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PREVIOUS YEAR PAPER · 2026

OLYMPIAD · STAGE I

NSEB

National Standard Examination in Biology

2026

Question paper, answer key and Zigyan solutions
Question 60 is not included in this booklet.

59 of 60	216	120 min	21
Questions included	Maximum marks	Time	Paper code

Question paper and TENTATIVE answer key: Indian Association of Physics Teachers (IAPT), NSEB 2026, paper code 21.
Solutions and notes: Zigyan. This booklet is not an IAPT publication.

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- Saksham Bishnoi — 4 Years Classroom

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- Priyanshi — 4 Years Classroom

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

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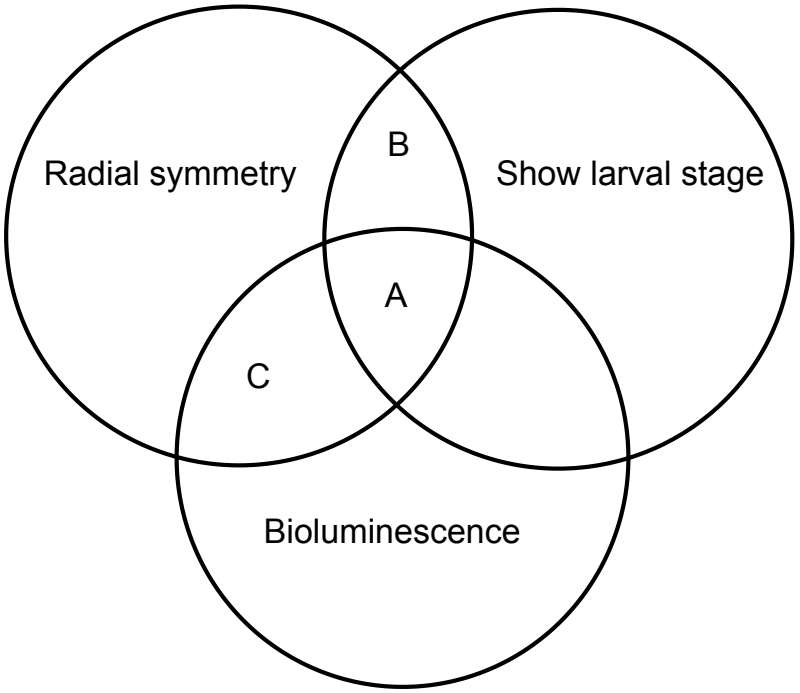
PART A-1 · ONE CORRECT OPTION

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

1. The Venn diagram below depicts three features observed in animal phyla. The major phyla that are characteristically attributed to Groups A and B are:



(A) A: Cnidaria, Ctenophora B: Echinodermata

(B) A: Arthropoda, Ctenophora B: Echinodermata

(C) A: Annelida, Cnidaria B: Mollusca

(D) A: Mollusca, Ctenophora B: Annelida

Solution · Q1 **Answer: (A)**

A (all three features): Cnidaria and Ctenophora.

Both are radially symmetrical, have a larval stage (planula, cydippid) and include light-emitting forms; bioluminescence is well marked in ctenophores.

B (radial symmetry and larval stage): Echinodermata, with radially symmetrical adults and free-swimming larvae.

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

2. In a hypothetical situation, if the cells of the proximal convoluted tubules of the human nephrons are replaced by squamous epithelium, what would be the mostly likely outcome?

(A) Creatinine will be detected in urine.

(B) Urine will be highly acidic.

(C) The person will show symptoms of diabetes like diuresis & glucosuria.

(D) Plasma proteins will be detected in the urine.

Solution · Q2 **Answer: (C)**

The PCT has brush-border cuboidal cells, rich in mitochondria, which reabsorb nearly all glucose and most of the water.

Flat squamous cells cannot do this, so glucose stays in the filtrate and holds water with it.

∴ Glucosuria with osmotic diuresis.

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

3. A virus consists of nucleic acid enclosed in a protein coat. Researchers often describe viruses as leading a "borrowed life". Which of the following statement best support this phrase?

i. Viruses are extremely small and structurally simple.

ii. Viruses lack their own metabolic enzymes for protein synthesis.

iii. Viruses are facultative intracellular parasites.

iv. Viruses can replicate only within a living host cell.

Select the most suitable combination.

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

Solution · Q3 **Answer: (B)**

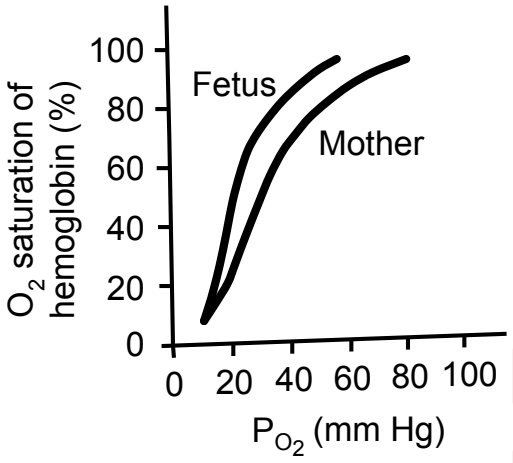
A virus has no metabolic machinery of its own for protein synthesis (ii).

It multiplies only inside a living host cell, using the host's machinery (iv).

(iii) is false: viruses are obligate, not facultative, intracellular parasites.

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

4. The haemoglobin of human foetus differs from that of adult haemoglobin. Compare the oxygen dissociation curves of these two types of haemoglobins given in the graph below.



Based on the graph, four students gave the following interpretations. Select the one which is best supported by graph.

(A) Maternal haemoglobin has a higher affinity for oxygen than foetal haemoglobin at high partial pressures of oxygen.

(B) At any given partial pressure of oxygen, the oxygen saturation of foetal haemoglobin is lower than that of maternal haemoglobin.

(C) A higher partial pressure of oxygen is required for foetal haemoglobin to achieve the same saturation as maternal haemoglobin.

(D) The observed difference in oxygen dissociation curves likely facilitates oxygen uptake by the foetus in the placental environment.

Solution · Q4 **Answer: (D)**

The foetal curve lies to the left of the maternal curve, so foetal Hb has the higher O_2 affinity.

At the low pO_2 of the placenta it is more saturated than maternal Hb, so it can take up O_2 from the mother's blood.

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

5. In an *E. coli* mutant, the lac operator is altered so that the repressor cannot bind. How will this mutation affect β-galactosidase production when the cells are grown in different sugar conditions (with respect to glucose and lactose)?

(A) Produced under all conditions.

(B) Produced only when lactose is present.

(C) Not produced when glucose is present.

(D) Absent if lactose is absent.

Solution · Q5 **Answer: (A)**

The repressor cannot bind the altered operator, so it can no longer block transcription.

The lac genes are expressed constitutively, with or without lactose.

With glucose, the level is low (catabolite repression), but the enzyme is still made.

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

6. The sickle cell allele (S) persists at a relatively high frequency in malaria-endemic regions. Individuals with genotype AS (heterozygotes) are less likely to suffer severe malaria compared to AA individuals, while SS individuals develop sickle cell disease.

Which evolutionary mechanism best explains this persistence of the S allele?

(A) Directional selection favouring the sickle allele (S).

(B) Balancing selection due to heterozygote advantage.

(C) Stabilizing selection eliminating both extremes (AA and SS).

(D) Genetic drift maintaining a deleterious allele at high frequency.

Solution · Q6 **Answer: (B)**

In malarial areas, AS individuals resist severe malaria and do not suffer sickle cell disease, so they are fitter than both AA and SS.

This heterozygote advantage keeps both alleles in the population: balancing selection.

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

7. The level of carbon monoxide (CO) in a room was found to be gradually increasing. The oxygen saturation (SpO_2) of a group of humans who were present in the room was measured periodically. The results are tabulated below.

CO concentration in air (ppm)	Average SpO_2 (%)
0	98
50	94
100	89
200	78

Which explanation best accounts for the observed decrease in oxygen saturation?

(A) CO, having nearly 200–250 times higher affinity for haemoglobin than O_2, displaces O_2 from haemoglobin binding sites and reduces oxygen transport.

(B) CO enhances the solubility of O_2 in plasma, decreasing its dependence on haemoglobin and thus lowering measured SpO_2.

(C) CO binding shifts haemoglobin into a relaxed conformation, causing premature release of O_2 in tissues and lowering arterial oxygen levels.

(D) High CO levels stimulate chemoreceptors, increasing respiratory rate and paradoxically lowering oxygen saturation.

Solution · Q7 **Answer: (A)**

CO binds haemoglobin about 200–250 times more strongly than O_2, forming carboxyhaemoglobin.

It occupies O_2-binding sites, so as CO rises, less O_2 is carried and saturation falls.

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

8. In the laboratory, an isolated segment of an axon can conduct nerve impulses in both directions. However, in living organisms, nerve impulses travel predominantly in one direction only. Which of the following best explains the unidirectional propagation of nerve impulses in the body?

(A) The presence of voltage-gated ion channels only at one end of the axon prevents backward transmission.

(B) Neurotransmitters are released exclusively at axon terminals, ensuring signals propagate forward across synapses.

