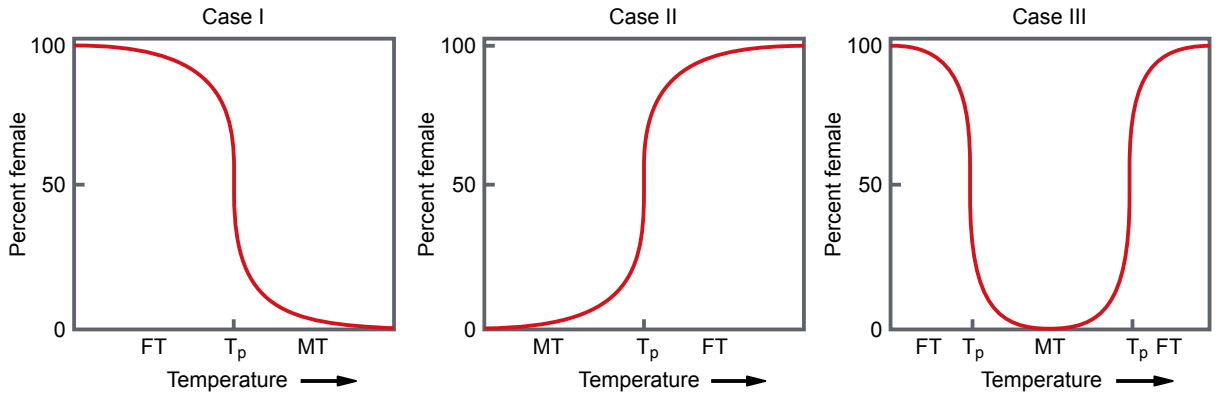
$$\frac{44000}{2} = 22000 \text{ Da}$$

Number of amino acids in one monomer:

$$\frac{22000}{110} = 200$$

IAPT answer: (C) | **Zigyan answer:** (C)

4. The graphs show the data on sex determination of the progeny which is dependent on temperature.



MT = Male favouring Temperature; FT = Female favouring Temperature;

Tp = Temperature obtaining ratios at equilibrium

A few statements regarding the data are made.

i. Case I: At a mid range temperature, 3:1 is a predicted the male: female ratio.

ii. Case II: The number of males will be much higher at lower temperatures.

iii. Case III: The number of females: males will always be higher at temperature extremes.

iv. Case I and II are likely to face ratio imbalance at mid ranges of temperatures.

The correct statement/s is/are:

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

Solution · Q4 **Answer: (C)**

The graphs show the percentage of females; the rest are males.

i: In Case I, at the mid temperature T_p, females are 50%, so male : female is 1 : 1, not 3 : 1. ∴ false.

ii: In Case II, females are nearly 0% at low temperatures, so males are far more. ∴ true.

iii: In Case III, females are nearly 100% at both extremes. ∴ true.

iv: In Cases I and II, the ratio is balanced at T_p and imbalanced towards the extremes. ∴ false.

IAPT answer: (C) | **Zigyan answer:** (C)

5. The given table showing the recombination frequencies between different gene loci on the same chromosome. Recombination frequencies are directly related to the distance between the two genes. Higher the recombination frequency, greater the distance between the two loci. However, even if the actual distance exceeds 50 units, the recombination frequency does not exceed 50%. Select the most probable arrangement of genes based on the data below:

Gene pairs	Recombination frequency
Ab	50
ac	7
Ad	22
bc	50
bd	50
Cd	15

(A) d-c-a-b / b-a-c-d
(B) b-d-a-c / c-a-d-b
(C) c-d-a-b / b-a-d-c
(D) d-a-c-b / b-c-a-d

Solution · Q5 **Answer: (A)**

The pairs printed as Ab, Ad and Cd are read as ab, ad and cd.

The two shorter distances add up to the third:

$$ac + cd = 7 + 15 = 22 = ad$$

So c lies between a and d, giving the order d-c-a.

Gene b shows 50% recombination with a, c and d, so it lies far away, at one end of this group.

Only (A), d-c-a-b (read backwards, b-a-c-d), fits.

IAPT answer: (A) | **Zigyan answer:** (A)

6. The compartmentalization of the cytoplasm by the membranes of the endoplasmic reticulum (ER) results in:

(A) increasing the surface area available for biochemical synthesis.
(B) providing a structural framework.
(C) facilitating cell mobility.
(D) maintaining cell fluidity and cell dynamics.

Solution · Q6 **Answer: (A)**

ER membranes form a large network that divides the cytoplasm into luminal and extraluminal compartments.

This greatly increases the membrane surface available for synthesis, for example of proteins and lipids.

IAPT answer: (A) | **Zigyan answer:** (A)

7. Cross pollination will take place when:

i. the flowers are Cleistogamous (flowers never open).

ii. the flowers show Herkogamy (physical barrier between anther and style).

iii. the flowers show Dichogamy (stamens and carpels of bisexual flowers mature at different times).

iv. the plants are Dioecious (plants having unisexual flower).

Choose the correct option:

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

Solution · Q7 **Answer: (D)**

i: Cleistogamous flowers never open, so they are only self-pollinated.

ii: Herkogamy, a barrier between anther and style, favours cross-pollination.

iii: Dichogamy, maturing of stamens and carpels at different times, favours cross-pollination.

iv: In dioecious plants, male and female flowers are on separate plants, so only cross-pollination is possible.

∴ ii, iii and iv are correct.

IAPT answer: (D) | **Zigyan answer:** (D)

8. Predict the phenotype of a promoter mutant (lacP) for the lac operon.

(A) The lac genes would be expressed efficiently only in the absence of lactose.

(B) The lac genes would be expressed efficiently only in the presence of lactose.

(C) The lac genes would be expressed continuously.

(D) The lac genes would never be expressed efficiently.

Solution · Q8 **Answer: (D)**

RNA polymerase binds at the promoter to start transcription of the lac genes.

In a lacP mutant, it cannot bind properly.

So the lac genes are never expressed efficiently, with or without lactose.

IAPT answer: (D) | **Zigyan answer:** (D)

9. A tall plant with red flowers is crossed with a dwarf plant that produces white flowers. In F_1 all plants are tall with pink flowers. The F_1 plant is crossed with dwarf parent that bears white flower. Four types of progenies were produced in a ratio of 102: 98: 103: 99. The progenies expressed:

(A) All the five characters of parents and F_1.

(B) All the characters except pink colour of the flower.

(C) All characters except white colour of the flower.

(D) All characters except red.

Solution · Q9 **Answer: (D)**

Tallness is dominant, and flower colour shows incomplete dominance (Rr is pink).

F_1 plant crossed with the dwarf, white-flowered parent:

TtRr × ttrr

The four types of progeny are formed in a 1 : 1 : 1 : 1 ratio:

TtRr (tall, pink), Ttrr (tall, white), ttRr (dwarf, pink), ttrr (dwarf, white)

Tall, dwarf, pink and white appear, but red does not.

IAPT answer: (D) | **Zigyan answer:** (D)

10. Thyroid gland produces hormones which control the rate of metabolism in animals. Which of the following would occur if the thyroid of cattle is fed to a man deficient in thyroid secretion?

i) It will speed up his metabolism.

ii) It will lower the rate of his metabolism.

iii) It will regulate the hormone secretion.

iv) It will not have any effect on hormone secretion.

Which of the following are correct options?

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

Solution · Q10 **As per Zigyan: (C)**

Thyroid hormones stay active when taken by mouth. So cattle thyroid supplies the missing hormone and speeds up his metabolism.

∴ i is correct and ii is wrong.

The hormone entering his blood acts by negative feedback and controls the secretion of TSH, the hormone that drives the thyroid.

∴ iii is correct and iv is wrong.

Why Zigyan differs from IAPT: statement iv cannot hold, because a rise in blood thyroid hormone reduces TSH secretion by negative feedback.

Reference: NCERT Biology Class XI, Chapter 19 'Chemical Coordination and Integration', sections 19.2.2 and 19.2.4: TSH stimulates secretion of thyroid hormones, which help regulate the basal metabolic rate.

Reference: OpenStax Anatomy and Physiology 2e, section 17.4 'The Thyroid Gland': by negative feedback, rising T_3 and T_4 levels decrease the production and secretion of TSH.

Reference: NIDDK (US National Institutes of Health), 'Hypothyroidism', treatment: thyroid hormone taken by mouth replaces the hormone that the patient's own thyroid can no longer make.

IAPT answer: (A) | **Zigyan answer:** (C)

11. Removal of which of the components from the given food chain will **not** result in complete collapse of the food chain?

Producers → Primary consumers → Secondary consumers → Decomposers

(A) Producers and primary consumers.

(B) Primary consumers and secondary consumers.

(C) Secondary consumers and decomposers.

(D) Producers and decomposers.

Solution · Q11 **Answer: (B)**

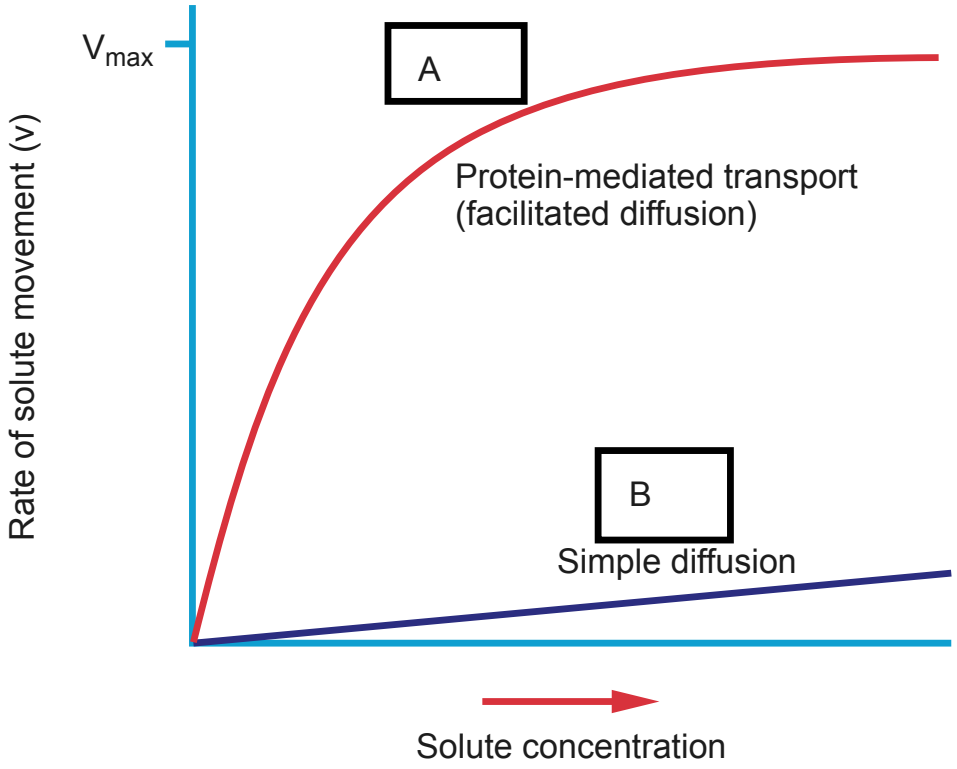
Without producers, no energy enters the chain.

Without decomposers, nutrients are not returned to the producers.

Without primary and secondary consumers, producers and decomposers can still keep energy flowing and recycle nutrients.

IAPT answer: (B) | **Zigyan answer:** (B)

12. Patterns of diffusion for two molecules A and B for a living cell are shown in the graph.



A and B most likely could be respectively:

(A) Na^+ and Glucose
(B) O_2 and CO_2
(C) Glucose and O_2
(D) O_2 and glycerol.

Solution · Q12 **Answer: (C)**

A rises and then levels off at V_{max} because the transport proteins get saturated. This is facilitated diffusion, as for glucose.

B rises in direct proportion to concentration. This is simple diffusion, as for O_2, a small non-polar molecule.

