zigyan

PREVIOUS YEAR PAPER · 2024

OLYMPIAD · STAGE I

NSEB

National Standard Examination in Biology

2024

Question paper, answer key and Zigyan solutions

60	216	120 min	21
Questions	Maximum marks	Time	Paper code

Question paper and official answer key: Indian Association of Physics Teachers (IAPT), NSEB 2024, paper code 21.
Solutions and notes: Zigyan. This booklet is not an IAPT publication.

Prepare for the Olympiads with Zigyan

www.zigyan.com

zigyan

SCO No. 107, Sector 16, Faridabad, Haryana 121002
0129-4048800 · +91 92115 38800 · info@zigyan.com

zigyan

JEE 2026 RESULTS

OUR TOPPERS

When talent meets the right guidance.

Saksham Bishnoi and Sulokya Bibhuty - our JEE 2026 toppers from Zigyan, Sector 16 - with the programme they took and the rank they earned.



Rahul Kaushik Sir
Founder & Director, Zigyan Eduvision
23 years of teaching



Saksham Bishnoi

4 YEARS CLASSROOM

JEE ADVANCED 2026	JEE MAIN 2026
AIR 168	AIR 811
	99.95 percentile



Sulokya Bibhuty

3 YEARS CLASSROOM

JEE ADVANCED 2026	JEE MAIN 2026
AIR 1,315	AIR 1,095
	99.94 percentile

OLYMPIAD RESULTS

Above the Minimum Admissible Score - the national band for the subject

CHEMISTRY

- Sulokya Bibhuty — 3 Years Classroom
- Anay Gupta — 3 Years Classroom
- Akshat Khator — 3 Years Classroom
- Harshit Goyal — 4 Years Classroom
- Hardik Sharma — 3 Years Classroom
- Aarush Kumar — 1 Year Classroom

PHYSICS

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

ASTRONOMY

- Sulokya Bibhuty — 3 Years Classroom

MATHEMATICS (IOQM)

- Priyanshi — 4 Years Classroom

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

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

Start where they started.

Register for ZEST - ₹200 · www.zigyan.com/scholarship/zest

+91 92115 38800
info@zigyan.com

PART A-1 · ONE CORRECT OPTION

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

1. A realized niche is the space occupied by a species under real-world conditions. Identify the factors that influence the establishment of realised niche of a species.

(i) interspecific competition.

(ii) predation.

(iii) availability of resources.

(iv) intraspecific competition.

Choose the correct option:

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

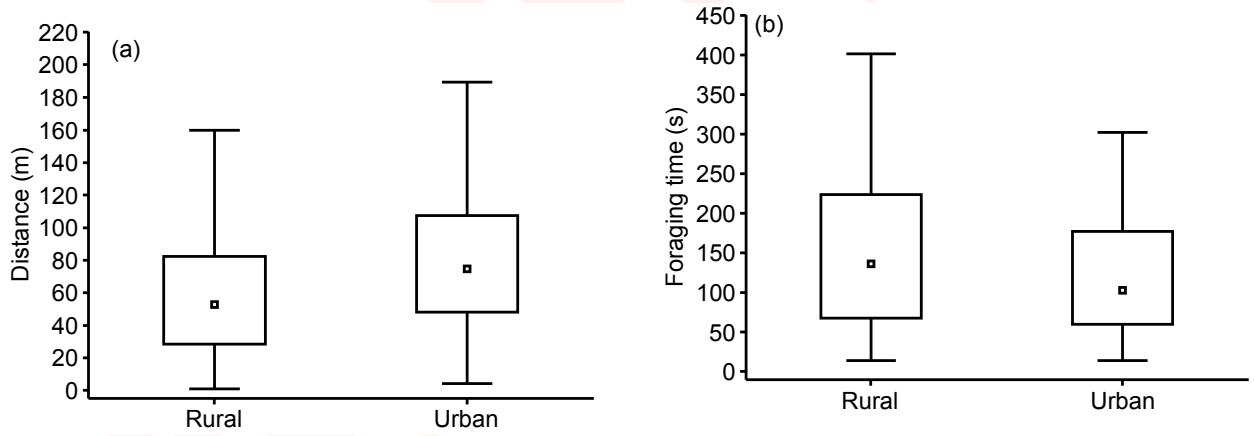
Solution · Q1 **Answer: (D)**

Interspecific competition, predation and the availability of resources confine a species to only a part of its fundamental niche. This part is the realised niche.

Intraspecific competition tends to widen the niche instead of restricting it.

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

2. A study conducted to analyse the foraging strategies of house sparrow compared observations on sparrow populations in rural and urban surroundings. The image below depicts the findings.



The Marginal Value Theorem says that animals must forage by using most economic and efficient strategy that will balance energy gain and consumption. Which of the following interpretations of the study results, support the theorem?

(A) The foraging distances in urban environs are shorter while those of rural environs are longer.
(B) The sparrows spent more time in foraging in urban environs due to more "artificial habitats" in urban environs.
(C) The sparrows spent less time foraging in urban areas where resources are at larger distances.
(D) Rural environs with "more natural" habitats offer lesser resources at shorter distances.

Solution · Q2 **Answer: (C)**

Graph (a): foraging distances are larger for urban sparrows than for rural sparrows.

Graph (b): foraging time is shorter for urban sparrows than for rural sparrows.

So urban sparrows spend less time foraging although their resources are farther away.

Only option (C) agrees with both graphs.

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

3. Which of the following **cannot** be considered an advantage of the efficient photosynthetic pathway for the fixation of atmospheric carbon dioxide in C_4 plants?

(A) It facilitates adaptation to arid conditions.

(B) It facilitates adaptation to high temperatures.

(C) It facilitates lower energy cost per CO_2 fixed.

(D) It facilitates survival in marginal environments.

Solution · Q3 **Answer: (C)**

For each CO_2 fixed, the C_3 pathway uses 3 ATP, while the C_4 pathway uses 5 ATP. Both use 2 NADPH.

The extra ATP is spent in regenerating PEP. So the C_4 pathway does not give a lower energy cost.

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

4. Like the bony skeletons in vertebrates, haemolymph hydraulics enables some invertebrates in locomotion. Which of the following animals uses haemolymph hydraulics for locomotion?

(A) Grasshopper (B) Spider (C) Crab (D) Octopus

Solution · Q4 **Answer: (B)**

Spiders have no extensor muscles at some of their main leg joints.

Flexor muscles bend the legs, and a rise in haemolymph pressure straightens them.

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

5. Which of the following has a turnover time equal to lifetime of humans?

(A) Lens of the eye (B) Sperm cells

(C) Muscle cells of ribs (D) Hepatocytes

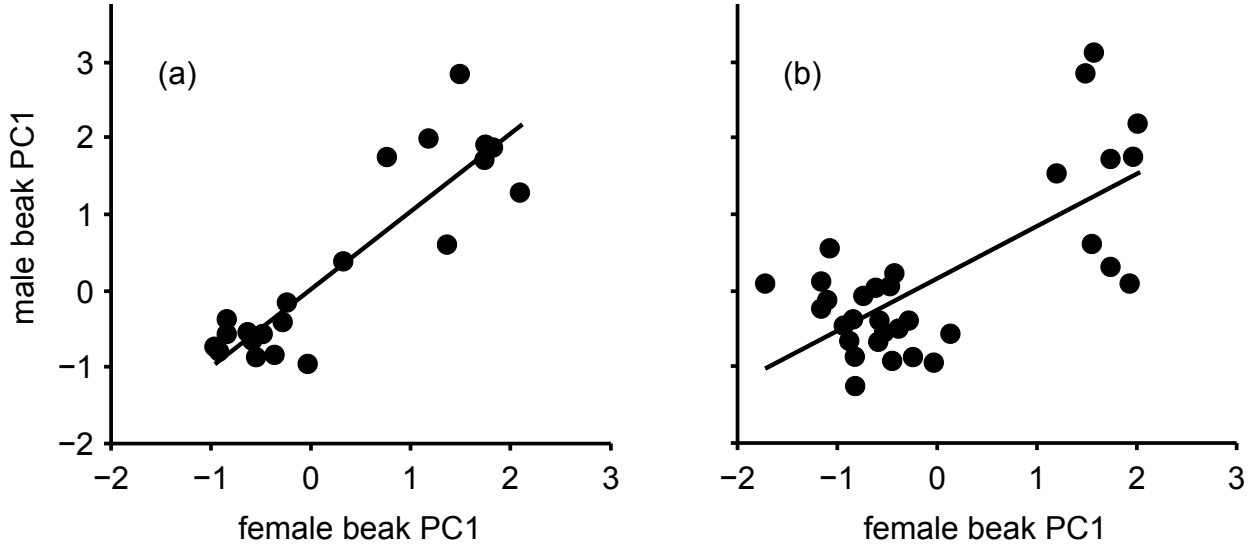
Solution · Q5 **Answer: (A)**

Fibre cells at the centre of the eye lens are formed before birth and are never replaced. They last for the whole life.

Sperm cells, hepatocytes and rib muscle cells have much shorter turnover times.

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

6. The population of Medium Ground Finch (*Geospiza fortis*) on Santa Cruz Island of Galapagos, features mainly large and small beak size morphs, with relatively few intermediates. The Figures (a) and (b) below depict the pairing patterns in two different breeding seasons. Male and female 'beak PC1' values are Principal Component - 1, indices derived based on beak length, depth and width.



Which of the following interpretation is correct?

(A) This type of breeding indicates a reproductive isolation purely of allopatric origin.

(B) There is disruptive selection in sympatry against birds with intermediate beak sizes.

(C) The pairing pattern indicates a selection pressure for intermediate beak sizes.

(D) The trend in the pairing patterns seen in two seasons indicates an efficient reproductive isolation between the morphs.

Solution · Q6 **As per Zigyan: (B)**

The large and small morphs live together on one island, and intermediates are few. These facts do not point to a purely allopatric origin.

The graphs show that birds mostly pair with partners of similar beak size. This pairing does not favour intermediate beaks.

In this population, intermediate birds survive less than the large and small morphs. This is disruptive selection in sympatry.

In graph (b), some large-beaked females have mates with clearly smaller beaks. So the isolation is only partial, not efficient.

Reference: A. P. Hendry and others, Proceedings of the Royal Society B (2009), research paper 'Disruptive selection in a bimodal population of Darwin's finches': in this population of *Geospiza fortis*, disruptive selection was strong between the two beak size modes.

Reference: S. K. Huber and others, Proceedings of the Royal Society B (2007), research paper 'Reproductive isolation of sympatric morphs in a population of Darwin's finches': the morphs pair by beak size, intermediate birds survive at lower rates, and the two morphs are partially distinct gene pools.

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

7. If one starts with 10,000 (10^4) bacterial cells in a culture that has a generation time of 2 hours, what would be the magnitude (ten-fold) of increase in cell number at 4 hours, 24 hours and 48 hours respectively?

(A) Less than 1, 4, and 7
(B) 1, 3, and 7
(C) Less than 1, 5, and 9
(D) 4, 16 and 49

Solution · Q7 **Answer: (A)**

With a generation time of 2 h, the cells divide 2, 12 and 24 times in 4 h, 24 h and 48 h.

At 4 h:

$$2^2 = 4$$

$$\Rightarrow \log_{10}4 \approx 0.6$$

At 24 h:

$$2^{12} = 4096$$

$$\Rightarrow \log_{10}4096 \approx 3.6$$

At 48 h:

$$2^{24} \approx 1.68 \times 10^7$$

$$\Rightarrow \log_{10}(1.68 \times 10^7) \approx 7.2$$

$\therefore$ Counted in ten-folds, the increases are less than 1, about 4 and about 7.

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

8. If atmospheric PO_2 is 130 mm of Hg and alveolar PO_2 of a person is 85 mm of Hg, which of the following is most likely correct?

(A) The person is suffering from lung dysfunction.
(B) The person is respiring at high altitude.
(C) The partial pressure of oxygen in pulmonary arteries for the person must be between 60-130 mmHg.
(D) The partial pressure of oxygen in pulmonary veins for the person must be between 40-60 mmHg.

Solution · Q8 **Answer: (B)**

At sea level, atmospheric PO_2 is about 159 mm Hg. A value of 130 mm Hg indicates high altitude, and an alveolar PO_2 of 85 mm Hg fits this. It does not by itself show lung disease.