(C) The refractory period temporarily inactivates recently depolarized membrane segments, preventing backward impulse conduction.

(D) Myelin sheath insulation on axons physically blocks impulses from traveling backward.

Solution · Q8 **As per Zigyan: (B)**

The refractory period stops a moving impulse from turning back, but an isolated axon also has it and still conducts both ways.

In the body, neurotransmitter leaves the axon terminal and acts on receptors of the post-synaptic membrane.

∴ A chemical synapse passes the signal forward only.

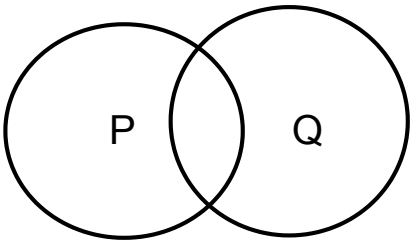
Why Zigyan differs from IAPT: the refractory period only stops a moving impulse from turning back. An isolated axon has it too, yet conducts both ways, so the one-way direction in the body comes from synapses.

Reference: NCERT Biology Class XI, Chapter 18 'Neural Control and Coordination', section 18.3.2: axon terminals hold the neurotransmitter vesicles, and the receptors are on the post-synaptic membrane.

Reference: OpenStax Biology 2e, section 35.2 'How Neurons Communicate': signalling at a chemical synapse goes in one direction only.

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

9. Refer to the Venn diagram given below, where:



- Circle P = parts of the female reproductive system that support conception
- Circle Q = parts of the female reproductive system that support pregnancy (fetal growth upto delivery)
- Overlap = parts of the female reproductive system that support both conception and pregnancy

Identify which of the following parts belong to P, Q, or the overlapping region:

i. Ovary

ii. Oviduct (Fallopian tube)

iii. Uterus

iv. Placenta

v. Cervix

Which classification is most appropriate?

(A) P → (i, ii); Q → (iv, v); Overlap → (iii)

(B) P → (i, iii, v); Q → (iv); Overlap → (ii)

(C) P → (ii, iv); Q → (iii, v); Overlap → (i)

(D) P → (i, ii, v); Q → (iii, iv); Overlap → none

Solution · Q9 **Answer: (A)**

P (conception only): ovary, which gives the ovum, and oviduct, the site of fertilisation.

Q (pregnancy): placenta, and cervix, which stays closed to hold the foetus till delivery.

Overlap: uterus, for sperm passage and implantation as well as foetal growth.

The cervix also lets sperms pass; here it is counted for holding the pregnancy.

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

10. A social insect colony under predator attack would benefit most from which combination of pheromone characteristics?

(A) Long duration with moderate range for sustained group coordination.

(B) Short duration with wide range for rapid information spread.

(C) Long duration with narrow range for precise location marking.

(D) Moderate duration with wide range for territorial establishment.

Solution · Q10 **Answer: (B)**

An alarm signal must reach nestmates quickly over a wide area and fade once the danger has passed.

∴ Alarm pheromone: volatile, fast-spreading and short-lived.

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

11. During spring migration, researchers observe that young birds initially follow innate directional preferences but gradually modify their routes. This behavioural transition demonstrates:

(A) Overriding of genetic programming with learned navigation.

(B) Integration of innate orientation with experiential route optimisation.

(C) Dominance of environmental cues over biological compass systems.

(D) Evolution of navigation abilities within a single generation.

Solution · Q11 **Answer: (B)**

Young birds start with an inherited compass direction.

With experience, they add learned cues and refine the route; the innate programme is built upon, not replaced.

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

12. A researcher studies the temporal organisation of behaviours in a nocturnal primate species. The animals show:

i. Peak foraging activity: 2 - 4 AM

ii. Social grooming: 6 - 8 PM

iii. Territorial calls: 10 - 11 PM

iv. Rest period: 8 AM - 4 PM

This behavioural rhythm is primarily regulated by which biological mechanism?

(A) Circannual cycles synchronized with seasonal food availability.

(B) Circadian oscillators entrained by photoperiod changes.

(C) Social synchronization with other community members.

(D) Thermoregulatory responses to ambient temperature cycles.

Solution · Q12 **Answer: (B)**

Foraging, grooming, calling and rest recur at fixed times every 24 hours, so this is a circadian rhythm.

An internal clock (suprachiasmatic nucleus) drives it, and the light–dark cycle mainly entrains it.

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

13. Cheetahs (*Acinonyx jubatus*) are known for extremely low genetic diversity. Studies show that skin grafts between unrelated individuals are often accepted without rejection, a phenomenon unusual for most mammals. Which statement best explains why cheetahs exhibit this unusual genetic similarity?

(A) The bottleneck effect reduced population size drastically, and genetic drift led to loss of many alleles, leaving descendants genetically uniform.

(B) Natural selection eliminated all harmful alleles, ensuring cheetahs became genetically identical over time.

(C) The bottleneck effect increased mutation rates, causing all individuals to converge on the same genetic variants.

(D) Hybridization with other species of cat family introduced uniformity across the population.

Solution · Q13 **Answer: (A)**

A bottleneck cuts the population to very few animals.

Genetic drift then removes many alleles, so the descendants are nearly uniform, even at the MHC genes that control graft rejection.

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

14. During a wildlife study in the Serengeti, researchers observed a group of Thomson's gazelles. When a lion appeared within 30 meters, about 60% of the gazelles displayed stotting (high vertical leaps with stiff legs). Interestingly, when the lion was farther away (about 80 meters), the frequency of stotting was much lower, at only 20%.

Based on this behavioural pattern, what is the most logical evolutionary explanation for stotting in gazelles?

(A) Stotting mainly functions as an alarm signal to warn conspecifics; higher stotting when predators are very close is because more individuals detect the predator.

(B) Stotting specifically primes the muscles for an immediate escape; it increases as the predator gets closer to prepare for rapid flight.

(C) Stotting is a pursuit-deterrent honest signal to predators showing fitness of the prey because higher stotting is associated with a lower probability that a lion will chase.

(D) Stotting serves chiefly to confuse or startle the predator, so the frequency of stotting should be highest when group is using scatter tactics.

Solution · Q14 **Answer: (C)**

Stotting is more frequent when the lion is close and the risk is high.

The costly leaps honestly advertise fitness to the lion, which is then less likely to chase: pursuit deterrence.

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

15. The Giant panda *(Ailuropoda melanoleuca)* and the Lesser red panda *(Ailurus fulgens)* are mammals from Asia that primarily eat bamboo. Despite their dietary similarity and similar name, the giant panda is phylogenetically related to bears (family Ursidae), while the red panda is the sister group to all canoid carnivores (dogs, raccoons, weasels, etc.). Given this information, what does this imply about the evolutionary grouping of 'Pandas'*?*

(A) 'Pandas' form a monophyletic group since they share a similar diet and ecological niche.

(B) 'Pandas' represent a paraphyletic group because the 'Giant panda group' excludes its closest relatives (other bears) from the group.

(C) 'Pandas' represent a polyphyletic group because their similarities are due to convergent evolution, and not due to common ancestry.

(D) 'Pandas' are an artificial group but still reflect evolutionary history since both belong to the order Carnivora.

Solution · Q15 **Answer: (C)**

The giant panda is a bear; the red panda belongs to a separate lineage.

Their shared bamboo diet and the features linked with it arose by convergent evolution.

A group based on convergent characters, not inherited from a common ancestor, is polyphyletic.

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

16. Clinical tests were conducted on a family who slept in a poorly ventilated room, during winter using a charcoal heater. The test results showed:

- Mean SpO_2 (by pulse oximeter) of 98%
- Arterial O_2 content was severely reduced
- Symptoms of headache, dizziness, cherry-red skin
- Some members complained of disorientation.

Which explanation best accounts for the clinical observations?

(A) CO_2 decreases the amount of dissolved O_2 in plasma, resulting in inadequate oxygen transport despite normal SpO_2 values.

(B) CO_2 increases the partial pressure of O_2 in blood, leading to falsely high SpO_2 readings and hypoxia in tissues.

(C) CO binds to Hb with much higher affinity than O_2, forming carboxyhemoglobin, which falsely maintains SpO_2 readings but severely reduces oxygen delivery to tissues.

(D) CO causes rapid hyperventilation, raising SpO_2 but paradoxically lowering oxygen content in the arterial blood.

Solution · Q16 **Answer: (C)**

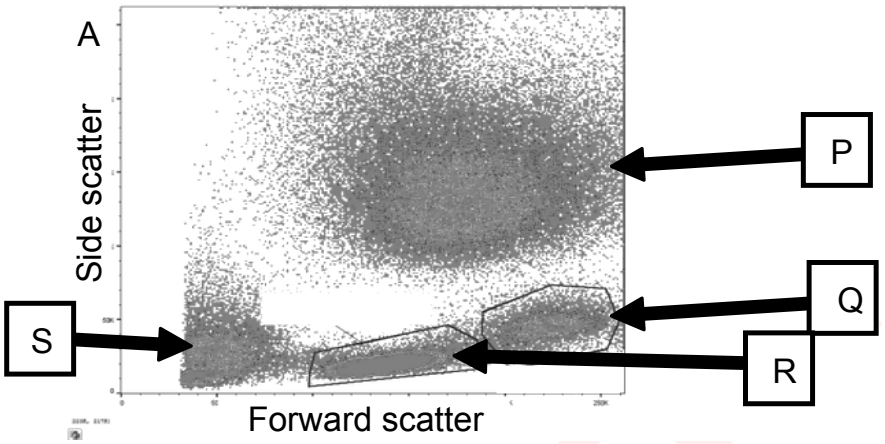
A charcoal heater in a poorly ventilated room releases CO.

