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

NSAT
NARAYANA SCHOLASTIC APTITUDE TEST
ASPIRE • ASSESS • ACHIEVE

NSAT-2024

CLASS – XI (Mathematics, Physics & Chemistry)
(Class XI Moving to XII-PCM)

NARAYANA SCHOLASTIC APTITUDE TEST (NSAT)

SAMPLE PAPER

Time: 1:00 Hr. ***Maximum marks: 160***

IMPORTANT INSTRUCTIONS:

1. **The test Booklet consists of 40 questions. The maximum marks are 160.**
2. **There are five parts in the question paper of Mathematics (Q. No. 1 to 14), Physics (Q. No. 15 to 27) & Chemistry (Q. No. 28 to 40) having 40 questions. Each question is allotted +4 (four) marks for each correct response & -1 for each incorrect answer**
3. **Mark only one correct answer out of four alternatives.**
4. **Use Blue/Black Ball Point Pen only for writing particulars/marking.**
5. **Use of Calculator is not allowed.**
6. **Dark the circle in the space provided only.**
7. **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

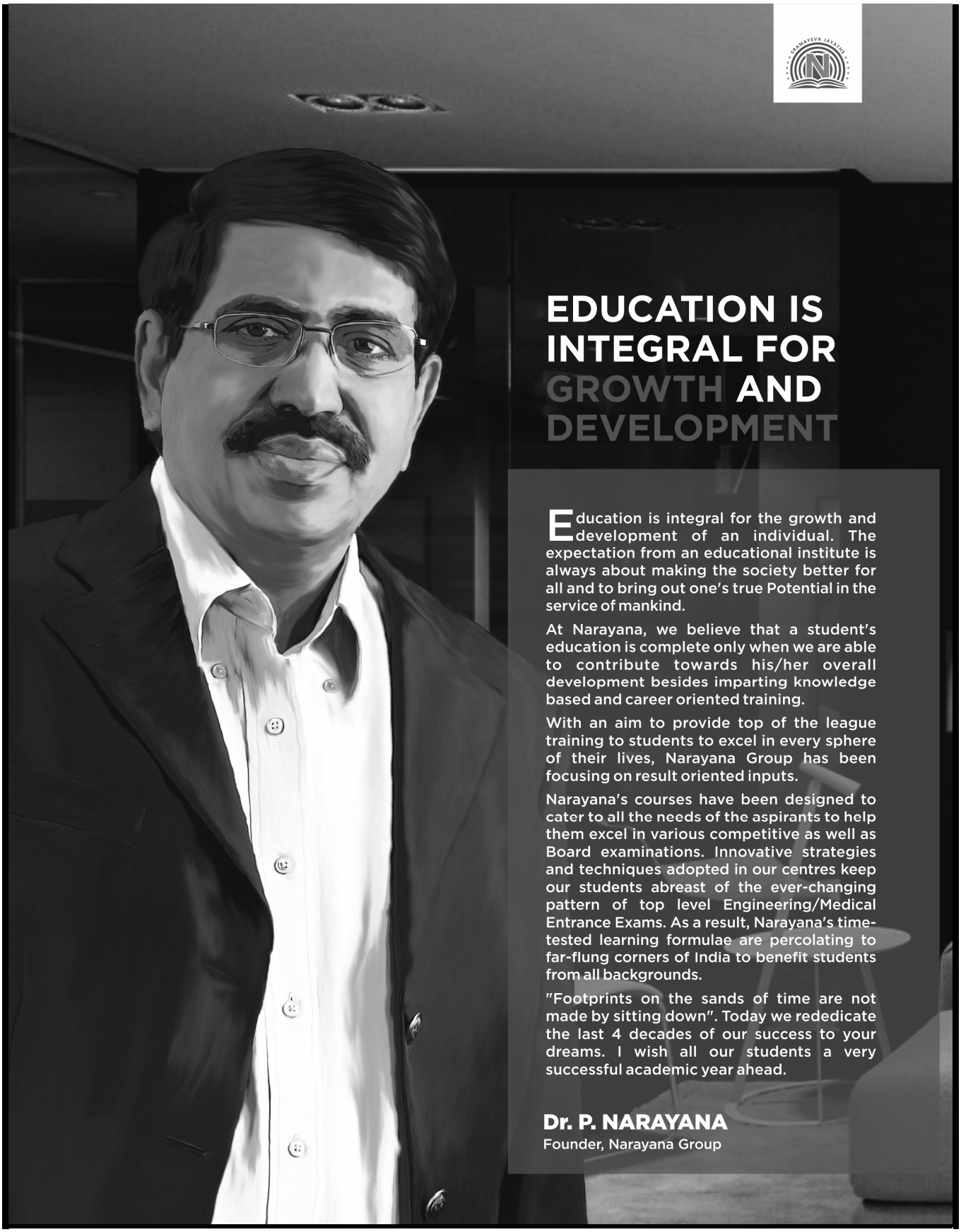
NAME OF THE STUDENT : _____

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

MATHS

1. In how many ways 20 persons can be arranged on 50 seats around a table such that diametrically opposite seat of each person is empty

(A) ${}^{24}C_{19}(19!)(2^{19})$ (B) ${}^{24}C_{19}(2^{19})$ (C) ${}^{25}C_{19}(19!)(2^{19})$ (D) None of these

2. The value of the expression

$$2\left(1+\frac{1}{\omega}\right)\left(1+\frac{1}{\omega^2}\right)+3\left(2+\frac{1}{\omega}\right)\left(2+\frac{1}{\omega^2}\right)+4\left(3+\frac{1}{\omega}\right)\left(3+\frac{1}{\omega^2}\right)+....+(n+1)\left(n+\frac{1}{\omega}\right)\left(n+\frac{1}{\omega^2}\right),$$

where ω is an imaginary cube root of unity, is

