NARAYANA
IIT-JEE / NEET / FOUNDATIONS
NSAT-2021

Class XII Moving to Class XII Pass (PCM)

MATHEMATICS, PHYSICS & CHEMISTRY

NARAYANA SCHOLASTIC APTITUDE TEST (NSAT)

Time: 1:00 Hr.   *Date : 28-11-21*   *Maximum marks: 140*

SET-1

IMPORTANT INSTRUCTIONS:

1. The test Booklet consists of 35 questions. The maximum marks are 140.
2. There are three parts in the question paper of Mathematics, Physics & Chemistry having 35 questions. Each question is allotted 4 (four) marks for each correct response.
3. No Negative Marking.
4. Mark only one correct answer out of four alternatives.
5. Use Blue/Black Ball Point Pen only for writing particulars/marking.
6. Use of Calculator is not allowed.
7. Dark the circle in the space provided only.
8. Use of white fluid or any other material which damage the answer sheet, is not permissible on the Answer Sheet.

TO BE FILLED IN CAPITAL LETTERS

NAME OF THE STUDENT : _____

FATHER'S NAME : _____

CONTACT NUMBERS:_____SCHOOL NAME : _____

ROLL NO. :_____TEST CENTRE : _____

I have read all the instructions and shall abide by them	I have verified all the information filled in by the Candidate
……..……………………………… **Signature of the Candidate**	……….……………….…………….… **Signature of the Invigilator**

EDUCATION IS INTEGRAL FOR GROWTH AND DEVELOPMENT

Education is integral for the growth and development of an individual. The expectation from an educational institute is always about making the society better for all and to bring out one's true Potential in the service of mankind.

At Narayana, we believe that a student's education is complete only when we are able to contribute towards his/her overall development besides imparting knowledge based and career oriented training.

With an aim to provide top of the league training to students to excel in every sphere of their lives, Narayana Group has been focusing on result oriented inputs.

Narayana's courses have been designed to cater to all the needs of the aspirants to help them excel in various competitive as well as Board examinations. Innovative strategies and techniques adopted in our centres keep our students abreast of the ever-changing pattern of top level Engineering/Medical Entrance Exams. As a result, Narayana's time-tested learning formulae are percolating to far-flung corners of India to benefit students from all backgrounds.

"Footprints on the sands of time are not made by sitting down". Today we rededicate the last 4 decades of our success to your dreams. I wish all our students a very successful academic year ahead.

Dr. P. NARAYANA
Founder, Narayana Group

MATHEMATICS

1. The domain of $f(x) = \log_{10} \dfrac{x-5}{x^2-10x+24} - \sqrt[3]{x+5}$

    (A) (4, 5)   (B) $(6, \infty)$ (C) $(4,5) \cup (6,\infty)$ (D) $(4,5] \cup (6,\infty)$

2. If $f(x) = \cos(\log x)$ then the value of $f(x^2)f(y^2) - \dfrac{1}{2}\left[f\left(\dfrac{x^2}{y^2}\right) + f(x^2 y^2) \right]$ is

    (A) –2   (B) –1   (C) $\dfrac{1}{2}$ (D) None

3. Give $f : R \to [0,1); f(x) = 2x - [2x]$ then it is.

    (A) one – one in $\left[0, \dfrac{1}{2}\right)$ (B) one – one in $[0, 2]$

    (C) Invertible in $[0, 3)$ (D) Invertible in $[0, 2]$

4. The least integral value of k for which
    $(k-2)x^2 + 8x + k + 4 > \sin^{-1}(\sin 12) + \cos^{-1}(\cos 12)$ for all $x \in R$, is