Pulmonary arteries carry deoxygenated blood, so their PO_2 must be below the alveolar value. A range of 60-130 mm Hg is not possible.

Blood in pulmonary veins comes close to the alveolar PO_2, so 40-60 mm Hg is not expected.

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

9. Consider the following pathway involving glycolysis that further leads to citric acid (TCA) cycle. (PFK = Phosphofructokinase).

$$\text{Glucose} \rightarrow \text{F}-6-\text{PO}_4 \underset{\text{PFK}}{\rightleftharpoons} \text{F1,6,bisPO}_4 \rightarrow \ \rightarrow \ \rightarrow \text{Pyruvate} \rightarrow \text{Acetyl CoA} \rightarrow \text{TCS Cycle}$$

Which of the following molecules are likely to act as activators and inhibitors respectively of the enzyme PFK?

(A) Citrate and ATP (B) AMP and ADP (C) ATP and citrate (D) AMP and citrate

Solution · Q9 **Answer: (D)**

PFK is a key allosteric control point of glycolysis and responds to the energy state of the cell.

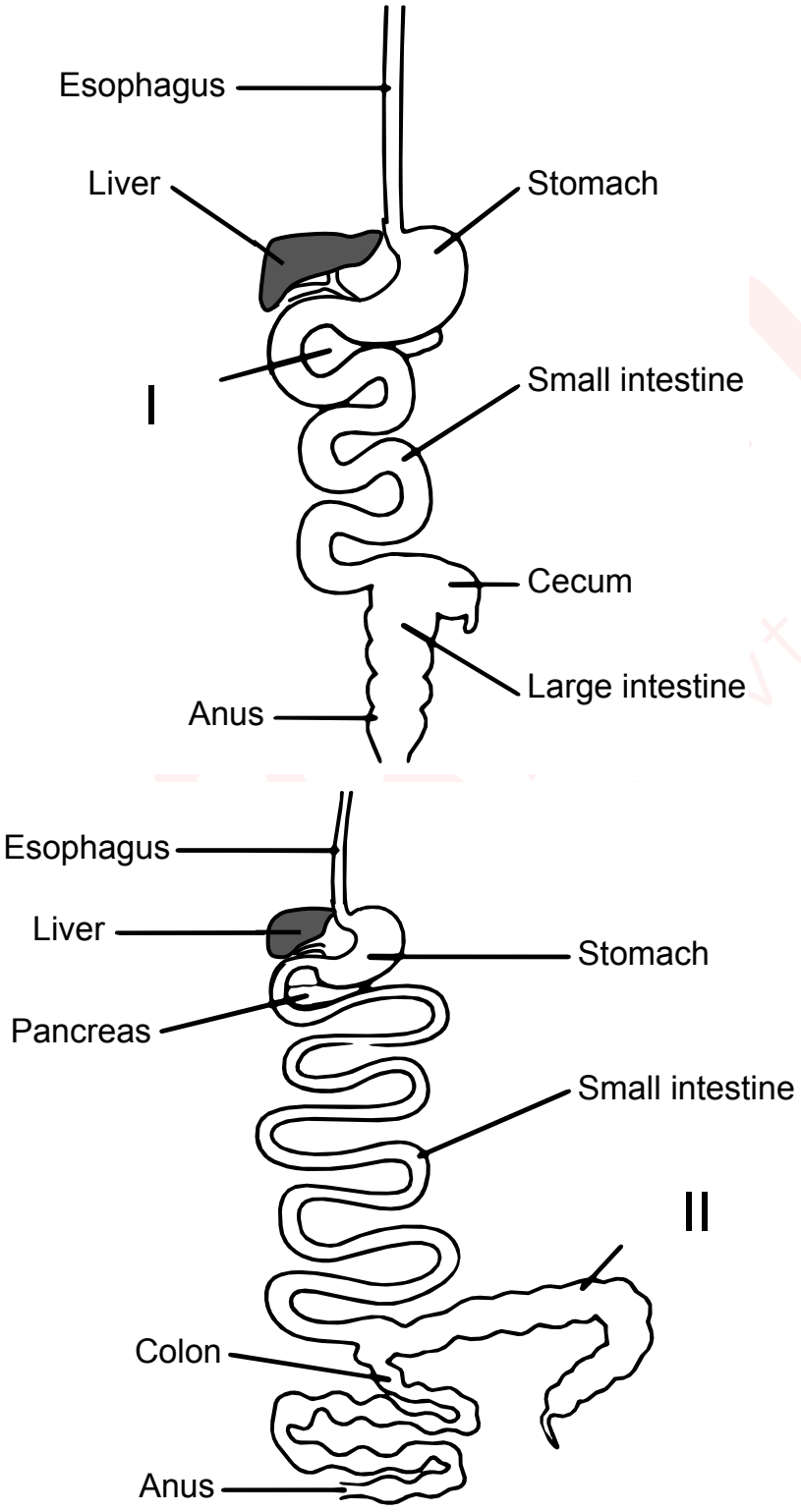
AMP signals low energy, so it activates PFK.

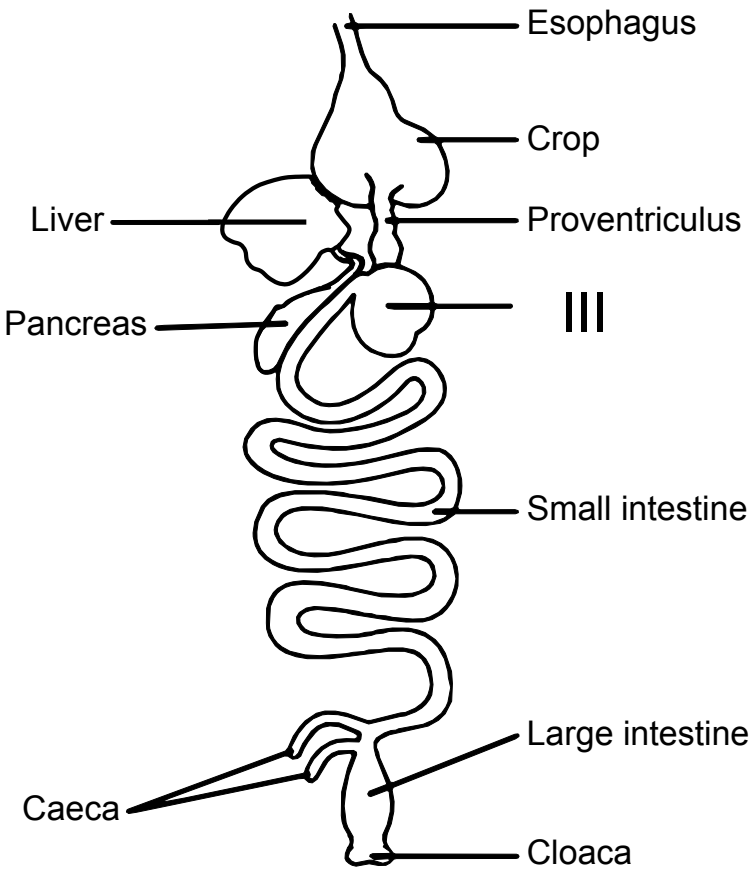
Citrate, like a high level of ATP, signals a plentiful supply, so it inhibits PFK.

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

Zigyan Eduvision Pvt Ltd

10. The Gastrointestinal tracts with some associated organs are shown in the diagrams below. The names of the organs marked I, II and III respectively are;





(A) Duodenum, gall bladder and cardiac stomach
(B) Gall bladder, Intestinal diverticulum and pyloric stomach
(C) Pancreas, caecum and gizzard
(D) Pancreas, Intestinal diverticulum and stomach

Solution · Q10 **Answer: (C)**

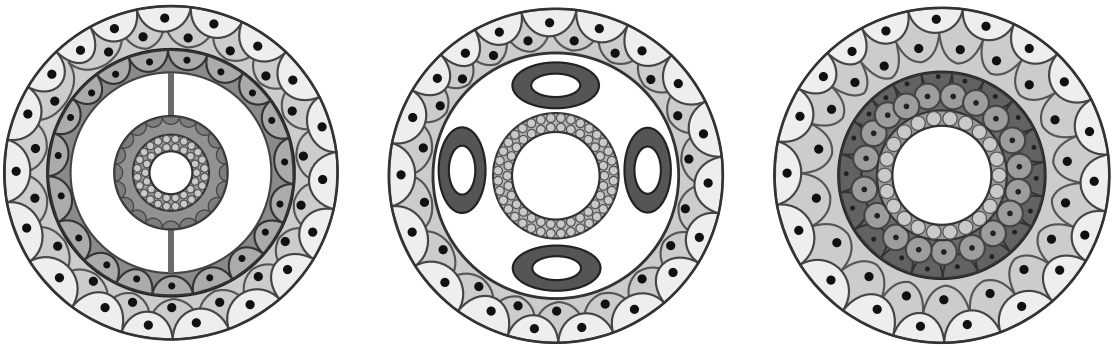
I lies in the loop of the duodenum: pancreas.

II is the long blind pouch near the junction of the small intestine and colon in the second tract: caecum.

III is the round muscular chamber after the proventriculus in the bird's gut: gizzard.

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

11. Coelom is the fluid filled space between the body wall and the digestive system. Its absence or presence significantly influences classification of animals. The schematic diagrams (i), (ii), and (iii) below depict three different variations in the coelomic condition. Select the correct sequence of animal group to respectively match the coelomic types (i), (ii) and (iii).



(i) (ii) (iii)

(A) Annelids, Roundworms and Flatworms
(B) Roundworms, Flatworms and Annelids
(C) Flatworms, Roundworms and Annelids
(D) Annelids, Flatworms and Roundworms

Solution · Q11 **Answer: (A)**

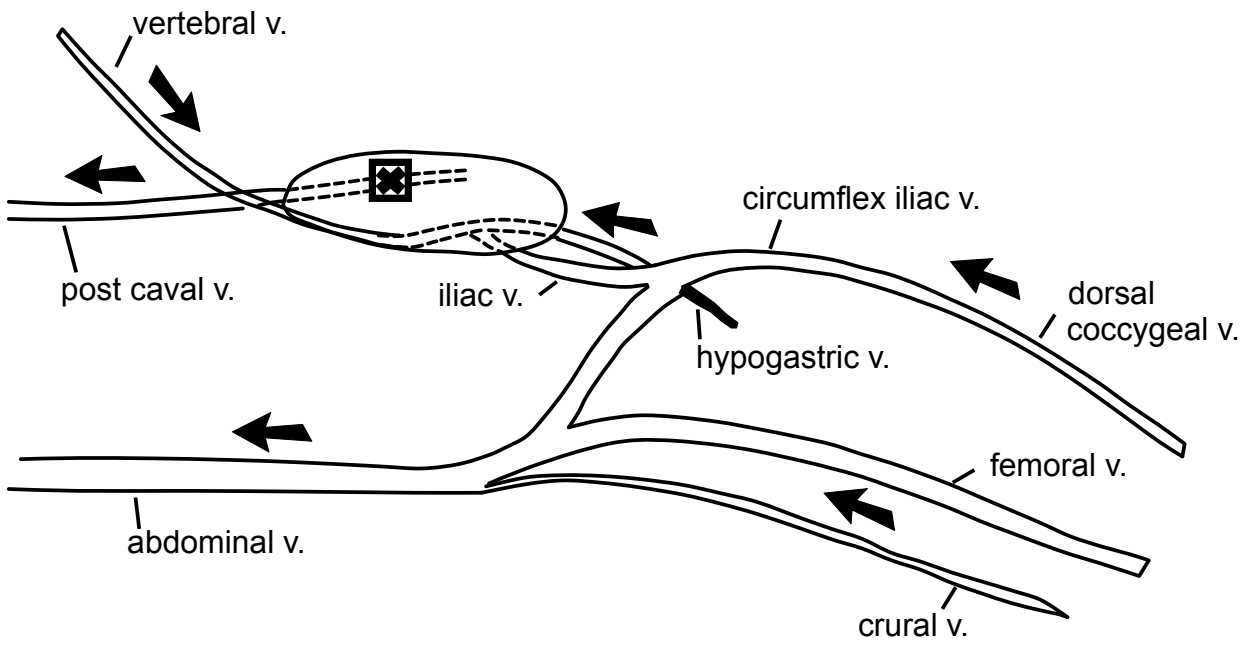
(i) Mesoderm lines the cavity on both sides, and mesenteries hold the gut: true coelom, as in annelids.

