zigyan

PREVIOUS YEAR PAPER · 2020-21

OLYMPIAD · STAGE I

IOQJS

Indian Olympiad Qualifier in Junior Science (Part I)

2020-21

Question paper with official answer key

32	120	60 min	51
Questions	Maximum marks	Time	Paper code

Question paper and official answer key: Indian Association of Physics Teachers (IAPT), IOQJS 2020-21, paper code 51.
Solutions and notes: Zigyan. This booklet is not an IAPT publication.

Prepare for the Olympiads with Zigyan

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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.

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Given in the question paper

Some useful physical constants and useful data		
Physical Constant	Symbol	Magnitude with SI units
Gravitation Constant	G	6.67×10^{-11} Nm^2/kg^2
Solar mass	$M_\odot$	2×10^{30} kg
Acceleration due to gravity on earth	g	9.8 ms^{-2}
Charge of an electron	e	1.6×10^{-19} C
Mass of an electron	m	9.1×10^{-31} kg
1 eV = 1.6×10^{-19} J		
An α particle is a doubly ionized He atom		

PART A-1 · ONE CORRECT OPTION

Q. 1 – 24 · +3 for a correct answer, –1 for a wrong one

1. Gravitational collapse is the contraction of an astronomical object under its own gravity. This draws the matter inwards towards the centre of gravity. A neutron star is an example of the collapsed core of a giant star. A certain neutron star of radius 10 km is of mass 1.5 $M_\odot$. The acceleration due to gravity on the surface of the neutron star is nearly

(A) 2.0×10^8 m/s^2 (B) 2.0×10^{12} m/s^2

(C) 2.6×10^{16} m/s^2 (D) 2.6×10^{20} m/s^2

2. The tympanic membrane (ear drum) is a very delicate component of the human ear. Typically, its diameter is 1 cm. The maximum force the ear can withstand is 2.5 N. In case a diver has to enter sea water of density $1.05 \text{ X } 10^3$ kg/m^3 without any protective gear, the maximum safe depth for the diver to go into water is about

(A) 12 m (B) 9 m (C) 3 m (D) 1.5 m

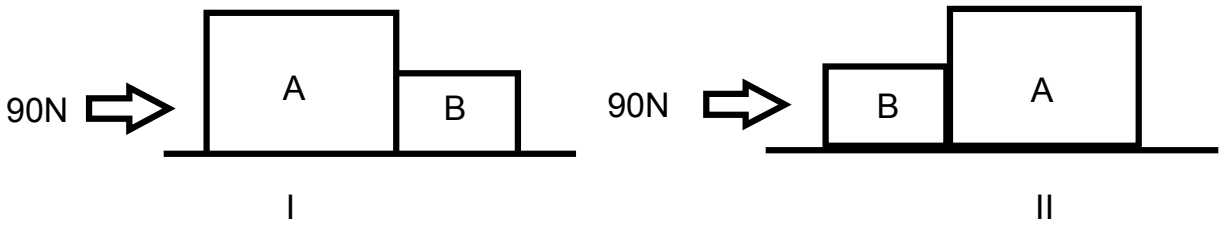
3. Two illuminated point objects O_1 and O_2 are placed at a distance 24 cm from each other along the principal axis of a thin convex lens of focal length 9 cm such that images of both the objects are formed at the same position. Then the respective distances of the lens from O_1 and O_2 (in cm) are

(A) 12 and 12 (B) 18 and 6 (C) 14 and 10 (D) 16 and 8

4. A nuclear reactor is working at 30% efficiency (i.e. conversion of nuclear energy to electrical energy). In this reactor $^{235}_{92}U$ nucleus undergoes fission and releases 200 MeV energy per atom. If 1000 kW of electrical power is obtained in this reactor, then the number of atoms disintegrated (undergone fission) per second in the reactor is

(A) 1.04×10^{17} (B) 6.5×10^{12} (C) 3.125×10^{12} (D) 3.25×10^{32}

5. Two blocks A and B are in contact with each other and are placed on a frictionless horizontal surface. A force of 90N is applied horizontally on block A (situation I) and the same force is applied horizontally on block B (situation II). Mass of A is 20 kg and B is 10 kg. Then the correct statement is