CO binds haemoglobin far more strongly than O_2, so the blood carries much less O_2 and tissues are starved of it.

A routine pulse oximeter cannot tell carboxyhaemoglobin from oxyhaemoglobin, so SpO_2 looks normal.

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

17. In a flow cytometer, cells are analyzed for their size and internal density or granularity. The forward scatter is a measure of cell size, while the side scatter is a measure of intracellular density/granularity. Given below is the result of flow cytometry for blood cells. P, Q, R and S respectively indicate:



(A) P - Basophils, Q - Neutrophils, R - Monocytes, S - Platelets

(B) P - Neutrophils, Q - Monocytes, R - Lymphocytes, S - Erythrocytes

(C) P - Erythrocytes, Q - Lymphocytes, R - Monocytes, S - Platelets

(D) P - Eosinophils, Q - Basophils, R - Neutrophils, S - Lymphocytes.

Solution · Q17 **Answer: (B)**

Forward scatter shows size; side scatter shows granularity.

P: high side scatter, granular cells ⇒ neutrophils

Q: low side scatter, larger cells ⇒ monocytes

R: low side scatter, smaller cells ⇒ lymphocytes

S: smallest events ⇒ erythrocytes, as given in the only option that fits P, Q and R

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

18. Researchers measured SAP2 gene expression in clinical *C. albicans* isolates using qPCR, normalized to the housekeeping gene ACT1. Lower Ct values indicate higher expression.

Isolate ID	Source	Ct (SAP2)	Ct (ACT1)	ΔCt (SAP2–ACT1)
Pt1	Blood	26	19	7
	Vaginal swab	23	19	4
	Oral swab	28	20	8
Pt2	Blood	21	20	1
	Oral swab	25	20	5

Which of the following statements is true?

(A) Patient 1 is suffering from a very serious infection and needs medical intervention immediately as compared to Pt2.

(B) Pt2 has recovered from the infection with few lesions in oral cavity.

(C) Pt1 has moderate form of infection and oral gargling and topical ointments can help reduce the infection.

(D) Pt2 shows well spread infection and persistent colonisation in the oral cavity.

Solution · Q18 **Answer: (D)**

A lower ΔCt means higher expression of SAP2, a virulence gene.

ΔCt in blood: Pt1 7, Pt2 1

ΔCt in oral swab: Pt1 8, Pt2 5

∴ Pt2 expresses more SAP2 at both sites.

Higher expression in Pt2's blood isolate (spread) and oral isolate (colonisation) fits only (D).

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

19. Abundance of specific intracellular organelles is closely associated with the metabolic and physiological demands of the cell. A few cell types/tissues are listed below.

I. Macrophages

II. Salivary glands

III. Ovary cells

IV. Pancreatic cells

The organelles that are especially abundant in them are respectively:

(A) Rough ER, Smooth ER, Mitochondria, Golgi bodies.

(B) Lysosomes, Smooth ER, Golgi bodies, Rough ER.

(C) Mitochondria, Rough ER, Nuclei, Smooth ER.

(D) Lysosomes, Golgi bodies, Smooth ER, Rough ER.

Solution · Q19 **Answer: (D)**

Macrophages: digestion of engulfed material ⇒ lysosomes

Salivary glands: packaging and secretion of glycoproteins ⇒ Golgi bodies

Ovary cells: synthesis of steroid hormones ⇒ smooth ER

Pancreatic cells: synthesis of secretory enzymes ⇒ rough ER

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

20. Few bacteria can produce enzyme lysine decarboxylase (LC) to utilize lysine as a carbon source when sugar is depleted. LC decarboxylates lysine to produce an amine. In order to know if the given bacterial species X contains this enzyme, the following experiment was done. A growth medium containing a pH indicator that turns yellow in acidic pH and purple in alkaline pH was prepared. The medium was divided into two tubes; to one tube only glucose was added and to the other tube glucose and lysine were added. The glucose concentration was adjusted to last 12 hours in both tubes. The media in both the tubes were yellow, and the tubes were inoculated with LC positive bacteria. What would be the expected color in the two tubes after incubation for 24 hours?

Option	Colour of tube containing glucose	Colour of the tube containing glucose + lysine
(A)	Purple	Purple
(B)	Yellow	Yellow
(C)	Purple	Yellow
(D)	Yellow	Purple

Solution · Q20 **Answer: (D)**

In both tubes, glucose is used first, forming acid, so the medium stays yellow.

Glucose only: no lysine is present to give an amine ⇒ yellow

Glucose and lysine: after the glucose is used up, LC converts lysine to cadaverine, an alkaline amine ⇒ purple

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

21. One can predict if an antibiotic is bactericidal or bacteriostatic based on the mechanism of action. Some statements with examples of different antibiotics and their respective modes of action are listed below:

I. Penicillin that targets cell walls can be effectively used against mycoplasma infections.

II. Erythromycin that acts as a 50S ribosomal subunit inhibitor can be used as an antibacterial against *B. subtilis*.

III. Daptomycin that causes leakage of cellular contents and rapid death can be used as a bactericidal agent for Streptococci.

IV. Ciprofloxacin that inhibits DNA gyrase and topoisomerase can be used as a bactericidal agent for *E. coli*.

Which of the statements are correct?

(A) III and IV only
(B) II and III only
(C) II, III and IV only
(D) I and IV only

Solution · Q21 **Answer: (C)**

I is false: mycoplasma lack a cell wall, the target of penicillin.

II is true: erythromycin acts on the Gram-positive *B. subtilis* through the 50S subunit.

III is true: daptomycin damages the cell membrane and rapidly kills streptococci.

IV is true: ciprofloxacin blocks DNA gyrase and topoisomerase IV and kills *E. coli*.

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

22. A surgical instrument was subjected to following two methods of sterilization:

I. Treated with a chemical that kills 99.99% of the bacteria followed by two steps that each reduce the load by 1 log order

II. Initial treatment that reduced bacterial load by 2 log orders and then treated with a disinfectant that kills 99.9% of live bacteria.

Assuming the initial load on the instrument was 1×10^6 bacteria, which of the following statements is true?

(A) Method I is preferred as it results in zero colony forming units.
(B) Method II is preferred as it requires less number of steps hence, less chance of additional source of contamination.
(C) Both methods are equally effective as both leave same number of colony forming units on the instrument.
(D) Method I is preferred over II as it leaves less number of bacteria on the instrument.

Solution · Q22 **Answer: (D)**

Method I (a 99.99% kill is a 4 log reduction):

$10^6 \rightarrow 10^2$

$\Rightarrow 10^1$

$\Rightarrow 10^0$

$\therefore$ 1 bacterium remains.

Method II:

$10^6 \rightarrow 10^4$

A 99.9% kill is a 3 log reduction.

$\Rightarrow 10^1$

$\therefore$ 10 bacteria remain.

So Method I leaves fewer bacteria, though not zero.

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

23. A few animals are listed below. Which of these are correctly described?

i. Beetles: acoelomates with a chitinous exoskeleton

ii. Snails: soft-bodied coelomates

iii. Dinosaurs: segmented coelomates

iv. Liver flukes: unsegmented coelomates

v. Earthworms: segmented pseudo-coelomates

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

Solution · Q23 **Answer: (C)**

i is false: beetles (arthropods) are coelomates.

ii is true: snails (molluscs) are soft-bodied coelomates.

iii is true: dinosaurs were vertebrates, with a coelom and a segmented body plan.

iv is false: liver flukes (flatworms) are acoelomates.

v is false: earthworms (annelids) are true coelomates.

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

24. A patient's pancreatic duct is completely blocked, but the liver and salivary glands are functioning normally. Which of the following is **NOT** likely to happen?

(A) Reduction in carbohydrate absorption.
(B) Presence of oily stools.
(C) Reduced protein absorption.
(D) Pale coloured stools and itchy skin.

Solution · Q24 **Answer: (D)**

Pancreatic amylase, lipase and proteases cannot reach the intestine.

So carbohydrate and protein absorption fall, and undigested fat makes the stools oily.

Only the pancreatic duct is blocked, so bile still reaches the intestine.

Pale stools with itchy skin indicate blocked bile flow, so they are not expected.

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

25. Naked mole rats live in large subterranean colonies in the dry hot regions where the temperature underground is generally warm and stable. They are nearly hairless and their skin lacks insulating layers of fat. When it is too cold, they huddle in large numbers, and body temperature can be as low as 15°C. Their body metabolism is much lower than other rodents of their size. They can be most appropriately described as;

(A) Endothermic homeotherms
(B) Ectothermic poikilotherms
(C) Ectothermic homeotherms
(D) Endothermic poikilotherms

Solution · Q25 **Answer: (D)**

A mammal that produces its own metabolic heat, including heat from brown fat, is an endotherm.