(ii) Mesoderm occurs only as scattered pouches in the cavity: pseudocoelom, as in roundworms.

(iii) Mesoderm fills the whole space and leaves no cavity: acoelomate, as in flatworms.

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

12. One of the portal systems evolved in lower vertebrates is to help drain the muscular hind legs. The image below depicts that portal system in the red-eared terrapin (*Trachemys scripta elegans*), a fresh water turtle and the most commonly kept pet reptile. The organ marked "⊠" is _____.



(A) Lymph node (B) Kidney (C) Testis (D) Liver

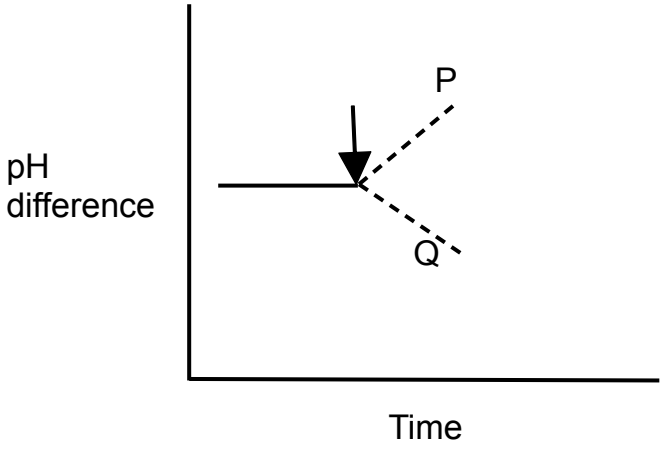
Solution · Q12 **Answer: (B)**

A portal system carries blood from one capillary bed to another. The one shown, draining the hind legs through the marked organ, is the renal portal system.

In the figure, blood from the leg veins reaches the marked organ through the iliac vein and its neighbouring branch, and leaves by the post caval vein. So the organ is the kidney.

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

13. pH difference across inner mitochondrial membrane over time in an actively respiring cell is shown in the graph. The likely effects of addition of P and Q to the cell at the time indicated by arrow are also shown. Which of the following statements is correct?



(A) P is likely to be ATP synthase inhibitor.
(B) Q is likely to be cytochrome inhibitor.
(C) P is likely to be metabolic activator.
(D) Q is likely to be activator of anaerobic respiration.

Solution · Q13 **As per Zigyan: (A)**

The electron transport chain pumps H^+ out of the matrix, and H^+ returns through ATP synthase.

An ATP synthase inhibitor closes this return path while pumping goes on.

∴ H^+ builds up outside the matrix and the pH difference rises, as shown by P.

Reference: NCERT Biology Class XI, Chapter 12 'Respiration in Plants', section 12.4.2: the energy of oxidation-reduction in respiration is used to build the proton gradient, and the F_0 part of ATP synthase is the channel through which protons cross the inner membrane, coupled to ATP synthesis.

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

14. Siamese cats show a mutated enzyme tyrosinase (required for the synthesis of melanin) that is active only below a temperature of 33^0C. Based on this information, which of the following is likely to be correct?

(A) Newly born Siamese kittens are likely to be creamy or white in colour.
(B) As the young grow to adulthood, mainly their belly portions are likely to turn dark.
(C) Newly born Siamese kittens are likely to show darker nose, paws, and ears than the rest of the body as compared to adults.
(D) The body of the Siamese cat is likely to be darker in summer as compared to winter season.

Solution · Q14 **Answer: (A)**

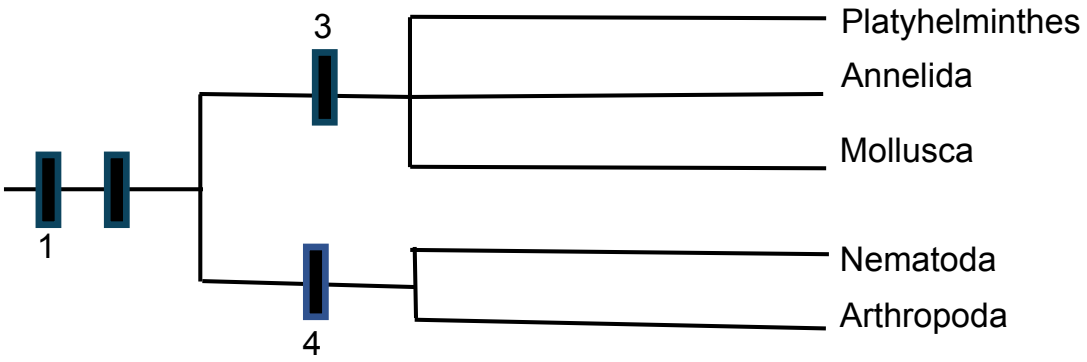
In the womb the kitten is at the mother's body temperature, which is above 33 °C.

So tyrosinase is inactive and no melanin forms before birth.

∴ Kittens are born creamy or white. Later, only cooler parts (ears, nose, paws, tail) turn dark.

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

15. Phylogenetic classification of five animal phyla is shown below.



Which of the following options correctly identifies the characteristics associated with labels 1 to 4?

(A) 1 is Bilateral symmetry and 3 is Protostomy

(B) 3 is Diploblasty and 4 is Triploblasty

(C) 1 is Bilateral symmetry and 2 is Deuterostomy

(D) 2 is Protostomy and 3 is Spiral cleavage

Solution · Q15 **As per Zigyan: (D)**

Label 2 is the unnumbered second bar on the common stem.

Traits on the common stem belong to all five phyla: they are bilaterally symmetrical, triploblastic protostomes. So 2 is protostomy.

3 marks only Platyhelminthes, Annelida and Mollusca, the group with spiral cleavage.

4 marks Nematoda and Arthropoda, the moulting animals.

Reference: OpenStax Biology 2e, section 27.2: arthropods, molluscs and annelids are protostomes; section 27.3 'Animal Phylogeny': the protostomes are made up of Ecdysozoa (with nematodes and arthropods) and Lophotrochozoa.

Reference: OpenStax Biology 2e, section 28.3 'Superphylum Lophotrochozoa': lophotrochozoans are protostomes, most of them with spiral cleavage, which is also seen in basal flatworm groups.

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

16. Among several excretory products of animals, P, Q and R are tabulated along with their properties.

Properties	P	Q	R
Toxicity	+++	++	+
Energy cost	+	++	+++
Water loss during excretion	+++	++	+

Waste product P most likely is:

(A) Urea (B) Carbon dioxide (C) Uric acid (D) Ammonia

Solution · Q16 **Answer: (D)**

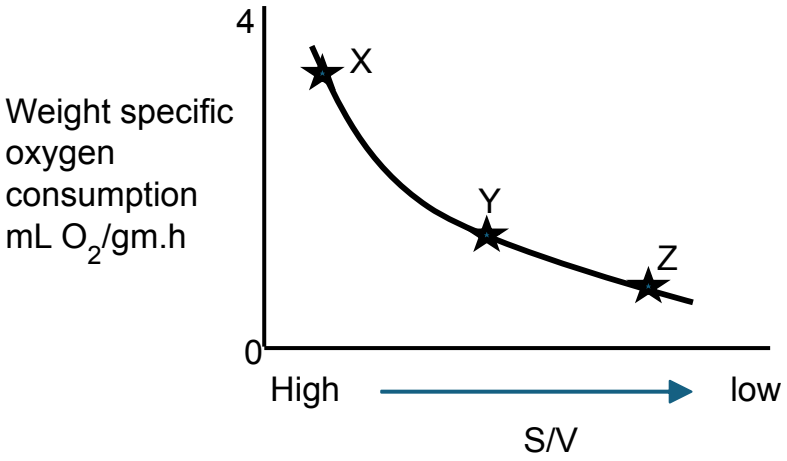
P has the highest toxicity, the lowest energy cost and the largest water loss.

Ammonia is the most toxic nitrogenous waste, needs a lot of water for removal and costs the least energy.

(Q fits urea and R fits uric acid.)

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

17. Weight specific oxygen consumption and body surface area to volume (S/V) ratio of three animals (X, Y and Z) is depicted in the graph.



X, Y and Z respectively indicate:

(A) Elephant, human, dog

(B) Shrew, sheep, cat

(C) Mouse, sheep, elephant

(D) Horse, dog, cat

Solution · Q17 **Answer: (C)**

A smaller animal has a higher S/V ratio, loses heat faster and uses more O_2 per gram per hour.

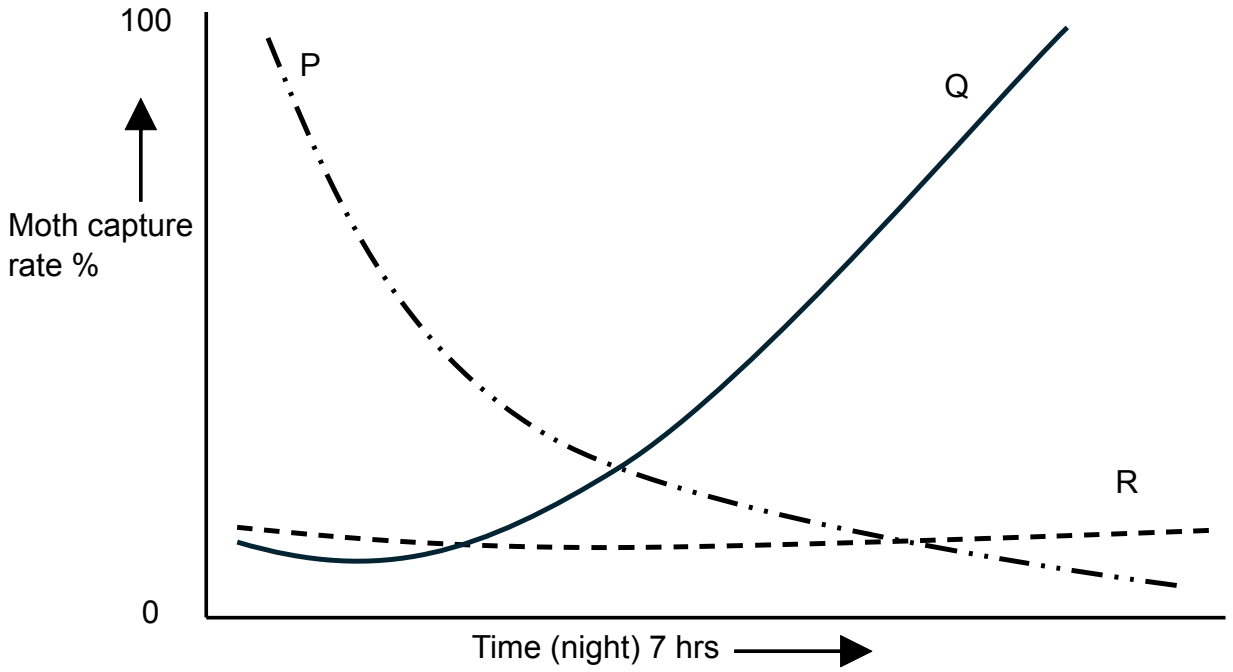
From X to Z both S/V and O_2 use per gram fall, so body size increases:

$$X < Y < Z$$

∴ X, Y and Z are mouse, sheep and elephant.

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

18. In the event of a bat attack, tiger moths show three different types of responses. Some tiger moths show warning colouration indicating their toxic chemical defense while some moths produce clicking sounds to jam bat's sonar. Some moths show acoustic startling responses to deter the attacking bats. Scientists experimented with a bat colony that was not exposed to these moths. When they studied the moth capture rate against each of these moth responses, the following data was obtained.



Which of the following can be deduced from these results?

(A) P indicates response to jamming behaviour.

(B) Q indicates response to acoustic startle behaviour.

(C) R indicates bat's response to warning colouration for chemical toxicity.

(D) R indicates control behavior of bats in absence of all the three types of moth behaviour.

Solution · Q18 **Answer: (B)**

The bats had never met these moths.

P (capture falls): bats first catch the warningly coloured moths, then learn that they are toxic and avoid them.

Q (low at first, then rises): bats are startled at first, then get used to the sound (habituation).