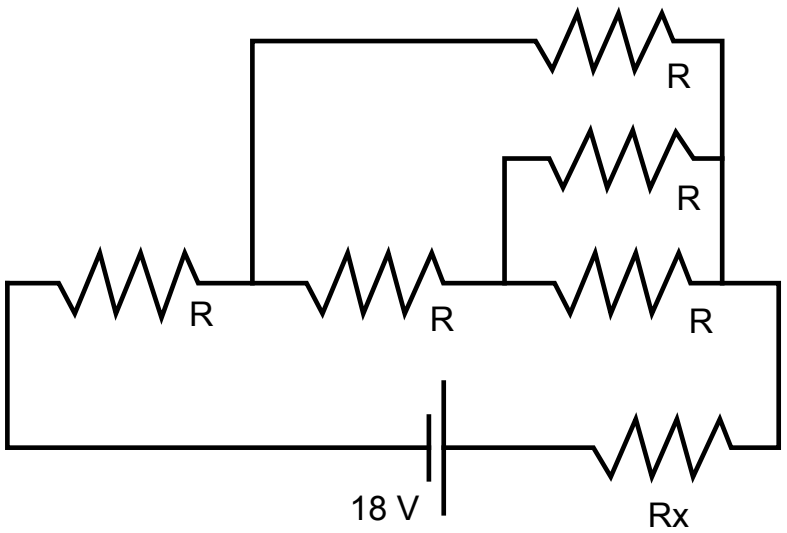
(A) Since both the blocks are in contact, magnitude of force by block A on B will be 90 N (situation I) and magnitude of force by block B on A will also be 90 N (situation II).

(B) Magnitude of force by block A on B is 30 N (situation I) and magnitude of force by block B on A is 60 N (situation II).

(C) Magnitude of force by block A on B is 60 N (situation I) and magnitude of force by block B on A is 30 N (situation II).

(D) The 90 N force will produce acceleration of different magnitudes in A and B.

6. In the adjoining circuit, R = 5 Ω. It is desired that the voltage across R_x should be 6 V, then the value of R_x should be



(A) 4 Ω (B) 12 Ω (C) 16 Ω (D) 20 Ω

7. In one process for waterproofing, a fabric is exposed to $(CH_3)_2SiCl_2$ vapors. The vapors react with the hydroxyl groups on the surface of the fabric or with traces of water to form the waterproofing film $[(CH_3)_2SiO]_n$, by the reaction; $n(CH_3)_2SiCl_2 + 2nOH^- \rightarrow 2nCl^- + nH_2O + [(CH_3)_2SiO]_n$ where n stands for a larger integer. The waterproofing film is deposited on the fabric layer upon layer. Each layer is 6 Å thick [the thickness of the $(CH_3)_2SiO$ group]. How much $(CH_3)_2SiCl_2$ is needed to waterproof one side of a piece of fabric, 1m by 2m, with a film 300 layers thick? The density of the film is 1.0 g/cm^3.

(A) 0.63g (B) 0.36g (C) 6.3g (D) 3.6g

8. Given that at a certain temperature, in 1.5 L vessel, 5.0 mole of A, 7.0 mole of B and 0.1 mole of C are present. Then the value of equilibrium constant for the reaction: A + B $\rightleftharpoons$ 2C + heat is about

(A) 7.22×10^{-4} (B) 2.31×10^{-4} (C) 7.22×10^{-5} (D) 6.11×10^{-4}

9. An alcohol (A) on dehydration with conc. H_2SO_4 at a high temperature yields compound (B). On ozonolysis every molecule of compound (B) yields two molecules of acetaldehyde. Which of the following is the starting alcohol (A)?

