zigyan

PREVIOUS YEAR PAPER · 2022

OLYMPIAD · STAGE I

NSEJS

National Standard Examination in Junior Science

2022

Question paper, answer key and Zigyan solutions

60	216	120 min	51
Questions	Maximum marks	Time	Paper code

Question paper and official answer key: Indian Association of Physics Teachers (IAPT), NSEJS 2022, paper code 51.
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

Given in the question paper

Constants you may need….

Mass of electron $m_e = 9.10 \times 10^{-31}$ kg

Mass of proton $m_p = 1.67 \times 10^{-27}$ kg

Acceleration due to gravity $g = 9.8\ ms^{-2}$

Universal gravitational constant $G = 6.67 \times 10^{-11}\ Nm^2Kg^{-2}$

Universal gas constant $R = 8.31\ Jmol^{-1}\ K^{-1}$

Boltzmann constant $k = 1.38 \times 10^{-23}\ JK^{-1}$

Avogadro's constant $A = 6.02 \times 10^{23}\ mol^{-1}$

Speed of light in free space $c = 3.0 \times 10^{8}\ ms^{-1}$

Magnitude of charge on electron $e = 1.60 \times 10^{-19}$ C

Planck's constant $h = 6.625 \times 10^{-34}$ Js

Density of water at $\rho = 1.0 \times 10^{3}\ kgm^{-3}$

$(1 + x)^n \approx 1 + nx$, if $|x| << 1$

$1eV = 1.6 \times 10^{-19}$ J

$\sin(A–B) = \sin A \cos B - \cos A \sin B$

$E = mc^2$, It's an equation which gives mass and energy equivalence.

One unit of electric power = 1kWh

PART A-1 · ONE CORRECT OPTION

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

1. In nineteenth century, farmers in Japan found that some seedlings of rice became very tall. They called it 'Bakane Disease' or mad seedling disease. All these mad plants were found to be infected by a fungus, *Fusarium moniliforme*. This led to the discovery of a phytohormone, later named:

(A) Vernalin (B) Auxin (C) Florigen (D) Gibberellin

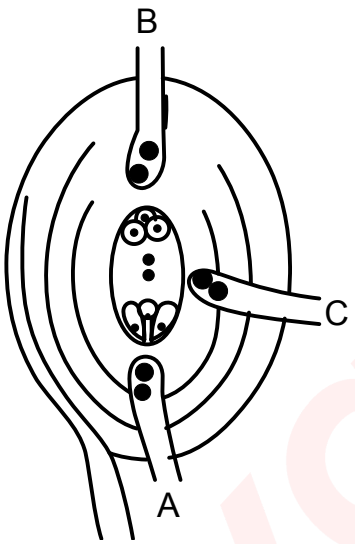
Solution · Q1 **Answer: (D)**

The Bakane fungus gives out a substance that makes rice seedlings grow very tall.

This phytohormone was named gibberellin, after the fungus *Gibberella*.

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

2. In most angiosperms, when the ovule is mature, the pollen germinates on stigma, travels through style and ultimately enters the ovule. In the adjacent diagram, three possibilities of pollen tube entry are shown. What do A, B and C represent?



(A) A- Mesogamy, B- Chalazogamy & C- Porogamy

(B) A- Porogamy , B-Chalazogamy & C- Mesogamy

(C) A- Chalazogamy, B- Mesogamy & C- Porogamy

(D) A & B – Porogamy, C-Chalazogamy

Solution · Q2 **Answer: (B)**

The egg apparatus lies at the end near A, so this is the micropylar end.

A enters through the micropyle: porogamy.

B enters through the chalaza at the opposite end: chalazogamy.

C enters from the side through the integuments: mesogamy.

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

3. It is a common observation that members of Cucurbitaceae, like bottle- gourd, pumpkin, watermelon, musk melon, etc. have large fruits while their stems are usually not more than a finger thick. What helps so much food to be translocated from leaves to the fruits for storage?

(A) Intraxylary phloem

(B) Sieve-tubes with companion cells

(C) Bicollateral vascular bundles

(D) Trichomes on internodes

Solution · Q3 **Answer: (C)**

Cucurbitaceae stems have bicollateral vascular bundles, with phloem on both the outer and the inner side of the xylem.

The two phloem strands in each bundle help to carry a large amount of food to the fruits.

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

4. In some birds, black plumage gene is dominant over white plumage gene. One black bird was mated with white feathered bird. It resulted in all chicks with blue plumage. Selfing among these blue birds would result in:

(A) 1 black : 1 white : 2 blue
(B) 9 blue : 3 black : 3 white
(C) 1 blue : 1 black : 1 white
(D) 3 blue : 1 white

Solution · Q4 **As per Zigyan: (A)**

All F_1 chicks are blue, unlike both parents. So black and white show incomplete dominance here, not complete dominance.

Take black as BB, white as WW and blue as BW.

Selfing of blue birds:

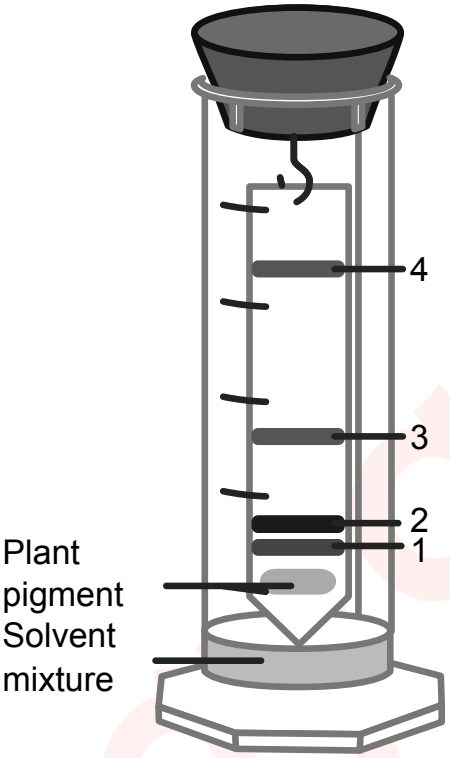
BW × BW → 1 BB : 2 BW : 1 WW

So the result is 1 black : 2 blue : 1 white.

Reference: NCERT Biology Class XII, Chapter 4 'Principles of Inheritance and Variation', section 4.2.2.1 (Incomplete Dominance): an F_1 lying between its two parents shows incomplete dominance. In snapdragon, selfing the pink F_1 gives 1 red : 2 pink : 1 white.

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

5. The adjacent diagram shows chromatographic separation of plant pigments, extracted from spinach leaves. The sequence of pigment bands from below upwards is:



(A) Chlorophyll b, Chlorophyll a, Carotenols & Carotenes
(B) Carotenes, Carotenols, Chlorophyll a & Chlorophyll b
(C) Chlorophyll a, Chlorophyll b, Carotenes & Carotenols
(D) Carotenols, Phycobilins, Chlorophyll a & Chlorophyll b

Solution · Q5 **Answer: (A)**

On a chromatogram of leaf pigments, the bands from below upwards are:

1: chlorophyll b

2: chlorophyll a

3: carotenols (xanthophylls)

4: carotenes, which move the farthest with the solvent.

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

6. In some plants and fungi, some cell organelles are found which convert lipids to sugar in early stages of oil seed's germination. What are these?

(A) Glyoxysomes (B) Lysosomes (C) Ribosomes (D) Liposomes

Solution · Q6 **Answer: (A)**

Glyoxysomes are microbodies that carry out the glyoxylate cycle.

In germinating oil seeds, they help to change stored fats into sugar.

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

7. In the analysis of waste water, *Escherichia coli* is used as:

(A) A standard organism for performing a plate count

(B) An indicator of fecal contamination of water

(C) An indicator of the number of N_2 fixing bacteria in water

(D) A measure of the amino acid content of water

Solution · Q7 **Answer: (B)**

E. coli normally lives in the intestine of humans and other warm-blooded animals and comes out with faeces.

So its presence in water shows faecal contamination.

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

8. Acid rain damages soil and lakes. Its high level depositions have damaged high altitude forests since being encircled by acidic fogs and clouds. It also affects aquatic plants and animals. Which pH range is most suitable for the survival of aquatic biota?

(A) 4.5 – 5.8 (B) 6.5 – 7.5 (C) 7.5 – 8.5 (D) Above 9.0

Solution · Q8 **Answer: (B)**

Most aquatic organisms do best in water that is close to neutral.

Acidic water (pH 4.5 to 5.8) and strongly alkaline water (pH above 9.0) harm them.

The most suitable range among the options is pH 6.5 to 7.5.

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

9. Steroid hormones include sex hormones and hormones from adrenal cortex. Based on the intensity of action which of the following ovarian hormones is produced in large amount ?