IAPT answer: (C) | **Zigyan answer:** (C)

13. Suppose a leaf containing chlorophyll 'a' molecule is irradiated at its absorption maxima i.e. 450 nm and 662 nm. The fluorescence emission of this leaf would be at 668 and 723 nm. If now the leaf is irradiated with either 400 nm or 550 nm wavelength of light then, the fluorescence emission of this leaf would probably be at:

(A) 668 and 723 nm (B) 610 and 700 (C) 610 nm only (D) 610 and 668 nm

Solution · Q13 **Answer: (A)**

Chlorophyll a fluoresces from its lowest excited singlet state, whichever wavelength is absorbed.

Extra energy absorbed at 400 nm or 550 nm is first lost as heat while the molecule drops to this state.

So the emission stays at 668 and 723 nm; only its intensity changes.

IAPT answer: (A) | **Zigyan answer:** (A)

14. During transmission of impulses across the nerve membrane; a simple impulse dies out just before the synapse, whereas several impulses reaching the synapse within a short period "Fire" the impulse into the next neuron. The reason for simple neuron to die out maybe that the:

(A) synapse gets fatigued by continuous work.

(B) impulse is unable to produce the adequate quantity of neurotransmitters.

(C) speed at which impulse travels is less.

(D) dendrites of nerve fibres take time to accept signal for nerve impulse.

Solution · Q14 **Answer: (B)**

One impulse releases too little neurotransmitter to take the postsynaptic membrane to threshold, so it dies out.

Several impulses in quick succession add up their neurotransmitter (temporal summation), and the next neuron fires.

IAPT answer: (B) | **Zigyan answer:** (B)

15. Double fertilization is not found in:

(A) Cucumber (B) Rice (C) *Pinus* (D) Mango

Solution · Q15 **Answer: (C)**

Double fertilisation (syngamy with triple fusion) is a feature of angiosperms.

Pinus is a gymnosperm, in which the haploid endosperm forms before fertilisation. Cucumber, rice and mango are angiosperms.

IAPT answer: (C) | **Zigyan answer:** (C)

16. Which of the following diploids produce β-galactosidase, in the absence of lactose?

(A) $p^+ lacZ^- lacI^+ / p^+ lacZ^+ lacI^-$

(B) $p^- lacZ^- lacI^- / p^- lacZ^+ lacI^-$

(C) $p^+ lacZ^+ lacI^- / p^+ lacZ^+ lacI^-$

(D) $p^+ o^c lacZ^- lacI^+ / p^+ o^+ lacZ^+ lacI^+$

Solution · Q16 **Answer: (C)**

Without lactose, the enzyme is made only if $lacZ^+$ has a working promoter and is not repressed (operator normal where not shown).

(A) $lacI^+$ gives a diffusible repressor that switches off both copies.

(B) Both promoters are p^-, so there is no transcription.

(C) No functional repressor and $lacZ^+$ with p^+, so expression is constitutive.

(D) o^c acts only in cis, on $lacZ^-$; the $lacZ^+$ copy with o^+ stays repressed.

IAPT answer: (C) | **Zigyan answer:** (C)

17. How many meiotic divisions will be required for the formation of 80 zygotes in an angiospermic plant?

(A) 40 (B) 100 (C) 80 (D) 160

Solution · Q17 **Answer: (B)**

80 zygotes need 80 eggs and 80 male gametes for syngamy.

One megaspore mother cell gives one functional megaspore, hence one egg.

So the eggs need 80 meiotic divisions.

Each pollen grain gives one male gamete for syngamy, and one meiosis gives 4 pollen grains.

Meiotic divisions for pollen:

$$80 \div 4 = 20$$

Total meiotic divisions:

$$80 + 20 = 100$$

IAPT answer: (B) | **Zigyan answer:** (B)

18. A food chain in a terrestrial ecosystem is shown.

Sun → Grass →Rabbit → Snake

The food chain is incomplete due to:

(A) Absence of tertiary consumer. (B) Absence of decomposers.

(C) Absence of quaternary consumer. (D) Absence of parasitic component.

Solution · Q18 **Answer: (B)**

Grass (producer), rabbit (primary consumer) and snake (secondary consumer) form a chain, which need not go to a higher consumer.

No decomposer is shown to break down dead matter and return nutrients to the soil.

IAPT answer: (B) | **Zigyan answer:** (B)

19. Eutrophication is considered bad for a water body because it leads to:

(A) increase in demand for carbon dioxide. (B) increase in demand for oxygen.

(C) increase in demand for nitrogen. (D) change in pH of the water body.

Solution · Q19 **Answer: (B)**

Nutrient enrichment causes an algal bloom.

Aerobic microbes decomposing the dead algae use up dissolved oxygen.

So the biological oxygen demand rises and aquatic animals such as fish die.

IAPT answer: (B) | **Zigyan answer:** (B)

20. Cells of *E.coli* are placed in a solution with 12% NaCl. Which effect would be visible after 24h of incubation?

(A) Plasmolysis. (B) Plasmoptysis.
(C) Osmotic lysis. (D) Swelling of cells.

Solution · Q20 **Answer: (A)**

12% NaCl is strongly hypertonic to *E. coli*.

Water leaves the cells and the protoplast shrinks away from the cell wall (plasmolysis).

The other three effects need water to enter the cell.

IAPT answer: (A) | **Zigyan answer:** (A)

21. Mutations in the genome of *E. coli* are introduced at a rate of $1/10^9$ bp per generation. If a scientist starts with a colony of 10^6 cells having 1000 bp DNA, the number of mutant cells observed after two doubling times will be:

(A) At least 2. (B) Not more than 4. (C) At least 4. (D) 0.

Solution · Q21 **As per Zigyan: (B)**

The rate gives the average number of new mutations per base pair copied in a generation.

Base pairs copied in the first doubling:

$$10^6 \times 1000 = 10^9 \text{ bp}$$

$\Rightarrow$ 1 mutation

Base pairs copied in the second doubling:

$$2 \times 10^6 \times 1000 = 2 \times 10^9 \text{ bp}$$

$\Rightarrow$ 2 new mutations

The first mutant cell has now become 2 mutant cells, and the 2 new mutations add at most 2 more.

Largest number of mutant cells:

$$2 + 2 = 4$$

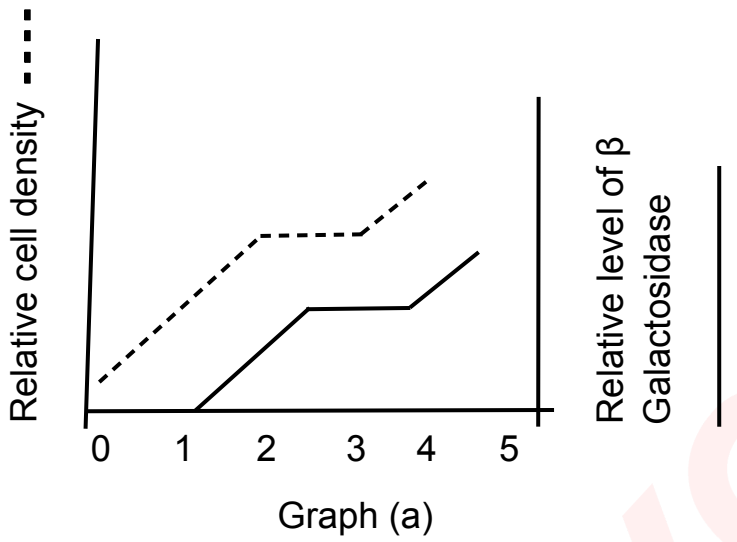
$\therefore$ there are not more than 4.

Check: three mutations arise in all. The first is carried by two cells and each of the other two can add only one cell, so the count cannot exceed four.

IAPT answer: (B) | **Zigyan answer:** (B)

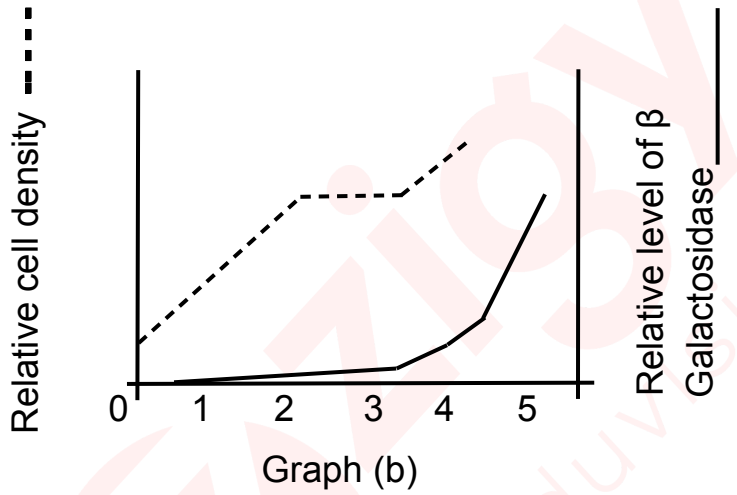
22. E. coli can utilize glucose as well as lactose as carbon source for growth and multiplication. Which of the following graphs (A – D) correctly reflect the levels of β-galactosidase, if these organisms is grown in a media containing glucose as well as lactose?

(A)



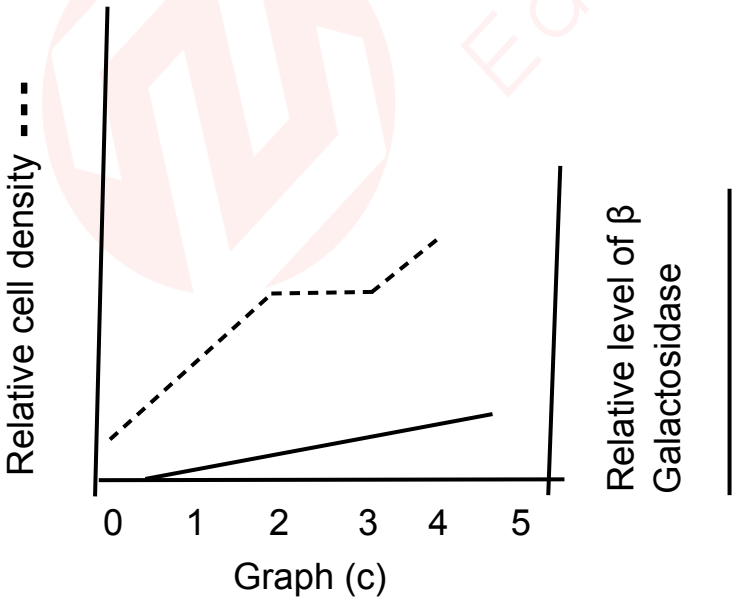
Graph (a)

(B)



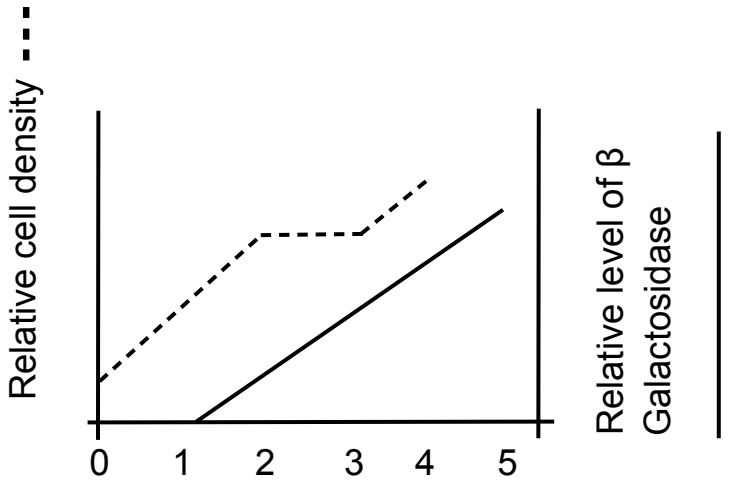
Graph (b)

(C)



Graph (c)

(D)



Graph (d)

Solution · Q22 **Answer: (B)**

Glucose is used first, and catabolite repression keeps β-galactosidase very low during this growth phase.