(A) $\frac{n\left(n^2+2\right)}{3}$ (B) $\frac{n\left(n^2-2\right)}{3}$ (C) $\frac{n^2(n+1)^2+4n}{4}$ (D) None of these

3. If $||x| - 2| \geq 4$ then

(A) $x \in [-4,8]$ (B) $x \in [-5,8]$ (C) $x \in [-6,6]$ (D) None of these

4. The equation $\sqrt{x+1}-\sqrt{x-1}=\sqrt{4x-1}$ has

(A) No solution (B) One solution

(C) Two solutions (D) More than two solutions

5. Find 50^{th} term of sequence 2, 10, 20, 32, 46, 62…….

(A) 2740 (B) 2742 (C) 2744 (D) 2746

6. The number of real roots of $\left(x+\frac{1}{x}\right)^3+\left(x+\frac{1}{x}\right)=0$ is

(A) 0 (B) 2 (C) 4 (D) 6

7. The number of ways in which four boys and four girls can be seated around a circular table so that no two girls sit together is

(A) 16 (B) 3!4! (C) 4!4! (D) 7!

8. $n \in N$ *then* $\left(\frac{1+i}{\sqrt{2}}\right)^{8n}+\left(\frac{1-i}{\sqrt{2}}\right)^{8n}=$

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

9. If A = {1, 3, 5, 7, 9, 11, 13, 15, 17}, B = {2, 4, ……, 18} and N is the universal set, then $A' \cup \{(A \cup B) \cap B'\}$ is

(A) A (B) N (C) B (D) None of these

Space for rough work

10. If $\frac{2x-3}{4}+9 \geq 3+\frac{4x}{3}$, then x $\in$

(A) $\left(-\infty, \frac{63}{10}\right]$ (B) $\left(-\infty, -\frac{63}{10}\right]$ (C) $\left(\frac{63}{10}, \infty\right]$ (D) $\left[\frac{63}{10}, \infty\right)$

11. If $\sqrt{2}$ sec x + tan x = 1, then the value of x is

(A) $2n\pi+\frac{\pi}{3}$ (B) $2n\pi-\frac{\pi}{4}$ (C) $2n\pi+\frac{\pi}{6}$ (D) $n\pi+\frac{\pi}{3}$

12. Number of ways in which 25 identical things be distributed among five persons if each gets odd number of things is

(A) $^{25}C_4$ (B) $^{12}C_8$ (C) $^{14}C_{10}$ (D) $^{13}C_3$.