(A) Estrone (B) Estriol (C) Estradiol (D) Estrane

Solution · Q9 **Answer: (C)**

Estradiol is the main estrogen made by the ovaries during the reproductive years.

It is also the most potent estrogen, stronger in action than estrone and estriol.

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

10. In the vertebrae column of man, there are about 26 vertebrae. Which of the following vertebrae is related with the pelvis region?

(A) Lumbar (B) Coccygeal (C) Sacral (D) Cervical

Solution · Q10 **Answer: (C)**

The sacral vertebrae are fused to form the sacrum.

The sacrum joins the two hip bones and forms the back wall of the pelvis.

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

11. In the following EMP pathway, enzymes catalyzing the reactions are numbered E_1 to E_{10}. At which enzyme levels, ATPs are generated at substrate level?

Glucose $\xrightarrow{E1}$ Glocose-6-phosphate $\xrightarrow{E2}$ Fructose-6-phosphate $\xrightarrow{E3}$ Fructose1, 6 Diphosphate $\xrightarrow{E4}$

Dihydroxyacetone Phos. $\xrightarrow{E5}$ 3 Phosphoglyceraldehyde $\xrightarrow{E6}$ 1, 3 Diphosphoglyceraldehyde $\xrightarrow{E7}$

3 Phosphoglyceric Acid $\xrightarrow{E8}$ 2 Phosphoglyceric Acid $\xrightarrow{E9}$ Phosphoenol Pyruvic Acid $\xrightarrow{E10}$

Pyruvic Acid.

(A) E1 and E3 (B) E3 and E6 (C) E7 and E10 (D) E6 and E10

Solution · Q11 **As per Zigyan: (C)**

The compound acted upon at E_7 is 1,3-bisphosphoglyceric acid, printed in the pathway as 1, 3 Diphosphoglyceraldehyde.

At substrate level, a phosphate group passes directly from the substrate to ADP.

At E_7 (phosphoglycerate kinase):

1,3-bisphosphoglyceric acid + ADP → 3-phosphoglyceric acid + ATP

At E_{10} (pyruvate kinase):

phosphoenolpyruvic acid + ADP → pyruvic acid + ATP

Reference: NCERT Biology Class XI, Chapter 12 'Respiration in Plants', section 12.2 Glycolysis: ATP is formed when 1,3-bisphosphoglycerate (BPGA) changes to 3-phosphoglyceric acid, and again when PEP changes to pyruvic acid.

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

12. A thick whitish band of semicircular nerve fibres is found bulging upon the inner surface of the dorsal wall of each cerebral hemisphere of mammalian brain. Choose the name of this structure from the following:

(A) Corpus albicans (B) Corpus luteum (C) Corpus striatum (D) Corpus callosum

Solution · Q12 **Answer: (D)**

The corpus callosum is a thick, curved band of white nerve fibres.

It connects the two cerebral hemispheres of the mammalian brain.

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

13. In animal classification, symmetry of body is a diagnostic feature. Besides truly bilateral symmetrical animals, exceptionally some other animals also exhibit bilateral symmetry. Which of the following is an example of such animals?

(A) *Giardia* (B) *Cliona* (C) *Obelia* (D) *Trypanosoma*

Solution · Q13 **Answer: (A)**

Giardia is a flagellated protozoan with a bilaterally symmetrical body and two similar nuclei, one on each side.

Cliona (a sponge) and *Trypanosoma* are asymmetrical, while *Obelia* (a cnidarian) is radially symmetrical.

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

14. Nissl's granules are in fact RNA bodies. In which of the following do they occur?

(A) Osteon (B) Chondrion (C) Neurons (D) Myocytes

Solution · Q14 **Answer: (C)**

Nissl's granules are clusters of rough endoplasmic reticulum and ribosomes, so they are rich in RNA.

They are found in the cell body (cyton) and dendrites of neurons.

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

15. One of the following statements is not applicable to viruses:

(A) The protein capsid of the virus does not enter the host cell

(B) The genetic material is either DNA or RNA, never both

(C) The virion replicates autonomously outside the host

(D) The virus replicates in a bacterial or other host cell

Solution · Q15 **Answer: (C)**

A virion is inactive outside a living cell, as it has no machinery of its own to make new proteins or nucleic acid.

It multiplies only inside a host cell, so statement (C) is not applicable to viruses.

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

16. Carolus Linnaeus, a Swedish botanist is credited with Binomial Nomenclature of plants and animals. While using binomials, he devised a system of classification of plants. His classification is:

(A) Artificial (B) Natural (C) Phylogenetic (D) Cladistic

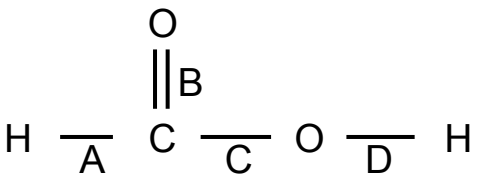
Solution · Q16 **Answer: (A)**

Linnaeus grouped plants on the basis of a few characters, mainly the androecium (his sexual system).

A classification based on only a few characters is an artificial system.

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

17. Which bond will break when following compound is dissolved in water?



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

Solution · Q17 **Answer: (D)**

The compound is formic acid, HCOOH.

In water, the polar O–H bond breaks and a proton is transferred to a water molecule.

$HCOOH + H_2O \rightleftharpoons HCOO^- + H_3O^+$

The O–H bond is marked D.

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

18. If the number of compounds formed by H, C, Cl and Co are N_1, N_2, N_3, N_4 respectively, then correct order is

(A) $N_1 > N_2 > N_3 > N_4$ (B) $N_1 > N_2 > N_4 > N_3$

(C) $N_2 > N_1 > N_4 > N_3$ (D) $N_2 > N_4 > N_3 > N_1$

Solution · Q18 **As per Zigyan: (A)**

Hydrogen is present in water, acids and almost all organic compounds, so it forms the largest number of compounds.

Carbon is very close behind it, due to catenation and tetravalency.

Chlorine combines with most elements and also replaces hydrogen in a huge number of organic compounds.

Cobalt, a single transition metal, forms far fewer compounds than chlorine.

$$\therefore N_1 > N_2 > N_3 > N_4$$

Why Zigyan differs from IAPT: IAPT's order places cobalt above chlorine, but chlorine compounds outnumber cobalt compounds many times over, and only option (A) has N_3 greater than N_4.

Reference: PubChem Compound database of the U.S. National Library of Medicine, element search on 28 November 2026: records containing H number about 124.93 million, C about 124.85 million, Cℓ about 22 million and Co about 46 thousand.

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

19. Heaviest nuclide which does not show radioactive nature is:

(A) Bismuth (B) Lead (C) Technetium (D) Neptunium

Solution · Q19 **Answer: (B)**

Technetium and neptunium have no stable isotope.

^{209}Bi, once taken as stable, is very weakly α-radioactive, with a half-life of the order of 10^{19} years.

So the heaviest non-radioactive nuclide is an isotope of lead:

$^{208}_{82}Pb$

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

20. 1 kg of aqueous urea solution (mole fraction of solute = 0.2) is diluted to 5 kg. Mole fraction of solute in diluted solution is:

(A) 0.2 (B) 4×10^{-2} (C) 0.029 (D) 0.971

Solution · Q20 **Answer: (C)**

Take 0.2 mol urea and 0.8 mol water. Mass of this sample:

$$0.2 \times 60 + 0.8 \times 18 = 26.4 \text{ g}$$

Moles of urea in 1000 g of the solution:

$$\frac{1000 \times 0.2}{26.4} = 7.576 \text{ mol}$$

Mass of urea:

$$7.576 \times 60 = 454.5 \text{ g}$$

After dilution to 5 kg, moles of water:

$$\frac{5000 - 454.5}{18} = 252.5 \text{ mol}$$

Mole fraction of urea:

$$x_{urea} = \frac{7.576}{7.576 + 252.5} \approx 0.029$$

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

21. Nickel forms a gaseous compound of the formula $Ni(CO)_x$. What is the value of x if under similar conditions of temperature and pressure, methane effuses 3.24 times faster than the compound? (For Ni, M = 58.7)

(A) 3.9 (B) 2.1 (C) 4.7 (D) 3.0

Solution · Q21 **Answer: (A)**

By Graham's law, with M as the molar mass of the compound:

$$\frac{r_{methane}}{r_{compound}} = \sqrt{\frac{M}{16}} = 3.24$$

$$\Rightarrow M = 16 \times (3.24)^2 \approx 167.96$$

Molar mass of CO is 28.

$$58.7 + 28x = 167.96$$

$$\Rightarrow x \approx 3.9$$

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

22. Inter-particle distance between Li and H in LiH is 1.596 A^o. Observed dipole moment of LiH is 1.964×10^{-29} C.m. The percentage (%) ionic character in LiH is

(A) 56.0 % (B) 90.8 % (C) 76.8 % (D) 100 %

Solution · Q22 **Answer: (C)**

For a 100% ionic bond, with charge e and bond length d:

$$\mu_{ionic} = e \times d$$

$$= 1.602 \times 10^{-19} \times 1.596 \times 10^{-10}$$

$$\approx 2.557 \times 10^{-29} \text{ C m}$$

Percentage ionic character:

$$\frac{1.964 \times 10^{-29}}{2.557 \times 10^{-29}} \times 100 \approx 76.8\%$$

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

23. What is the percentage of $MgCO_3$ in a mixture of $MgCO_3$ and $CaCO_3$ if its 2g require 2g H_2SO_4 for complete neutralization?