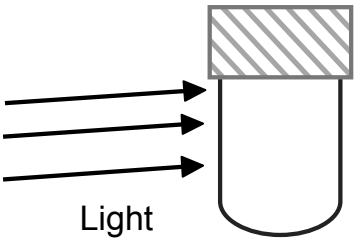
With little insulation and a low metabolic rate, its body temperature follows the surroundings: it is a poikilotherm.

∴ Endothermic poikilotherms.

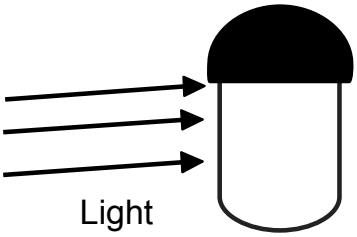
IAPT tentative answer: (D) | **Zigyan answer:** (D)

26. In which of the following conditions, negative phototropism will be observed in plant shoots?

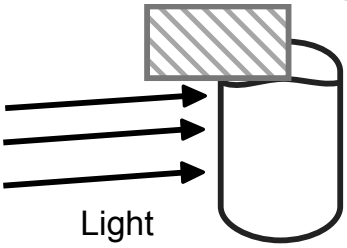
(A) Plant shoot tip is cut and placed on an agar block. The block is then placed on plant tip and light allowed only from one side.



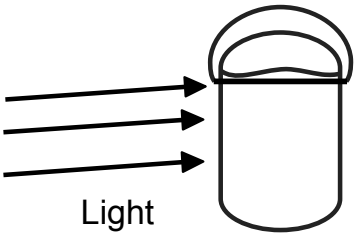
(B) Plant shoot tip covered with non-transparent cap and light allowed to fall only from one side on the plant.



(C) Plant grown in the dark for a few days. Then shoot tip cut. An agar block containing auxin is kept on one side of the cut tip and light allowed to fall only on the same side.



(D) Plant kept in dark for a couple of days and then shoot tip covered with transparent cap and light allowed to fall only on one side.



Solution · Q26 **Answer: (C)**

In (C), the tip is gone, so light cannot redistribute auxin. Auxin from the block moves down the lit side.

That side elongates more, and the shoot bends away from light.

(A): the block covers the whole cut end, so growth stays straight.

(B): the capped tip cannot sense light, so there is no bending.

(D): the tip senses light, so the shoot bends towards it.

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

27. Most carbon atoms found in the atmosphere are of atomic weight 12 (^{12}C). However, a few exist as radioactive isotope ^{14}C as a result of bombardment of particles from space. Thus, at any given time, there is a proportion of ^{14}C:^{12}C in the air.

Consider samples tested for this ratio:

(i) Grass → (ii) Grass moth → (iii) Mouse → (iv) Hawk

From members i, ii, and iii in the above food chain and iv-a fossil skeleton of a hawk, what relationship is expected to be observed for ^{14}C:^{12}C ratio?

(A) i > ii > iii > iv
(B) i = ii > iii > iv
(C) i > ii > iii < iv
(D) i = ii = iii > iv

Solution · Q27 **Answer: (D)**

Plants fix atmospheric CO_2, and animals get carbon from food. So living members i, ii and iii have the same ^{14}C:^{12}C ratio.

After death, no new carbon enters. ^{14}C decays, while ^{12}C is stable, so the fossil hawk has a lower ratio.

$\therefore$ i = ii = iii > iv

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

28. There are several factors that bring about evolutionary change. Select the factor along with its correct consequences:

(A) Mutation: The sole source of adaptive evolutionary change.
(B) Non-random mating: It alters allelic frequency and stabilises heterozygotes.
(C) Migration: Results from movement of individuals or gene flow.
(D) Genetic Drift: Non-random changes in allele frequencies occurring in small populations.

Solution · Q28 **Answer: (C)**

Migrating individuals carry alleles between populations, which is gene flow.

(A): mutation creates new alleles, but adaptive change also needs natural selection.

(B): non-random mating by itself changes genotype frequencies, not allele frequencies; inbreeding reduces heterozygotes.

(D): genetic drift is random.

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

29. Which of the following factors can affect Tm (melting temperature) of a DNA strand?

i. Salt concentration of reaction mixture

ii. Total length of DNA strand

iii. % GC content

iv. Concentration of DNA in the reaction mixture.

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

Solution · Q29 **Answer: (D)**

i. Salt cations screen the negative phosphate groups, so Tm rises.

ii. A longer duplex is more stable; the effect is strongest for short strands.

iii. G–C pairs have three hydrogen bonds and stronger stacking, so Tm rises with GC content.

iv. Pairing of two strands depends on their concentration; this matters mainly for short DNA.

∴ All four affect Tm.

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

30. Facultative anaerobe such as *E. coli* was grown under three different conditions as follows:

I. Grown in media which contains optimum concentration of glucose (media X) with high aeration facility

II. Grown in sealed container containing media X

III. Grown in sealed container containing media X along with alternative electron acceptors like nitrates (NO_3^-)

What is the correct order of doubling time (DT) of *E. coli* grown in the above three media?

(A) (DT) I > (DT) II > (DT) III
(B) (DT) III > (DT) II > (DT) I
(C) (DT) II > (DT) III > (DT) I
(D) (DT) I > (DT) III > (DT) II

Solution · Q30 **Answer: (C)**

Faster growth means a shorter doubling time.

In energy yield and growth rate:

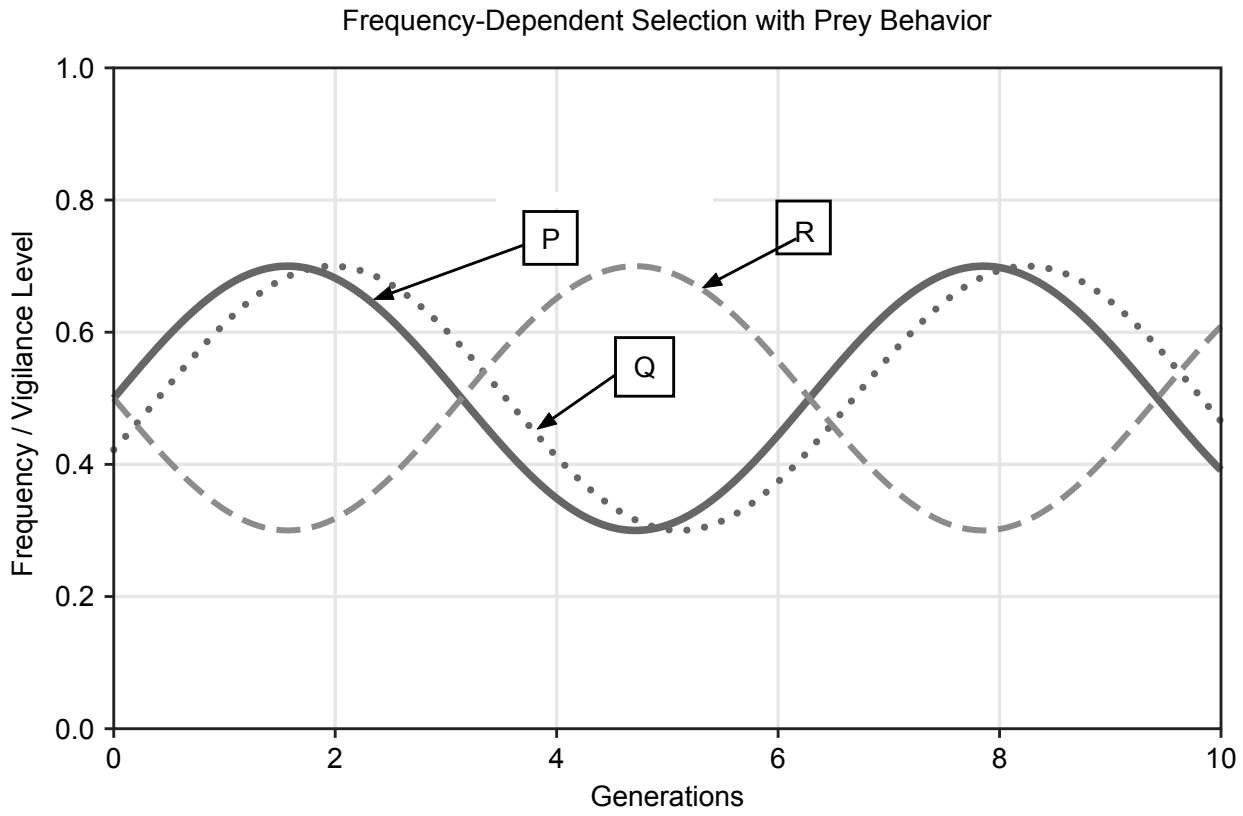
aerobic respiration (I) > nitrate respiration (III) > fermentation (II)

∴ (DT) II > (DT) III > (DT) I

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

31. In the scale-eating cichlid fish, individuals have asymmetrical mouth openings where left-mouthed fish snatch scales from the right flank of prey, and right-mouthed fish attack the left flank. Scientists observed that the frequencies of left-mouthed and right-mouthed morphs oscillate across generations rather than one type dominating permanently.