(A) 1- butanol (B) 2- butanol (C) propanal (D) 2-propanol

10. In an experiment with 100 mL 0.1 M solution of Copper Chloride, by mistake 5 gm of a mixture containing equal weights of Tin, Silver, Lead and Calcium, was added. Finally after some time the solution gets completely decolorized. This is mainly due to:

(A) Silver reacts with Copper Chloride
(B) Calcium reacts with Copper Chloride
(C) All the metals react with Copper Chloride
(D) Only Lead reacts with Copper Chloride forming white precipitate of lead chloride

11. Triclosan ($C_{12}H_7Cl_3O_2$) is an antibacterial and antifungal agent. It is a polychloro phenoxy phenol. It is widely used as a preservative and antimicrobial agent in personal care products such as soaps, skin creams, and deodorants etc. A label on a 200 mL hand sanitizer bottle claims that it contain Triclosan 0.2% w/v. What will be the number of molecules of Triclosan present in the bottle? (N_A is Avogadro's Number)

(A) $1.4 \text{ X } 10^{25}\ N_A$ (B) $1.4 \text{ X } 10^{24}\ N_A$ (C) $1.4 \text{ X } 10^{23}\ N_A$ (D) $1.4 \text{ X } 10^{22}\ N_A$

12. Suppose that A and B forms compound B_2A_3 and B_2A. If 0.05 mole of B_2A_3 weighs 12 g and 0.1 mole of B_2A weighs 10 g, what are the atomic weight of A and B respectively?

(A) 70 and 25 (B) 50 and 20 (C) 40 and 30 (D) 30 and 40

13. If in a wheat mutant, the length of chromosome 1B was found to be 6.7 µm instead of 5.0 µm, approximately how many additional base pairs are incorporated in the mutant chromosome?

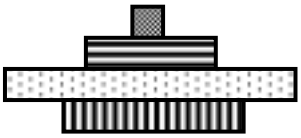
(A) $0.5 \text{ X } 10^4$ bp (B) $5 \text{ X } 10^4$ bp (C) $1.7 \text{ X } 10^4$ bp (D) $5.78 \text{ X } 10^4$ bp

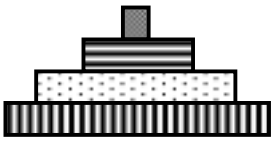
14. Considering following characteristics, identify the correct inheritance pattern from the given options.

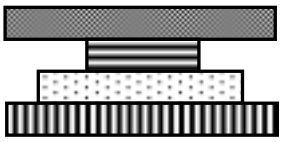
- Most affected individuals are male.
- Affected sons result from female parents who are either affected or who are known to be carriers because they have affected brothers, fathers, or maternal uncles.
- Affected daughters are born to affected fathers and either affected or carrier mothers.
- The sons of affected mothers should be affected.
- Approximately half the sons of carrier mothers should be affected.

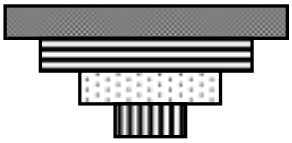
(A) Autosomal Recessive Inheritance (B) Autosomal Dominant Inheritance
(C) Sex-Linked Recessive Inheritance (D) Sex-Linked Dominant Inheritance

15. In a marine ecosystem with rich diversity of fauna, which of the following images would be a correct representation of pyramid of biomass?

(A) 

(B) 

(C) 

(D) 

16. The transpiration pull is maximum under which of the following conditions?

(A) Closed stomata, low light intensity, humid air

(B) Open stomata, dry air, moist soil

(C) Open stomata, dry air, dry soil

(D) Open stomata, high humidity in air, moist soil

17. *Curcuma longa*, *Azadirachta indica,* Basmati Rice, Indian Ginseng are all related to which of the following concepts?