(A) 89% (B) 11% (C) 50% (D) 25%

Solution · Q23 **Answer: (B)**

Each carbonate reacts with the acid in the mole ratio 1 : 1 (M is Mg or Ca).

$MCO_3 + H_2SO_4 \rightarrow MSO_4 + H_2O + CO_2$

Let the mass of $MgCO_3$ be x g; the mass of $CaCO_3$ is then (2 − x) g.

Equating the total moles of carbonate and of acid,

$$\frac{x}{84} + \frac{2-x}{100} = \frac{2}{98}$$

$$\Rightarrow x \approx 0.214$$

Percentage of $MgCO_3$:

$$\frac{0.214}{2} \times 100 = 10.7 \approx 11\%$$

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

24. Sum of oxidation states of all the carbon atoms in toluene molecule is:

(A) −1 (B) $-\frac{7}{8}$

(C) $-\frac{8}{7}$ (D) −8

Solution · Q24 **Answer: (D)**

Toluene is $C_6H_5CH_3$, i.e. C_7H_8.

The molecule is neutral and each H is +1. Let S be the sum for the seven carbon atoms.

$$S + 8(+1) = 0$$

$$\Rightarrow S = -8$$

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

25. Oxidation state of oxygen in O_2PtF_6 is:

(A) $-\frac{1}{2}$ (B) −2

(C) $\frac{1}{2}$ (D) −1

Solution · Q25 **Answer: (C)**

O_2PtF_6 is an ionic compound:

$O_2^+ [PtF_6]^-$

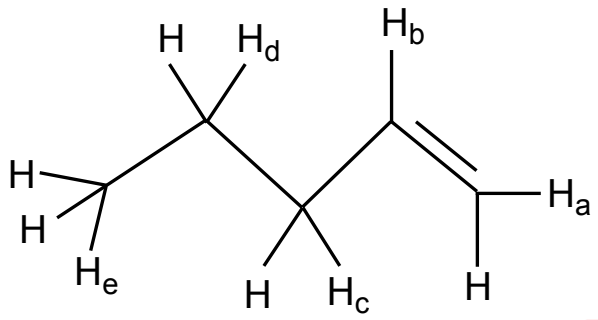
Let the oxidation state of each oxygen atom be x. For O_2^+,

$$2x = +1$$

$$\Rightarrow x = +\frac{1}{2}$$

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

26. When attacked by $Br^{\bullet}$, which H-atom will be replaced most readily?



(A) H_a (B) H_b (C) H_c (D) H_d

Solution · Q26 **Answer: (C)**

The given compound is pent-1-ene:

$$CH_3CH_2CH_2CH{=}CH_2$$

H_c is on the carbon next to the double bond (allylic carbon). Removing it gives an allylic free radical, which is stabilised by resonance:

$$CH_3CH_2C^{\bullet}H{-}CH{=}CH_2 \leftrightarrow CH_3CH_2CH{=}CH{-}C^{\bullet}H_2$$

$\therefore$ H_c is replaced most readily.

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

27. Consider the molecules having formula $C_{10}H_{16}$. Which of the following structural features are not possible within this set of molecules?

(A) 2 triple bonds (B) 1 ring and 1 triple bond
(C) 3 double bonds (D) None of these

Solution · Q27 **Answer: (A)**

Double bond equivalent (DBE) of $C_{10}H_{16}$:

$$\text{DBE} = \frac{2\times 10 + 2 - 16}{2} = 3$$

A ring or a double bond counts as 1 and a triple bond counts as 2.

For 2 triple bonds, the DBE needed is:

$$2 \times 2 = 4 > 3$$

$\therefore$ 2 triple bonds are not possible.

1 ring with 1 triple bond, and 3 double bonds, each need only 3, so both are possible.

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

28. Which metal adsorbs hydrogen to large extent?

(A) Al (B) Cr (C) Pd (D) Zn

Solution · Q28 **Answer: (C)**

Palladium holds a very large volume of hydrogen, many times its own volume, on its surface and in the gaps of its crystal lattice. This is called occlusion.

∴ Pd takes up hydrogen to a large extent.

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

29. Among the following the compound which is both paramagnetic and coloured is:

(A) $K_2Cr_2O_7$ (B) $(NH_4)_2[TiCl_6]$

(C) $VOSO_4$ (D) $K_3[Cu(CN)_4]$

Solution · Q29 **Answer: (C)**

An unpaired d electron makes the compound paramagnetic and usually coloured.

$K_2Cr_2O_7 : Cr^{6+}, 3d^0$

$(NH_4)_2[TiC\ell_6] : Ti^{4+}, 3d^0$

$VOSO_4 : V^{4+}, 3d^1$

$K_3[Cu(CN)_4] : Cu^{+}, 3d^{10}$

Only V^{4+} has an unpaired electron. So $VOSO_4$ is paramagnetic and coloured (blue).

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

30. A mixture of HCOOH and $H_2C_2O_4$ is heated with Conc. H_2SO_4. The gases produced were passed through KOH solution where their volume decreased by $\frac{1}{6}$. Ratio of two acids in the mixture:

(A) 1 : 4 (B) 4 : 1

(C) 1 : 1 (D) data insufficient

Solution · Q30 **Answer: (B)**

Conc. H_2SO_4 removes water from both acids:

$HCOOH \rightarrow CO + H_2O$

$H_2C_2O_4 \rightarrow CO + CO_2 + H_2O$

Take x mol of HCOOH and y mol of $H_2C_2O_4$. Water stays with the conc. H_2SO_4.

Total moles of gas (CO and CO_2):

$$n = (x + y) + y = x + 2y$$

KOH absorbs only CO_2 (y mol). At the same temperature and pressure, volume is proportional to moles.

$$\frac{y}{x + 2y} = \frac{1}{6}$$

$$\Rightarrow 6y = x + 2y$$

$$\Rightarrow x = 4y$$

∴ HCOOH : $H_2C_2O_4$ is 4 : 1.

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

31. The correct order of energy levels in H – atom is:

(A) 3s = 3p = 3d > 2s
(B) 3d > 3p > 3s > 2s
(C) 3d > 3p = 3s > 2s
(D) 3d > 3p > 3s = 2s

Solution · Q31 **Answer: (A)**

H atom has only one electron, so the energy of an orbital depends only on the principal quantum number n.

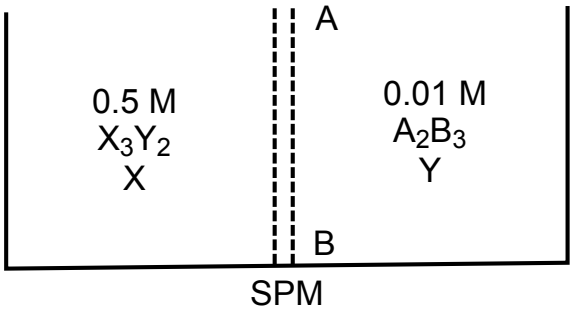
$$E_n = -\frac{13.6}{n^2}\,eV$$

So 3s, 3p and 3d have the same energy, which is higher than that of 2s.

$$3s = 3p = 3d > 2s$$

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

32. X_3Y_2 when reacts with A_2B_3 in aqueous solution, it gives brown colour. These are separated by a semipermeable membrane AB as shown in figure. Assuming that electrolytes are completely ionized in solution then due to osmosis there is:



(A) brown colour formation in side X
(B) brown colour formation in side Y
(C) brown colour is formed in both sides X and Y
(D) no brown colour formation in sides X or Y

Solution · Q32 **Answer: (D)**

A semipermeable membrane lets only the solvent (water) pass through it. The dissolved ions cannot cross it. So only water moves, from the dilute side Y to the concentrated side X. X_3Y_2 and A_2B_3 never meet.

∴ No brown colour is formed in side X or side Y.