When glucose runs out, growth pauses (diauxic lag) while the lac operon gets switched on.

The enzyme level then rises sharply as growth resumes on lactose. Only graph (B) shows a low level followed by a steep rise.

IAPT answer: (B) | **Zigyan answer:** (B)

23. If a budding yeast cell is compared to a mitotically dividing cell, the most likely difference observed will be in:

(A) conventional prophase.
(B) conventional metaphase.
(C) conventional anaphase.
(D) conventional telophase.

Solution · Q23 **As per Zigyan: (B)**

In a typical mitotic metaphase, whole chromosomes come to the spindle equator and form a metaphase plate.

In budding yeast, the centromeres behave much as at metaphase, but the chromosome arms do not line up before anaphase.

So the difference is observed in the conventional metaphase.

Reference: NCERT Biology Class XI, Chapter 10 'Cell Cycle and Cell Division', section 10.2.2: metaphase is the stage when all the chromosomes gather at the middle of the spindle, and the plane in which they line up is the metaphase plate.

Reference: Pearson and co-authors, 'Budding Yeast Chromosome Structure and Dynamics during Mitosis', Journal of Cell Biology, volume 152, 2001: in budding yeast, before anaphase begins, the centromeres sit much as at metaphase while the arms of the chromosomes have not lined up.

IAPT answer: question dropped by IAPT | **Zigyan answer:** (B)

24. Which of the following strategy will be the most appropriate to grow seedless watermelon?

(A) Growing triploid plant in isolation.

(B) Growing diploid plant with polypoid plant in the vicinity.

(C) Growing diploid and tetraploid plant in the vicinity.

(D) Growing triploid plant with diploid plant in the vicinity.

Solution · Q24 **Answer: (D)**

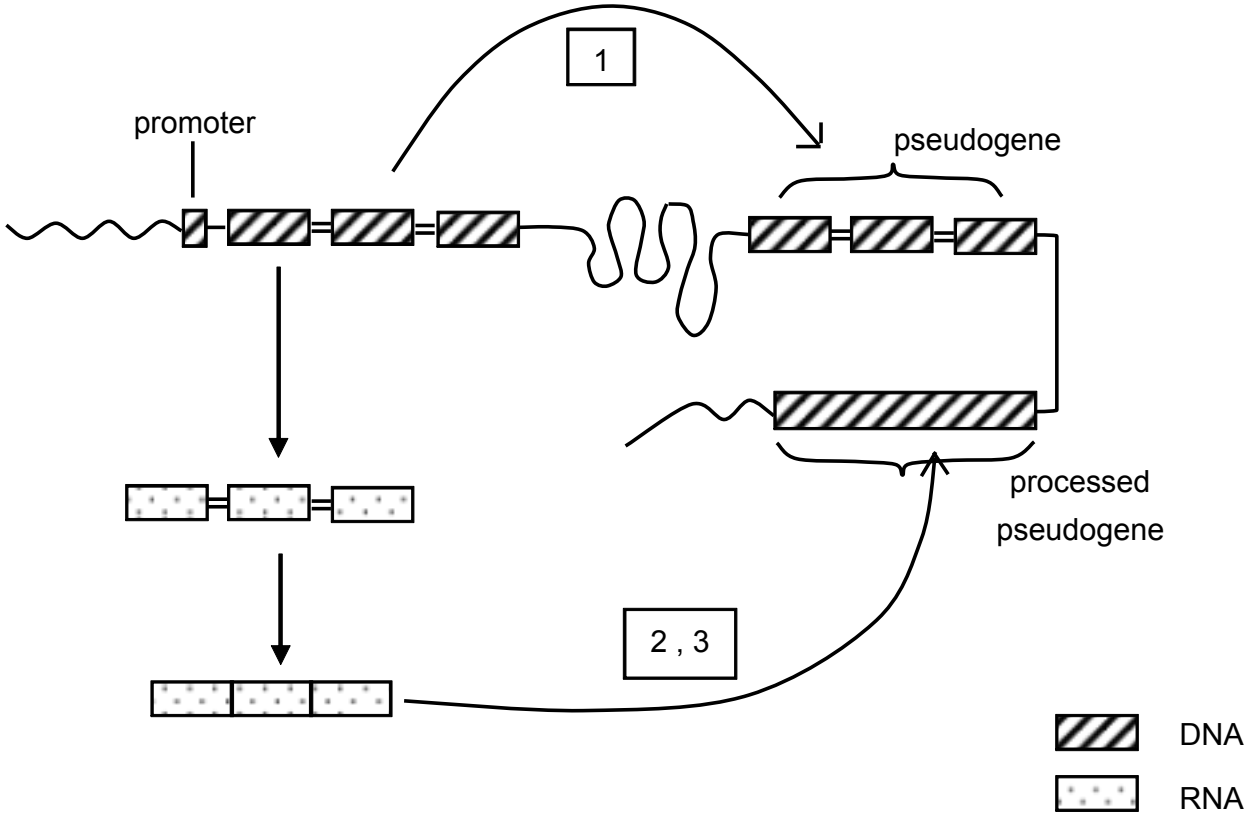
A triploid (3n) watermelon is sterile because its meiosis is irregular, so proper seeds do not form.

Its ovary still needs the stimulus of pollination to grow into a fruit, but its own pollen is largely non-viable.

So diploid plants are grown nearby as pollen donors.

IAPT answer: (D) | **Zigyan answer:** (D)

25. There are various ways which can give rise to pseudogenes. A small portion of genomic DNA is shown along with formation of pseudogenes.



The processes 1, 2 & 3 responsible for the formation of pseudogenes respectively could be:

(A) 1: mutation 2: duplication 3: reverse transcription

(B) 1: duplication 2: mutation 3: reverse transcription

(C) 1: reverse transcription 2: mutation 3: duplication

(D) 1: deletion 2: duplication 3: mutation

Solution · Q25 **Answer: (B)**

Process 1 makes a second DNA copy that still has introns: gene duplication. This copy becomes a non-functional pseudogene.

The processed pseudogene has no introns and no promoter. It arises when spliced RNA is reverse transcribed and inserted into DNA, with mutations (2, 3).

∴ only (B) fits.

IAPT answer: (B) | **Zigyan answer:** (B)

26. The decreasing order of net primary productivity per unit area per year is:

(A) Estuaries> Savannah > Open ocean

(B) Temperate grassland > Swamp and marshes > Desert shrub

(C) Tropical rain forest > Open ocean >Temperate forest

(D) Savannah > Tundra >Estuaries

Solution · Q26 **Answer: (A)**

Per unit area, estuaries are far more productive than savannah, and savannah far more than the open ocean.

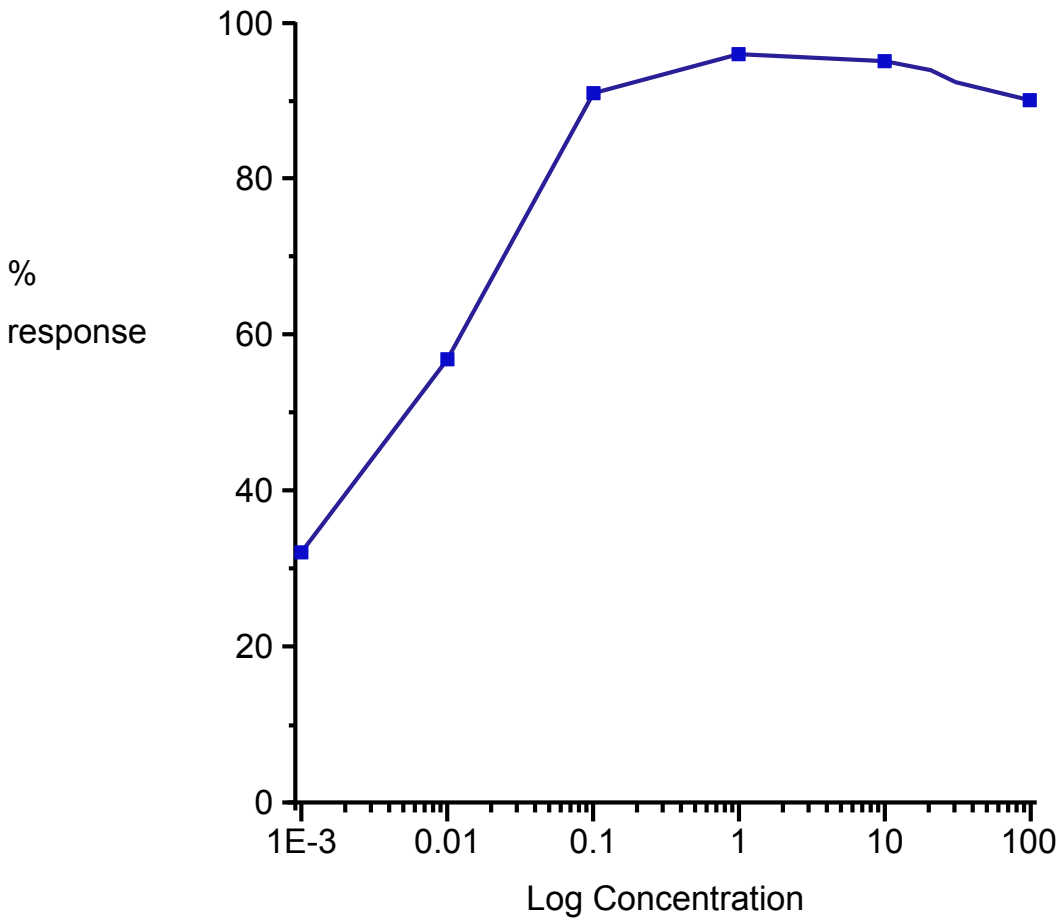
Approximate means, in g m^{-2} yr^{-1}: estuaries 1500, open ocean 125.

(B): swamp and marsh are far more productive than temperate grassland.

(C), (D): open ocean is below temperate forest, and tundra is far below estuaries.

IAPT answer: (A) | **Zigyan answer:** (A)

27. A student wanted to study the effect of caffeine on heart beats of *Daphnia*. Ideally, the experiment should span the entire range of concentrations that produce a response. To determine this, she performed a pilot experiment and the results obtained are shown in the graph.



Based on these results, which of the following would be the most appropriate concentration range for the actual experiment?

(A) Log concentration 0.001 - 0.1
(B) Log concentration 0.001-10
(C) Log concentration 0.001-1
(D) Log concentration 0.01-100

Solution · Q27 **Answer: (C)**

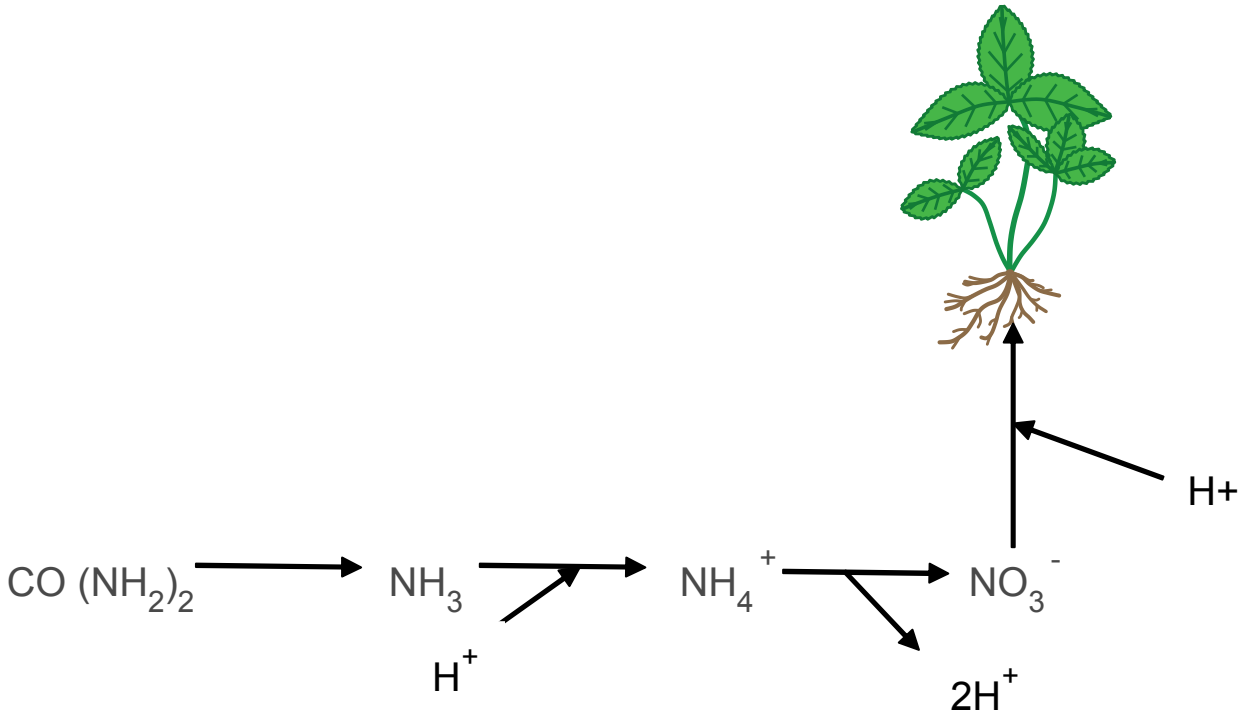
The response rises from about 32% at 0.001 to about 91% at 0.1, and is maximum (about 96%) at 1.