In the following graph P, Q and R indicate:



(A) P: Prey vigilance defending right flank, Q: left-mouthed fish, R: Right-mouthed fish

(B) P: Prey vigilance defending left flank, Q: right-mouthed fish, R: left-mouthed fish

(C) P: left-mouthed fish, Q: Prey vigilance defending right flank, R: Right-mouthed fish

(D) P: Right-mouthed fish, Q: left-mouthed fish, R: Prey vigilance defending right flank

Solution · Q31 **Answer: (C)**

P and R are exact mirror images, so they are the two mouth morphs: as one rises, the other falls.

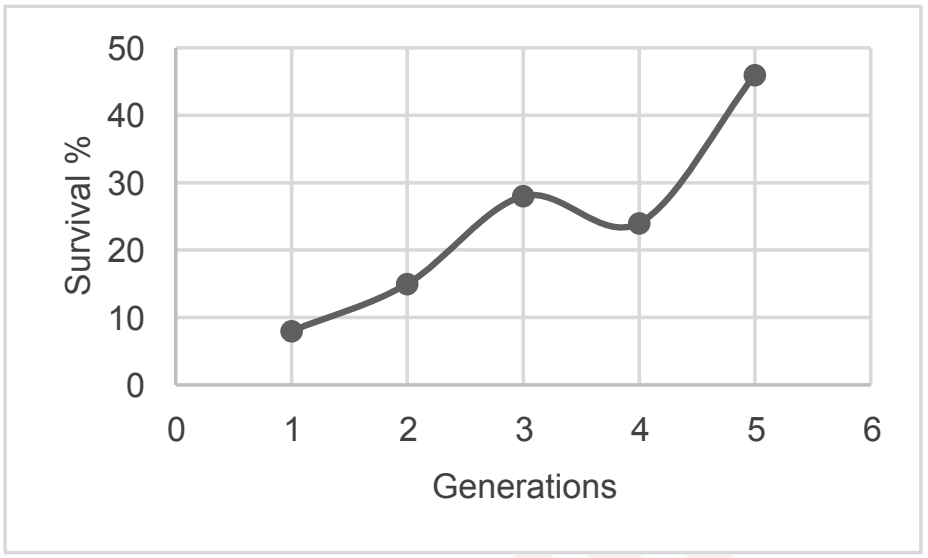
Q follows P after a short lag, so it is the prey's response to P.

With P as left-mouthed fish, which attack the right flank, Q is vigilance defending the right flank and R is right-mouthed fish.

The other options do not pair the two mirror-image curves as the morphs.

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

32. The graph below shows the percentage survival of an insect population after pesticide treatment across six consecutive generations.



Which explanation best accounts for the observed pattern?

(A) The pesticide lost effectiveness because environmental factors like rainfall and sunlight reduced its concentration, creating apparent increases in survival with each new generation.

(B) Although some random fluctuations occur, resistant individuals survive pesticide exposure and reproduce, causing the frequency of resistant alleles to show an overall rise in the population.

(C) Each generation of insects gradually learns to avoid sprayed surfaces and passes this avoidance behaviour genetically to offspring, increasing survival percentages.

(D) The pesticide stimulated insects to develop stronger resistance mechanisms during their lifetime, and these traits were inherited by the next generation.

Solution · Q32 **Answer: (B)**

The pesticide kills susceptible insects. Resistant ones already present survive and reproduce.

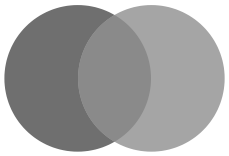
So resistance alleles become more frequent and survival rises overall; the dip at generation 4 is a fluctuation.

(C) and (D) need learned or acquired traits to be inherited. (A) involves no genetic change in the population.

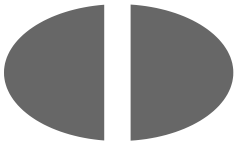
IAPT tentative answer: (B) | **Zigyan answer:** (B)

33. Speciation is a process by which genetically independent group of organisms are formed through the process of evolution. Steps that lead to allopatric speciation are given below. Their correct order is:

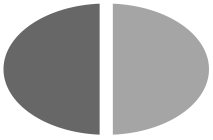
I



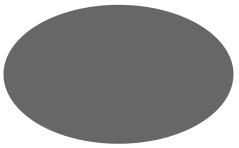
II



III



IV



(A) IV → I → II → III

(B) II → III → I → IV

(C) IV → II → I → III

(D) IV → II → III → I

Solution · Q33 **Answer: (D)**

IV: one continuous population.

II: a geographical barrier divides it into two parts that are still alike.

III: the isolated parts diverge genetically.

I: they meet again and overlap but remain distinct.

∴ IV → II → III → I

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

34. Proteins are large, complex macromolecules made of long chains of amino acids. Based on their structures, they can be broadly classified as fibrous or globular. The examples of globular and fibrous proteins respectively are:

(A) Immunoglobulins and aquaporins.

(B) Myosin and actin.

(C) Collagen and pepsin.

(D) Hemoglobin and collagen.

Solution · Q34 **Answer: (D)**

Haemoglobin is a compact, soluble globular protein. Collagen is a fibrous structural protein with a triple helix.

(A): aquaporin is a membrane channel protein, not a fibrous one.

(B): myosin has a long fibrous tail and actin is built of globular units, so this order does not fit.

(C): the order is reversed.

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

35. A life process P shows the following characteristics:

i. genetically regulated.

ii. involve chromatin condensation.

iii. require ATP

iv. absent in prokaryotes.

v. are important part of homeostasis.

P refers to:

(A) Mitosis
(B) Meiosis
(C) Programmed cell death
(D) Necrosis

Solution · Q35 **As per Zigyan: (C)**

Apoptosis is a gene-controlled, ATP-dependent death of eukaryotic cells with marked chromatin condensation.

It maintains homeostasis by removing unwanted cells, and this list is commonly used to separate it from necrosis.

Meiosis forms haploid cells for sexual reproduction, not for homeostasis.

Why Zigyan differs from IAPT: mitosis also condenses chromatin and uses ATP, but this list of features is the standard description of programmed cell death, used to tell it apart from necrosis.

Reference: OpenStax Biology 2e, section 9.3 'Response to the Signal': apoptosis is programmed cell death, a controlled removal of abnormal cells.

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

36. When a green plant is kept in dark or very low light condition for a prolonged period, it shows morphological difference during growth. Which one of the following options correctly describe such a plant?

(A) Thick stem, red leaves, short internodes
(B) Profusely branched stem, green leaves, short internodes
(C) Thin stem, yellow leaves, long internodes
(D) Thick stem, large yellow leaves, long internodes

Solution · Q36 **Answer: (C)**

This is etiolation. Without light, chlorophyll does not form and the stem elongates rapidly.

∴ Thin stem, long internodes and yellow leaves, which also stay small.

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

37. If a man with X-linked dominant disorder marries an unaffected woman, the phenotype of their children would be:

(A) 50% of sons and 50% of daughters will be affected.

(B) All daughters and sons will be affected.

(C) Only sons will show the symptoms while all daughters will be carriers.

(D) All daughters will show the symptoms and sons will be unaffected.

Solution · Q37 **Answer: (D)**

Father is X^DY and the unaffected mother is X^dX^d.

Every daughter receives the father's X^D, so all daughters are affected.

Every son receives his Y and the mother's X^d, so no son is affected.

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

38. Thick waxy cuticles, reduced leaf surface area and widespread root systems are adaptations found in:

(A) Hydrophytes and hygrophytes.

(B) Halophytes and xerophytes.

(C) Hydrophytes and mesophytes.

(D) Halophytes and hygrophytes.

Solution · Q38 **Answer: (B)**

A thick waxy cuticle and a small leaf area cut transpiration, while widespread roots collect water from more soil.

These suit xerophytes, and also halophytes, which face physiological drought in saline soil.

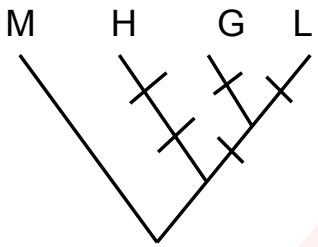
IAPT tentative answer: (B) | **Zigyan answer:** (B)

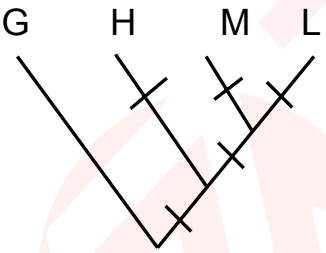
39. A few characteristics of cryptogams are tabulated.

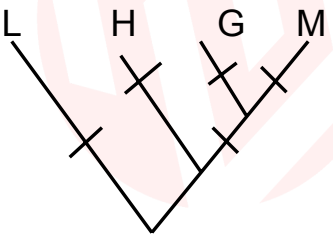
	C1 Protected multicellular embryo	**C2** Peristome teeth	**C3** Oil bodies	**C4** Dominant gametophyte	**C5** Basal meristem in sporophyte
Moss (**M**)	1	1	0	1	0
Hornwort (**H**)	1	0	0	0	1
Green alga (**G**)	0	0	0	0	0
Liverwort (**L**)	1	0	1	1	0

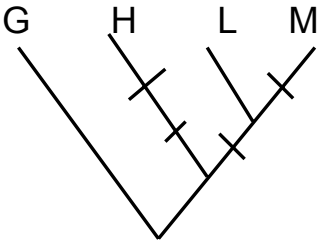
Note: "1" indicates Prescence and "0" indicates absence of a particular characteristic.