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

33. A particle of mass 0.3 kg starts moving from rest, in one dimension, under a force that delivers constant power P = 1.5 watt. The kinetic energy of the particle will be KE = 15 Joule after a time of

(A) 5 S (B) 10 S (C) 12 S (D) 15 S

Solution · Q33 **Answer: (B)**

The particle starts from rest and the power is constant, so the work done in time t becomes kinetic energy:

$$KE = Pt$$

$$\Rightarrow 15 = 1.5 \times t$$

$$\Rightarrow t = 10\ s$$

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

34. A trolley of mass 200 kg carrying a sandbag of mass 20 kg is moving on a frictionless horizontal track with speed 36 km/hr. After a while, sand starts leaking out of the bag on the floor of trolley at the rate 0.04 kg/sec. What is the speed of trolley after the entire sand bag is empty?

(A) 8 m/s (B) 9.2 m/s (C) 10 m/s (D) 10.8 m/s

Solution · Q34 **Answer: (C)**

The track is frictionless, so there is no outside horizontal force.

The leaking sand leaves the bag with the same horizontal velocity as the trolley, so it gives the trolley no horizontal push or pull. The speed of the trolley does not change.

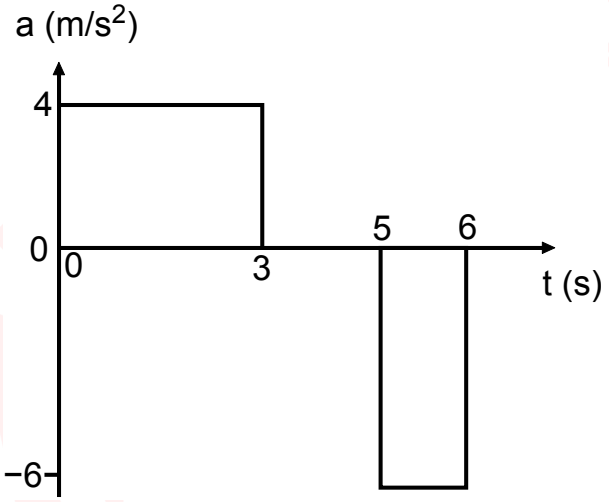
$$v = 36 \times \frac{5}{18}\ \text{m/s}$$

$$\Rightarrow v = 10\ \text{m/s}$$

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

35. A particle, initially at rest at origin, starts moving under acceleration a along + x direction. The acceleration versus time graph is shown in figure.

The displacement and the velocity of the particle after 6 second are



(A) 51 meter, 6 m/s (B) 33 meter, 6 m/s (C) 42 meter, 18 m/s (D) 27 meter, 24 m/s

Solution · Q35 **Answer: (A)**

From 0 s to 3 s, starting from rest:

$$v = 4 \times 3 = 12\ \text{m/s}$$

$$s_1 = \frac{1}{2} \times 4 \times 3^2 = 18\ \text{m}$$

From 3 s to 5 s, the acceleration is zero:

$$s_2 = 12 \times 2 = 24\ \text{m}$$

From 5 s to 6 s, the acceleration is $-6\ \text{m/s}^2$:

$$s_3 = 12 \times 1 - \frac{1}{2} \times 6 \times 1^2 = 9\ \text{m}$$

Velocity at 6 s:

$$v = 12 - 6 \times 1 = 6 \text{ m/s}$$

Total displacement:

$$s = 18 + 24 + 9 = 51 \text{ m}$$

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

36. Gravitational potential energy of a system of two particles of masses m_1 and m_2, separated by distance r, is given by $U = -\frac{Gm_1m_2}{r}$, where G is the universal Gravitational constant.

Consider two stars, each of mass M, initially separated by distance d and at rest with respect to each other. The two stars start moving towards each other under their mutual gravitational attraction. The stars can be treated as point objects and motion is assumed non-relativistic. As measured from the laboratory frame, the speed of each star when they are at a distance $\frac{d}{2}$ apart from each other is

(A) $\sqrt{\frac{GM}{d}}$ (B) $\sqrt{\frac{2GM}{d}}$

(C) $\sqrt{\frac{GM}{2d}}$ (D) $\sqrt{\frac{GM}{4d}}$

Solution · Q36 **Answer: (A)**

The stars start from rest in the laboratory frame. Being equal in mass, both have the same speed v at any instant.

By conservation of energy,

$$-\frac{GM^2}{d} = -\frac{2GM^2}{d} + 2 \times \frac{1}{2}Mv^2$$

$$\Rightarrow Mv^2 = \frac{GM^2}{d}$$

$$\therefore v = \sqrt{\frac{GM}{d}}$$

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

37. An engine approaches a vertical cliff with constant speed 72 km/hour. When the engine is at a distance of 0.7 km from the cliff, it blows a whistle. The driver hears the echo after a time (Speed of sound in air is 330 m/s.)

(A) 3.88 S (B) 4.00 S (C) 4.12 S (D) 4.24 S

Solution · Q37 **Answer: (B)**

Speed of the engine:

$$72 \text{ km/h} = 20 \text{ m/s}$$

In time t, the paths of the sound and of the engine together make twice the distance to the cliff.

$$330t + 20t = 2 \times 700$$

$$\Rightarrow 350t = 1400$$

$$\therefore t = 4.00 \text{ s}$$

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

38. A vessel contains a liquid–1 of density 0.8 gm/cm^3 over a liquid–2 of density 13.6 gm/cm^3. The two liquids are immiscible. A homogeneous solid sphere floats with half of its volume immersed in liquid–1 and other half in liquid–2. The density of the material of the sphere in gm/cm^3 is

(A) 3.3 (B) 6.4 (C) 7.2 (D) 12.8

Solution · Q38 **Answer: (C)**

The weight of the sphere equals the total upthrust of the two liquids.

$$\rho Vg = 0.8 \times (V/2)g + 13.6 \times (V/2)g$$

$$\Rightarrow \rho = (0.8 + 13.6)/2$$

$$\therefore \rho = 7.2 \text{ g/cm}^3$$

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

39. One fine morning, Mr. Ravi visited Gandhi park with his grandson. When he was just on a bridge over the lake in the park, an old wooden toy 'just' dropped from his hand. The toy went straight down to hit surface of calm water, then sinked into water to a certain depth below water surface and returns back due to upthrust of water to the hands of Mr. Ravi in the same position from where it was dropped. Assuming this position to be at height 19.6 meter above the surface of water, and density of material of toy to be just half the density of water in lake, the total time in which toy is received back to the hand of Mr. Ravi is calculated to be

(A) 2 second (B) 4 second (C) 8 second (D) 16 second

Solution · Q39 **Answer: (C)**

Neglect air resistance and the drag of water.

Fall through air:

$$19.6 = (1/2) \times 9.8 \times t^2$$

$$\Rightarrow t = 2 \text{ s}$$

Speed on reaching the water:

$$v = 9.8 \times 2 = 19.6 \text{ m/s}$$

The toy is half as dense as water, so inside water the upthrust is twice its weight. The net acceleration is upward.

$$a = (2mg - mg)/m = g$$

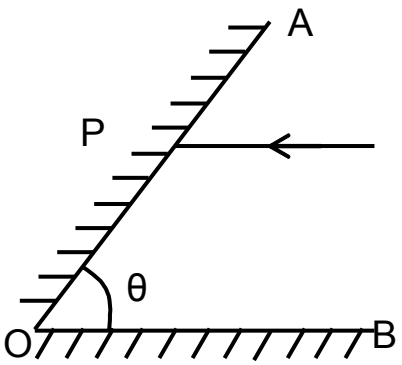
So it stops in 2 s and returns to the surface in another 2 s. It then rises to the hand in 2 s.

$$T = 2 + 2 + 2 + 2$$

$$\therefore T = 8 \text{ s}$$

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

40. Two plane mirrors OA and OB are inclined at an angle θ as shown in figure. A ray of light incident parallel to BO strikes the mirror OA at point P. It gets reflected from mirror OA and then reflected from the mirror OB, the ray finally emerges parallel to OA. The value of angle θ is



(A) 90^0 (B) 60^0 (C) 45^0 (D) 30^0

Solution · Q40 **Answer: (B)**

Let the ray reflected at P meet OB at Q.