At 10 and 100 there is no further rise.

∴ the range 0.001-1 covers the rising response up to its maximum.

IAPT answer: (C) | **Zigyan answer:** (C)

28. Relationship between soil acidity and nitrogen fertilizers is shown in the diagram.



Mark the correct interpretation:

(A) Urea fertilizers will make soil more acidic.

(B) Ammonium fertilizers will have no effect on soil acidity.

(C) Nitrate fertilizer, if not run off, will make soil alkaline.

(D) Applying excess urea to soil will make soil alkaline.

Solution · Q28 **Answer: (C)**

Net change in H^+ for each nitrogen atom:

Urea, with all NO_3^- taken up (no net change):

$$-1 + 2 - 1 = 0$$

Ammonium fertiliser (acidic):

$$+2 - 1 = +1$$

Nitrate fertiliser: H^+ enters the plant with NO_3^-, so the soil becomes alkaline.

Excess urea: unused NO_3^- takes no H^+ into the plant, so the soil becomes acidic.

IAPT answer: (C) | **Zigyan answer:** (C)

29. Which of the following is/are principal mode/s of information transfer in a cell?

i. Transcription

ii. Translation

iii. Replication

(A) i only (B) i & ii only (C) ii only (D) i, ii & iii

Solution · Q29 **Answer: (D)**

By the central dogma, genetic information is transferred by:

Replication (DNA → DNA), transcription (DNA → RNA) and translation (RNA → protein).

∴ i, ii and iii are all principal modes.

IAPT answer: (D) | **Zigyan answer:** (D)

30. Which of the following vitamin protects cell against damage by reactive oxygen species?

(A) Riboflavin (B) Ascorbic acid (C) Cobalamin (D) Thiamine

Solution · Q30 **Answer: (B)**

Ascorbic acid (vitamin C) is a water-soluble antioxidant. It donates electrons to reactive oxygen species and neutralises them.

Riboflavin, cobalamin and thiamine mainly serve as coenzymes or coenzyme precursors.

IAPT answer: (B) | **Zigyan answer:** (B)

31. Which of the following contains amphipathic molecules that act as detergents dispersing lipids into droplets?

(A) Saliva (B) Lymph (C) Pancreatic juice (D) Bile

Solution · Q31 **Answer: (D)**

Bile contains amphipathic bile salts. They act as detergents and break large fat globules into small droplets (emulsification).

This gives lipase a larger surface to act on.

IAPT answer: (D) | **Zigyan answer:** (D)

32. Which part of the cell is in continuity with the nucleus?

(A) Golgi (B) Mitochondria

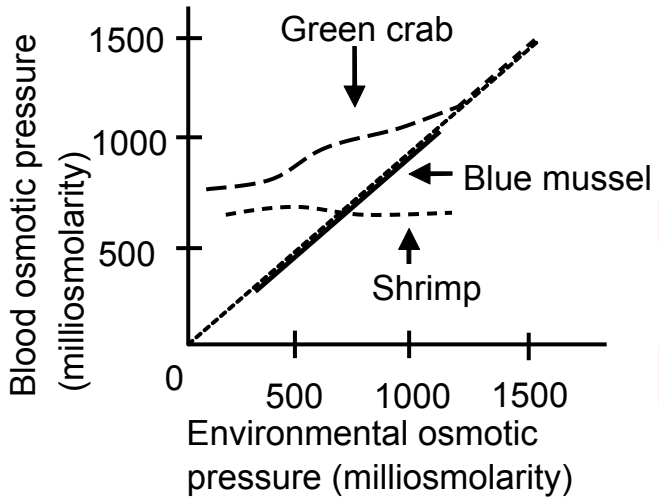
(C) Endoplasmic reticulum (D) Cell membrane

Solution · Q32 **Answer: (C)**

The outer membrane of the nuclear envelope is continuous with the endoplasmic reticulum (rough ER).

IAPT answer: (C) | **Zigyan answer:** (C)

33. Animals exhibit responses that are mixed or intermediate between idealized regulation and idealized conformity. The osmotic pressure of the blood plasma as a function of the environmental osmotic pressure is shown for three species of marine invertebrates, the blue mussel, the green crab and grass shrimp.



(1000 milliosmolarity is the approximate osmotic pressure of full strength sea water)

Which of the following statement/s is/are correct?

(i) Mussel is a strict osmotic conformer.

(ii) The crab regulates in water more concentrated than sea water.

(iii) The shrimp regulates over a wide range of environmental pressure.

(iv) Crab is a osmotic conformer at high environmental osmotic pressure.

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

Solution · Q33 **Answer: (B)**

(i) The mussel line runs along the isosmotic line: strict conformer, true.

(ii) The crab regulates mainly in dilute water; in concentrated water its curve merges with the isosmotic line: false.

(iii) Shrimp blood stays nearly constant (about 650-700 milliosmolarity) for environmental values of about 200-1200: true.

(iv) At high external osmotic pressure the crab follows the isosmotic line: true.

∴ (i), (iii) and (iv) are correct.

IAPT answer: (B) | **Zigyan answer:** (B)

34. Nisha was observing a pond sample using 15X eyepiece. She measured one of the protist using a micrometer and found it to be approximately 0.2 cm in size under the microscope. Her friend told her that the actual size of this protist is known to be 3μ. Thus Nisha was observing the organism using an objective lens of _____ magnification.

(A) 4X (B) 10 X (C) 45 X (D) 100 X

Solution · Q34 **Answer: (C)**

Size seen under the microscope:

0.2 cm = 2000 µm

Total magnification:

$$M = \frac{2000}{3} \approx 667$$

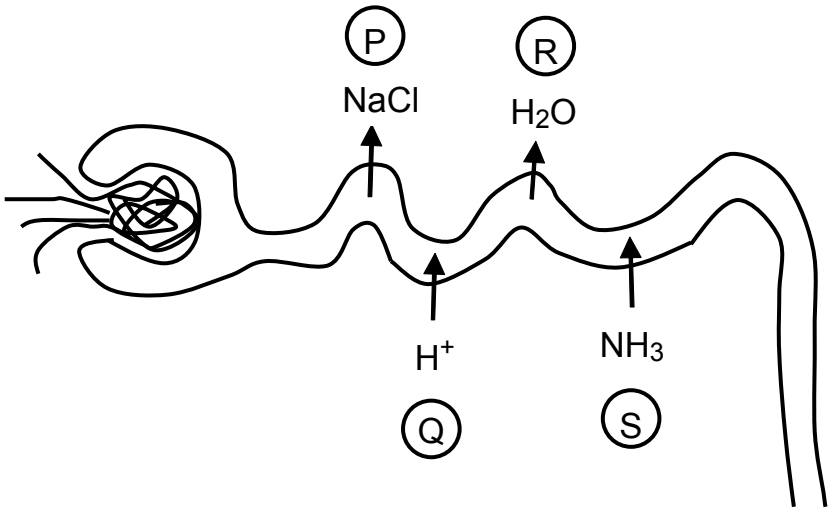
Objective magnification:

$$m_o = \frac{667}{15} \approx 44.4$$

∴ the objective lens is 45X.

IAPT answer: (C) | **Zigyan answer:** (C)

35. The movement of some solutes across the membrane of the proximal tubule of the kidney is shown below.



The modes of transport of P, Q, R and S respectively would be:

(A) Active, Passive, Active, Passive
(B) Active, Active, Passive, Passive
(C) Active, Passive, Passive, Active
(D) Passive, Passive, Active, Active

Solution · Q35 **Answer: (B)**

P: Na^+ is reabsorbed using energy and Cl^- follows: active.

Q: H^+ is secreted into the filtrate by Na^+/H^+ exchange and H^+ pumps: active.

R: water follows the solutes by osmosis: passive.

S: lipid-soluble NH_3 diffuses into the filtrate: passive.

IAPT answer: (B) | **Zigyan answer:** (B)

36. Blood Ca^{2+} is maintained at a level of about 10mg/100ml in a normal healthy individual. Which of the following occur when there is a drop in the blood Ca^{2+} level ?

i. Stimulation of Ca^{2+} uptake in kidneys.

ii. Stimulation of Ca^{2+} uptake in bones.

iii. Suppression of parathyroid hormone (PTH) release.

iv. Increase in Ca^{2+} uptake in intestine.

v. Vitamin D activation in liver.

(A) (i), (ii) and (iii)
(B) (iii) and (v)
(C) (i), (iv) and (v)
(D) (ii), (iii), (iv) and (v)

Solution · Q36 **Answer: (C)**

A fall in blood Ca^{2+} increases PTH release: (iii) false.

PTH increases Ca^{2+} reabsorption by the renal tubules: (i) true.

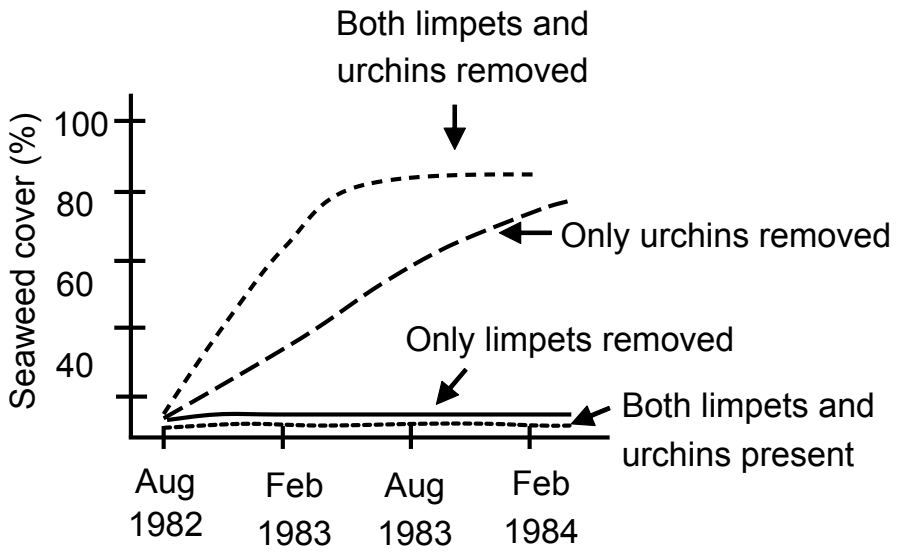
PTH causes bone resorption, which releases Ca^{2+} from bone: (ii) false.

Vitamin D is activated in the liver and then in the kidney (a step raised by PTH): (v) true.