Based on the data, the most appropriate cladogram is:

(A) 

(B) 

(C) 

(D) 

Solution · Q39 **Answer: (B)**

The table is followed as given, although hornworts too have a dominant gametophyte.

G lacks all five characters, so it is the outgroup.

M, H and L share C1; only M and L share C4, so M and L are sister groups.

C2, C5 and C3 are unique to M, H and L respectively.

Only tree (B) places all five changes correctly.

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

40. In a population of Superb fairywren, a socially monogamous male feeds chicks in a nest. Genetic analysis later reveals that due to extra-pair copulation, only 3 out of the 5 chicks in the nest are actually its biological offspring. If the male feeds all 5 chicks equally, what is the average genetic relatedness of the male to the chicks it is investing in?

(A) 0.50 (B) 0.30 (C) 0.25 (D) 0.60

Solution · Q40 **Answer: (B)**

Relatedness is 0.5 to each own chick, and 0 to each extra-pair chick (sire taken as unrelated to him).

Average relatedness:

$$r = \frac{3 \times 0.5 + 2 \times 0}{5}$$

$$\Rightarrow r = 0.30$$

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

41. Different animals show different sensitivities to wavelengths of light depending on their sensory receptor cells, organ structures, and ecological needs. Few statements regarding three animals: X, Y and Z are made.

I. Animal X shows peak sensitivity in infrared region.

II. Animal Y has retina dominated almost entirely by rods that are highly specialized to detect the blue wavelengths of light.

III. Animal Z shows sensitivity shift towards blue-green spectrum with rod dominance in retina.

X, Y and Z most likely, respectively, are:

(A) bee, bird, and primate.
(B) mammal, shallow water fish, and bird.
(C) snake, deep sea fish, and owl.
(D) bird, mammal, and bee.

Solution · Q41 **Answer: (C)**

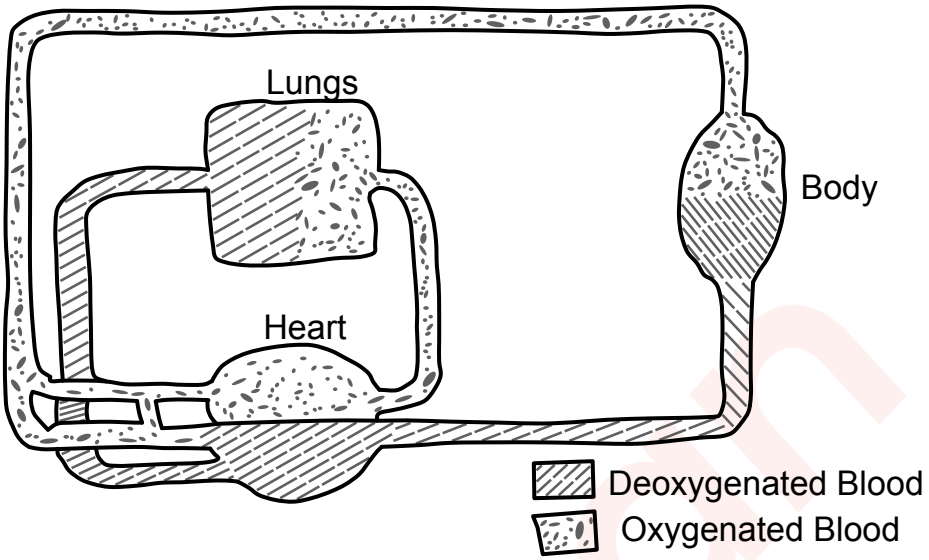
X: infrared detection points to a snake, for example a pit viper with its heat-sensing pits.

Y: mainly blue light reaches deep water, so a blue-tuned retina made almost wholly of rods suits a deep sea fish.

Z: a rod-rich retina with blue-green sensitivity suits a night hunter, the owl.

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

42. The circulatory system in crocodile is represented in the drawing below;



Mark the correct statement.

(A) The body always receives fully oxygenated blood.

(B) When underwater for long hours, the blood is shunted to lungs from right ventricle.

(C) When diving deep in water bodies, diverting the blood to brain is more advantageous.

(D) The system is less efficient than that of an amphibian as the oxygenated and de-oxygenated blood gets mixed.

Solution · Q42 **Answer: (C)**

Crocodiles have a four-chambered heart and two aortae that can shunt blood.

In a long dive, resistance to lung flow rises, so part of the right ventricular blood bypasses the lungs through the left aorta.

So the body can get O_2-poor blood, and that blood is led away from the lungs.

∴ (A) and (B) are false.

The right aorta, from the left ventricle, can keep sending the O_2-rich blood to the brain, an advantage when O_2 is limited.

The ventricles are fully separate, unlike the single ventricle of amphibians, so (D) is false.

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

43. Coyotes and badgers hunt small mammals such as prairie dogs, ground squirrels, and rabbits. Coyotes are fast runners while badgers have powerful claws. They are often seen together in open grasslands. The relationship between them can be best described as:

(A) Proto-cooperation

(B) Mutualism

(C) Commensalism

(D) Amensalism

Solution · Q43 **Answer: (A)**

Hunting together helps both: the coyote chases prey above ground and the badger digs it out of burrows.

Either can also hunt alone, so the association is not obligatory.

A mutually helpful but optional interaction is proto-cooperation.

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

44. Biological membranes are selectively permeable, meaning they only let specific molecules pass through. This selective control allows cells to manage energy, communicate, and stay alive. However, membrane permeability can vary across different organs depending on the functions of the organs. The correct decreasing order of permeability in the human body is:

(A) Brain > Liver > Kidney
(B) Liver > Kidneys > brain
(C) Skeletal muscles > Kidney > Liver
(D) Brain > Intestine > Liver

Solution · Q44 **Answer: (B)**

Here permeability depends on the type of capillary.

Liver: sinusoids with wide gaps, the most leaky.

Kidneys: fenestrated capillaries, as in the glomerulus.

Brain: tight junctions form the blood–brain barrier, the least permeable.

∴ Liver > Kidneys > brain.

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

45. Arabian babblers are social birds. Individual birds are seen feeding chicks and guarding the flock. A bird perched on a high branch as a guard; risks being seen by predators. While feeding, they are also known to feed chicks of unrelated birds.

Which of the following is the correct interpretation?

(A) This is a selfless act to protect their family and benefit the species.
(B) Being social birds, they are hardwired to help members surrounding them.
(C) By doing these chores, they showcase their fitness and thus increase their chances of getting a future mate.
(D) Guarding and feeding of birds is not an energy demanding task and is a good strategy to survive in harsh environments by receiving benefits.

Solution · Q45 **Answer: (C)**

Guarding exposes a babbler to predators, and feeding unrelated chicks costs it food and energy.

By Zahavi's handicap principle, only a fit bird can afford this, so the chores advertise its quality.

The higher social rank improves its chance of getting a mate.

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

46. Stomata are microscopic pores found on the epidermis of leaves. Which of the following will lead to stomatal closure?

i. High vapour pressure deficit

ii. High soil moisture

iii. Pathogen attack

iv. Extremely low temperatur

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

Solution · Q46 **Answer: (B)**

i: a high vapour pressure deficit speeds up water loss, so stomata close.

iii: guard cells close the pores to keep pathogens out (stomatal immunity).

iv: extreme cold disturbs guard cell activity and water uptake, causing closure.

ii: moist soil keeps guard cells turgid and favours opening.

∴ i, iii and iv only.

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

47. Insect legs can show modifications based on the habitats they live in and the predominant functions such as moving, hunting, and gathering food. Four such modifications are listed below. Match them sequentially, against the correct insect.

i. Long, slim legs

ii. Hind legs with broad thighs

iii. Broad fore legs shaped like shovels

iv. Fore legs with spines

(A) i: cockroach, ii: grasshopper, iii: mole cricket, iv: praying mantis
(B) i: praying mantis, ii: grasshopper, iii: mole cricket, iv: cockroach
(C) i: mole cricket, ii: grasshopper, iii: cockroach, iv: praying mantis
(D) i: cockroach, ii: mole cricket, iii: grasshopper, iv: praying mantis

Solution · Q47 **Answer: (A)**

i: long, slim running legs, cockroach.

ii: broad, muscular hind thighs for jumping, grasshopper.

iii: shovel-like fore legs for digging, mole cricket.

iv: spiny fore legs for seizing prey, praying mantis.

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

48. Three antibiotics are being considered for treating an infection caused by an antibiotic- resistant *E.coli* strain. Therapeutic index is the ratio of toxic dose to the effective dose of the antibiotic.

Antibiotic	Toxic dose	Effective dose	Cost
X	100mg	2mg	Inexpensive
Y	100µg	40µg	Inexpensive
Z	1mg	50 µg	Expensive

Which of the following statements is true?