The incident ray is parallel to OB, so it makes angle θ with OA. By the law of reflection, PQ makes the same angle with OA.

$$\angle OPQ = \theta$$

In triangle OPQ:

$$\angle OQP = 180° - 2\theta$$

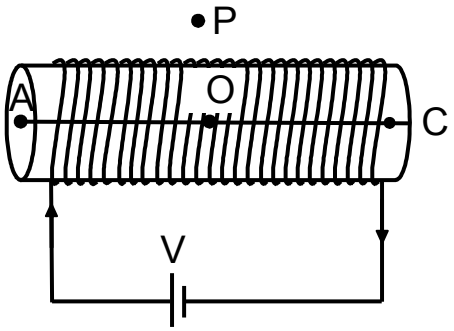
By reflection at Q, the outgoing ray makes this same angle with QB. As it is parallel to OA, that angle is θ.

$$180° - 2\theta = \theta$$

$$\therefore \theta = 60°$$

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

41. A long solenoid of length 2 m and radius 10 cm having 2000 turns per meter carries a current of 1.0 A. The strength of magnetic field **(B)** is maximum at point



(A) A at the left end
(B) C at the right end
(C) O at the centre of solenoid
(D) P outside the solenoid

Solution · Q41 **Answer: (C)**

In a long solenoid, the field at the centre O is:

$$B = \mu_0 nI$$

At the ends A and C, it is only about half of this.

$$B_{end} = \mu_0 nI/2$$

Outside, at P, the field is nearly zero. So B is maximum at O.

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

42. A tank with a square base of area 2.0 meter^2 is divided by a vertical partition in the middle. The bottom of the partition has a small hinged door of area 10 cm^2. The tank is filled with water in one compartment and a liquid of relative density 1.8 in other compartment, both to a height 5.0 meter. The force necessary to keep the door close is approximately ($g = 9.8$ m/s^2)

(A) 0.04 N (B) 3.9 N (C) 39 N (D) Zero

Solution · Q42 **Answer: (C)**

The two liquids push the door from opposite sides at a depth of 5.0 m. Difference of pressure:

$$\Delta P = (1800 - 1000) \times 9.8 \times 5.0$$

$$\Rightarrow \Delta P = 39200 \text{ Pa}$$

Area of the door:

$$A = 10 \text{ cm}^2 = 10^{-3} \text{ m}^2$$

Force needed:

$$F = \Delta P \times A = 39200 \times 10^{-3}$$

$$\therefore F = 39.2 \text{ N} \approx 39 \text{ N}$$

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

43. An electron is projected horizontally towards east in uniform magnetic field B. The electron is deflected towards north by the magnetic field. The magnetic field is directed

(A) East wards (B) West wards (C) Upward (D) Downward

Solution · Q43 **Answer: (C)**

The electron moves east, so the conventional current is towards the west.

By Fleming's left-hand rule, with the current towards the west and the force towards the north, the magnetic field is directed upward.

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

44. Sir CV Raman announced the discovery of Raman Effect on February 28, 1928. He received 1930 Nobel Prize in Physics for this discovery. Raman Effect is the discovery of

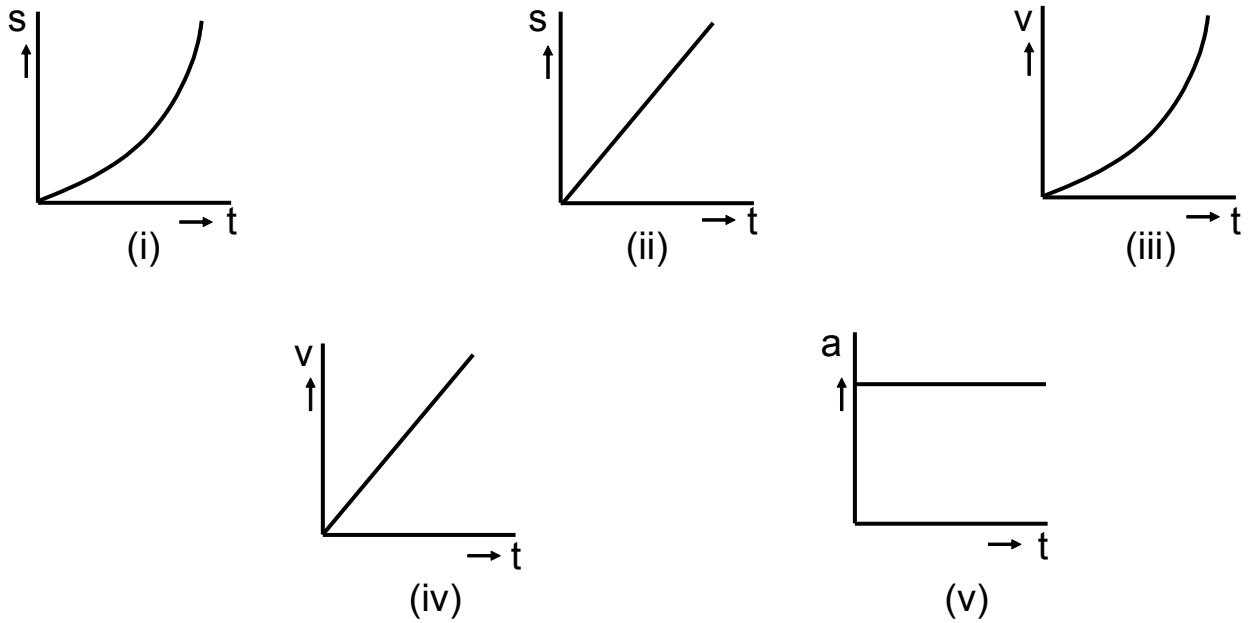
(A) Dispersion of light
(B) Total Internal Reflection of light
(C) Refraction of light
(D) Inelastic scattering of light

Solution · Q44 **Answer: (D)**

In the Raman effect, a small part of the light scattered by a substance comes out with a changed frequency, because energy is exchanged with its molecules. So it is the inelastic scattering of light.

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

45. Figures (i) to (v) show graphical representation of motion in one-dimension. Here s, v, a and t represent the displacement, the velocity, the acceleration and the time respectively.



Which of the above graphs represent uniform motion?

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

Solution · Q45 **As per Zigyan: (B)**

Uniform motion in a straight line means constant velocity.

Graph (ii) is a straight s–t line, so its slope, the velocity, is constant.

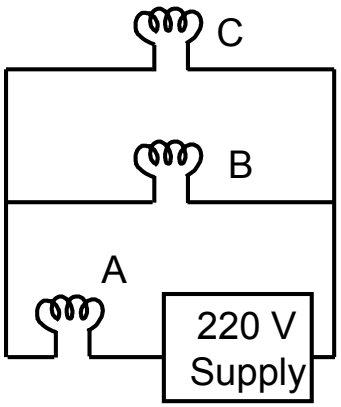
In (i) and (iii) the velocity changes. Graphs (iv) and (v) show motion with a constant acceleration, so the velocity changes there too.

Reference: NCERT Science Class IX (Exploration), Chapter 4 'Describing Motion Around Us', sections 4.1.3 and 4.2.2: covering equal distances in equal times along a straight line is uniform motion, and a straight position-time graph shows constant velocity.

Reference: Same chapter, section 4.2.3: a rising straight velocity-time graph shows velocity increasing with constant acceleration.

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

46. Three identical electric bulbs A, B and C having specification 60 W, 220 V are connected across a 220 V supply as shown. The total power dissipated in three bulbs is close to



(A) 180 W (B) 60 W (C) 30 W (D) 40 W

Solution · Q46 **As per Zigyan: (D)**

Take the resistance R of each bulb as constant.

$$R = V^2/60$$

B and C are in parallel, and this pair is in series with A.

$$R_{eq} = R + R/2 = 3R/2$$

Total power from the same supply:

$$P = V^2/R_{eq} = (2/3) \times (V^2/R)$$

$$\therefore P = (2/3) \times 60 = 40 \text{ W}$$

Reference: NCERT Science Class X, Chapter 11 'Electricity', sections 11.6.1, 11.6.2 and 11.8: series resistances add, reciprocals of parallel resistances add, and power is voltage squared divided by resistance.

Check: Bulb A gets two-thirds of 220 V and B and C get one-third. Their powers, about 26.7 W, 6.7 W and 6.7 W, add up to 40 W.

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

47. A copper wire is stretched to decrease its radius by 0.15%. The percentage change in the resistance of wire is

(A) +0.3% (B) −0.3 % (C) +0.6% (D) −0.6 %

Solution · Q47 **As per Zigyan: (C)**

The volume of the wire stays constant.

$$V = \pi r^2 l$$

$$R = \rho l/(\pi r^2) = \rho V/(\pi^2 r^4)$$

$$\Rightarrow R \propto 1/r^4$$

For a small change:

$$\Delta R/R = -4 \times (\Delta r/r)$$

$$\Rightarrow \Delta R/R = -4 \times (-0.15\%)$$

$$\therefore \Delta R/R = +0.6\%$$

Reference: NCERT Science Class X, Chapter 11 'Electricity', section 11.5: the resistance of a uniform metallic conductor is directly proportional to its length and inversely proportional to its area of cross-section.

Check: Without the small-change rule, one divided by the fourth power of 0.9985 is about 1.006, a rise of about 0.6%.