Active vitamin D increases intestinal Ca^{2+} absorption: (iv) true.

IAPT answer: (C) | **Zigyan answer:** (C)

37. In order to study the effect of limpets and sea urchins on the seaweed survival in a particular event, the ecologist Fletcher carried out certain experiment and the effects are shown in the graph:



(i) Urchins had a greater effect on seaweed cover than limpets.

(ii) Removing limpets had a dramatic positive effect on seaweed growth.

(iii) Removing urchins led to increased growth of the seaweed as compared to its natural growth rate.

(iv) Both species have some influence on the seaweed distribution.

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

Solution · Q37 **As per Zigyan: (D)**

Removing only urchins raises the seaweed cover far more than removing only limpets.

∴ (i) is correct.

With only limpets removed, the curve stays close to the one with both present.

∴ (ii) is wrong.

Removing both gives more cover than removing only urchins, so limpets also have an effect.

∴ (iv) is correct.

The graph supports (iii) too, but no option lists (i), (iii) and (iv) together; (D) is the fullest correct choice.

Check: (B) contains the wrong statement (ii). The word only in (A) and (C) shuts out (iv), which the topmost curve supports.

IAPT answer: (D) | **Zigyan answer:** (D)

38. A few characteristic features of blood vessels of the human circulatory system are tabulated below:-

	P	Q	R
Blood flow	Even	Pulsatile	Even
Presence of valves	Absent	Absent	Present
Blood pressure	Low	High	Very low
Elastic tissue in walls	-	+++	+

P, Q and R respectively represent:

(A) Artery, vein, capillary
(B) Capillary, artery, vein
(C) Vein, artery, capillary
(D) Vein, capillary, artery

Solution · Q38 **Answer: (B)**

P: no elastic tissue, no valves, even flow, low pressure ⇒ capillary.

Q: highly elastic wall, pulsatile flow, high pressure ⇒ artery.

R: valves present, even flow, very low pressure ⇒ vein.

IAPT answer: (B) | **Zigyan answer:** (B)

39. Following is the data obtained for two fishes (1 and 2) of similar body mass:

	1	2
Heart mass (mg)	4.7 ± 0.6	2.2 ± 1.1
Spleen mass (mg)	14.2 ± 6	5.7 ± 4
Pectoral muscle LDH u/g	38 ± 16	110 ± 42

Which of the following is the most appropriate conclusion from the data?

(A) Fish 1 is benthic (bottom dwelling) while 2 is limnetic.
(B) Fish 1 performs endurance like activities while 2 is likely to perform short quick bursts of activities.
(C) Fish 2 has to supply blood to smaller biomass than fish 1.
(D) Fish 1 lives in well oxygenated stream while 2 lives in less aerobic environment.

Solution · Q39 **Answer: (B)**

Fish 1 has a larger heart and spleen, which favour a greater oxygen supply for sustained aerobic swimming.

Fish 2 has much higher muscle LDH, which supports anaerobic glycolysis.

∴ Fish 1 is suited to endurance activity and fish 2 to short, quick bursts.

IAPT answer: (B) | **Zigyan answer:** (B)

40. In marine mammals, which of the following is NOT observed during deep sea diving?

(A) Decrease in heart rate.
(B) Peripheral vasoconstriction.
(C) Hypometabolism.
(D) Myoglobin saturation.

Solution · Q40 **Answer: (D)**

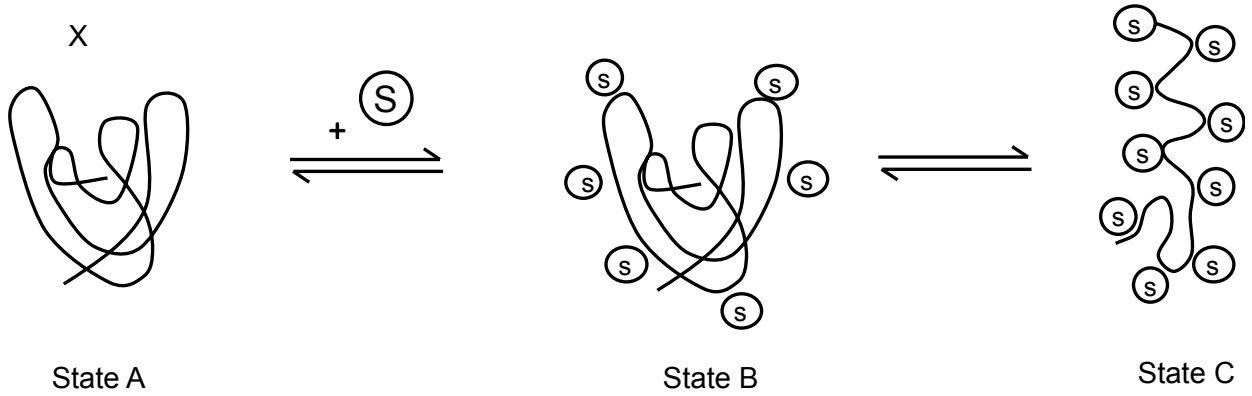
During a deep dive, bradycardia, peripheral vasoconstriction and hypometabolism save oxygen.

Myoglobin releases its stored oxygen to the muscles, so its saturation falls.

∴ Myoglobin saturation is not observed.

IAPT answer: (D) | **Zigyan answer:** (D)

41. Enzyme 'x' is a polypeptide in nature. When added to solvent 's' it acquires following conformation-



Which of the following is correct?

(A) Enzyme will be most active in state C.
(B) The solvent acts as a denaturant for the protein molecule.
(C) Further addition of solvent will lead to precipitation of the protein.
(D) Further addition of solvent will lead to breaking of polypeptide bonds of the protein.

Solution · Q41 **Answer: (B)**

In going to state C, the folded chain opens out in solvent s and loses its three-dimensional structure.

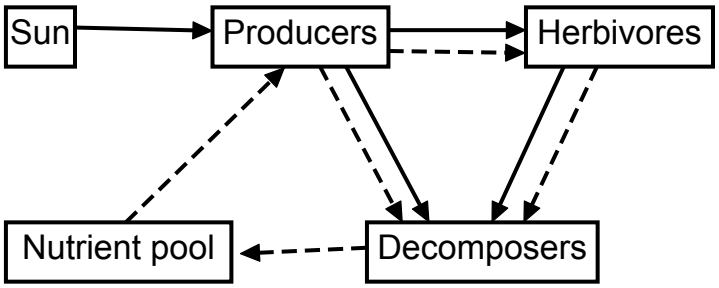
This is denaturation, so the solvent is a denaturant.

The unfolded enzyme in state C is not the active form, and its peptide bonds remain intact.

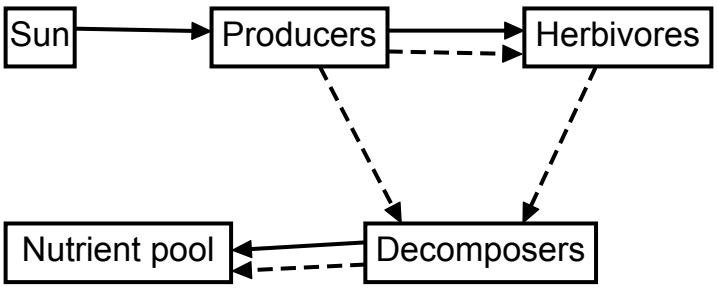
IAPT answer: (B) | **Zigyan answer:** (B)

42. Which of the following correctly represents simplified model of energy and mineral movement in an ecosystem?

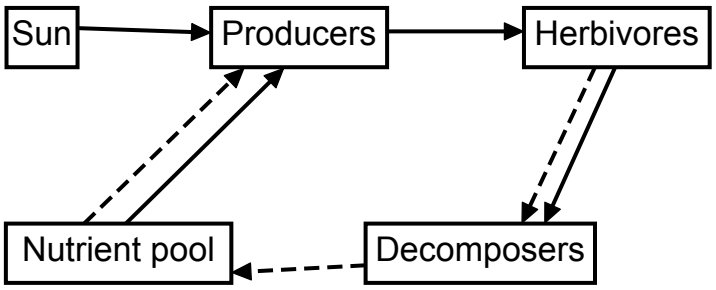
(A)



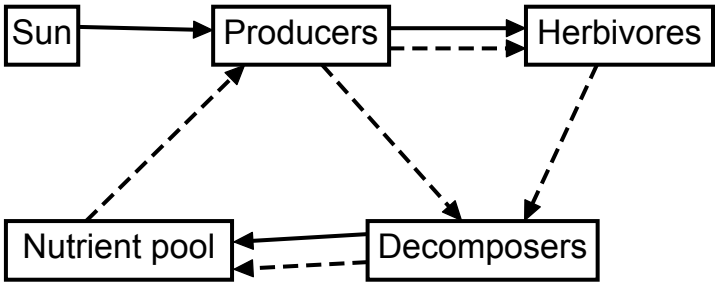
(B)



(C)



(D)



Solution · Q42 **Answer: (A)**

Solid arrows start at the Sun, so they show energy; dashed arrows show minerals.

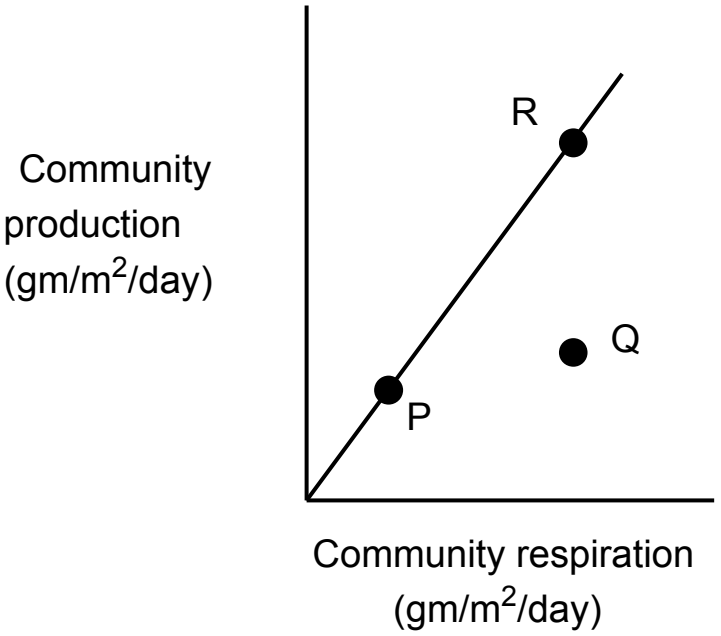
Energy flows one way: Sun → producers → herbivores, with producers and herbivores both passing it to decomposers.

Minerals cycle: nutrient pool → producers → herbivores; both pass them to decomposers, which return them to the pool.

Only (A) shows both paths completely.

IAPT answer: (A) | **Zigyan answer:** (A)

43. Various communities can be classified based on their metabolic characteristics such as productivity and respiration. Communities P, Q and R in the graph respectively represent:



(A) oceans, deserts and ponds.

(B) coral reefs, deserts and fertile agricultural area.

(C) estuaries, oceans and grassland.

(D) oceans, swamp waters and coral reefs.

Solution · Q43 **Answer: (D)**

The sloping line marks balanced production and respiration. Q, below it, respires more than it produces.