(A) Drug Z should be the drug of choice as it is most effective although expensive.

(B) Drug X should be the drug of choice as it is safer than drug Z and also inexpensive.

(C) Y and Z should be preferred over X as they are more potent than X.

(D) Y is a preferred drug as it is most effective and also least expensive.

Solution · Q48 **Answer: (B)**

Therapeutic index (TI), with both doses in the same unit:

$$1\text{ mg} = 1000\ \mu\text{g}$$

$$\text{TI}_X = \frac{100}{2} = 50$$

$$\text{TI}_Y = \frac{100}{40} = 2.5$$

$$\text{TI}_Z = \frac{1000}{50} = 20$$

A higher TI means a safer drug, so X is safer than Z and is also inexpensive.

A lower effective dose shows higher potency, not safety; Y has the narrowest margin.

Z is not even the most potent, since Y acts at a lower dose.

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

PART A-2 · ONE OR MORE CORRECT OPTIONS

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

49. Electrocardiograms of two individuals (1) and (2) are given below. ECG (2) shows a variation from the normal ECG(1).





In which of the following cases would you expect ECG (2)?

(A) An aged man

(B) A pregnant woman in her third trimester

(C) Person running on a treadmill

(D) Person showing persistent low levels of T3 & T4

Solution · Q49 **Answer: (B), (C)**

At the same paper speed, trace (2) has more beats per strip than (1): faster heart rate.

(A) Ageing does not normally raise resting heart rate. ∴ false.

(B) Heart rate and cardiac output rise in late pregnancy. ∴ true.

(C) Running raises heart rate. ∴ true.

(D) Low T_3 and T_4 slow the heart. ∴ false.

IAPT tentative answer: (B), (C) | **Zigyan answer:** (B), (C)

50. In hospitals, medicines are administered intravenously to patients instead of intra-arterial route. Which of the following statements correctly justify the practice?

(A) Veins carry deoxygenated blood so its overall chemical reactivity is very low.

(B) Intravenous administration helps in even distribution of medicine throughout the body since veins drain blood into the heart.

(C) Valves present in veins slow down the flow of medicine which helps in retaining it in vicinity of affected organ.

(D) Intra-arterial injections have the risk of large dosage reaching under high pressure to the target organ.

Solution · Q50 **Answer: (B), (D)**

(A) Low O_2 content does not make venous blood unreactive. ∴ false.

(B) Veins return the drug to the heart, which pumps it, diluted, to the body. ∴ true.

(C) Valves only prevent backflow; they do not hold a drug near an organ. ∴ false.

(D) An artery feeds one tissue bed directly, so a concentrated dose can reach it under high pressure and damage it. ∴ true.

IAPT tentative answer: (B), (D) | **Zigyan answer:** (B), (D)

51. In a population of 2,820 Shorthorn cattle, 260 are white, 1,430 are red, and 1,130 are roan. Which of the following assumptions are justified by the data?

(A) The coat-colour trait is controlled by a single autosomal locus with two alleles showing codominance.

(B) Mating with respect to this locus has been random in the population.

(C) There is strong heterozygote advantage favouring roan individuals.

(D) The data implies that there is no significant deviation from the Hardy–Weinberg law.

Solution · Q51 **As per Zigyan: (A), (B), (D)**

A statement is taken as justified when the counts agree with it.

Roan is the heterozygote.

For the red and white alleles:

$$p = 3990/5640 \approx 0.707$$

$$q = 1 - p \approx 0.293$$

Expected red, roan and white:

$$p^2N \approx 1411,\ 2pqN \approx 1167,\ q^2N \approx 241$$

Comparing these with 1430, 1130 and 260:

$$\chi^2 \approx 2.88 < 3.84$$

(D) No significant deviation at the 5% level, 1 degree of freedom. ∴ true.

(C) Roan are fewer than expected. ∴ false.

(A) Red, roan and white fit one locus with two codominant alleles, taken as autosomal. ∴ true.

(B) The fit agrees with random mating. ∴ true.

Reference: NCERT Biology Class XII, Chapter 6 'Evolution', section 6.7: expected genotype frequencies are p^2, 2pq and q^2, and a departure of measured values from them indicates evolutionary change.

Check: a chi-square of 2.88 with one degree of freedom has a probability of about 0.09, which is above 0.05.

IAPT tentative answer: (A), (B), (D) | **Zigyan answer:** (A), (B), (D)

52. When two freshwater algae, spirogyra (cell diameter 5 μm and length 75 μm) and chlorella (cell diameter 14 μm) were grown in stagnant nutrient poor water, spirogyra was found to grow at a faster rate than chlorella. The most likely reasons are:

(A) Spirogyra being a buoyant alga can remain on surface to capture light as compared to chlorella.

(B) The elongated shape of spirogyra reduces total volume compared to sphere reducing its metabolic demand.

(C) Loss of nutrients by diffusion is greater in chlorella due to shorter diffusion distance.

(D) Spirogyra has greater surface area per unit volume enabling efficient nutrient absorption.

Solution · Q52 **As per Zigyan: (D)**

Spirogyra cell, a cylinder:

$$V = \pi \times 2.5^2 \times 75 \approx 1473\ \mu m^3$$

$$A = 2\pi \times 2.5 \times (75 + 2.5) \approx 1217\ \mu m^2$$

Chlorella cell, a sphere:

$$V = (4/3) \times \pi \times 7^3 \approx 1437\ \mu m^3$$

$$A = 4\pi \times 7^2 \approx 616\ \mu m^2$$

For surface area per unit volume, in the same order:

$$A/V \approx 0.83\ \mu m^{-1} \text{ and } 0.43\ \mu m^{-1}$$

(D) Spirogyra has about twice the uptake surface per unit volume. ∴ true.

(B) The volumes are nearly equal. ∴ false.

(C) Chlorella has the longer diffusion distance. ∴ false.

(A) The stem points to a shortage of nutrients and gives no sign that light limits growth. ∴ not a likely reason.

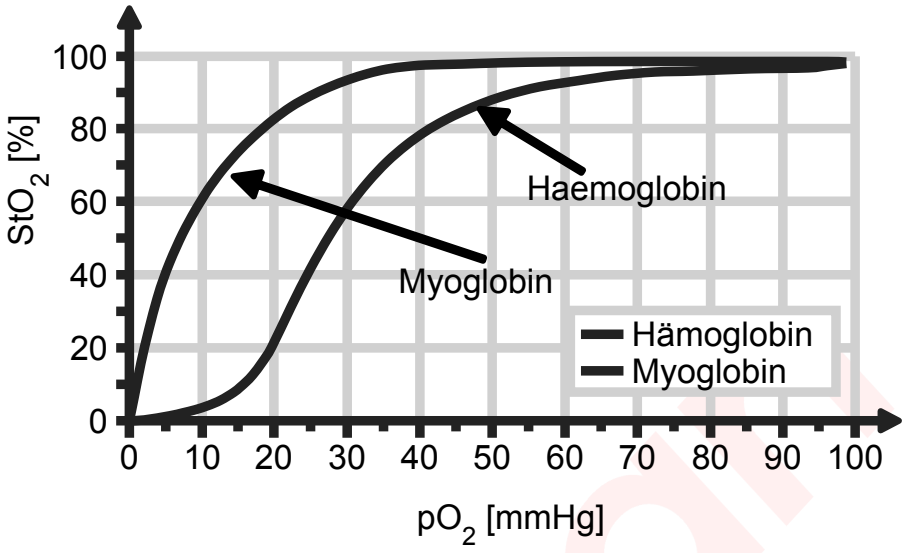
Why Zigyan differs from IAPT: the stem points to a shortage of nutrients and gives no sign that light limits growth, so floating to reach light, in (A), is not a likely reason.

Reference: OpenStax Biology 2e, section 4.2 'Prokaryotic Cells', Cell Size: surface area per unit volume falls as a cell grows, and too little membrane cannot support the diffusion that the larger volume needs.

Check: three divided by the sphere's radius gives about 0.43, and two divided by the filament's radius gives about 0.8.

IAPT tentative answer: (A), (D) | **Zigyan answer:** (D)

53. Oxygen saturation curves of haemoglobin and myoglobin are shown below.



What will happen if a mutant haemoglobin is discovered which shows oxygen saturation curve like myoglobin?

(A) The blood would load oxygen less efficiently in the lungs.

(B) It would fail to unload oxygen to working muscles and tissues.

(C) The loading of oxygen in the blood will worsen if such a person travels to higher altitudes.

(D) Body will upregulate synthesis of red blood cells.

Solution · Q53 **Answer: (B), (D)**

A myoglobin-like curve means very high O_2 affinity.

(A) It still saturates in the lungs. ∴ false.

(B) At tissue pO_2 it stays almost saturated and releases little O_2. ∴ true.

(C) It still loads well at the lower pO_2 of high altitude. ∴ false.

(D) Tissue hypoxia raises erythropoietin from the kidneys, so more RBCs are made. ∴ true.