R (low all night): jamming disturbs the sonar itself, so experience does not help the bats.

∴ Q shows the response to acoustic startle.

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

19. Zebra finches are monogamous birds mainly found in Australia and Indonesia. These birds (both male and female) lack any crest feather (ornamentation) on their head. To study the mate choice behaviour of zebra finches, the following experimental groups of modified individuals were made.

Group	Modification	Mate preference of female offspring
I	Both male and female ornamented and mated.	Ornamented male
II	Only males ornamented and mated with females.	Ornamented male
III	Only females ornamented and mated with males.	Both preferred equally
IV	Neither sex was ornamented and mated.	Both preferred equally

The results indicate that:

(A) Ornamentation of crest on either parent influences mate choice.

(B) Mate choice behavior is genetically determined and cannot be changed.

(C) Mate choice is influenced by imprinting.

(D) Mate choice behavior is dictated by presence or absence of ornamentation of female parent.

Solution · Q19 **Answer: (C)**

Daughters prefer ornamented males only when the father was ornamented (groups I and II).

An ornamented mother alone (group III) gives the same result as no ornament (group IV).

So a daughter learns her father's look early in life, even an artificial crest, and later chooses a similar mate: sexual imprinting.

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

20. How many times does megaspore mother cell nucleus divide till the formation of female gametophyte in angiosperms?

(A) 5 (B) 11 (C) 4 (D) 8

Solution · Q20 **Answer: (A)**

The megaspore mother cell nucleus undergoes meiosis, with two successive nuclear divisions (meiosis I and II), forming megaspores.

The nucleus of the functional megaspore then divides three times by mitosis, forming the 8-nucleate embryo sac.

Successive divisions:

$$2 + 3 = 5$$

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

21. Consider a germ cell having 3 pairs of homologous chromosomes. After meiotic division, how many possible combinations of chromosomes will be found in egg cells?

(A) 8 (B) 16 (C) 6 (D) 9

Solution · Q21 **Answer: (A)**

Each homologous pair separates independently, giving 2 choices per pair (without counting crossing over).

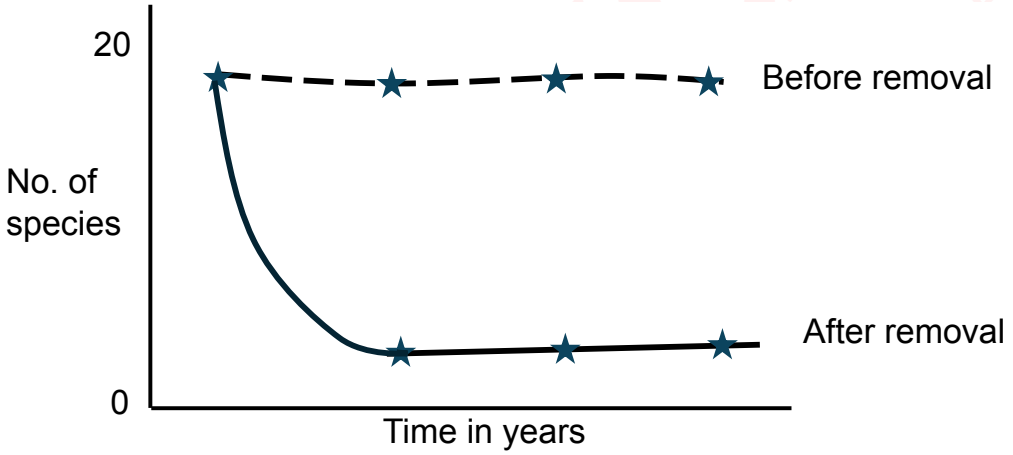
Number of pairs:

$$n = 3$$

$$\Rightarrow 2^n = 8$$

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

22. On a rocky intertidal habitat, a sea star (*Pisaster ochraceus)* and mussel (*Mytilus californianus)* are commonly found along with several other smaller sized species of various animals and algae. When all sea stars were removed from the habitat, the results obtained are depicted in the following graph.



What can be deduced from this data plotted in the graph?

(A) Sea star was a likely predator of mussels that overgrew in the habitat in the absence of Sea star.

(B) Mussels are the keystone species of the habitat.

(C) In absence of sea star, severe competition between the remaining species led to their extinction.

(D) Sea star is the dominant competitor for space to all other species thriving in the intertidal zone.

Solution · Q22 **As per Zigyan: (A)**

The sea star *Pisaster* preys on the mussel *Mytilus*.

Once all sea stars were removed, the mussels could multiply and overgrow the rock surface, pushing out many other species.

So the number of species fell sharply. The keystone species here is the sea star.

Reference: OpenStax Biology 2e, section 45.6 'Community Ecology' (keystone species): *Pisaster ochraceus* is a keystone species; when it is removed, its natural prey, mussels, increase in number, which completely alters the species composition and reduces biodiversity.

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

23. Primary spermatocytes undergo meiotic division to give rise to sperm cells. Nondisjunction of sex chromosomes during this division can lead to male gamete formation with abnormal number of chromosomes. If such a sperm cell fuses with a normal egg cell, which one of the following genotypes will not be found in the offsprings?

(A) XXY (B) XXX (C) XYY (D) YO

Solution · Q23 **Answer: (D)**

The male has the sex chromosomes X and Y.

Nondisjunction in meiosis I gives XY or O sperm; in meiosis II it gives XX, YY or O sperm.

A normal egg always carries one X. With such sperm:

XY sperm → XXY

XX sperm → XXX

YY sperm → XYY

O sperm → XO

∴ YO, which has no X, cannot form.

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

24. Australian Bush fly lays its eggs in the fresh dung of herbivores. As the dung hardens, no more eggs can be laid. When the eggs hatch, larvae feed on the dung until they pupate in the nearby soil. In an experiment, fixed volume of cow dung cakes (2 dm^3) was populated with different number of eggs ranging from 1400 – 4250. Figure 1 shows percentage of eggs emerged as adults from each dung cake. Each dot represents a 2 dm^3 dung cake. Figure 2 represents percentage survival for any original egg number which will give exactly 915 adults. What conclusion can be drawn?

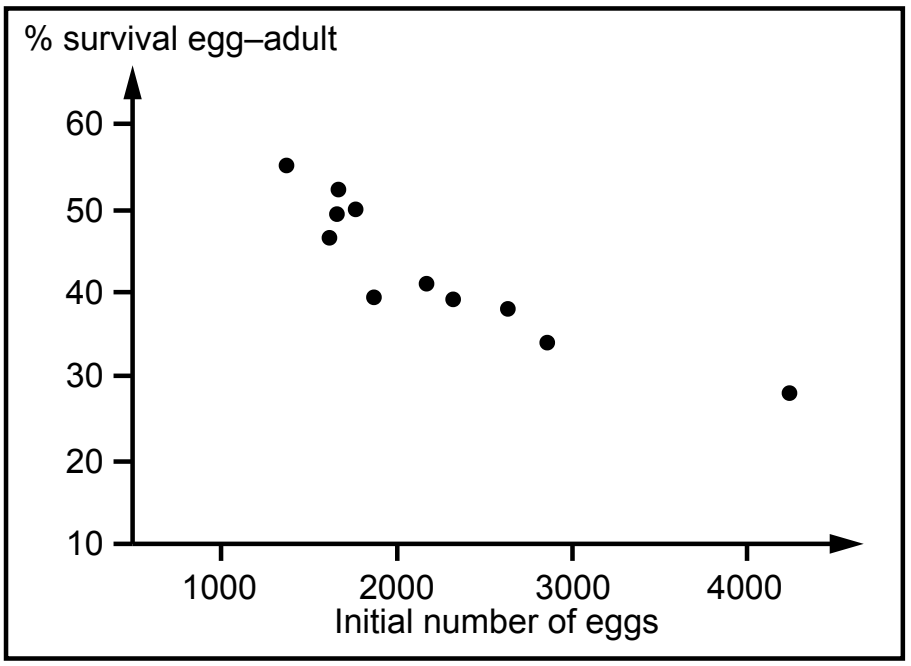


Figure 1

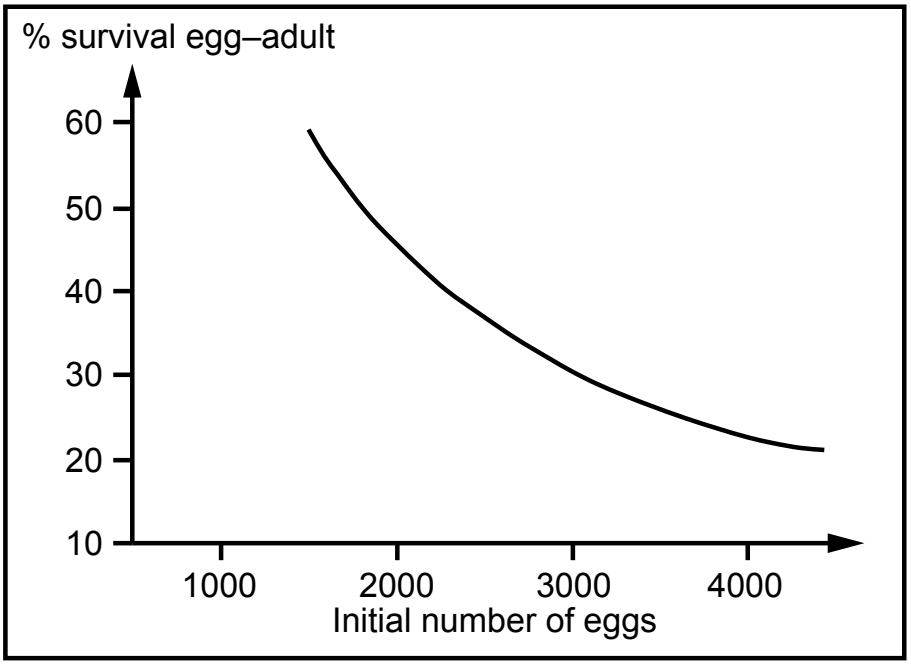


Figure 2

(A) The number of adults emerging from the dung cake of any size is always fixed.

(B) Dung cake populated with lesser number of eggs would have given higher number of adults emergence.

(C) Number of adults emerging is fixed if dung cake size is nearly constant.

(D) All the eggs laid by bush fly are not viable if the number is above 1400.

Solution · Q24 **Answer: (C)**

In Figure 1, percentage survival falls as the egg number rises, much like the curve in Figure 2.

On the Figure 2 curve every egg number gives 915 adults.

So each 2 dm^3 cake yields roughly similar numbers of adults: the food in a cake of fixed size limits how many larvae can grow up (density-dependent mortality).

∴ For a nearly constant cake size, the number of adults is nearly fixed.

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

25. The amount of dead organic matter accumulated on the forest floor at any given point of time differs as one goes from equator to higher altitude. The table given below represents 4 forest types with the amount of dead organic matter measured per hectare.

Forest type	Mass of dead organic matter (tons/ha)
M	10
N	2
O	85
P	30-45

Which one represents a tropical rain forest?

(A) M (B) N (C) O (D) P

Solution · Q25 **Answer: (B)**

In a tropical rain forest, warm and moist conditions make decomposition very fast, so very little dead organic matter stays on the forest floor.

The lowest value, 2 tons/ha, is that of N.

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

26. IUCN has listed several criteria in order to protect the area under the biological diversity hotspots. Some of these criteria are 1) the area must support 0.5 percent of the global total plant species (≈ 3,00,000) and 2) the region must have lost more than 70 percent of its original habitat. Based on this IUCN has already protected 25 hot spots all over the world.

A researcher comes up with four areas (i, ii, iii and iv) that support several endemic plants and face substantial loss of their natural habitat over a period. Which of these area/s can be protected under the global biodiversity hotspots?

Name of area	Number of endemic plant species in the area	Total area of Habitat (in sq km)	Loss of habitat (sq. km)
i	1250	15000	7500
ii	1512	80000	64000
iii	1525	90000	62000
iv	1275	36000	6000

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

Solution · Q26 **Answer: (C)**

Minimum number of endemic plant species needed:

$$0.5\% \times 3{,}00{,}000 = 1500$$

Only areas ii and iii cross this number.

Habitat lost must be more than 70%.

$$\text{ii: } \frac{64000}{80000} \times 100 = 80\%$$

$$\text{iii: } \frac{62000}{90000} \times 100 \approx 68.9\%$$

∴ only area ii meets both criteria.