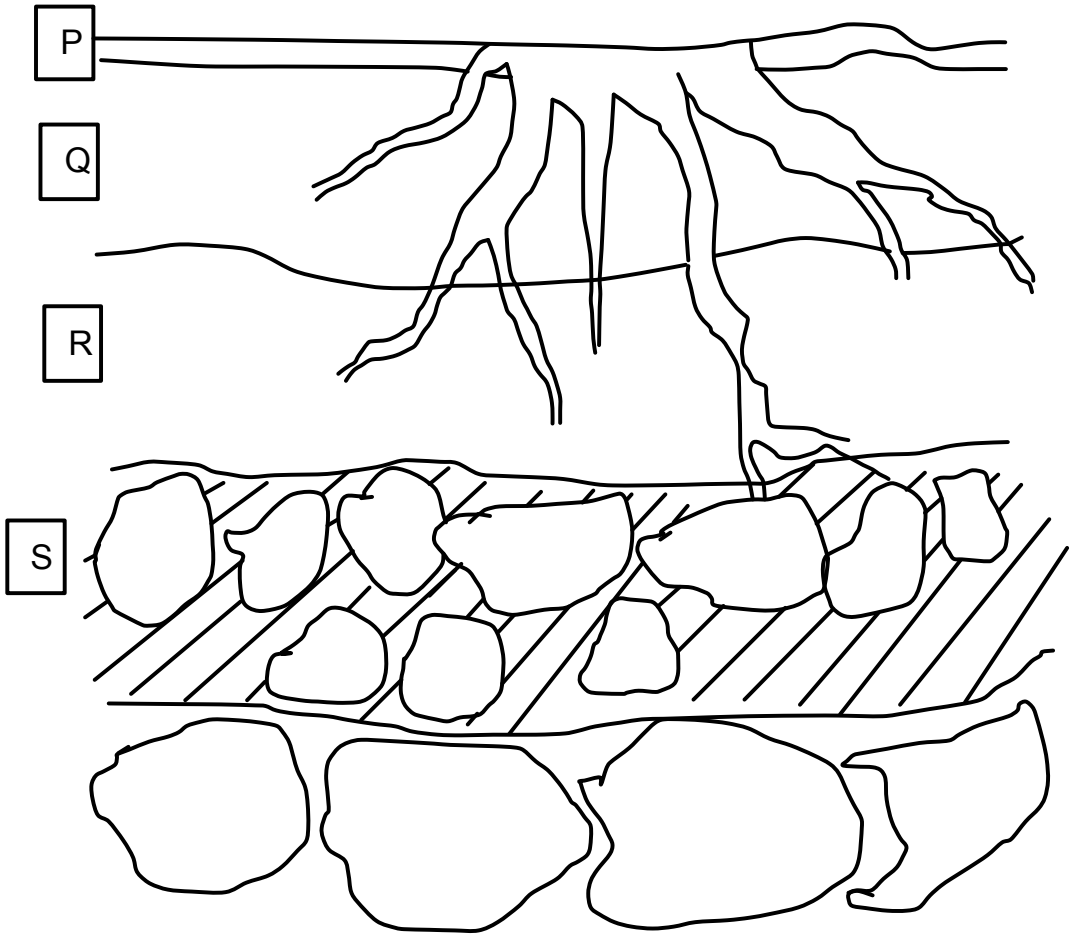
P: low production and low respiration ⇒ open ocean.

Q: respiration far above production ⇒ swamp water.

R: high production and high respiration, in balance ⇒ coral reef.

IAPT answer: (D) | **Zigyan answer:** (D)

44. Generalized profile of a soil in which a plant is growing is shown.



The region/s rich in humus will be:

(A) P only. (B) P and Q. (C) R only. (D) S only.

Solution · Q44 **Answer: (B)**

P is the thin surface layer of organic litter and humus (O horizon).

Q is the topsoil (A horizon), where humus is mixed with minerals.

R is the subsoil, poor in humus, and S is weathered rock.

∴ P and Q are rich in humus.

IAPT answer: (B) | **Zigyan answer:** (B)

45. The following represents a tri-peptide (3 amino acids) stretch of a protein sequence:

Arginine-Methionine-Lysine

Given below are four DNA sequences. Only one strand of the double stranded DNA has been represented. Which one of the following can possibly code for the above tri-peptide?

(A) 5' AAA GTA CGC 3' (B) 5' TTT CAT GCG 3'

(C) 5' GCG TAC TTT 3' (D) 5' CGC AUG AAA 3'

Solution · Q45 **Answer: (B)**

One possible mRNA for Arg-Met-Lys:

5′ CGC AUG AAA 3′

Its template DNA strand, complementary and antiparallel:

3′ GCG TAC TTT 5′

The same strand written from the 5′ end:

5′ TTT CAT GCG 3′

The sequence in (D) contains U, so it is not DNA.

IAPT answer: (B) | **Zigyan answer:** (B)

46. In a diploid organism the total DNA content of a sperm was found to be 'C'. What will be the DNA content of its cell that is at Metaphase I of meiosis?

(A) C (B) 0.5C (C) 2C (D) 4C

Solution · Q46 **Answer: (D)**

The haploid sperm has DNA content C, so a diploid cell in G_1 has 2C.

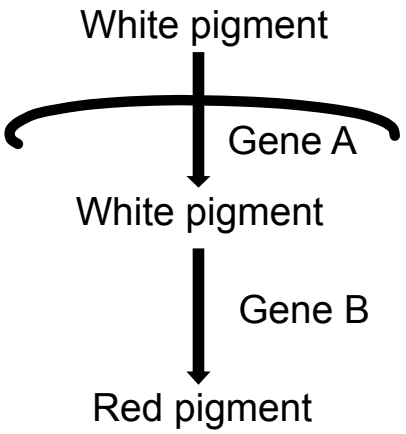
DNA replication in S phase raises it to 4C.

At metaphase I the cell has not yet divided.

∴ Its DNA content is 4C.

IAPT answer: (D) | **Zigyan answer:** (D)

47. In a plant, the color of a flower is determined by the conversion of a white pigment into a red pigment that is controlled by the product of gene 'B'. Product of the gene 'A' is responsible for bringing the white pigment into the cell for conversion. The process is schematically represented in the figure.



Alleles 'a' and 'b' are non-functional mutant alleles of genes 'A' and 'B', respectively. Two parental plants with white flowers are crossed. F_1 progeny have red flowers only. When the F_1 progeny is self-pollinated, the F_2 progeny has plants that have either red or white flowers.

Considering that the two genes are on two independent chromosomes, what is the expected ratio of the two phenotypes in the F_2 progeny?

(A) 3 Red : 1 white (B) 9 Red : 7 white (C) 1 Red : 1 white (D) 15 Red : 1 white

Solution · Q47 **Answer: (B)**

Red colour needs both a working gene A (pigment entry) and a working gene B (conversion).

As two white parents give only red F_1 plants, the cross is:

AAbb × aaBB

F_1: AaBb

Fraction of red (A_B_) plants on selfing:

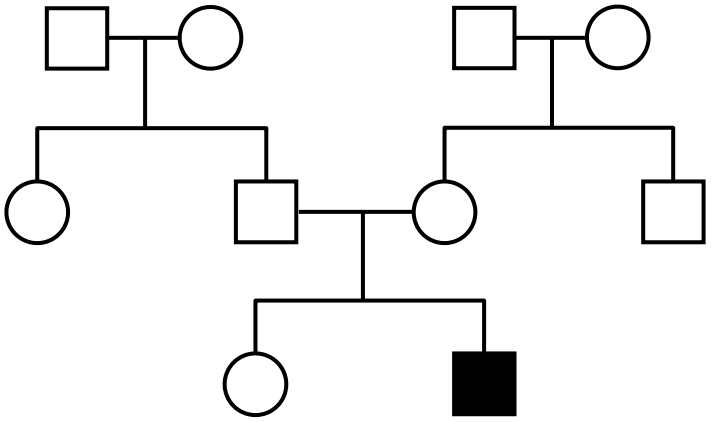
$$3/4 \times 3/4 = 9/16$$

The remaining 7/16 are white.

∴ Red : white is 9 : 7 (complementary genes).

IAPT answer: (B) | **Zigyan answer:** (B)

48. The following pedigree represents the inheritance of a rare disorder caused due to an autosomal recessive allele. Filled square indicates affected male.



What is the probability that the daughter in the third generation carries the allele responsible for the disorder?

(A) 1/2 (B) 2/3 (C) 3/4 (D) 1/4

Solution · Q48 **Answer: (B)**

The affected son is aa while both his parents are unaffected.

∴ Both parents are Aa.

Offspring of Aa × Aa, in the ratio 1 : 2 : 1, are:

AA, Aa, aa

The daughter is unaffected, so aa is ruled out.

∴ The probability that she is a carrier (Aa) is 2/3.

IAPT answer: (B) | **Zigyan answer:** (B)

49. Bacteriophages are viruses that infect bacterial cells.. In a given experiment bacteriophages were grown in the presence of radioisotopes ^{14}C and ^{32}P. These bacteriophages were used to infect bacterial cells. Following infection, radioisotopes present in the bacterial cells were analyzed. The radioactivity in the bacterial cell will be observed due to the presence of:

(A) Only ^{32}P (B) Only ^{14}C

(C) Both ^{32}P and ^{14}C (D) Either ^{32}P or ^{14}C

Solution · Q49 **Answer: (C)**

^{32}P labels the phage DNA, while ^{14}C labels both the DNA and the protein coat.

During infection the DNA enters the bacterium and the protein coat stays outside.

DNA contains carbon as well as phosphorus.

∴ both ^{32}P and ^{14}C are found inside the cell.

IAPT answer: (C) | **Zigyan answer:** (C)

50. A water strider can walk on the surface of water without even getting its claws wet. The insect can do it due to which property of water?

(A) Specific gravity (B) Surface tension

(C) Specific heat (D) Anomalous behaviour

Solution · Q50 **Answer: (B)**

Surface tension makes the water surface act like a stretched film.

The water-repelling legs of the strider only dent this film, which supports its weight.

IAPT answer: (B) | **Zigyan answer:** (B)

51. The spider silk has a predominant component called 'spiderwin', with five times the strength of steel, weight for weight. The elasticity of the web strands is due to the presence of :

(A) beta sheets (B) alpha helices (C) disordered loops (D) sugar residues

Solution · Q51 **As per Zigyan: (C)**

Spider silk protein has stiff, orderly β-sheet crystals, which give the fibre its strength.

These crystals lie among less ordered, glycine-rich loops and turns.

The disordered regions can open out when the strand is pulled, so they account for its elasticity.

Why Zigyan differs from IAPT: chains in a β-sheet are already stretched almost fully and form the stiff part of silk; the elasticity belongs to the less ordered glycine-rich regions.

Reference: NCERT Chemistry Class XII (Part II), Unit 10 'Biomolecules', section 10.2.3: in a β-pleated sheet all peptide chains are stretched out to nearly maximum extension.

Reference: Peng and co-authors, Molecules (2024), review on spider silk protein structure, section 2.2.1: glycine-rich areas are responsible for elasticity and flexibility; β-sheet crystalline domains lay the groundwork for tensile strength and stiffness.

Reference: Keten and Buehler, Journal of the Royal Society Interface (2010), introduction: in dragline silk, stiff orderly domains are embedded in a semi-amorphous matrix with less orderly structures.

IAPT answer: (A) | **Zigyan answer:** (C)

52. The hepatocytes of an elephant, in comparison to the hepatocytes of a mouse are:

(A) twice as big.
(B) five times bigger.
(C) twenty times bigger.
(D) of the same size.

Solution · Q52 **Answer: (D)**

Cell size does not increase in proportion to body size.

An elephant's liver is bigger because it has far more hepatocytes, each of about the same size as those of a mouse.

IAPT answer: (D) | **Zigyan answer:** (D)

53. Plant scientists are worried that C_4 crops such as corn and sugarcane may suffer stiffer competition from C_3 weeds since there is a global

(A) increase in temperature.
(B) increase in CO_2 content of atmosphere.
(C) decrease in rainfall.
(D) increase in genome contamination of C_4 crops.

Solution · Q53 **Answer: (B)**

In C_3 plants, more CO_2 suppresses photorespiration and raises the rate of photosynthesis.

C_4 plants already have a CO_2-concentrating mechanism and saturate at a lower CO_2 level, so they gain much less.

$\therefore$ rising atmospheric CO_2 favours the C_3 weeds.

IAPT answer: (B) | **Zigyan answer:** (B)

54. During menstrual cycle there are two surges in estrogen concentration of blood. The first and major surge is just prior to the ovulation phase and the next one is in:

(A) menstruation phase
(B) early follicular phase
(C) mid- luteal phase
(D) late- luteal phase

Solution · Q54 **Answer: (C)**

Estrogen reaches its main peak in the late follicular phase, just before ovulation.