IAPT tentative answer: (B), (D) | **Zigyan answer:** (B), (D)

54. In a state of metabolic overload such as obesity, the liver becomes packed with excess fat. As a result, specific lipid intermediates called sn-1,2-diacylglycerols (DAGs) accumulate in the cell membrane. DAGs activate a destructive enzyme called Protein Kinase C (PKC). It physically attaches to and disables the insulin receptor. Uncouplers are chemicals which delink the process of electron transport via the respiratory complexes from ATP production. If mice with fatty liver are exposed to uncouplers, it will result in an increase in:

(A) insulin sensitivity.

(B) lipogenesis.

(C) VLDL synthesis by liver cells.

(D) beta oxidation of fatty acids.

Solution · Q54 **Answer: (A), (D)**

Uncouplers let protons leak back without making ATP, so electron transport and fuel oxidation speed up.

(D) β-oxidation of fatty acids rises. ∴ true.

(A) Liver fat and DAG fall, PKC activation drops and the insulin receptor works again. ∴ true.

(B) Lower ATP activates AMPK, which restrains fat synthesis. ∴ false.

(C) With less liver fat to export, VLDL synthesis does not rise. ∴ false.

IAPT tentative answer: (A), (D) | **Zigyan answer:** (A), (D)

55. A person experiences excessive summer heat for long period. Which of the following will be the immediate effects on the body physiology of that person?

(A) Widening of blood vessels near extremities

(B) Reduced brain perfusion

(C) Decrease in blood pressure

(D) Hypoventilation leading to respiratory acidosis

Solution · Q55 **Answer: (A), (B), (C)**

(A) Skin vessels dilate to lose heat. ∴ true.

(C) This vasodilation, with fluid lost in sweat, lowers blood pressure. ∴ true.

(B) Blood shifts to the skin and pressure falls, so brain blood flow drops. ∴ true.

(D) Heat increases breathing, which tends to cause respiratory alkalosis. ∴ false.

IAPT tentative answer: (A), (B), (C) | **Zigyan answer:** (A), (B), (C)

56. Along with light and carbon dioxide, plants require several nutrients for their optimum growth. A plant growing in soil type I showed yellowing of maturing leaves while plant growing in soil type II showed browning of tips of young leaves, yellowing in regions between the veins.

This could be explained as:

(A) Plant in soil I most likely lacked mobile nutrients such as nitrogen.

(B) Plant in soil II most likely lacked immobile nutrients such as calcium.

(C) Yellowing observed in plant in soil I is natural as a result of senescence.

(D) Observed fact in plant in soil II indicates excessive sunlight leading to bleaching of chlorophyll.

Solution · Q56 **Answer: (A), (B)**

A shortage of a mobile nutrient shows first in older leaves, as it is moved to young ones.

A shortage of an immobile nutrient shows first in young leaves.

(A) Soil I: lack of a mobile nutrient such as N. ∴ true.

(B) Soil II: lack of an immobile nutrient such as Ca. ∴ true.

(C), (D) These patterns point to nutrient shortage, not natural ageing or bleaching by light. ∴ false.

IAPT tentative answer: (A), (B) | **Zigyan answer:** (A), (B)

57. In yeast cells, mating type *a* secrete 'a factor' and cells of mating type *α* secrete 'α factor.' Each cell type has receptors that specifically detect the pheromone secreted by the opposite type, initiating signal transduction leading to mating. Considering this system, which explanations appropriately describes why yeast rely on chemical signalling for mate recognition instead of direct physical contact?

(A) Chemical signalling ensures that only cells of appropriate mating type recognize each other, preventing waste of energy on fusion attempts.

(B) Chemical signalling lowers the activation energy of membrane fusion, making the mating process energetically favourable.

(C) Direct physical contact relies entirely on random collisions, which is a highly inefficient process.

(D) Pheromones permanently bind to receptors, locking cells together and ensuring fusion occurs without error.

Solution · Q57 **Answer: (A), (C)**

(A) Each type responds to the other's pheromone, so effort goes only into suitable partners. ∴ true.

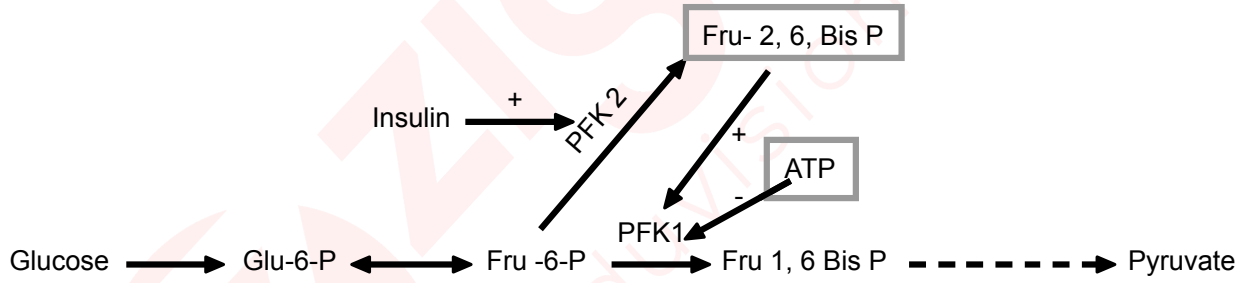
(C) Yeast cells cannot swim, and chance contact alone is a poor way to find a partner. ∴ true.

(B) A pheromone is a receptor signal, not a catalyst; activation energy also affects only rate, not whether fusion is energetically favourable. ∴ false.

(D) Pheromone binding is reversible and does not lock cells together. ∴ false.

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

58. Part of the glycolytic pathway is shown below:



'+' indicates activation and '–' indicates inhibition.

Which of the following statements are true?

(A) In a well-fed state, insulin will trigger glycolysis.

(B) If PFK-2 is mutated, in a well-fed state, it will lead to hypoglycemia.

(C) Any mutation in PFK-1 or PFK-2 will lead to complete halt of glycolysis which will be lethal to cell.

(D) If the ATP binding site of enzyme PFK-1is altered, glycolysis will proceed regardless of energy level in the cell.

Solution · Q58 **Answer: (A), (D)**

(A) Insulin → PFK-2 → Fru-2,6-bisphosphate, which activates PFK-1. ∴ true.

(B) Without PFK-2 activity, glucose use falls, so blood sugar tends to rise. ∴ false.

(C) A mutation may be silent or partial, and loss of PFK-2 only removes an activator. ∴ false.

(D) Taking the altered site as the inhibitory one shown in the figure, ATP can no longer brake PFK-1. ∴ true.

IAPT tentative answer: (A), (D) | **Zigyan answer:** (A), (D)

59. In some fish species, young ones are born as females and later in life, they transition to males. This is termed as protogyny. In others, young ones are born as males and later in life they transition to females. This is termed as protoandry. This type of sequential hermaphroditism evolved because the evolutionary model suggests that it is advantageous for an organism to be of one sex when young and the opposite sex when older.

In which of the following social systems, protoandry and protogyny will be favoured?

(A) Large male defends a territory, or it defends a harem of females → protoandry

(B) A larger female can carry and lay significantly more eggs → protogyny

(C) Mating system involves strict monogamous pairs → protoandry

(D) Polygynous mating system → protogyny.

Solution · Q59 **Answer: (C), (D)**

A fish should be, when large, the sex that gains more from large size.

(A) A large male holding a harem gains most, which favours protogyny. ∴ false.

(B) A large female gains most, which favours protandry. ∴ false.

(C) In a monogamous pair, egg number limits output, so the larger partner should be female. ∴ true.

(D) In polygyny, large males win many mates: female first, male later. ∴ true.

IAPT tentative answer: (C), (D) | **Zigyan answer:** (C), (D)

Question 60 is not included in this booklet.

ANSWER KEY

NSEB 2026 · PAPER CODE 21 · IAPT TENTATIVE KEY

60
QUESTIONS · 216 MARKS

IAPT's TENTATIVE answer key for paper code 21; the final key may differ. ★ marks an answer given as per Zigyan.

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

Question 60 is not included in this booklet.

★ Answers as per Zigyan

- **Q8** — As per Zigyan: (B); IAPT tentative key (C).
- **Q35** — As per Zigyan: (C); IAPT tentative key (A).
- **Q51** — As per Zigyan: (A), (B), (D); IAPT tentative key (A), (B), (D).
- **Q52** — As per Zigyan: (D); IAPT tentative key (A), (D).

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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

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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

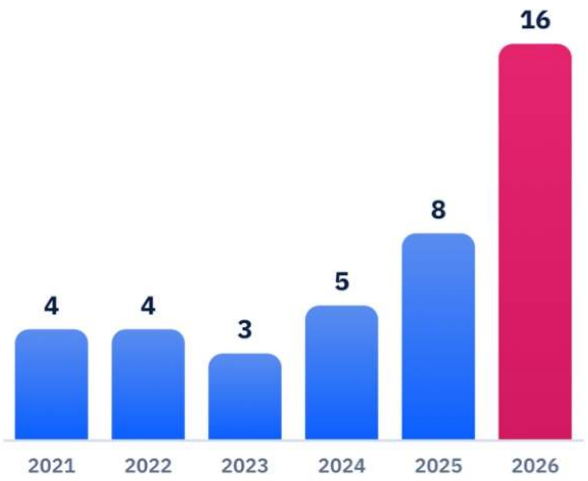
40
JEE Advanced selections in 6 years

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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