13. If the ratio of the sum to n terms of two A.P.'s is (5n + 3) : (3n + 4), then the ratio of their 17^{th} terms is

(A) 172 : 99 (B) 168 : 103 (C) 175 : 99 (D) 171 : 103

14. Three numbers form an increasing G.P. if the middle number is doubled, then the new numbers are in A.P. The common ratio of the G.P. is

(A) $2-\sqrt{3}$ (B) $2+\sqrt{3}$ (C) $\sqrt{3}-2$ (D) $3+\sqrt{2}$

Space for rough work

PHYSICS

15. Unit of $\frac{CV^2t}{\rho\varepsilon_0}$ (where C- Capacitance, V- Voltage, ρ-Resistivity, $\in_0$- Permittivity, t- time) represent the physical quantity is:

(A) Charge (B) Time (C) Power (D) Current

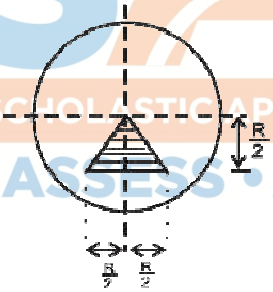
16. A particle of mass m is projected at an angle with horizontal with kinetic energy E. The potential energy at the top of its trajectory is E/2. Find the range.

(A) $\frac{E}{mg}$ (B) $\frac{E}{2mg}$ (C) $\frac{2E}{mg}$ (D) $\frac{E}{mg\sqrt{2}}$

17. Two masses of mass m and 4 m are moving with equal kinetic energies. The ratio of their momentum (magnitudes) is:

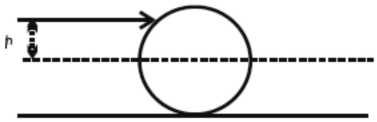
(A) 4 : 1 (B) 1 : 2 (C) $\sqrt{2}$: 1 (D) 1 : 16

18. In the figure as shown, a triangular portion is cut from a circular disc of radius R. The distance of centre of mass of the remainder from the centre of the disc is:



(A) $\frac{R}{3(4\pi-1)}$ (B) $\frac{R}{4(3\pi-1)}$ (C) $\frac{2R}{3(4\pi-1)}$ (D) $\frac{3R}{4(3\pi-1)}$

19. A disc of mass m and radius r is placed on a rough horizontal surface. A cue hits the disc at a height r/2 from the axis passing through centre and parallel to the surface, as shown. The disc starts its motion just after hitting



(A) Pure rolling (B) Rolling with forward slipping

(C) Rolling with backward slipping (D) Pure slipping

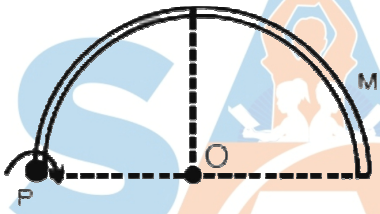
Space for rough work

20. A body is moved along a straight line by an machine delivering constant power. The distance moved by the body in time t is proportional to:
(A) $t^{3/2}$ (B) $t^{1/2}$ (C) $t^{3/4}$ (D) t^2.

21. Plank A moves on a horizontal surface with an acceleration a. Sphere B rolls on the plank A without slipping with linear acceleration a_0. Plank C does not slip- and moves on the sphere parallel to the plane. Find the acceleration with which plank C moves:
(A) $a + a_0$ (B) $2a + a_0$ (C) $2a_0 - a$ (D) $2(a + a_0)$

22. A force $\vec{F} = -K\left(y\hat{i} + x\hat{j}\right)$ (where K is a positive constant) acts on a particle moving in xy plane. Starting from the origin, the particle is taken along positive x-axis to the point (a, 0) and then parallel to y-axis to the point (a,a). The total work done by the force F on the particle is:
(A) $-2Ka^2$ (B) $2Ka^2$ (C) Ka^2 (D) $-Ka^2$.

23. Calculate the moment of inertia about an axis passing through point P, perpendicular to the plane of semi circular ring of mass M and radius R as shown in figure.