(A) Bioterrorism (B) Biomagnification (C) Biopiracy (D) Biodegradation

18. Read following criteria carefully.

- Slow evolutionary change relative to similar entities
- Gross similarity to an ancestral fossil
- Very low taxonomic richness today compared to the past
- Phylogenetic inference of specific characters as plesiomorphic
- Phylogenetic inference of a genealogical divergence between other groups that diverged in the distant past
- Known in the fossil record before being discovered alive

These criteria can be used to categorize a group of organisms the most probably into

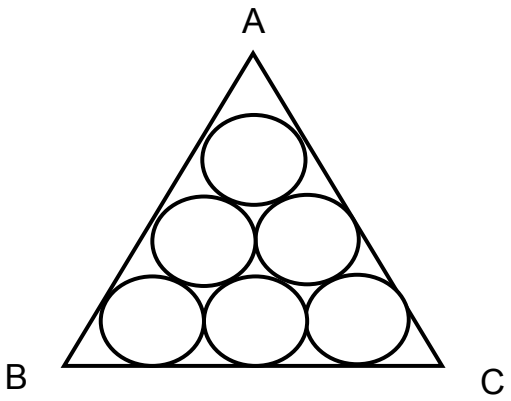
(A) Connecting links (B) Living fossils

(C) Endangered species (D) Extinct species

19. If $x^2 + ax + b = 0$ and $x^2 + bx + a = 0$ have one common root, then

(A) $a + b = 0$ (B) $a + b = 1$ (C) $a + b = -1$ (D) $a^2 + b^2 = 1$

20. Six circles each of radius 3 cm are inscribed in an equilateral triangle ABC such that they touch each other and also touch the sides of the triangle as shown in the adjacent figure. Then height of triangle ABC is



(A) $6\left(2\sqrt{3}+3\right)$
(B) $3\left(2\sqrt{3}+6\right)$
(C) $3\left(2\sqrt{3}+3\right)$
(D) $6\left(2+\sqrt{3}\right)$

21. Find the remainder when x^{51} is divided by $x^2 - 3x + 2$

(A) x
(B) $(2^{51} - 2)x + 2 - 2^{51}$
(C) $(2^{51} - 1)x + 2 - 2^{51}$
(D) 0

22. If $\frac{3}{x-2} < 1$, where x is a real number, then

(A) $2 < x < 5$
(B) $x < 2$ or $5 < x$
(C) $x < -2$ or $x > 5$
(D) None of these

23. If $100^{25} - 25$ is written in decimal notations, then the sum of its digits is

(A) 444
(B) 442
(C) 424
(D) 422

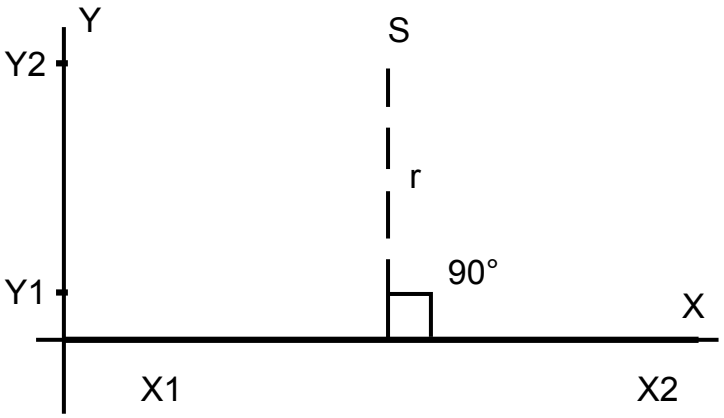
24. ABC is a triangle, the bisector of angle A meets BC in D. The relation between AD, AB and AC is

(A) $AD > \sqrt{AB.AC}$
(B) AD > AB.AC
(C) $AD = \sqrt{AB.AC}$
(D) $AD < \sqrt{AB.AC}$

PART A-2 · ONE OR MORE CORRECT OPTIONS

Q. 25 – 32 · 6 marks only if all correct options are marked · no negative marking

25. An infinitely long conductor when carrying current I, produces a magnetic field B around it. If such a conductor is placed along the X-axis, then the magnitude of B at a distance r is given by the relation $B = \frac{\mu_0}{4\pi}\frac{2I}{r}$, (where $\frac{\mu_0}{4\pi} = 10^{-7}\ NA^{-2}$ is a constant). The following figure shows such an infinitely long conductor placed along X-axis carrying current I and B at S is 2×10^{-4} T, directed into the plane of the paper at S. Given r = 1 cm. Then, the correct statements are



(A) I = 10 A

(B) The number of electrons transported across the cross section of the conductor during time 1s is 6.25×10^{19}

(C) The direction of current I is from X_2 to X_1.