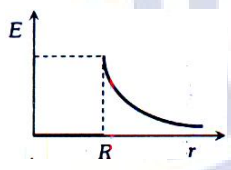   (A) -7   (B) -5   (C) -3   (D) 5
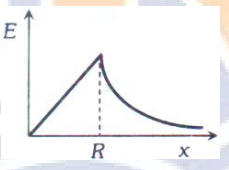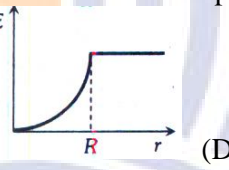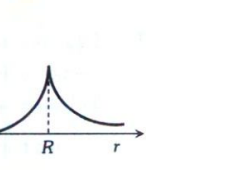
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5. If $\begin{vmatrix} x^n & y^n & z^n \\ x^{n+2} & y^{n+2} & z^{n+2} \\ x^{n+3} & y^{n+3} & z^{n+3} \end{vmatrix} = (x-y)(y-z)(z-x)\left(\dfrac{1}{x}+\dfrac{1}{y}+\dfrac{1}{z}\right)$ then

    (A) n = 1   (B) n = –1   (C) n = 2   (D) n = –2

6. Let X and Y be two arbitrary, 3×3, non zero, skew-symmetric matrices and Z be an arbitrary 3×3, non zero, symmetric matrix. Then which of the following matrices is (are) skew symmetric?

    (A) $Y^3Z^4 - Z^4Y^3$ (B) $X^{44} + Y^{44}$

    (C) $X^4Z^3 - Z^3X^4$ (D) $X^{50} + Y^{40}$

7. The left hand derivative of $f(x)=[x]\sin(\pi x)$ at x = k, where k is an integer and [.] denotes greatest integer function, is

    (A) $(-1)^k (k-1)\pi$ (B) $(-1)^{k-1} (k-1)\pi$

    (C) $(-1)^k k\pi$ (D) $(-1)^{k-1}k\pi$

8. The no. of points at which the function $f(x) = \left(x-|x|\right)^2 (1-x+|x|)^2$ is not differentiable in the interval (–3, 4) is

    (A) 0   (B) 1   (C) 2   (D) 3
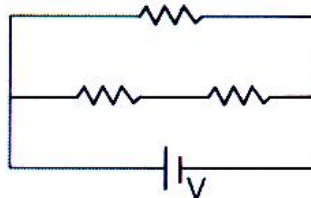
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9.   The two curves $x = y^2$, $xy = a^3$ cut orthogonally at a point. The a^2 is equal to

(A) $\dfrac{1}{3}$ (B) 3   (C) 2   (D) $\dfrac{1}{2}$

10.   The triangle formed by the tangent to the curve $f(x) = x^2 + bx - b$ at the point (1, 1) and the coordinate axes lies in the first quadrant. If its area is 2, then the value of b is

(A) – 1   (B) 3   (C) – 3   (D) 1

11.   The function $f(x) = \dfrac{\log(\pi + x)}{\log(e + x)}$ is

(A) increasing on $[0, \infty)$

(B) decreasing $[0, \infty)$

(C) increasing on $[0, \pi/e)$ and decreasing on $[\pi/e, \infty)$

(D) decreasing on $[0, \pi/e)$ and increasing on $[\pi/e, \infty)$

12.   If $f(x) = \begin{cases} [x] + [-x], & x \neq 2 \\ \lambda, & x = 2 \end{cases}$ (where, [.] denotes greatest integer function), f is continuous

then λ equal to

(A) –1   (B) 0   (C) 1   (D) 2

13.   The point of non-differentiability of the function $f(x) = \Big|\big||x - 1| - 1\big| - 1\Big|$ are:

(A) $\{0, 1, 2, 3, 4\}$ (B) $\{-1, 0, 1, 2, 3\}$ (C) $\{-1, 0, 1\}$ (D) None of these

Space for rough work

PHYSICS

14. A charged particle of mass m_1 and charge q_1 is revolving in a circle of radius r. Another charged particle of charge q_2 and mass m_2 is situated at the centre of the circle. If the velocity and time period of the revolving particle be v and T respectively then

   (A) $v = \sqrt{\dfrac{q_1 q_2 r}{4\pi\varepsilon_0 m_1}}$

   (B) $v = \dfrac{1}{m_1}\sqrt{\dfrac{q_1 q_2}{4\pi\varepsilon_0 r}}$

   (C) $T = \sqrt{\dfrac{16\pi^3 \varepsilon_0 m_1^2 r^3}{q_1 q_2}}$

   (D) $T = \sqrt{\dfrac{16\pi^3 \varepsilon_0 m_1 r^3}{q_1 q_2}}$

15. Two equal −ve charges −q are fixed at the points (0, a) and (0, −a) on the y-axis. A positive charge Q is released from rest at the point (2a, 0) on the x-axis. The charge will
   (A) execute SHM about the origin
   (B) move to the origin and remain at rest
   (C) move to infinity
   (D) execute oscillatory but not SHM