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

27. 'Reproductive isolating mechanisms play an important role in speciation. One such interesting example is of two closely related species of cicadas of the genus *Magicicada*. Both *Magicicada tredecim* and *Magicicada septendecim* spend almost 99% of their lifetime underground in immature nymph state. They feed on xylem fluids from the roots. Individuals of both the populations are developmentally synchronized and in both the species, emergence occurs in large numbers. The mature nymph of *Magicicada tredecim* emerges out after 13 years and moults into adult form whereas *Magicicada septendecim* emerges out after 17 years. Therefore, even though being closely related and belonging to the same habitat, interspecific mating is avoided. This type of reproductive isolation is

(A) Spatial isolation (B) Temporal isolation
(C) Mechanical isolation (D) Behavioural isolation

Solution · Q27 **Answer: (B)**

The two cicadas share a habitat, but their adults emerge after different intervals (13 and 17 years), so they generally do not breed at the same time.

Isolation due to a difference in breeding time is temporal isolation.

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

28. Under normal circumstances, lipid bilayer of cell membrane allows certain molecules to readily pass through it. Which one is the correct order of molecules with respect to increasing permeability across the membrane?

(A) Vit. A < Ca^{2+} < Glycerol < Glucose

(B) Ca^{2+} < Glucose < Glycerol < Vit. A

(C) Glucose < Glycerol < Vit. A < Ca^{2+}

(D) Glycerol < Vit. A < Ca^{2+} < Glucose

Solution · Q28 **Answer: (B)**

A lipid bilayer lets lipid-soluble molecules pass most easily and is nearly impermeable to ions.

Ca^{2+} (ion) < glucose (large polar) < glycerol (small uncharged polar) < vitamin A (lipid-soluble)

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

29. An experiment was carried out with a purified extract of a functional protein ribonuclease (R). The following steps were followed:

(i) Extract and purify R from tissue.

(ii) Add urea (disrupts the H_2 and ionic bonds) and mercaptoethanol (disrupts disulphide bridges).

(iii) Slowly remove the chemical agents used in the previous step and then check for enzyme activity.

(iv) Functional protein detected.

The type of structure/s of R affected at step (ii) is/are:

(A) 1° and 2° structures

(B) 2° and 3° structures

(C) 3° structure only

(D) 1° structure only

Solution · Q29 **Answer: (B)**

Urea and mercaptoethanol break hydrogen, ionic and disulphide bonds, which hold the secondary and tertiary structures.

Peptide bonds are not broken, so the primary structure stays intact and the enzyme can refold and work again.

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

30. A few statements regarding C_3, C_4 and CAM plants are given. Mark the correct statement.

(A) In C_4 plants, the C_4 and C_3 pathways are separated temporally.

(B) CAM plants utilize the C_4 pathway during the day and the C_3 pathway at night.

(C) The C_3 pathway takes place in the bundle sheath cells of the C_4 plants.

(D) Both C_4 and CAM plants keep their stomata open at night.

Solution · Q30 **Answer: (C)**

In C_4 plants, CO_2 is first fixed in mesophyll cells and the C_3 (Calvin) cycle runs in bundle sheath cells, so (C) is correct.

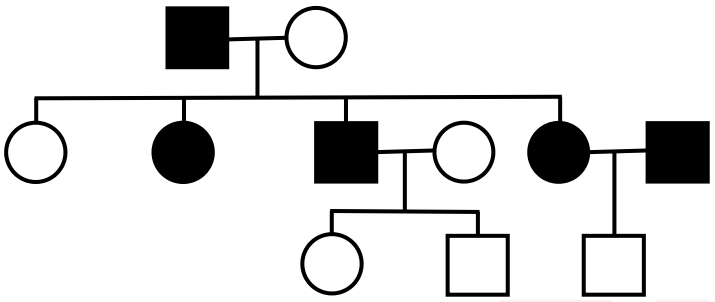
(A): the two pathways in C_4 plants are separated spatially, not temporally.

(B): CAM plants use the C_4 pathway at night and the C_3 pathway during the day.

(D): C_4 plants open their stomata during the day.

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

31. A pedigree for a rare congenital cataract condition is given below.



The most likely mode of transmission of the trait is:

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

Solution · Q31 **Answer: (C)**

The affected couple of the second generation has an unaffected son, so the trait is neither autosomal recessive nor X-linked recessive.

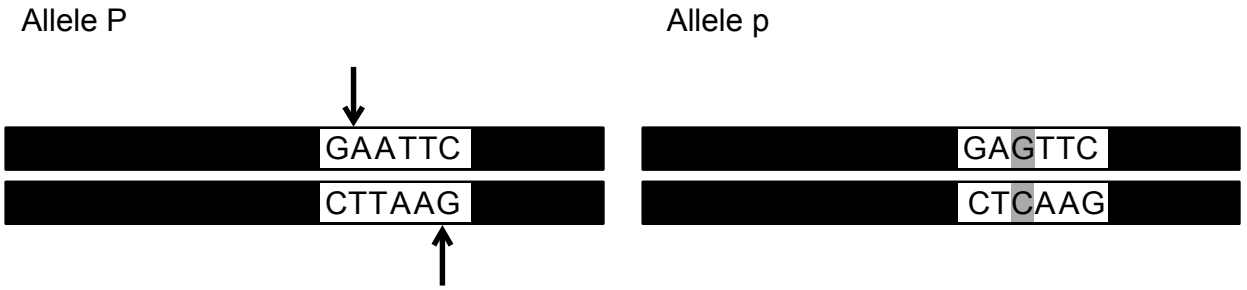
Affected fathers have unaffected daughters, so it is not X-linked dominant.

∴ the trait is autosomal dominant.

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

32. Restriction fragment length polymorphisms (RFLPs) are differences in DNA sequences due to mutations in restriction sites. These can serve as genetic markers. The RFLP gel patterns for members of a family can be obtained by restriction digestion of the sample containing the alleles for a particular trait and then carrying out electrophoresis, probing and blotting.

Consider the following alleles – *P* (dominant allele) and *p* (recessive allele) responsible for an autosomal recessive trait. Note: Arrows indicate restriction sites.



The number of bands that the RFLP profiles of an unaffected, affected and carrier individual for this trait would respectively show is:

(A) 2, 1 and 2
(B) 2, 1 and 3
(C) 1, 2 and 3
(D) 1, 1 and 2

Solution · Q32 **Answer: (B)**

Allele P has the site GAATTC, so it is cut into two fragments of unequal length. The base change in allele p removes the site, so it remains one fragment.

The probe is taken to detect all these fragments.

Unaffected non-carrier (PP): 2 bands.

Affected (pp): 1 band.

Carrier (Pp): both patterns together, 3 bands.

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

33. The presence or absence of certain structures in three types of cells is tabulated below.

	Plant	Animal	Bacteria
M	Present	Present	Present
N	Present	Present	Absent
O	Present	Absent	Present

Structures M, N and O could respectively be:

(A) Nucleus, Golgi apparatus and cell membrane

(B) Cell wall, endoplasmic reticulum and chloroplast

(C) Centrioles, ribosomes and cell wall

(D) Ribosomes, endoplasmic reticulum and cell wall

Solution · Q33 **Answer: (D)**

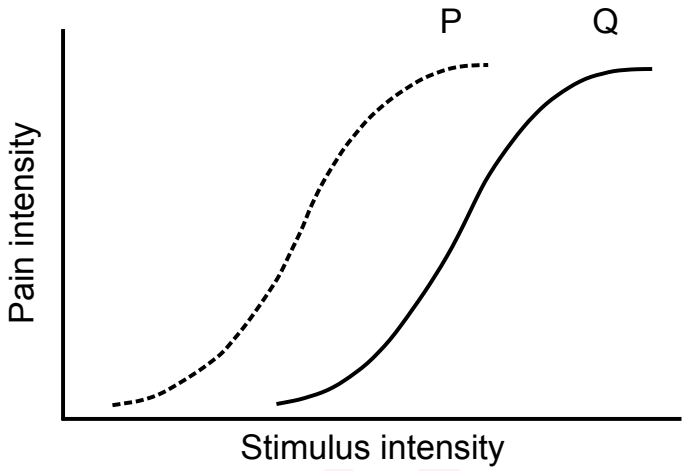
M occurs in all three cells: ribosomes.

N occurs in plant and animal cells but not in bacteria: endoplasmic reticulum.

O occurs in plant and bacterial cells but not in animal cells: cell wall.

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

34. The sensation of pain and its intensity begins with the peripheral receptors (nociceptors) that are activated by thermal, mechanical, and chemical stimuli. Nociceptors are found in the skin, muscle and viscera. Hyperalgesia refers to an abnormally increased sensitivity to pain, which may be caused by damage to nociceptors or peripheral nerves and can cause hypersensitivity to stimulus. The following graph represents pain intensity as measured against stimulus intensity in two individuals represented by curves P and Q.



Mark the correct statement from the following statements.

(A) Curve P shows early habituation to pain as compared to Q.

(B) Curve Q could be the response in a normal healthy person while curve P could be a victim of platypus venom which is known to cause increased sensitivity to pain.

(C) Curve Q shows increased sensitization to stimulus of the same intensity as compared to that in curve P.

(D) It has been observed that long-term opioid usage for treatment of chronic pain leads to hyperalgesia. This can be observed in curve Q.

Solution · Q34 **Answer: (B)**

Curve P lies to the left of Q, so the same pain intensity is produced by a weaker stimulus. P therefore shows hyperalgesia.

(B) is correct: Q can be a normal person, and P a person made more sensitive by platypus venom.

(A): habituation is a falling response to a repeated stimulus, which this graph does not show.

(C), (D): the more sensitive, hyperalgesic curve is P, not Q.

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

35. The type of parental care for a particular species of fish, bird and mammal is given below;

Species of	Parental care	Mating Type
Fish	Male only	X
Bird	Both male and female	Y
Mammal	Female only	Z

Mating systems X, Y and Z respectively, in these species would most likely be:

(A) Polygyny; promiscuous and polyandry
(B) Monogamy; Polygyny and monogamy
(C) Polyandry; monogamy and polygyny
(D) Polyandry; monogamy and polyandry

Solution · Q35 **Answer: (C)**

Bird, care by both parents: monogamy is most likely (Y).

Mammal, care by the female only: the male is free to mate with several females, which is polygyny (Z).

Fish, care by the male only: the female is free to mate with several males, which is polyandry (X).

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

36. Pulse-chase analysis is a commonly used technique to study proteins in the cell. Cultured cells expressing the protein of interest are allowed to take up radioactively labelled amino acids for a brief interval (pulse) during which all the newly synthesized proteins incorporate the label. In an experiment 3H-leucine was added to a cell culture to label secretory proteins in the cell and radioactivity at different locations in the cell was recorded at 5, 10 and 45 minutes after addition. Which organelles respectively will show maximum radioactivity at these time points respectively?

(A) Golgi apparatus; endoplasmic reticulum and secretory granules
(B) Secretory granules; endoplasmic reticulum and Golgi apparatus
(C) Endoplasmic reticulum; secretory granules and Golgi apparatus
(D) Endoplasmic reticulum; Golgi apparatus and secretory granules

Solution · Q36 **Answer: (D)**

A secretory protein follows this route:

rough endoplasmic reticulum → Golgi apparatus → secretory granules

So the pulse label is maximum in the endoplasmic reticulum at 5 minutes, in the Golgi apparatus at 10 minutes and in secretory granules at 45 minutes.

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

37. Treatment with which type of the following enzymes will be the most effective in digesting the basic framework of the myelin sheath around the axons?

(A) Glycosidase (B) Protease (C) Nuclease (D) Lipase

Solution · Q37 **Answer: (D)**

The myelin sheath is made of many tightly wrapped layers of plasma membrane of Schwann cells or oligodendrocytes, and it is very rich in lipids.

Its basic framework is formed by lipid bilayers, so a lipid-digesting enzyme (lipase) is the most effective.