(D) The electrons will flow in the direction X_2 to X_1.

26. The ratio of the charge of an ion or subatomic particle to its mass (q/m) is called specific charge. Then the correct options are

(A) SI unit of specific charge can be written as A·s /kg.

(B) If all the isotopes of hydrogen are ionized then tritium will have least specific charge among them.

(C) specific charge of an α- particle will be greater than that of an electron.

(D) specific charge ratio of an electron is 1.75×10^{11} C/kg.

27. Acetylene torches and burners used by glassblowers produce intense ultraviolet light. Glassblowers wear special glasses that contain which of the following elements to absorb the UV?

(A) Neodymium (B) Praseodymium (C) Cerium (D) Didymium

28. Equal lengths of magnesium ribbons are taken in four test tubes A, B, C, and D. In test tube A, 1M acetic acid is added; in test tube B, 1M HCl is added; in test tube C, 1M HNO_3 is added; and in test tube D, 1M NaOH is added. The observed results will be:

(A) The fizzing occurs more vigorously in A

(B) The fizzing occurs more vigorously in B

(C) The fizzing occurs more vigorously in C

(D) The fizzing occurs more vigorously in D

29. Choose the correct statements from following options.

(A) A robust adaptive immune response is initiated using weakened forms of the bacterium known as live attenuated vaccines.

(B) Administration of a killed or chemically inactivated virus can trigger a weaker adaptive immune response, but can be strengthened with booster doses.

(C) A conjugate or multivalent component always reduces immunogenicity of the vaccine.

(D) Inclusion of alum, cytokines, and/or lipids always reduces the immune response to a vaccine.

30. The minimum energy required to exist that is the energy required to perform chemical reactions even when a person is at rest is called the *basal metabolic rate* (BMR), which accounts for about 50 to 70 per cent of the daily energy expenditure in most sedentary individuals. It is influenced by many factors. Some statements are made about these factors. Choose the correct statements from the following options.

(A) Thyroid hormone decreases metabolic rate

(B) Growth hormone increases metabolic rate

(C) Fever decreases metabolic rate

(D) Malnutrition decreases metabolic rate

31. If $0 \le x \le \pi$ and $81^{\sin^2 x} + 81^{\cos^2 x} = 30$, then x =

[Useful information: $\pi^c = 180°$, $\sin(180 - \theta) = \sin\theta$, $\sin\theta \ge 0$ when $0 \le \theta \le 180°$]

(A) $\frac{\pi}{6}$

(B) $\frac{\pi}{3}$

(C) $\frac{5\pi}{6}$

(D) $\frac{2\pi}{3}$

32. Given $(a - b)^2 + (a - c)^2 = (b - c)^2$, then which of the following statements are true?

(A) equation is valid when b = c and $a \ne c$

(B) equation is valid when a = b

(C) equation is valid when a = c

(D) Given equation is not valid when a, b and c are distinct.

ANSWER KEY

IOQJS 2020-21 · PAPER CODE 51

32
QUESTIONS · 120 MARKS

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

1	(B)	2	(C)	3	(B)	4	(A)	5	(B)
6	(A)	7	(A)	8	–★	9	(B)★	10	(B)
11	–★	12	–★	13	(A)	14	(C)	15	(D)
16	(B)	17	(C)	18	(B)	19	(C)	20	(C)
21	(C)	22	(B)	23	(A)	24	(D)	25	(A), (B), (C)
26	(A), (B), (D)★	27	(A), (B)★	28	(B), (C)	29	(A), (B)	30	(B), (D)
31	(A), (B), (C), (D)	32	(B), (C), (D)						

★ Answers as per Zigyan

- **Q8** — As per Zigyan: no option is correct; IAPT key (B).
- **Q9** — As per Zigyan: (B); IAPT key (A) or (B).
- **Q11** — As per Zigyan: no option is correct; dropped by IAPT.
- **Q12** — As per Zigyan: no option is correct; dropped by IAPT.
- **Q26** — As per Zigyan: (A), (B), (D); IAPT key (A), (B), (C) or (A), (B), (D).
- **Q27** — As per Zigyan: (A), (B); IAPT key (A), (B).