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

48. Speed of sound in air is directly proportional to square root of absolute temperature of air (keeping other parameters constant). The speed of sound in air at 273 K and 1 atom is 332 m/s.

On a clear day, when temperature in the laboratory was 27^0C, an experiment was performed to measure speed of sound in air in the laboratory. The measured value comes out to be 352 m/s. the percentage error in this measurement is

(A) 0.2% (B) 1.15% (C) 3.15% (D) 6.02%

Solution · Q48 **As per Zigyan: (B)**

Temperature in the laboratory:

$$T = 27 + 273 = 300 \text{ K}$$

The speed of sound is proportional to the square root of T.

$$v = 332 \times \sqrt{\frac{300}{273}}$$

$$\Rightarrow v \approx 348 \text{ m/s}$$

Percentage error:

$$\frac{352 - 348}{348} \times 100 \approx 1.15\%$$

Check: Using 273.15 K and 300.15 K, the expected speed is still about 348.0 m/s. Without rounding, the error is about 1.14%, and the only option close to it is 1.15%.

IAPT answer: question dropped by IAPT | **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. Which of the following evolutionary lineages of man can be categorized under pre-historic man ?

(A) *Ramapithecus* (B) *Homo habilis*

(C) *Homo sapiens fossilis* (D) *Homo heidelbergensis*

Solution · Q49 **As per Zigyan: (B), (C), (D)**

A pre-historic man is a human who lived before written history began.

Ramapithecus was only a man-like primate and not a man, so (A) is out.

Homo habilis, *Homo sapiens fossilis* (Cro-Magnon man) and *Homo heidelbergensis* are all early humans of that time before writing.

∴ (B), (C) and (D) are pre-historic men.

Why Zigyan differs from IAPT: *Homo sapiens fossilis* is an ancient fossil human, tens of thousands of years older than any written record. So (C) is as clearly pre-historic as (B) and (D).

Reference: NCERT Biology Class XII, Chapter 6 'Evolution', section 6.9: *Ramapithecus* was a man-like primate. The book puts pre-historic cave art at about 18,000 years ago, after modern *Homo sapiens* arose, and calls such painters pre-historic humans.

Reference: Smithsonian National Museum of Natural History, collection record 'Cro-Magnon 1': this *Homo sapiens* fossil found in France is about 30,000 years old.

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

50. Select the set of diseases caused by deficiency of B-Complex Vitamins:

(A) Beri-Beri & Pelagra
(B) Dermatitis & Wernicke-Korsakoff Syndrome
(C) Cheilosis & Pernicious anaemia
(D) Marasmus & Kwashiorkor

Solution · Q50 **Answer: (A), (B), (C)**

(A) Beri-beri is due to lack of vitamin B_1 and pellagra to lack of B_3. ∴ correct.

(B) Lack of B-complex vitamins such as B_3 or B_6 causes dermatitis. Wernicke-Korsakoff syndrome is due to lack of B_1. ∴ correct.

(C) Cheilosis is due to lack of B_2 and pernicious anaemia to lack of B_{12}. ∴ correct.

(D) Marasmus and kwashiorkor are due to lack of protein and energy in food. ∴ wrong.

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

51. After rainy season, a Biology teacher took the students on a plant collection tour. From a pond, they collected a beaker of water with aquatic plants in it. The students are likely to find which of the following organisms in it?

(A) *Spirogyra, Azolla, Riccia fluitans & Cosmarium*
(B) *Ulothrix, Chlorella, Chara & Ricciocarpus natans*
(C) *Marchantia, Funaria, Lycopodium & Gnetum*
(D) *Salvinia molesta, Azolla, Chlorella & Cladophora*

Solution · Q51 **Answer: (A), (B), (D)**

A pond sample can have fresh-water algae and water-living plants.

(A) *Spirogyra* and *Cosmarium* are algae, *Azolla* is a water fern and *Riccia fluitans* is a water liverwort. ∴ likely.

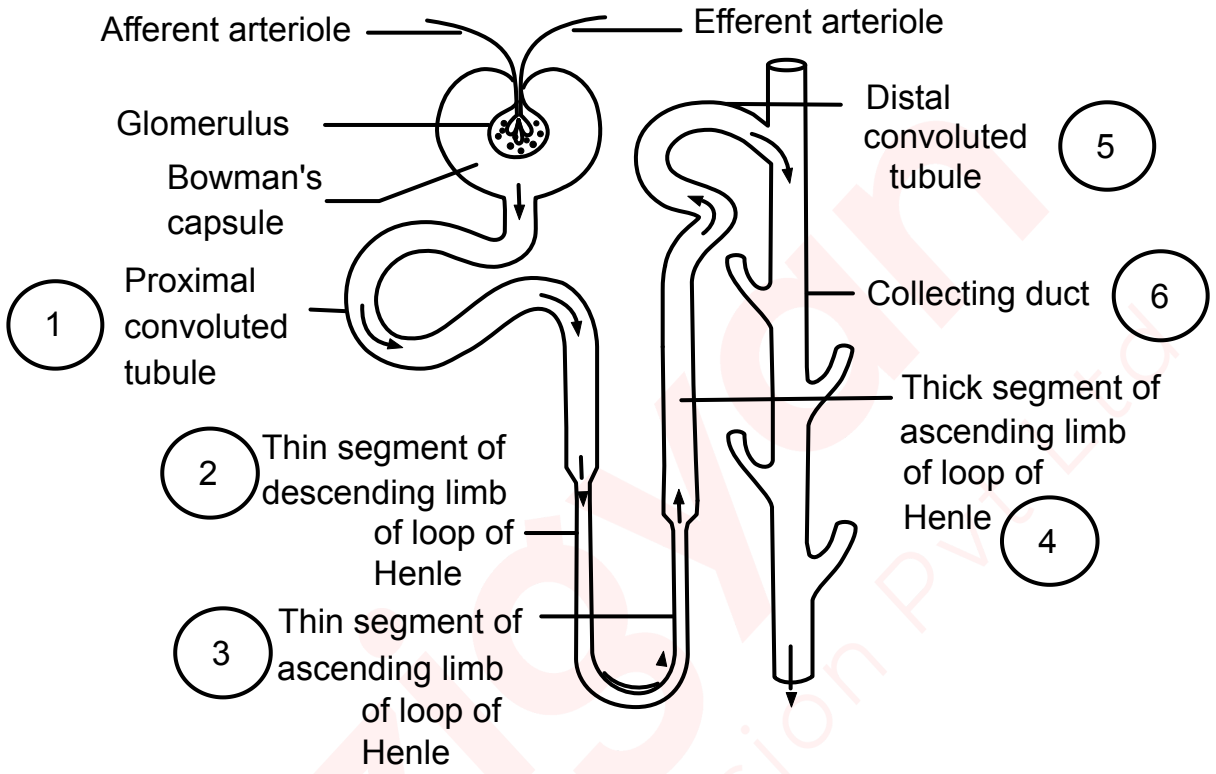
(B) *Ulothrix*, *Chlorella* and *Chara* are fresh-water algae; *Ricciocarpus natans* is a floating liverwort. ∴ likely.

(C) *Marchantia*, *Funaria*, *Lycopodium* and *Gnetum* grow on land. ∴ not likely.

(D) *Salvinia* and *Azolla* are water ferns; *Chlorella* and *Cladophora* are algae. ∴ likely.

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

52. Various parts of mammalian uriniferous tubules (nephrons), play an important role in Urine formation through processes like ultrafilteration, selecitve reabsorption by active transport, reabsorption by passive osmosis and secretion. While the filterate flows through different parts of the uriniferous tubules (**Numbered 1 – 6 in the diagram given below**), not only its volume is reduced but its composition is also considerably changed, due to exchange of materials between the filterate and the blood of the peritubular capillaries.



From among the **numbered parts (1 - 6)** in the above diagram, the options are given in a manner that they highlight two aspects separately, i.e., part(s) having columnar epithelial cells with 'brush border', suitable for reabsorption and those parts completely or poorly permeable to water. Select-out the desired options:

(A) 4, 5 (B) 1 (C) 2, 3 (D) 2, 3, 6

Solution · Q52 **As per Zigyan: (A), (B)**

Brush border: part 1 (proximal convoluted tubule) has it and takes back most of the useful materials. ∴ (B) is correct.

The second aspect is taken as parts that are completely impermeable or poorly permeable to water.

Part 4 (thick ascending limb) is impermeable to water.

In part 5 (distal convoluted tubule) water is taken back only conditionally; otherwise little water passes. ∴ (A) is correct.

Part 2 (descending limb) is permeable to water. ∴ (C) and (D), which contain 2, are wrong.