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

38. Modern vascular plants have evolved organs like the roots, stems and leaves to support terrestrial life. In evolutionary history, structural modifications are products of natural selection, that enable specialized adaptations. Pair the following plants with the plant organs that support an adaptation:

I. *Solanum tuberosum*
II. *Beta vulgaris*
III. *Allium cepa*

i. Root
ii. Shoot

(A) I –ii, II – i, III – ii
(B) I – i, II – ii, III – ii
(C) I – ii, II – ii, III – i
(D) I – i, II – i, III – ii

Solution · Q38 **Answer: (A)**

Solanum tuberosum (potato): the tuber is a modified underground stem (shoot).

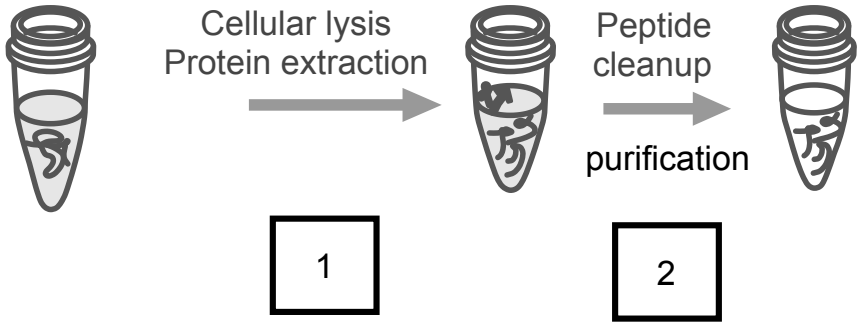
Beta vulgaris (beetroot): the storage organ is a modified tap root.

Allium cepa (onion): the bulb is a modified shoot with a very short stem and fleshy leaf bases.

∴ I – ii, II – i, III – ii.

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

39. The following image shows a sequence of processes involved in the classical solid – liquid extraction of peptides from a cell culture.



Which of the following enzymes is generally used in this process during the step marked 1?

(A) Lipase (B) Trypsin (C) Pepsin (D) Papain

Solution · Q39 **As per Zigyan: (B)**

Peptide cleanup comes after the stage marked 1, so the extracted proteins have to be digested into peptides in that stage.

Trypsin is the protease generally used for this. It cuts peptide bonds on the carboxyl side of lysine and arginine.

A lipase does not break proteins into peptides.

Reference: Mansuri and co-authors, 'Optimal Conditions for Carrying Out Trypsin Digestions on Complex Proteomes: From Bulk Samples to Single Cells', Journal of Proteomics, 2024 (PubMed Central PMC10939724): in bottom-up proteomics, where extracted proteins are digested into peptides, trypsin is the most widely used protease.

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

40. Which among the following statements about chloroplast is **false**?

(A) Proteins found in chloroplast are either encoded by the chloroplast DNA or the nuclear DNA.

(B) Chloroplast genes exhibit Mendelian pattern of inheritance.

(C) Photosystems I and II are spatially separated in the thylakoid membrane of the chloroplast.

(D) Chemiosmotic mechanism converts the energy stored in chemical and electric potential to ATP similar to mitochondria.

Solution · Q40 **Answer: (B)**

Chloroplast genes lie outside the nucleus and are passed on with the cytoplasm, in most flowering plants through the female parent.

So they show non-Mendelian (cytoplasmic) inheritance, and statement (B) is false.

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

41. Which of the following is true for a competitive inhibitor of an enzyme?

(A) The inhibitor increases the stability of enzyme-substrate complex formed.

(B) Maximum reaction velocity cannot be reached even at very high concentration of substrate.

(C) Very high concentration of substrate can relieve inhibition completely.

(D) The inhibitor only binds to the enzyme-substrate complex.

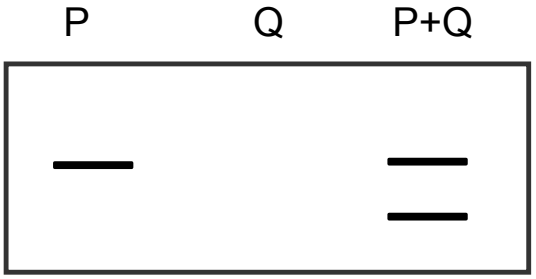
Solution · Q41 **Answer: (C)**

A competitive inhibitor resembles the substrate and competes with it reversibly for the same active site.

At a very high substrate concentration, the substrate outcompetes the inhibitor, so V_{max} is still reached.

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

42. P and Q are the two nuclear proteins that are required for activating transcription of gene Y. Individually neither of the two is sufficient to activate the transcription of the gene Y. The upstream DNA sequence of gene Y was used to study the DNA binding properties of purified P and Q proteins separately as well as in combination. The bound fractions were eluted and confirmed by Western blotting (shown below) using antibodies against P and Q.



From the above which of the following statements are true?

(i) Only P can bind to upstream DNA of gene Y

(ii) P and Q both can bind to upstream DNA of gene Y

(iii) Q activates transcription once it is recruited to upstream DNA of gene Y by P

(iv) P is likely to activate the transcription of gene Y

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

Solution · Q42 **Answer: (C)**

Lane P has a band and lane Q is empty, so only P binds the DNA on its own. (i) is true.

In lane P+Q both proteins are retained, so P brings Q to the upstream DNA of gene Y.

P alone cannot activate the gene, so (iv) is false. Transcription follows only after P recruits Q, as in (iii).

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

43. Following table depicts the carbon transport and decarboxylation in C_4 plant species. Fill in the blanks with the correct options for P, Q and R.

C_4 acid transported to bundle sheath cells	**C_3 acid transported to mesophyll cells**	**Decarboxylase**
Malate	------P-------	NADP + malic enzyme
------Q-------	Alanine	NAD + malic enzyme
Aspartate	------R-------	PEP carboxykinase

(A) P: Pyruvate Q: Aspartate R: Pyruvate

(B) P: Pyruvate Q: Malate R: Alanine

(C) P: Aspartate Q: Pyruvate R: Malate

(D) P: Aspartate Q: Aspartate R: Phosphoenol pyruvate

Solution · Q43 **Answer: (A)**

In the NADP-malic enzyme type, malate goes to the bundle sheath and pyruvate returns to the mesophyll.

∴ P is pyruvate.

In the NAD-malic enzyme type, aspartate goes to the bundle sheath and alanine returns.

∴ Q is aspartate.

Only option (A) has both.

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

44. When two species of Monkey Flower plant (X and Y) were studied, following data was obtained:

Species	Nectar volume (µl)	Seeds per flower	Weight of horizontal shoots (stolons) that develop into roots
X: *Mimulus eastwoodiae*	4.94	25	0.49
Y: *Mimulus cardinalis*	50	280	0.07

Which of the following statements about plant X and / or Y is correct?

(A) Plant X allocates more resources towards shoot growth as compared to plant Y.

(B) Plant X allocates its resources to asexual reproduction more than plant Y.

(C) Species X is likely to be native in habitat with abundant water availability.

(D) Root to shoot growth ratio of both plants show inverse relationship.

Solution · Q44 **Answer: (B)**

X has less nectar (4.94 µl against 50 µl) and fewer seeds per flower (25 against 280), so it spends less on sexual reproduction.

X has a much greater weight of rooting stolons (0.49 against 0.07). These stolons give new plants asexually.

∴ X allocates more to asexual reproduction than Y.

The data do not give total shoot growth, root to shoot ratio or water availability.

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

45. Few characteristics of a particular animal behaviour are listed below:

- Performed without learning
- Are stereotypic
- Cannot be modified by learning

Which type of behaviour from the following do these indicate?

(A) Operant conditioning

(B) Habituation

(C) Classical Conditioning

(D) Fixed action pattern

Solution · Q45 **Answer: (D)**

An inborn, stereotyped behaviour that needs no learning and is not changed by learning is a fixed action pattern.

Habituation and both types of conditioning are forms of learning.

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

46. Read the following observations made in the experiments done to investigate whether DNA or protein is the genetic material:

i. ^{35}S labelled T_2 phages were adsorbed onto bacterial host cells. Upon thorough mixing bacterial cells and phage ghosts were separated. The radioactivity was recorded only in phage-ghosts and not in bacterial host cells.

ii. ^{32}P labelled T_2 phages were adsorbed onto bacterial host. Upon thorough mixing bacterial cells and phage ghosts were separated. The bacterial host cells exhibited radioactivity.

iii. Purified DNA of ϕ174 bacteriophage can successfully infect bacterial protoplasts and produce parental phage progeny.

Which of the observations confirm that DNA and not protein propagates genetic information?

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

Solution · Q46 **Answer: (D)**

(i) ^{35}S labels protein. It stays with the phage ghosts, so the protein coat does not enter the host.

(ii) ^{32}P labels DNA. It is found in the host cells, so DNA enters them.

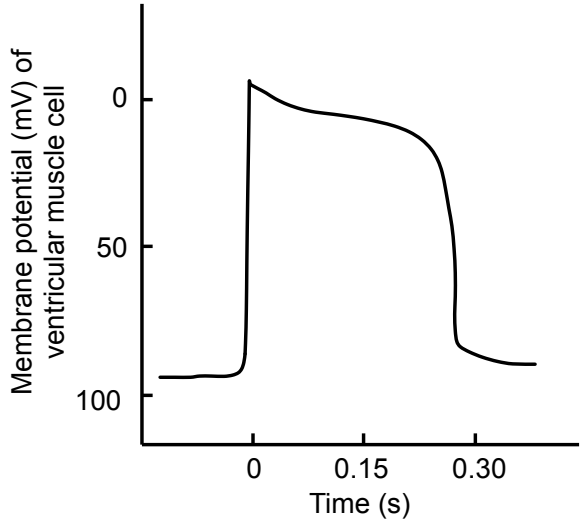
(iii) Purified phage DNA alone infects protoplasts and gives parental phages, so DNA by itself carries the genetic information.

∴ all three show that DNA, not protein, is the genetic material.

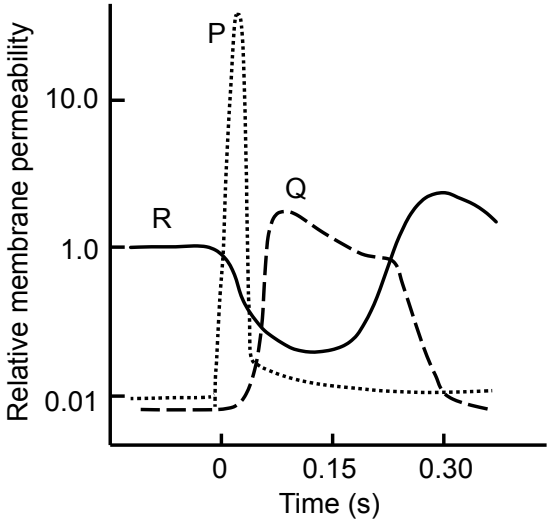
IAPT answer: (D) | **Zigyan answer:** (D)

47. The changes in membrane potential of ventricular muscle cell are depicted in graph I. These changes result from the activity of the various ion channels involved in nerve conduction as represented in a corresponding graph II.

Graph I



Graph II



P, Q and R in graph II respectively correspond to:

(A) K^+ channels; Na^+ channels and Ca^{2+} channels

(B) K^+ channels; Ca^{2+} channels and Na^+ channels

(C) Na^+ channels; K^+ channels and Ca^{2+} channels

(D) Na^+ channels; Ca^+ channels and K^+ channels

Solution · Q47 **As per Zigyan: (D)**

Graph I values stand for 0, −50 and −100 mV. The lowest mark of graph II corresponds to 0.1, and Ca^+ in (D) means Ca^{2+}.

P shoots up with the rapid upstroke and falls at once: Na^+ channels.

Q stays high during the plateau and falls as it ends: Ca^{2+} channels.

R is high at rest, low during early depolarisation and the plateau, and high again at repolarisation: K^+ channels.

Reference: OpenStax, Anatomy and Physiology 2e, section 19.2 'Cardiac Muscle and Electrical Activity': ventricular contractile cells rest near −90 mV; sodium entry causes rapid depolarisation; slow calcium channels open in the plateau while few potassium channels are open; calcium channels then close and potassium channels open for repolarisation.

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

48. An enzyme "M" has a low Km value relative to the physiological concentration of its substrate. Another enzyme "N" has a high Km value relative to the physiological concentration of its substrate. In the normal physiological condition, and substrate concentrations within the physiological range, which of the following statement is correct?

(A) The activity of "M" will vary as the concentration of substrate varies, and the rate of formation of product will depend on the availability of substrate.