16. Which of the following graphs shows the variation of electric field E due to a hollow spherical conductor of radius R as a function of distance from the centre of the sphere

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

17. Three identical resistors are connected across a voltage source V so that one of them is in parallel with two other which are connected in series as shown. The first one, compared to the power dissipated by each of the other two, is approximately;


   (A) the same   (B) half as much   (C) twice as much   (D) four times as much

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Space for rough work

18.   Maximum power developed across variable resistance R in the circuit shown in figure, is
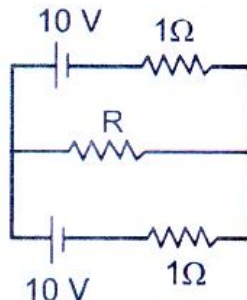

(A) 50 watt   (B) 75 watt   (C) 25 watt   (D) 100 watt

19.   Eight drops of mercury of equal radii possessing equal charges combine to form a big drop. Then the capacitance of bigger drop compared to each individual small drop is

(A) 8 times   (B) 4 times   (C) 2 times   (D) 32 times

20.   A proton, a deuteron and an α-particle having the same kinetic energy are moving in trajectories in a constant magnetic field. If r_p, r_d and $r_α$ denote respectively the radii of the trajectories of these particles, then

(A) $r_\alpha = r_p < r_d$ (B) $r_\alpha > r_d > r_p$ (C) $r_\alpha = r_d > r_p$ (D) $r_p = r_d = r_\alpha$

21.   A semi-circular wire PQR of radius R is connected to a wire bent in the form of a sine curve RSTUP to form a closed loop as shown in the figure. If the loop carries a current I and is placed in a uniform magnetic field B, then the total force acting on the sine curve is:
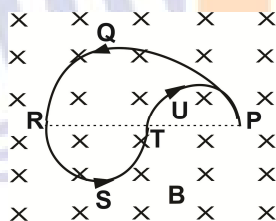
(A) 2BIR (downward).   (B) 2BIR (upward).

(c) BIR (upward).   (D) Zero.

22.   If ϕ_1 and ϕ_2 be the angles of dip observed in two vertical planes at right angles to each other and ϕ be the true angle of dip, then

(A) $\cos^2 \phi = \cos^2 \phi_1 + \cos^2 \phi_2$ (B) $\sec^2 \phi = \sec^2 \phi_1 + \sec^2 \phi_2$

(C) $\tan^2 \phi = \tan^2 \phi_1 + \tan^2 \phi_2$ (D) $\cot^2 \phi = \cot^2 \phi_1 + \cot^2 \phi_2$
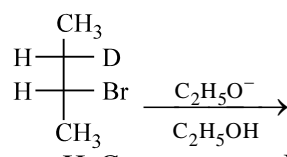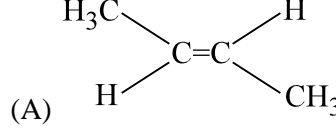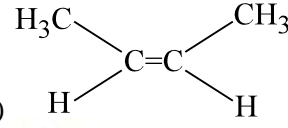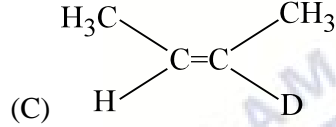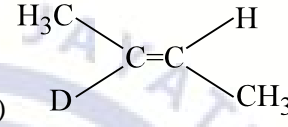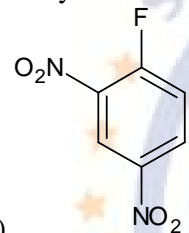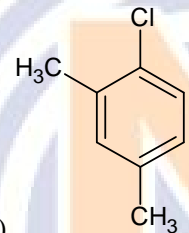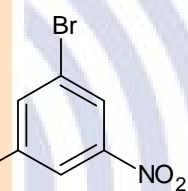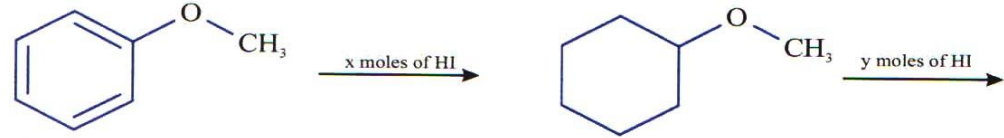
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23. A coil having n turns and resistance RΩ is connected with a galvanometer of resistance 4R Ω. This combination is moved in time t second from a magnetic flux ϕ_1 weber to ϕ_2 weber. The induced current in the circuit is:

(A) $\dfrac{\phi_2 - \phi_1}{5Rnt}$ 　　　(B) $-\dfrac{n(\phi_2 - \phi_1)}{5Rt}$ 　　　(C) $-\dfrac{(\phi_2 - \phi_1)}{Rnt}$ 　　　(D) $-\dfrac{n(\phi_2 - \phi_1)}{Rt}$

24. The instantaneous emf in AC circuit is given by E = 50 sin(314 t) V, where t is in seconds. In how much time the emf will becomes 25 V starting from zero?

(A) $\dfrac{1}{50}s$ 　　　(B) $\dfrac{1}{200}s$ 　　　(C) $\dfrac{1}{314}s$ 　　　(D) $\dfrac{1}{600}s$
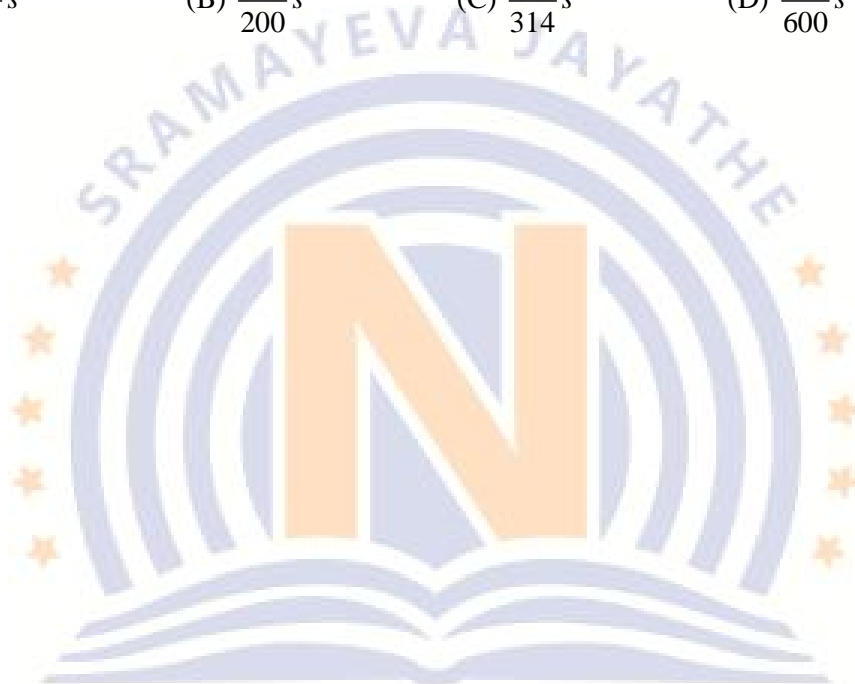
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CHEMISTRY

25.

? Major product is:

(A)

(B)

(C)

(D)

26. Identify correct reactivity order for ArSN reaction

(i)   (ii)   (iii)

(A) (i) > (ii) > (iii)   (B) (ii) > (iii) > (i)   (C) (i) > (iii) > (ii)   (D) (iii) > (i) > (ii)

27.