Why Zigyan differs from IAPT: (D) contains part 2, through which water readily leaves the filtrate, so it cannot be such a set. Parts 4 and 5 in (A) do fit.

Reference: NCERT Biology Class XI, Chapter 16 'Excretory Products and their Elimination', section 16.3: the proximal tubule has a brush border, the descending limb lets water through, the ascending limb does not, and water reabsorption in the distal tubule is conditional.

Reference: Biology LibreTexts, Human Physiology, section 20.2 'Water Balance': water permeability stays low in the early distal tubule, and with excess body water the late distal tubule remains poorly permeable too.

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

53. The 0.01 M NH_4Cl solution at 25^0C has:

(A) $[Cl^-_{aq}] < 10^{-2}$ M

(B) $[NH_4{}^+_{aq}] < 10^{-2}$M

(C) pOH > 7

(D) $[H^+] > 10^{-7}$M

Solution · Q53 **Answer: (B), (C), (D)**

$NH_4C\ell$ is a salt of a strong acid and a weak base. It ionises completely, and $C\ell^-$ does not hydrolyse.

$$[C\ell^-] = 10^{-2}\ M$$

∴ (A) is wrong.

The ammonium ion hydrolyses:

$NH_4{}^+ + H_2O \rightleftharpoons NH_4OH + H^+$

So a little of it is used up.

$$[NH_4{}^+] < 10^{-2}\ M$$

The solution is therefore acidic.

$$[H^+] > 10^{-7}\ M$$

$$pH < 7 \text{ and } pOH > 7$$

∴ (B), (C) and (D) are correct.

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

54. Amphoteric nature of Al_2O_3 is employed in which of the following process/es?

(A) Bayer's process (B) Hall's process (C) Serpek's process (D) Dow's process

Solution · Q54 **As per Zigyan: (A), (B)**

$A\ell_2O_3$ is amphoteric, so it also reacts like an acidic oxide with a base and forms soluble sodium aluminate. This separates it from impurities.

(A) Bayer's process:

$A\ell_2O_3 + 2NaOH \rightarrow 2NaA\ell O_2 + H_2O$

(B) Hall's process of purifying bauxite (fusion with sodium carbonate):

$A\ell_2O_3 + Na_2CO_3 \rightarrow 2NaA\ell O_2 + CO_2$

(C) Serpek's process makes the nitride with carbon and nitrogen; no acid or base acts on the oxide.

$A\ell_2O_3 + 3C + N_2 \rightarrow 2A\ell N + 3CO$

(D) Dow's process is not used for treating $A\ell_2O_3$.

Reference: NCERT Science Class X, Chapter 3 'Metals and Non-metals': aluminium oxide is amphoteric; it reacts with acids and also with sodium hydroxide, which gives sodium aluminate.

Reference: OpenStax Chemistry 2e, section 18.2: in purifying bauxite, hot sodium hydroxide forms soluble sodium aluminate, while clay and other impurities stay undissolved.

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

55. As a general trend the First Ionization Energy (IE_1) of elements decreases on moving down in a group in the periodic table. Keeping the observation in mind select the correct order of elements with respect to their IE_1

I. Li > Na > K > Rb > Cs > Fr

II. Li > Na > K > Rb > Cs < Fr

III. Sr < Ba > Ra

IV. Sr > Ba < Ra

V. Cu > Ag > Au

VI. Cu > Ag < Au

VII. Cd > Hg

VIII. Cd < Hg

(A) I, V, VII (B) II, IV, VIII (C) III, V, VII (D) II, VI, VIII

Solution · Q55 **As per Zigyan: (B), (D)**

First ionisation energies in eV, group by group:

Li 5.39 > Na 5.14 > K 4.34 > Rb 4.18 > Cs 3.89 < Fr 4.07

Sr 5.69 > Ba 5.21 < Ra 5.28

Cu 7.73 > Ag 7.58 < Au 9.23

Cd 8.99 < Hg 10.44

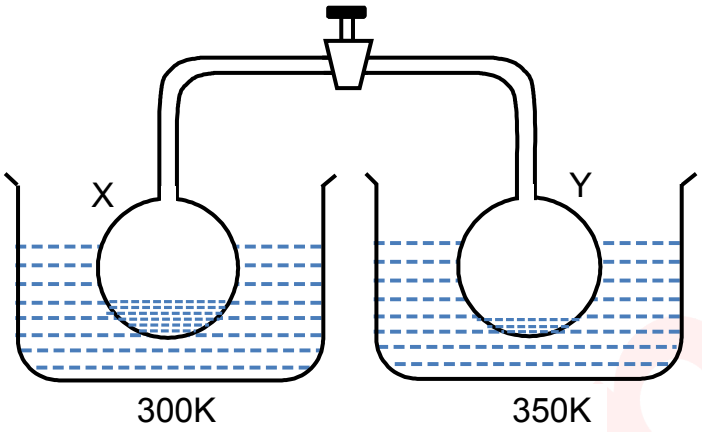
So the correct orders are II, IV, VI and VIII.

Every order listed in (B) and in (D) is correct. (A) and (C) contain wrong orders.

Reference: NIST Atomic Spectra Database, ionization energies of the neutral atoms: the measured values give francium above caesium, radium above barium, gold above silver and mercury above cadmium.

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

56. Two containers each containing water in liquid state are connected by a valve as shown in diagram



Given that vapour pressure of water at 300 K and 350 K are 22 torr and 40 torr, select correct statement(s):

(A) The final pressure in each container after the valve is opened, while keeping the containers at their respective temperatures, is equal but more than 22 torr.

(B) The final pressure in each container after the valve is opened, while keeping the containers at their respective temperatures, is 40 torr.

(C) Mass of water is decreased in container X.

(D) Mass of water is decreased in container Y.

Solution · Q56 **As per Zigyan: (D)**

With the given values, the vapour pressure in Y is higher than in X. On opening the valve, vapour flows from Y to X.

At 300 K, X cannot hold vapour above 22 torr, so the extra vapour condenses in X.

So water in Y keeps evaporating until all of it has moved to X. The pressure is then the same everywhere:

$$P = 22 \text{ torr}$$

Water increases in X and decreases in Y.

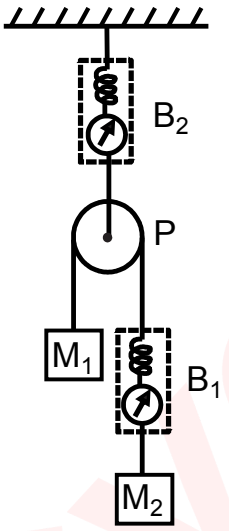
$\therefore$ only (D) is correct.

Reference: NCERT Chemistry Class XI (Part I), Unit 6 'Equilibrium', section 6.1.2: water and its vapour in equilibrium have a fixed vapour pressure at a given temperature, and this pressure rises with temperature.

Check: While X is at 300 K, any pressure above 22 torr makes vapour condense in X, so a higher pressure cannot last.

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

57. Two blocks M_1 and M_2 of masses 3 kg and 6 kg respectively are connected through a string and spring balance B_1. The string passes over a massless and frictionless pulley P. The pulley is suspended from a rigid support through spring balance B_2. Strings are massless and inextensible. Masses of spring balances are negligible. The system is released from rest. At the instant when masses M_1 and M_2 are moving with same speed ($g = 9.8\ m/sec^2$)



(A) reading of B_1 is 4.5 kg wt.

(B) reading of B_1 is 4.0 kg wt.

(C) reading of B_2 is 9.8 kg wt.

(D) acceleration of M_1 is $\frac{9.8}{3}\ mS^{-2}$

Solution · Q57 **As per Zigyan: (B), (D)**

With steady spring balances, both blocks have the same acceleration.

$$a = \frac{(M_2 - M_1)g}{M_1 + M_2}$$

$$\Rightarrow a = \frac{(6-3)\times 9.8}{6+3} = \frac{9.8}{3}\ m\ s^{-2}$$

For the lighter block, moving up:

$$T - 3g = 3a$$

$$\Rightarrow T = 3\left(g + \frac{g}{3}\right) = 4g\ N$$

So B_1 reads 4.0 kg wt.

The pulley is massless, so the upper balance supports both sides of the string. Its reading is

$$R_2 = 2 \times 4 = 8\ kg\ wt$$

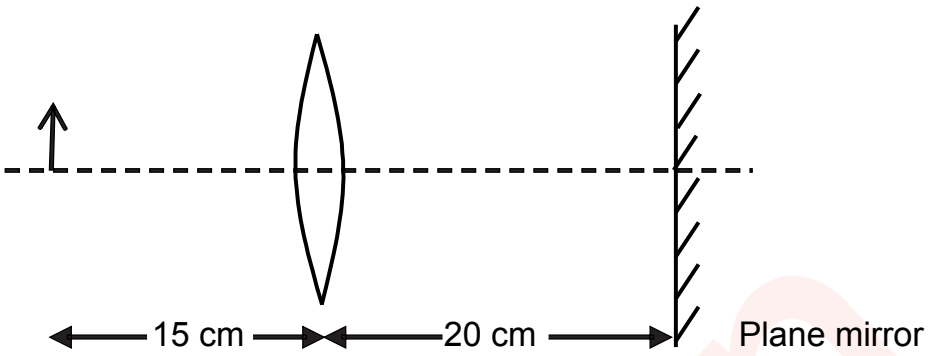
So (C) is wrong.