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OLYMPIADS · 2026

Olympiad results



TOP ACHIEVEMENT · CHEMISTRY

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

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

Qualified twice | HBCSE selection camp | Only student from Faridabad

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

CHEMISTRY · ABOVE MAS



Sulokya Bibhuty
Class XII
3 Years Classroom
Above MAS



Anay Gupta
Class XI
3 Years Classroom
Above MAS



Akshat Khator
Class XI
3 Years Classroom
Above MAS



Harshit Goyal
Class XII
4 Years Classroom
Above MAS



Hardik Sharma
Class XI
3 Years Classroom
Above MAS



Aarush Kumar
Class XII
1 Year Classroom
Above MAS

PHYSICS · ASTRONOMY · MATHEMATICS

PHYSICS



Sulokya Bibhuty
Class XII
3 Years Classroom
Above MAS

PHYSICS



Saksham Bishnoi
Class XII
4 Years Classroom
Above MAS

ASTRONOMY



Sulokya Bibhuty
Class XI
3 Years Classroom
Above MAS

MATHEMATICS · IOQM



Priyanshi
Class XI
4 Years Classroom
IOQM Qualifier

OLYMPIADS WE PREPARE STUDENTS FOR

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

The olympiad pathway starts in Class 8.

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

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RESULTS · 2021 – 2026

Our toppers, year by year

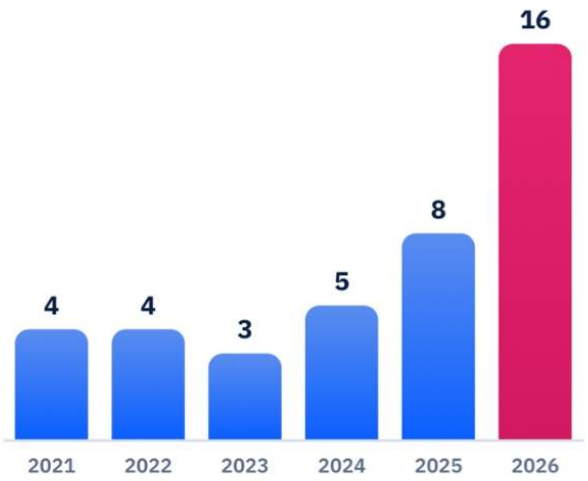
40
JEE Advanced selections in 6 years

AIR 168
best rank — Saksham Bishnoi, 2026

16 of 35
students selected, JEE Advanced 2026

14 of 35
above 98 percentile, JEE Main 2026

JEE ADVANCED SELECTIONS PER YEAR



BEST RANK EACH YEAR

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

JEE ADVANCED 2026 — THIRTEEN NAMED SELECTIONS



Saksham Bishnoi
AIR 168
4 Years Classroom



Sulokya Bibhuty
AIR 1,315
3 Years Classroom



Aarush
AIR 2,699
1 Year Classroom



Manishka
AIR 2,869
4 Years Classroom



Oojit Kumar
AIR 5,765
4 Years Classroom



Harshit Goyal
AIR 6,407
4 Years Classroom



Pranab Sharma
AIR 6,750
3 Years Classroom



Aditya Dhar
AIR 15,183
3 Years Classroom



Arpit Anshuman
AIR 19,308
4 Years Classroom



Lokesh
AIR 22,857
3 Years Classroom



Arjun
AIR 24,674
3 Years Classroom



Sanyam Gulyani
AIR 25,123
1 Year Classroom



Saket
AIR 27,628
3 Years Classroom

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

JEE MAIN 2026 — TOP SIX, WITH PERCENTILE



Saksham Bishnoi
AIR 811
99.95 %ile
4 Years Classroom



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



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



Manishka
AIR 4,817
99.70 %ile
4 Years Classroom



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



Aarush
AIR 5,276
99.67 %ile
1 Year Classroom

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

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