Sum of x and y is

(A) 2   (B) 3   (C) 4   (D) 5

28. $C_6H_5OH \xrightarrow[NaOH, \Delta]{CCl_4} X \xrightarrow[Heat]{Zn\ dust} Y \xrightarrow[Soda\ lime]{Na} Z$

In the above sequence Z is

(A) totuene   (B) cresol   (C) benzene   (D) benzol

Space for rough work

29. The following carbohydrate is:
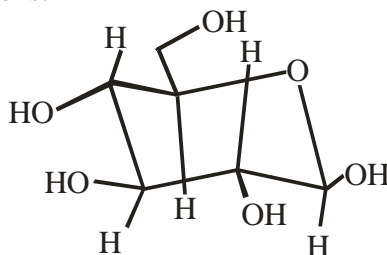
(A) a ketohexose   (B) an aldohexose   (C) an α-furanose   (D) an α-pyranose

30. The structure of glycine (amino acid) is given below $H_3\overset{\oplus}{N}CH_2 - \overset{\overset{O}{\|}}{C}O^{\ominus}$ is select the incorrect statement of the following

(A) the above structure is known as zwitter ion

(B) The acidic functional group in amino acids is $-\overset{\oplus}{N}H_3$

(C) The basic functional group in amino acids is $-CO_2^{\ominus}$

(D) Glycine is optically active amino acid

31. The ratio of volume of metal atoms occupied in one fcc unit cell and that of in one hcp unit cell is, respectively

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

32. Number of solutions which have $\Delta H_{mixer} > 0; \Delta V_{mixer} > 0; \Delta S_{mixer} > 0; \Delta G_{mixer} < 0$

I) Bromo ethane + Chloro ethane
II) Benzene + Toluene
III) Ethanol + acetone
IV) CS_2 + acetone
V) Phenol + aniline
VI) Chloroform + acetone
VII) Pyridine + CH_3COOH
VIII) $C_6H_5Cl + C_6H_5Br$
IX) $CHCl_3 + CCl_4$
X) $H_2O + HClO_4$

(A) 4   (B) 3   (C) 2   (D) 8

33. A molecule $A_2B \left(Mw = 166.4 \right)$ occupies triclinic lattice with $a = 5\overset{0}{A}, b = 8\overset{0}{A},$ and $c = 4\overset{0}{A}$. If the density of AB_2 is $5.2\, g\, cm^{-3}$, the number of molecules present in one unit cell is

(A) 2   (B) 3   (C) 4   (D) 5

Space for rough work

34. Pressure over ideal binary liquid mixture containing 10 moles each of liquid A and B is gradually decreased isothermally. If $P_A^\circ = 200\,mm$ Hg and $P_B^\circ = 100$ mm Hg, find the pressure at which half of the liquid is converted into vapour.

    (A) 150 mm Hg   (B) 166.5 mm Hg

    (C) 133 mm Hg   (D) 141.4 mm Hg

35. Oxygen is more electronegative than sulphur, Yet H_2S is acidic while H_2O is neutral. This is because

    (A) Water is highly associated compound

    (B) H- S bond is weaker than H- O bond

    (C) H_2S is a gas while H_2O is liquid

    (D) molecular weight of H_2S is more than that of H_2O

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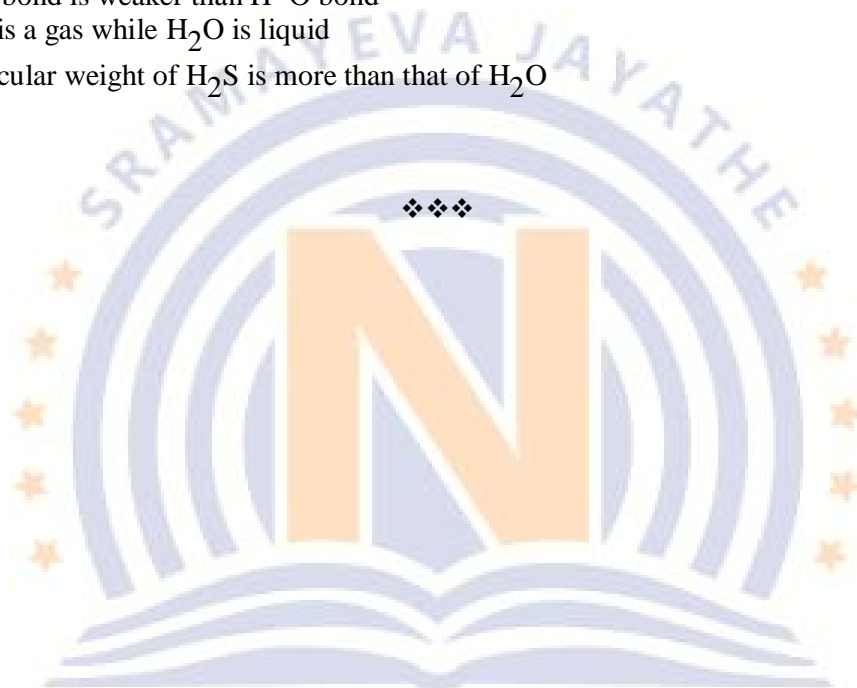
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COURSES OFFERED FOR STUDENTS STUDYING IN:

Class 7th	Class 8th	Class 9th	Class 10th	Class 11th	Class 12th
7th Moving to 8th	8th Moving to 9th	9th Moving to 10th	10th Moving to 11th	11th Moving to 12th	Studying Students
1,3 & 5 Year Integrated Courses	1,2 & 4 Year Integrated Courses	1 & 3 Year Integrated Courses	2 Year Integrated Courses	1 Year Integrated Courses	1 Year Repeater Courses

School / Board Exams, NTSE, Olympiads, NEET / JEE (MAIN & ADVANCED FOUNDATION) | NEET / JEE (MAIN & ADVANCED)

SENSATIONAL SUCCESS
in JEE ADVANCED-2021
ALL INDIA OPEN CATEGORY

Rank	Name	Roll No.
1st	MRIDUL AGARWAL	Roll. No. 2050447
4th	SANTOSH REDDY	Roll No. 6115012
5th	SAI LOKESH REDDY	Roll. No. 6103113
9th	ARNAV ADITYA	Roll No. 2063168
14th	AMEYA PRASHANT D	Roll No. 1063147
18th	ASHWIN ABRAHAM	Roll No. 6085120

ALL INDIA OPEN CAT. 100 — **26**
ALL INDIA BELOW 100 — **98**
ALL INDIA BELOW 1000 — **502**

Ranks: 21, 25, 26, 27, 29, 36, 41, 43, 48, 51
53, 55, 63, 64, 74, 82, 85, 86, 97, 100

JEE MAIN 2021
ALL INDIA OPEN CATEGORY TOP 10 RANKS

Rank	Name	App. No.
1st	K. Sharanya	App. No. 210310200613
1st	M Adarsh Reddy	App. No. 210310179692
1st	P. Veera Shiva	App. No. 210310321974
1st	Rahul Naidu	App. No. 210310322801
1st	Gaurab Das	App. No. 210310200516
2nd	Venkat Aditya	App. No. 210310215185
4th	P L Sai Lokesh	App. No. 210310181629
6th	K. Puneeth Kumar	App. No. 210310272002
7th	B. Rohith Reddy	App. No. 210310206278

BELOW 100	**25** RANKS
BELOW 1000	**126** RANKS
TOTAL QUALIFIED FOR JEE-ADV.	**15146** (SO FAR)

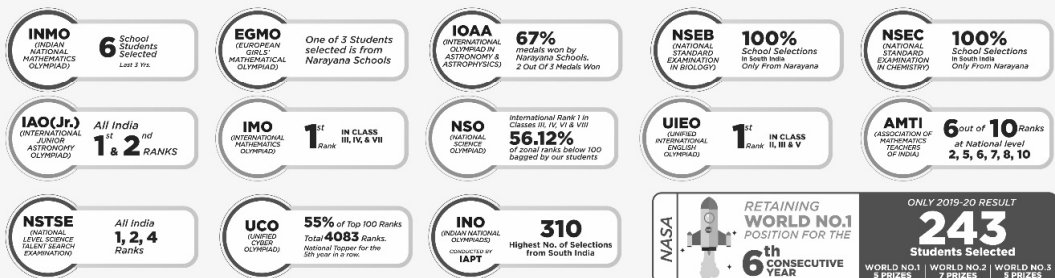**NARAYANA STUDENTS WHO SECURED HIGHEST PERCENTILE IN MATHS, PHYSICS & CHEMISTRY**