$\therefore$ (B) and (D) are correct.

Check: On the heavier block the weight 6g exceeds the tension 4g by 2g; dividing by its mass of 6 kg gives one third of g again.

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

58. Focal length of a thin convex lens is 10 cm. An object is placed at a distance 15 cm in front of the lens and a plane mirror is kept at 20 cm on the other side as shown in figure.



(A) The final image is formed at distance 10 cm from lens towards the mirror

(B) The final image is formed at a distance 30 cm from lens means 10 cm behind the mirror

(C) The final image has magnification m = −2

(D) The final image has magnification m = +2

Solution · Q58 **As per Zigyan: no option is correct**

First refraction through the lens:

$$\frac{1}{v} - \frac{1}{-15} = \frac{1}{10}$$

$$\Rightarrow v = 30 \text{ cm}$$

This point lies behind the mirror, at a distance from it of

$$30 \text{ cm} - 20 \text{ cm} = 10 \text{ cm}$$

So the mirror forms a real image at the same distance in front of it. Its distance from the lens is

$$20 \text{ cm} - 10 \text{ cm} = 10 \text{ cm}$$

This is the focus of the lens. The reflected light passes through the lens again:

$$\frac{1}{v'} - \frac{1}{-10} = \frac{1}{10}$$

$$\Rightarrow \frac{1}{v'} = 0$$

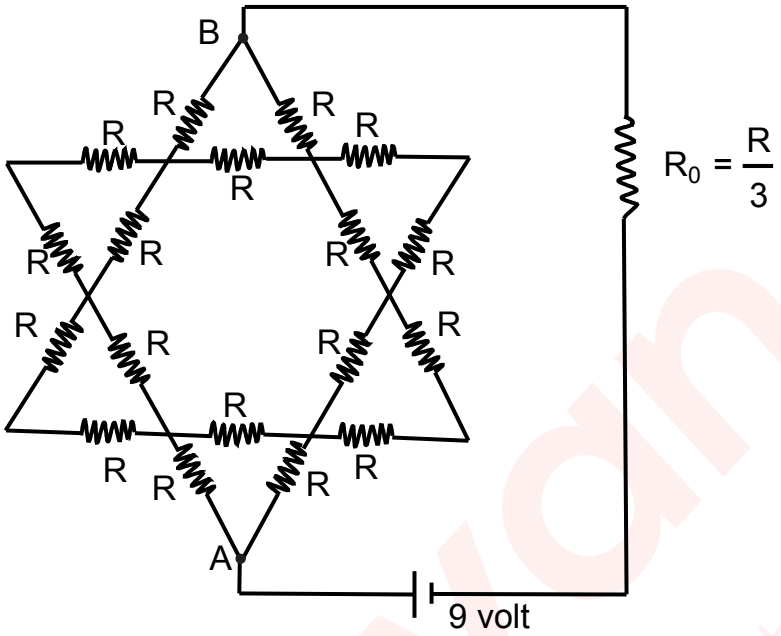
$\therefore$ the final image is at infinity, and its magnification is neither −2 nor +2.

Why Zigyan differs from IAPT: The image 10 cm from the lens, of magnification −2, is only the one formed after reflection. The rays cross there, go through the lens again and come out parallel.

Reference: NCERT Science Class X, Chapter 9 'Light – Reflection and Refraction', Table 9.4: for an object at the focus of a convex lens, the image is at infinity.

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

59. Given network of 18 resistors, each equal to R = 3 ohm, is connected in series with resistor R_0 to a source of emf = 9 volt. Choose the correct option.



(A) Current drawn from battery is 1.5 A

(B) Potential difference between A and B is 7.5 V

(C) Electrical power dissipated in R_0 is 2.25 watt

(D) Electrical power dissipated in network between A and B is 12.25 watt.

Solution · Q59 **Answer: (A), (B), (C)**

The network is symmetric about line AB. So the middle top resistor and the middle bottom resistor carry no current.

At each of the four side corners, two resistors in series lie across one resistor:

$$R_1 = \frac{2R \times R}{2R + R} = \frac{2R}{3}$$

One path from B to A:

$$R + \frac{2R}{3} + \frac{2R}{3} + R = \frac{10R}{3}$$

Two equal paths are in parallel:

$$R_{AB} = \frac{5R}{3} = 5\ \Omega$$

$$I = \frac{9}{5+1} = 1.5\ A$$

$$V_{AB} = 1.5 \times 5 = 7.5\ V$$

Power in the series resistor:

$$P_0 = (1.5)^2 \times 1 = 2.25\ W$$

Power in the network:

$$P_{AB} = (1.5)^2 \times 5 = 11.25\ W$$

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

60. Two bodies of masses m_1 = 2 kg and m_2 = 1 kg are moving towards each other in the same straight line with speed 12 m/s and 6 m/s respectively as shown in figure. The bodies can be assumed as point masses. After some time, the two bodies undergo elastic collision. After the collision



(A) the two bodies mearly exchange their velocities

(B) m_1 comes to rest

(C) m_2 moves with speed 18 m/s towards right

(D) m_1 and m_2 move with same speeds but they reverse their directions of motion.

Solution · Q60 **Answer: (B), (C)**

Taking right as positive:

$$u_1 = 12 \text{ m/s}, u_2 = -6 \text{ m/s}$$

For an elastic collision,

$$v_1 = \frac{(m_1 - m_2)u_1 + 2m_2u_2}{m_1 + m_2}$$

$$\Rightarrow v_1 = \frac{12 - 12}{3} = 0$$

$$v_2 = \frac{(m_2 - m_1)u_2 + 2m_1u_1}{m_1 + m_2}$$

$$\Rightarrow v_2 = \frac{6 + 48}{3} = 18 \text{ m/s}$$

So the first body stops and the second moves right at this speed. They neither exchange velocities nor keep equal speeds.

∴ (B) and (C) are correct.

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

ANSWER KEY

NSEJS 2022 · PAPER CODE 51

60
QUESTIONS · 216 MARKS

IAPT final answer key for paper code 51. ★ marks an answer given as per Zigyan.

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

★ Answers as per Zigyan

- **Q4** — As per Zigyan: (A); IAPT key (A).
- **Q11** — As per Zigyan: (C); IAPT key (C).
- **Q18** — As per Zigyan: (A); IAPT key (B).
- **Q45** — As per Zigyan: (B); dropped by IAPT.
- **Q46** — As per Zigyan: (D); dropped by IAPT.
- **Q47** — As per Zigyan: (C); dropped by IAPT.
- **Q48** — As per Zigyan: (B); dropped by IAPT.
- **Q49** — As per Zigyan: (B), (C), (D); IAPT key (B), (D).
- **Q52** — As per Zigyan: (A), (B); IAPT key (B), (D).
- **Q54** — As per Zigyan: (A), (B); dropped by IAPT.
- **Q55** — As per Zigyan: (B), (D); dropped by IAPT.
- **Q56** — As per Zigyan: (D); dropped by IAPT.
- **Q57** — As per Zigyan: (B), (D); dropped by IAPT.
- **Q58** — As per Zigyan: no option is correct; IAPT key (A), (C).

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

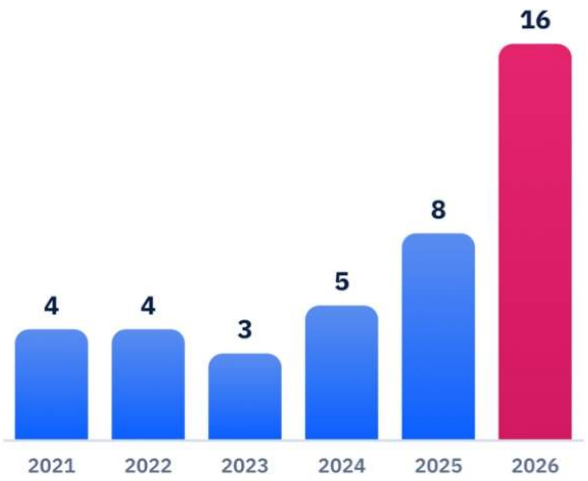
40
JEE Advanced selections in 6 years

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