(B) Enzyme "M" will act at a more or less constant rate, regardless of variations in the concentration of substrate.

(C) Enzyme "M" will not be normally saturated with the substrate.

(D) Enzyme "N" will act at a more or less constant rate, regardless of variations in the concentration of substrate.

Solution · Q48 **Answer: (B)**

For M, in the physiological range:

$[S] \gg K_m$

$\Rightarrow$ M stays nearly saturated and works close to V_{max}, so a change in substrate concentration hardly changes its rate.

For N:

$[S] \ll K_m$

$\Rightarrow$ the rate of N rises and falls with the substrate concentration.

IAPT 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. In Bioinformatics, transcriptome is identified as the complete set of mRNA transcripts produced by the genome at any one time. Which of the following statements are correct?

(A) Transcriptomes are made up of the complementary regions of both intron and exon portions of the transcribed DNA

(B) Transcriptomes reflect the genes that are being actively expressed at any given time in the cell.

(C) Transcriptome shows the conserved regulatory sequences of genes in active physiological state of a secretory cell.

(D) Transcriptome varies considerably in different cells due to different patterns of gene expression.

Solution · Q49 **Answer: (B), (D)**

(A) Splicing removes introns, so mRNA does not carry intron regions. ∴ false.

(B) Only genes being expressed at that time give mRNA. ∴ true.

(C) Control sequences such as promoters and enhancers are not part of mRNA. ∴ false.

(D) Different cells express different sets of genes. ∴ true.

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

50. Octopuses and Horseshoe crabs have blue blood because the protein transporting oxygen in their blood, hemocyanin, contains copper, instead of iron, making their blood appear blue rather than red. It is also seen in invertebrates living in habitats with very low temperature. Select the correct statement from the following.

(A) Hemocyanin binds more oxygen molecules than haemoglobin and is found freely floating in blood.

(B) Hemocyanin binds less oxygen molecules than haemoglobin and is found in the haemocytes.

(C) Hemocyanin is more thermostable than haemoglobin and is bigger in size than haemoglobin

(D) Hemocyanin is less thermostable than haemoglobin and is smaller in size than haemoglobin

Solution · Q50 **Answer: (A), (C)**

Haemocyanin is a very large, multi-subunit copper protein dissolved in the haemolymph.

One such molecule can bind many more O_2 molecules than haemoglobin, which binds four.

∴ (A) is true and (B) is false.

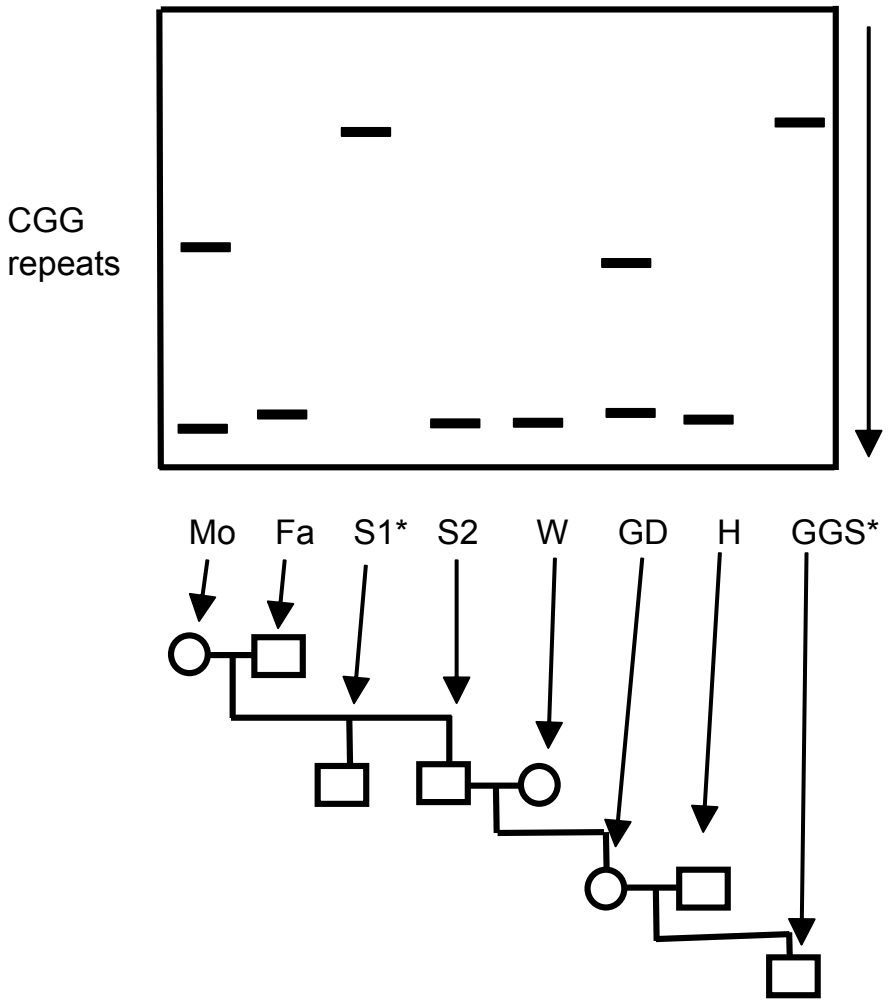
Haemocyanin is also bigger than haemoglobin and more resistant to heat.

∴ (C) is true and (D) is false.

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

51. Fragile X Syndrome (FXS) is a X-linked genetic disorder in which CGG base triplet number is abnormal as compared to normal healthy individual. The carriers have intermediate copy number of CGG repeats. The presence of CGG region is responsible for inactivation of protein required in brain and neural development.

Gel pattern of CGG repeats along with the family pedigree is shown below. * indicates persons affected with FXS.



Which of the following statements are correct?

(A) CGG repeat number is found highest in diseased person.

(B) CGG repeat number remains stable when passed through sperm.

(C) The FXS trait is X-linked recessive.

(D) Individual S2 is a carrier for the disease and will transmit the disease to next generation.

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

The arrow shows the direction of migration, so a band nearer the top has more CGG repeats.

(A) The affected persons S1 and GGS have the highest bands. ∴ true.

(B) The long allele appears in S1 and GGS, each born to a mother with an intermediate band. A man's premutation does not expand to a full mutation. ∴ true.

(C) FXS is X-linked dominant; women with only the intermediate allele here are unaffected carriers. ∴ false.

(D) S2 shows only the short normal band, so he is not a carrier. ∴ false.

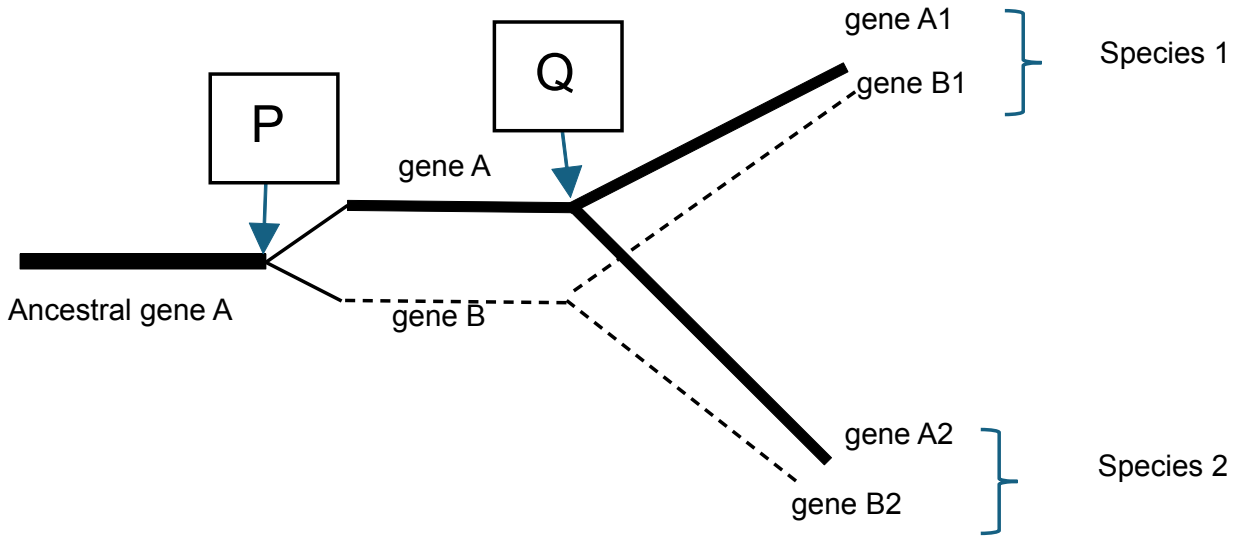
In the printed gel, the intermediate band of GD is seen in neither S2 nor W; (D) rests on the lane of S2.

Reference: NCERT Biology Class XII, Chapter 9 'Biotechnology : Principles and Processes', section 9.2.1: in gel electrophoresis, a smaller DNA fragment moves farther.

Reference: MedlinePlus Genetics (U.S. National Library of Medicine), 'Fragile X syndrome': inheritance is X-linked dominant; a premutation can expand beyond 200 repeats when passed on by a woman, but not by a man.

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

52. An organism's evolutionary history is documented in its genome. Evolution of ancestral gene A is shown in the figure below. Genes A1 and A2 are called orthologues while genes A1 and B1 are called paralogues.



Which of the following statements are true?

(A) P and Q respectively indicate speciation and duplication events.

(B) Hemoglobin and myoglobin are examples of paralogous genes.

(C) Paralogous genes are likely to provide chance to evolve novel functions in an organism.

(D) Polypoidy observed in plants is an example of event P.

Solution · Q52 **Answer: (B), (C), (D)**

At P, one gene gives two copies, gene A and gene B, in the same line of descent: gene duplication.

At Q, the line splits into Species 1 and Species 2: speciation.

∴ (A) is false.

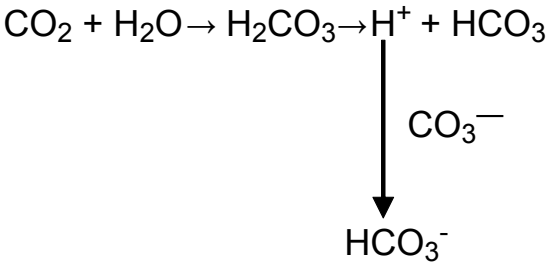
(B) Haemoglobin and myoglobin genes arose by duplication of an ancestral globin gene. ∴ true.

(C) One copy keeps the old function while the other is free to mutate and gain a new one. ∴ true.

(D) Polyploidy copies whole chromosome sets, so genes are duplicated, as at P. ∴ true.

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

53. Study the following reaction:



The reaction indicates:

(A) Alveolar hyperventilation

(B) Oceanic acidification

(C) Calcium depletion of coral reefs.

(D) Increased photosynthesis of oceanic algae.

Solution · Q53 **Answer: (B), (C)**

Carbon dioxide dissolved in sea water releases hydrogen ions:

$CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^-$

These ions then use up carbonate ions:

$H^+ + CO_3^{2-} \rightarrow HCO_3^-$

The rise in acidity is ocean acidification. ∴ (B) is true.

With less carbonate, corals cannot build calcium carbonate well, and reefs lose it. ∴ (C) is true.

Hyperventilation lowers blood carbon dioxide, and more algal photosynthesis removes carbon dioxide. ∴ (A) and (D) are false.

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

54. A scientist found a brown cat with ears having an unusual curl. In order to find if this trait is dominant or recessive, she mated the cat with a random cat of the same species with uncurled ears. The mating resulted in all offsprings with non-curled ears. Which of the following can be deduced from this?

(A) The assumption for curled ear trait to be dominant is justified by the results.

(B) The assumption that the curled ear trait is recessive would have got justified only if the offspring showed 1:1 ratio of both phenotypes.

(C) The assumption for curled ear trait to be recessive is justified by the results.

(D) The results confirm that the randomly chosen cat is true breeding.

Solution · Q54 **Answer: (C), (D)**

If curled is dominant, the curled cat must be Cc, since CC would give only curled kittens.

Cc × cc → 1 curled : 1 non-curled

The result does not fit this. ∴ (A) is false.

If curled is recessive:

aa × AA → all Aa (non-curled)

This fits the result without any 1 : 1 ratio. ∴ (B) is false and (C) is true.