(A) MR^2 (B) $2MR^2$ (C) $MR^2/2$ (D) $3MR^2/2$

24. A ball is thrown vertically upwards with velocity of 20 m/s from top of a building. The height of building from where ball is thrown is 25 m from the ground. How long will it be before the ball hits the ground? Take g = 10 m/s^2.
(A) t = 5s (B) t = 10 (C) t = 15s (D) t = 20s

25. A heavy stone is thrown from a cliff of height h with a speed v. The stone will hit the ground with maximum speed if it is thrown.
(A) vertically downward (B) vertically upward
(C) horizontally
(D) the speed does not depend on the initial direction.

26. A car accelerates on a horizontal road due to the force exerted by
(A) the engine of the car (B) the driver of the car (C) the earth (D) the road.

27. The moment of inertia of a uniform semicircular wire of mass M and radius r about a line perpendicular to the plane of the wire through the centre is
(A) Mr^2 (B) $\frac{1}{2}Mr^2$ (C) $\frac{1}{4}Mr^2$ (D) $\frac{2}{5}Mr^2$.

Space for rough work

CHEMISTRY

28. 25 g of sample of ferrous sulphate was dissolved in dilute sulphuric acid and water and its volume was made up to 1 litre. 25 ml of this solution required 20 ml of N/10 $KMnO_4$ solution for complete oxidation. What is percentage of $FeSO_4.7H_2O$ in the sample?
(A) 88.96 % (B) 90 % (C) 87 % (D) 91 %

29. What is the angular velocity of an electron occupying second orbit of Li^{2+} ion
(A) $\frac{8\pi^3 me^4}{h^3}K^2$ (B) $\frac{8\pi^3 me^4}{9h^3}K^2$ (C) $\frac{64\pi^3 me^4}{9h^3}K^2$ (D) $\frac{9\pi^3 me^4}{h^3}K^2$

30. Which represent impossible arrangement?

	n	λ	m	s
(A)	3	2	-2	$\pm$1/2
(B)	4	0	0	$\pm$1/2
(C)	3	2	-3	$\pm$1/2
(D)	5	3	0	$\pm$1/2

31. Select the correct order of ionic reaction
(A) $O^{2-} > S^{2-} > Se^{2-} > Te^{2-}$ (B) $S^{2-} > O^{2-} > Se^{2-} > Te^{2-}$
(C) $Te^{2-} > Se^{2-} > S^{2-} > O^{2-}$ (D) $Se^{2-} > Te^{2-} > O^{2-} > S^{2-}$

32. 3.0 moles of ideal gas is heated at constant pressure from 27ºC to 127ºC then the work done during expansion is
(A) – 2.494 KJ (B) + 2.494 KJ (C) – 10.5 KJ (D) + 10.5 KJ

33. Ground state electronic configuration of nitrogen atom can be represented by

(i)  (ii) 

(iii)  (iv) 

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

34. Difference between nth and $(n + 1)^{th}$ Bohr's radius of H – atom is equal to its $(n – 1)^{th}$ Bohr's radius. The value of n
(A) 3 (B) 4 (C) 5 (D) 6

35. Among the following, the linear species is:
(A) NO_2 (B) Cl_2O (C) O_3 (D) N_3^-.

Space for rough work

36. The standard molar enthalpies for formation of cyclohexane (λ) and benzene (λ) at 25ºC are -156 and + 49 KJ/mol respectively. The standary enthalpy of hydrogenation of cyclohexene (λ) at 25ºC is – 119 KJ/mol. The resonance energy of benzene is
(A) 152 KJ/mol (B) – 240 KJ/mol (C) – 152 KJ/mol (D) 240 KJ/mol

37. The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate in acidic medium is
(A) 2/5 (B) 3/5 (C) 4/5 (D) 1

38. The molecule which has pyramidal shape is
(A) PCl_3 (B) SO_3 (C) CO_3^{2-} (D) NO_3^-

39. In which of the following pairs of molecules/ions both the species are not likely to exist?
(A) H_2^+, He_2^2 (B) H_2^-, He_2^{2-} (C) H_2^{2+}, He_2 (D) H_2^-, He_2^{2+}

40. The correct order of increasing C—O bond length of CO_2, CO_3^{2-}, CO is
(A) $CO_3^{2-} < CO_2 < CO$ (B) $CO_2 < CO_3^{2-} < CO$
(C) $CO < CO_3^{2-} < CO_2$ (D) $CO < CO_2 < CO_3^{2-}$

Space for rough work