Percentile & Above	in Maths	in Physics	in Chemistry
100	70	48	21
99	719	532	610
98	1325	864	1030
97	1848	1201	1392
96	2420	1490	1742
95	2969	1785	2095
94	3502	2076	2447
93	4035	2401	2807
92	4639	2746	3182
91	5223	3022	3539
90	5806	3364	3967

ALL CATEGORIES ALL INDIA RANKS BELOW 100	**109**
ALL CATEGORIES ALL INDIA RANKS BELOW 1000	**564**
NARAYANA STUDENTS QUALIFIED FOR JEE-ADVANCED	**15146**

NEET- 2020

Rank	Name	HT No.
1st	ABHIUDAY PRATAP SINGH	HT.No. 440810830
2nd	D. SAI CHAKRADHAR	HT No. 1202006287
2nd	SHIVA RAMA KRISHNA	HT No. 1305021314
3rd	NARENDRA BISHNOI	HT.No. 3905217001
6th	D. VISHNU SAI	HT No. 1206017081
7th	J VENU PRAKASH	HT No. 1206017081
8th	KARTHIK REDDY	HT.No. 2705094153
9th	K. SHARANYA	HT No. 1202005435

*All Cat.

Below 10	**8** Ranks
Below 100	**32** Ranks
Below 200	**43** Ranks
Below 300	**59** Ranks

*All Cat.

SOLID FOUNDATION GIVEN BY NARAYANA MAKES STUDENTS WORLD CHAMPIONS
IN MATHS, PHYSICS, CHEMISTRY, BIOLOGY, ASTRONOMY, ENGLISH & CYBER OLYMPIADS

INMO (INDIAN NATIONAL MATHEMATICS OLYMPIAD) — **6** School Students Selected Last 3 Yrs.

EGMO (EUROPEAN GIRLS' MATHEMATICAL OLYMPIAD) — One of 3 Students selected is from Narayana Schools

IOAA (INTERNATIONAL OLYMPIAD IN ASTRONOMY & ASTROPHYSICS) — **67%** medals won by Narayana Schools. 2 Out Of 3 Medals Won

NSEB (NATIONAL STANDARD EXAMINATION IN BIOLOGY) — **100%** School Selections In South India Only From Narayana

NSEC (NATIONAL STANDARD EXAMINATION IN CHEMISTRY) — **100%** School Selections In South India Only From Narayana

IAO(Jr.) (INTERNATIONAL JUNIOR ASTRONOMY OLYMPIAD) — All India **1st & 2nd** RANKS

IMO (INTERNATIONAL MATHEMATICS OLYMPIAD) — **1st** Rank IN CLASS III, IV, & VII

NSO (NATIONAL SCIENCE OLYMPIAD) — International Rank 1 in Classes III, IV, VI & VIII **56.12%** of zonal ranks below 100 bagged by our students

UIEO (UNIFIED INTERNATIONAL ENGLISH OLYMPIAD) — **1st** Rank IN CLASS III & V

AMTI (ASSOCIATION OF MATHEMATICS TEACHERS OF INDIA) — **6 out of 10** Ranks at National level 2, 5, 6, 7, 8, 10

NSTSE (NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION) — All India **1, 2, 4** Ranks

UCO (UNIFIED CYBER OLYMPIAD) — **55%** of Top 100 Ranks Total **4083** Ranks. National Topper for the 5th year in a row.

INO (INDIAN NATIONAL OLYMPIAD) CONDUCTED BY IAPT — **310** Highest No. of Selections from South India

NASA RETAINING WORLD NO.1 POSITION FOR THE **6th** CONSECUTIVE YEAR

ONLY 2019-20 RESULT **243** Students Selected
WORLD NO.1 5 PRIZES | WORLD NO.2 7 PRIZES | WORLD NO.3 5 PRIZES

SRAMAYEVA JAYATHE

NARAYANA
IIT-JEE / NEET / FOUNDATIONS
(A Unit of NSPIRA Management Services Pvt. Ltd.)