After ovulation, the corpus luteum secretes progesterone along with estrogen, giving a second, smaller rise in the mid-luteal phase.

IAPT answer: (C) | **Zigyan answer:** (C)

55. Match the following examples with the evolutionary phenomena, namely, convergent evolution (p), divergent evolution (q) and adaptive radiation (r).

i. Sugar gliders of Australia and European flying squirrel.

ii. Squirrel species on opposite rims of Grand Canyon.

iii. Sharks and dolphins.

iv. Darwin's finches.

(A) i- p, ii- q, iii- p , iv- r
(B) i- r, ii- r, iii- p , iv- r
(C) i- r, ii- q, iii- p , iv- q
(D) i- q, ii- r, iii- p , iv- p

Solution · Q55 **Answer: (A)**

i. Marsupial sugar glider and placental flying squirrel look alike: convergent (p).

ii. Squirrel populations separated by the canyon have evolved apart from a common ancestor: divergent (q).

iii. Shark (a fish) and dolphin (a mammal) have similar body forms: convergent (p).

iv. Darwin's finches: adaptive radiation (r).

∴ i-p, ii-q, iii-p, iv-r.

IAPT answer: (A) | **Zigyan answer:** (A)

56. Most of the drugs are eliminated by nephrons through:

(A) Filtration at loop of Henle.
(B) tubular reabsorption at proximal convoluted tubules.
(C) tubular secretion at distal convoluted tubules.
(D) tubular secretion at collecting duct.

Solution · Q56 **As per Zigyan: no option is correct**

Many drugs are bound to plasma proteins and are filtered very little.

The main tubular route for removing drugs is active secretion by the proximal convoluted tubule.

No option names this route. Filtration does not occur in the loop of Henle, and reabsorption returns a substance to the blood.

Why Zigyan differs from IAPT: the primary route of kidney secretion for drugs is in the proximal tubule, so the distal convoluted tubule cannot be named for most drugs.

Reference: Wang and Kestenbaum, 'Proximal Tubular Secretory Clearance: A Neglected Partner of Kidney Function', Clinical Journal of the American Society of Nephrology (2018): proximal tubular secretion is the primary kidney mechanism for eliminating hundreds of commonly prescribed medications.

IAPT answer: (C) | **Zigyan answer:** none of the options is correct

57. Consumption of salty food results in increased thirst and a cascade of events. Select and arrange the sequence of events:

i) Increased reabsorption of water.

ii) High Na^+ in blood

iii) Increased release of aldosterone.

iv) Increased ADH in blood.

v) Passing out more concentrated urine.

Choose the correct sequence.

(A) ii, iv, i, v
(B) i, iii, iv, ii, v.
(C) iii,i, iv, v, ii
(D) ii, iii, vi, i.

Solution · Q57 **Answer: (A)**

Salty food raises the Na^+ level and osmolarity of blood (ii).

Osmoreceptors then cause more ADH to be released (iv).

ADH increases water reabsorption in the later parts of the nephron (i), and more concentrated urine is passed out (v).

A high salt load does not increase aldosterone release, so (iii) is not part of this chain.

∴ ii, iv, i, v.

IAPT answer: (A) | **Zigyan answer:** (A)

58. Acid precipitation refers to rain, snow or fog with a pH lower or more acidic than pH 5.6. It results primarily by the presence of which of the following components in the atmosphere?

(A) CO and CO_2
(B) sulphur and nitrogen oxides
(C) lead and phosphorous oxides
(D) ozone and hydrocarbons

Solution · Q58 **Answer: (B)**

Oxides of sulphur and nitrogen, released mainly by burning fossil fuels, react with water and oxygen in air.

The sulphuric acid and nitric acid formed come down as acid precipitation.

IAPT answer: (B) | **Zigyan answer:** (B)

59. Peroxisomes are often noticed in proximity of mitochondria. This is due to the fact that the products can be transported to mitochondria. Which of the following functions is most relevant to this explanation?

(A) Peroxisomes use oxygen to break fatty acids down into smaller molecules that are then used as fuel for cellular respiration.
(B) Peroxisomes oxidise alcohol to detoxify it in liver.
(C) Peroxisomes transfer hydrogen from toxins to oxygen rendering them harmless.
(D) Peroxisomes produce H_2O_2 and also convert it to water.

Solution · Q59 **Answer: (A)**

Peroxisomes use O_2 to break fatty acids into smaller molecules by β-oxidation.

These molecules pass to the nearby mitochondria and serve as fuel for cellular respiration.

IAPT answer: (A) | **Zigyan answer:** (A)

60. Homology suggests a common ancestry, while analogy suggests:

(A) monophyletic origin.
(B) character displacement.
(C) polyphyletic origin.
(D) adaptation to common environment.

Solution · Q60 **Answer: (D)**

Analogous structures arise by convergent evolution.

In a similar habitat, different groups of organisms are selected for similar adaptive features serving the same function.

∴ analogy suggests adaptation to a common environment.

IAPT answer: (D) | **Zigyan answer:** (D)

61. Sulfolobus bacteria that fix CO_2 using energy from inorganic chemicals are classified to be :

(A) photoautotrophs.
(B) photoheterotrophs.
(C) chemoautotrophs.
(D) chemoheterotrophs

Solution · Q61 **Answer: (C)**

The carbon source is CO_2, so the organism is an autotroph.

Its energy comes from oxidation of inorganic chemicals, not from light.

∴ it is a chemoautotroph.

IAPT answer: (C) | **Zigyan answer:** (C)

62. A cell of seta of a moss and a cell of endosperm of a cycad, both having n=18, will respectively have the chromosome numbers:

(A) 36 and 54 (B) 36 and 18 (C) 36 and 36 (D) 18 and 54

Solution · Q62 **Answer: (B)**

The seta of a moss is part of the sporophyte, which is diploid.

$$2n = 2 \times 18 = 36$$

In a cycad (gymnosperm), the endosperm is the female gametophyte, formed before fertilisation, so it is haploid.

$$n = 18$$

∴ 36 and 18.

IAPT answer: (B) | **Zigyan answer:** (B)

63. Lata came across a slide without label. On microscopic examination she realised that it was a cross section of some plant organ. She noticed metaxylem vessels in the centre and protoxylem vessels towards the periphery in 4 groups alternating with phloem patches, surrounded by pericycle, endodermis, cortex and epidermis with long narrow outgrowths. It should be labelled as a cross section of :

(A) young root of a gymnosperm.
(B) young root of a dicot.
(C) young root of a monocot.
(D) old root of a dicot.

Solution · Q63 **Answer: (B)**

Protoxylem towards the periphery and metaxylem towards the centre show exarch xylem, a feature of roots.

Long narrow epidermal outgrowths are root hairs, so the root is young.

Four xylem groups alternating with phloem (tetrarch) indicate a dicot; monocot roots usually have more than six (polyarch).

Gymnosperms generally lack xylem vessels.

∴ young root of a dicot.

IAPT answer: (B) | **Zigyan answer:** (B)

64. Which of the following is the largest animal without any endoskeleton or exoskeleton?

(A) Jellyfish. (B) Sea cucumber. (C) Hag fish. (D) Sword fish.

Solution · Q64 **Answer: (A)**

A jellyfish has neither an endoskeleton nor an exoskeleton; mesoglea and water support its body.

A sea cucumber has calcareous ossicles, while hag fish and sword fish have internal skeletons.

∴ jellyfish.

IAPT answer: (A) | **Zigyan answer:** (A)

65. Open circulatory system is encountered in which of the following?

i. Starfish
ii. Hydra
iii. Spider
iv. Planaria
v. Crab

(A) i, iii and iv (B) ii, iii and v (C) iii and v (D) i and v

Solution · Q65 **Answer: (C)**

Spider and crab are arthropods, which have an open circulatory system.

Hydra and Planaria have no circulatory system, so choices containing ii or iv are wrong.

Choice (D) leaves out the spider.

∴ iii and v.

IAPT answer: (C) | **Zigyan answer:** (C)

66. Cabbage, cauliflower, broccoli, kohlrabi, kale, brussels sprouts have all sprung from the wild mustard plant through:

(A) Variations and natural selection.
(B) Induced mutations and their propagation.
(C) Induced transgenesis.
(D) Artificial selection of variations.

Solution · Q66 **Answer: (D)**

Farmers repeatedly selected and bred wild mustard plants showing desired variations in leaves, stem, buds or flower clusters.

These different vegetables are therefore products of artificial selection.

IAPT answer: (D) | **Zigyan answer:** (D)

67. Air dried seeds and dry wood were soaked in water. After a day both of them were found to be swollen. Which of the following inference is correct?

(A) Dry wood absorbed water by imbibition for few hours and thereafter by osmosis.
(B) Dried seeds absorbed water only by osmosis.
(C) Dried seeds absorbed water by imbibition for few hours and thereafter by osmosis.
(D) Both of them absorbed water by osmosis and imbibition simultaneously.

Solution · Q67 **Answer: (C)**

Dry wood is dead tissue without functional cell membranes, so it takes up water by imbibition and not by osmosis.

A dry seed has a living embryo. It first takes up water by imbibition; later its living cells absorb water by osmosis through their membranes.

∴ the inference about dried seeds in (C) is correct.

IAPT answer: (C) | **Zigyan answer:** (C)

68. Which of the following are the effects of growth hormones in humans?

i. Enhanced uptake of amino acids from blood by the body cells.
ii. Decreased uptake of sulphur from blood.
iii. Enhanced storage of lipids in fat depots.
iv. Enhanced glycogenolysis increasing sugar level in blood.

(A) i, ii and iii (B) i and iv (C) ii and iv (D) I and iii

Solution · Q68 **Answer: (B)**

i. True: growth hormone increases amino acid uptake by cells and protein synthesis.

ii. False: acting through IGF-1, it increases sulphate uptake by growing cartilage.

iii. False: it mobilises fat from fat depots (lipolysis).

iv. True: it opposes insulin, increases glucose output of the liver and raises blood sugar.

∴ i and iv.

IAPT answer: (B) | **Zigyan answer:** (B)

69. Catecholamines- hormones secreted by adrenal glands cause all the following except:

(A) increased heart rate.
(B) increased metabolic rate.
(C) increased blood pressure
(D) constriction of bronchioles.

Solution · Q69 **Answer: (D)**

Catecholamines (adrenaline and noradrenaline) are the fight-or-flight hormones.

They raise heart rate, blood pressure and metabolic rate.

Adrenaline relaxes bronchial muscle, so the bronchioles dilate and do not constrict.

∴ constriction of bronchioles is the exception.

IAPT answer: (D) | **Zigyan answer:** (D)

70. An endoparasite present at which of the following sites can tolerate lowest oxygen tension in the medium?

(A) Blood stream (B) Bile duct (C) Lungs (D) Oropharynx

Solution · Q70 **Answer: (B)**

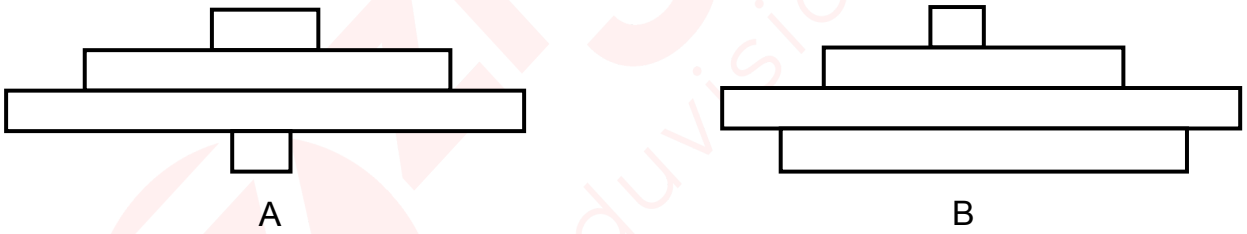
Blood carries oxygen from the lungs, while the lungs and oropharynx receive inhaled air.