As in a test cross, only the dominant form among the offspring shows that the non-curled parent is AA.

It is therefore true breeding. ∴ (D) is true.

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

55. Considering Meiosis II as an independent event, which one of the following phenomena makes Meiosis II different from Mitotic division?

i. Sister chromatids are held together by protein complex called cohesins in metaphase-II only.

ii. Daughter cells may have sister chromatids with different genetic composition.

iii. In meiosis II, chromosome number of daughter cells remains unchanged.

iv. DNA replication does not take place before prophase II.

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

Solution · Q55 **Answer: (C)**

(i) Cohesins hold sister chromatids in mitotic metaphase too. ∴ wrong.

(ii) After crossing over in meiosis I, sister chromatids can differ genetically. ∴ a difference.

(iii) Chromosome number is unchanged in mitosis also. ∴ not a difference.

(iv) Mitosis follows an S phase, but there is no DNA replication just before prophase II. ∴ a difference.

So only ii and iv.

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

56. A few processes that occur in a cell are listed below.

(i) Cholesterol uptake

(ii) Chemiosmotic generation of ATP

(iii) Movement of oxygen into cells

(iv) Movement of glucose into cells

(v) Secretion of mucous

Which of the following statements regarding these processes are true?

(A) (i) and (ii) are active processes while (iii), (iv) and (v) are passive processes.

(B) (i) occurs by carrier-mediated endocytosis while (v) occurs by exocytosis.

(C) (iii) and (v) occur by direct passage through the membrane.

(D) A membrane protein is involved in the processes (ii) and (iv).

Solution · Q56 **Answer: (B), (D)**

(A) Secretion of mucus is exocytosis, which needs energy. ∴ false.

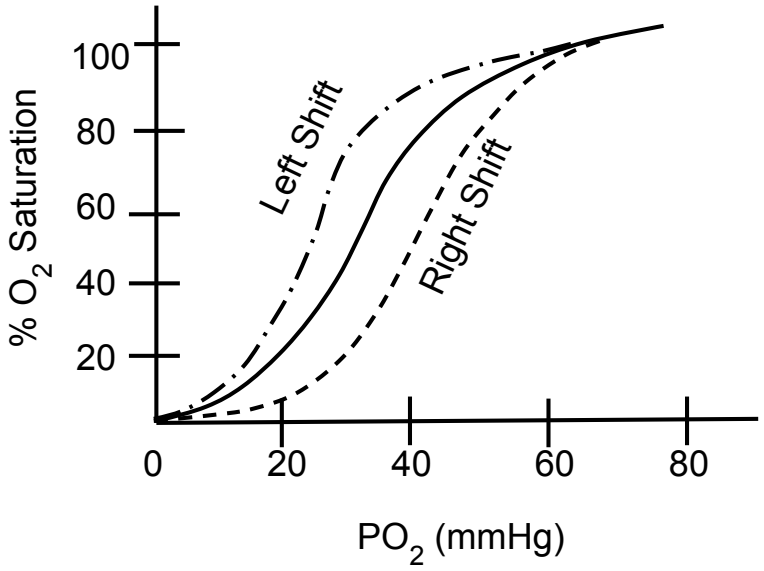
(B) Cholesterol enters on its carrier LDL by receptor-mediated endocytosis; mucus leaves by exocytosis. ∴ true.

(C) Oxygen diffuses straight through the lipid bilayer, but mucus leaves in vesicles. ∴ false.

(D) ATP synthase works in (ii) and glucose transporter proteins in (iv). ∴ true.

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

57. Approximately 97% of the total oxygen is transported as haemoglobin-bound O_2. Our body tries to maintain PO_2 in the blood and therefore oxygen delivery to tissues differs based on different physiological situations. The picture shows a O_2-dissociation curve (solid line). The curve shifts to right or left at different physiological conditions.



Based on the graph, indicate which of the following statements are true.

(A) At high altitude O_2 dissociation curve will exhibit a left shift.

(B) In Methemoglobinemia, where methaemoglobin (Fe^{3+} in heme) is higher than normal, a right shift of the normal curve is observed.

(C) During exercise, elevated level of CO_2 in the muscles needs to be removed. In this case, the normal graph will shift to the right.

(D) In foetus, higher O_2 affinity of haemoglobin will cause a left shift of the curve.

Solution · Q57 **Answer: (C), (D)**

(A) At high altitude, red cells make more 2,3-BPG, which lowers oxygen affinity and shifts the curve right. ∴ false.

(B) Ferric haem cannot bind oxygen, and the remaining ferrous haems hold it more tightly: left shift. ∴ false.

(C) More carbon dioxide and hydrogen ions lower oxygen affinity (Bohr effect): right shift. ∴ true.

(D) Higher affinity of foetal haemoglobin gives a left shift. ∴ true.

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

58. Cortisol is a glucocorticoid hormone secreted in the blood whenever there is any kind of stress or 'fight or flight' situation. Which of the following is/are correct about this hormone?

(A) It is likely to follow circadian rhythm.

(B) It is likely to stimulate body carbohydrate and fat metabolism.

(C) It is likely to reduce the blood pressure.

(D) It is likely to induce immune system to mount greater response.

Solution · Q58 **Answer: (A), (B)**

(A) Cortisol secretion has a daily rhythm, with a peak in the early morning. ∴ true.

(B) It stimulates gluconeogenesis, lipolysis and proteolysis. ∴ true.

(C) It helps to maintain the cardiovascular system and tends to raise blood pressure, not lower it. ∴ false.

(D) It is anti-inflammatory and suppresses the immune response. ∴ false.

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

59. Lettuce seeds are known to germinate if exposed to a brief period of light. Plant physiologists carried out experiments to study the effects of repeated alternating flashes of red light (R) for 01 minute and far-red light (FR) for 4 minutes on the germination of lettuce seeds. The results of four experiments (1 – 4) are tabulated below.

Experiment	Treatment	Observations
1	R	Most germinate
2	R – FR	Few germinate
3	R – FR – R – FR – R – FR - R	Most germinate
4	R – FR – R – FR – R – FR – R – FR	Few germinate

Based on the results obtained, mark the correct statement(s) from the following:

(A) Red light and far-red light reverse each other's effects.

(B) Dormancy in experiment 4 could be overcome if the sequence had 4 periods of red light preceding the last far-red period.

(C) The ratio of 1:4 minutes of R:FR is required to ensure germination.

(D) The final exposure determines the germination response.

Solution · Q59 **Answer: (A), (D)**

Red light turns phytochrome into the active Pfr form; far-red light turns Pfr back into Pr.

(A) Each light cancels the effect of the other. ∴ true.

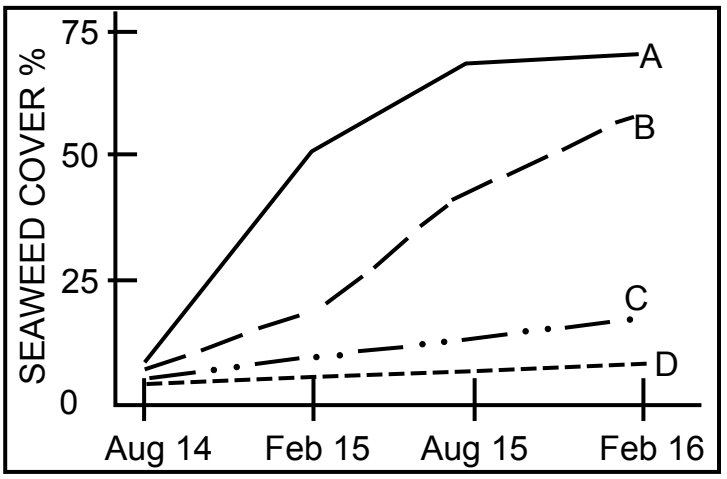
(B) Experiment 4 already has four red periods before the last far-red one, and it still ends in far-red. ∴ false.

(C) Red light alone gives germination, so no such ratio is needed. ∴ false.

(D) A last flash of red gives germination; a last flash of far-red does not give much. ∴ true.

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

60. An experiment was carried out to understand animal interactions and community structure in an inter-tidal habitat. Four experimental plots were created: (A) Both Sea urchin and Limpets are removed, (B) Only Sea urchins are removed, (C) Only Limpets are removed and (D) None is removed (Control). The % seaweed cover recorded over the experimental period lasting several months is depicted below;



Which of the following observations are correct?

(A) Seaweed growth was equally regulated by grazing of limpets and sea urchin.

(B) Limpets had least impact on the seaweed growth.

(C) Sea urchins have higher grazing potential as compared to limpets.

(D) In this community, sea urchins are regulators of the seaweed growth.

Solution · Q60 **Answer: (B), (C), (D)**

Final seaweed cover is highest in A, then B, while C stays close to the control D.

(A) B is far above C, so the two grazers do not act equally. ∴ false.

(B) Removing only limpets changes the cover very little. ∴ true.

(C) Removing only sea urchins raises the cover much more, so urchins graze more. ∴ true.

(D) Sea urchins mainly control seaweed growth in this community. ∴ true.

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

ANSWER KEY

NSEB 2024 · PAPER CODE 21

60
QUESTIONS · 216 MARKS

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

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

★ Answers as per Zigyan

- **Q6** — As per Zigyan: (B); IAPT key (B).
- **Q13** — As per Zigyan: (A); IAPT key (A).
- **Q15** — As per Zigyan: (D); IAPT key (D).
- **Q22** — As per Zigyan: (A); IAPT key (A).
- **Q39** — As per Zigyan: (B); IAPT key (B).
- **Q47** — As per Zigyan: (D); IAPT key (D).
- **Q51** — As per Zigyan: (A), (B); IAPT key (A), (B).

zigyan

OLYMPIADS · 2026

Olympiad results



TOP ACHIEVEMENT · CHEMISTRY

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

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

Qualified twice | HBCSE selection camp | Only student from Faridabad

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

CHEMISTRY · ABOVE MAS



Sulokya Bibhuty
Class XII
3 Years Classroom
Above MAS



Anay Gupta
Class XI
3 Years Classroom
Above MAS



Akshat Khator
Class XI
3 Years Classroom
Above MAS



Harshit Goyal
Class XII
4 Years Classroom
Above MAS



Hardik Sharma
Class XI
3 Years Classroom
Above MAS



Aarush Kumar
Class XII
1 Year Classroom
Above MAS

PHYSICS · ASTRONOMY · MATHEMATICS

PHYSICS



Sulokya Bibhuty
Class XII
3 Years Classroom
Above MAS

PHYSICS



Saksham Bishnoi
Class XII
4 Years Classroom
Above MAS

ASTRONOMY



Sulokya Bibhuty
Class XI
3 Years Classroom
Above MAS

MATHEMATICS · IOQM



Priyanshi
Class XI
4 Years Classroom
IOQM Qualifier

OLYMPIADS WE PREPARE STUDENTS FOR

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

The olympiad pathway starts in Class 8.

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

Zigyan Eduvision Pvt. Ltd. · SCO No. 107, Sector 16, Faridabad 121002
0129-4048800 · +91 92115 38800 · info@zigyan.com

zigyan

RESULTS · 2021 – 2026

Our toppers, year by year

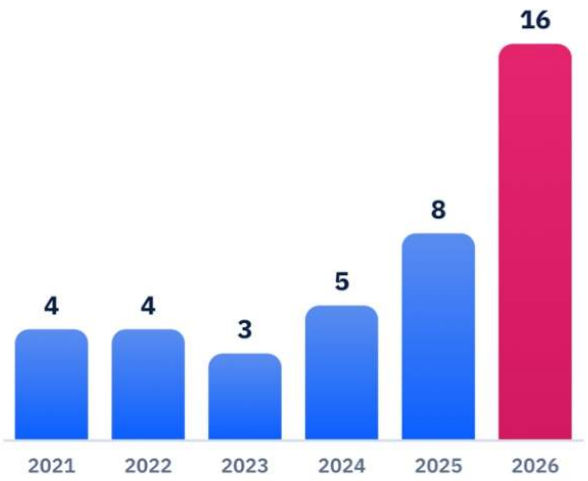
40
JEE Advanced selections in 6 years

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.

Zigyan Eduvision Pvt. Ltd. · SCO No. 107, Sector 16, Faridabad 121002
0129-4048800 · +91 92115 38800 · info@zigyan.com