The bile duct lies deep inside the body with no contact with air, and bile holds very little oxygen.

∴ a parasite of the bile duct can tolerate the lowest oxygen tension.

IAPT answer: (B) | **Zigyan answer:** (B)

71. Two ecological pyramids are represented in the diagrams A and B:



Choose the correct statement/s from the following:

i. A is based on biomass and B is based on energy at every level.

ii. In B, the producers are very small in size and produce enough food for first order consumers and the turnover of producers is much more rapid than that of herbivore.

iii. In A, the size of the producer is huge and supports large number of herbivores.

iv. In B the producers have longer life span and in A the producers have shorter life span.

(A) i and iv (B) Only ii (C) ii and iii (D) Only iv

Solution · Q71 **Answer: (C)**

A pyramid of energy is always upright. B has a producer bar smaller than its herbivore bar, so i is false.

B fits the inverted biomass pyramid of an aquatic ecosystem: tiny phytoplankton with a small standing crop and rapid turnover feed a larger mass of herbivores. So ii is true.

A fits the pyramid of numbers on a big tree: one huge producer supports many herbivores. So iii is true.

Trees live much longer than phytoplankton, so iv states the reverse and is false.

∴ ii and iii.

IAPT answer: (C) | **Zigyan answer:** (C)

72. What is the probability that, in an organism with a diploid number 20, a sperm will be formed which contains all 10 chromosomes that come from the mother?

(A) $\left(\frac{1}{2}\right)^{20}$ (B) $\left(\frac{1}{2}\right)^{10}$

(C) $\left(\frac{1}{4}\right)^{20}$ (D) $\left(\frac{1}{4}\right)^{10}$

Solution · Q72 **Answer: (B)**

A diploid number of 20 means 10 pairs of homologous chromosomes.

Each pair gives the sperm its maternal member with probability one half, and the pairs assort independently (crossing over is ignored).

$$P = \left(\frac{1}{2}\right)^{10}$$

IAPT answer: (B) | **Zigyan answer:** (B)

73. The nuclei in the tender coconut water and the hard white pulp of coconut are respectively:

(A) Triploid, Diploid (B) Diploid, Diploid

(C) Triploid, Triploid (D) Triploid, Haploid

Solution · Q73 **Answer: (C)**

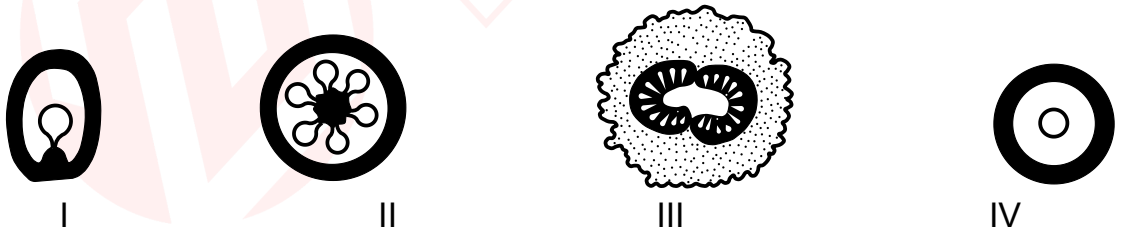
Coconut water is free-nuclear endosperm and the white pulp is cellular endosperm.

Both develop from the triploid primary endosperm nucleus.

∴ Both have triploid nuclei.

IAPT answer: (C) | **Zigyan answer:** (C)

74. The following are the T.S. of different types of ovaries. The types of placentation in I, II, III and IV are respectively-



(A) Axile, free central, axile, basal.

(B) Marginal, free central, axile, basal

(C) Marginal, free central, axile, free central

(D) Basal, axile, free central, axile

Solution · Q74 **Answer: (B)**

I: one ovule on a placenta at one side of a single chamber, marginal.

II: ovules on a central column without septa, free central.

III: many ovules on a central placenta in a chambered ovary, axile.

IV: a lone ovule seen free in the centre, as it rises from the base, basal.

IAPT answer: (B) | **Zigyan answer:** (B)

75. The following characters are found in many trees that belong to temperate forests.

i. Pollen shed occurs at the beginning of growing season before the leaves develop.

ii. Pollen shed is also timed to avoid high humidity and rain.

Identify the type of pollination.

(A) Entomophily (B) Anemophily (C) Ornithophily (D) Chiropterophily

Solution · Q75 **Answer: (B)**

With no leaves in the way, wind carries the pollen freely.

Dry weather matters because rain and humidity hinder pollen transport through air.

∴ The trees show anemophily.

IAPT answer: (B) | **Zigyan answer:** (B)

76. A son with Klinefelter syndrome is born to a mother who is phenotypically normal. The father has X linked skin defect (Anhidrotic ectodermal dysplacia). But the son has patches of normal as well as defective skin. This can be explained as:

i. Non- disjunction of X chromosome took place during oogenesis and the son inherited two X chromosomes.

ii. Non- disjunction of X and Y chromosomes took place during spermatogenesis.

iii. Mosaic phenotype caused by random inactivation of X chromosome resulted in different patches on skin.

iv. X linked gene might have crossed over to Y and the son inherited the skin disorder.

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

Solution · Q76 **Answer: (B)**

The mother is normal, so the defective allele comes from the father.

X and Y fail to separate in meiosis I of spermatogenesis, giving this sperm:

X^dY

Fertilisation of a normal egg:

$X^D + X^dY \rightarrow X^DX^dY$

Random inactivation of one X in different cells gives normal and defective skin patches.

i gives no defective X. iv gives no patches, as an allele on Y escapes X inactivation.

∴ ii and iii are correct.

IAPT answer: (B) | **Zigyan answer:** (B)

77. An aphid is fed on a herbaceous plant and its stylet is removed by anesthetizing the insect. The fluid in the stylet is analysed for its chemical content. Which of the following will be the correct observation/s?

i. The main component will be starch if it is a potato plant. Sugars like sucrose and fructose also will be found.

ii. The main component will be fructose when the plant bears sweet fruits.

iii. The contents will be minerals from xylem as well as sucrose from phloem.

iv. The contents will be mostly sucrose.

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

Solution · Q77 **Answer: (C)**

The aphid stylet taps a sieve tube, so the fluid is phloem sap.

Its main solute is sucrose. Starch is not translocated, fructose is not the main component, and xylem is not tapped.

∴ Only iv is correct.

IAPT answer: (C) | **Zigyan answer:** (C)

78. The floral characters that **cannot** be identified by floral diagram and floral formula are respectively:

(A) Position of ovary and monadelphous stamens.

(B) Epipetalous stamens and position of ovary.

(C) Position of ovary and aestivation in calyx and corolla.

(D) Gamopetalous condition and number of locules in ovary.

Solution · Q78 **Answer: (C)**

A floral diagram does not show whether the ovary is superior or inferior.

A floral formula shows ovary position, cohesion and adhesion, but not the aestivation of calyx and corolla.

∴ Position of ovary and aestivation, respectively.

IAPT answer: (C) | **Zigyan answer:** (C)

79. If for convenience, the biochemical pathway of photosynthesis is represented briefly by the following equation;

$$CO_2 + 2H_2A \xrightarrow{\text{Light}} [CH_2O] + H_2O + 2A$$

Then, A can represent:

i. Oxygen utilised by land plants and in blue green algae.

ii. Oxygen utilized by phototrophic bacteria and sulphur by cyanobacteria.

iii. Oxygen utilised by angiosperm and sulphur in phototrophic bacteria.

iv. Oxygen utilized by all eukaryotes and sulphur by all prokaryotes.

(A) i and ii (B) ii and iv (C) i and iii (D) i, iii and iv

Solution · Q79 **Answer: (C)**

A is the oxidation product of the hydrogen donor.

In angiosperms, other land plants and blue green algae, A is oxygen:

$CO_2 + 2H_2O \rightarrow [CH_2O] + H_2O + O_2$

In purple and green sulphur bacteria, A can be sulphur:

$CO_2 + 2H_2S \rightarrow [CH_2O] + H_2O + 2S$

ii and iv fail because cyanobacteria, though prokaryotes, release oxygen.

∴ i and iii are correct.

IAPT answer: (C) | **Zigyan answer:** (C)

80. Which of the following sets of tissues represents the ground tissue of plants?

(A) Epidermis, sclerenchyma fibres, xylem vessels, phloem sieve tube members.

(B) Parenchyma of cortex of stem, mesophyll cells of leaf, collenchyma of young stem, sclereids in the pulp of guava.

(C) Parenchyma of pith of stem, epidermis of leaf, epidermis of young stem, root hair.

(D) Collenchyma of hypodermis of young stem, cork cells of the bark, parenchyma of pith, cortex of young root.

Solution · Q80 **Answer: (B)**

All tissues except epidermis and vascular bundles form the ground tissue.

Cortical parenchyma, mesophyll, collenchyma and sclereids of guava pulp all belong to it.

(A) and (C) include epidermis; (D) includes cork, a protective tissue.

IAPT answer: (B) | **Zigyan answer:** (B)

ANSWER KEY

NSEB 2019 · PAPER CODE 21

80
QUESTIONS · 240 MARKS

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

1	(A)	2	(A)	3	(C)	4	(C)	5	(A)
6	(A)	7	(D)	8	(D)	9	(D)	10	(C)★
11	(B)	12	(C)	13	(A)	14	(B)	15	(C)
16	(C)	17	(B)	18	(B)	19	(B)	20	(A)
21	(B)★	22	(B)	23	(B)★	24	(D)	25	(B)
26	(A)	27	(C)	28	(C)	29	(D)	30	(B)
31	(D)	32	(C)	33	(B)	34	(C)	35	(B)
36	(C)	37	(D)★	38	(B)	39	(B)	40	(D)
41	(B)	42	(A)	43	(D)	44	(B)	45	(B)
46	(D)	47	(B)	48	(B)	49	(C)	50	(B)
51	(C)★	52	(D)	53	(B)	54	(C)	55	(A)
56	–★	57	(A)	58	(B)	59	(A)	60	(D)
61	(C)	62	(B)	63	(B)	64	(A)	65	(C)
66	(D)	67	(C)	68	(B)	69	(D)	70	(B)
71	(C)	72	(B)	73	(C)	74	(B)	75	(B)
76	(B)	77	(C)	78	(C)	79	(C)	80	(B)

★ Answers as per Zigyan

- **Q10** — As per Zigyan: (C); IAPT key (A).
- **Q21** — As per Zigyan: (B); IAPT key (B).
- **Q23** — As per Zigyan: (B); dropped by IAPT.
- **Q37** — As per Zigyan: (D); IAPT key (D).
- **Q51** — As per Zigyan: (C); IAPT key (A).
- **Q56** — As per Zigyan: no option is correct; IAPT key (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.

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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
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Above MAS

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Priyanshi
Class XI
4 Years Classroom
IOQM Qualifier

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RESULTS · 2021 – 2026

Our toppers, year by year

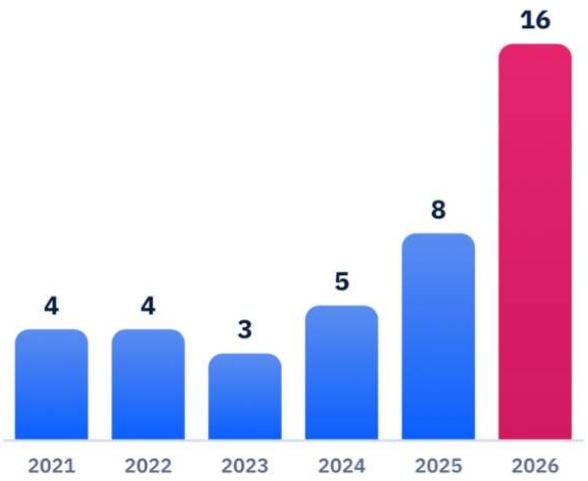
40
JEE Advanced selections in 6 years

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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