(CODE : 1P)

NARAYANA

IIT-JEE / NEET / FOUNDATIONS

NSAT-2021

Class XI Moving to Class XII (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 180.**
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

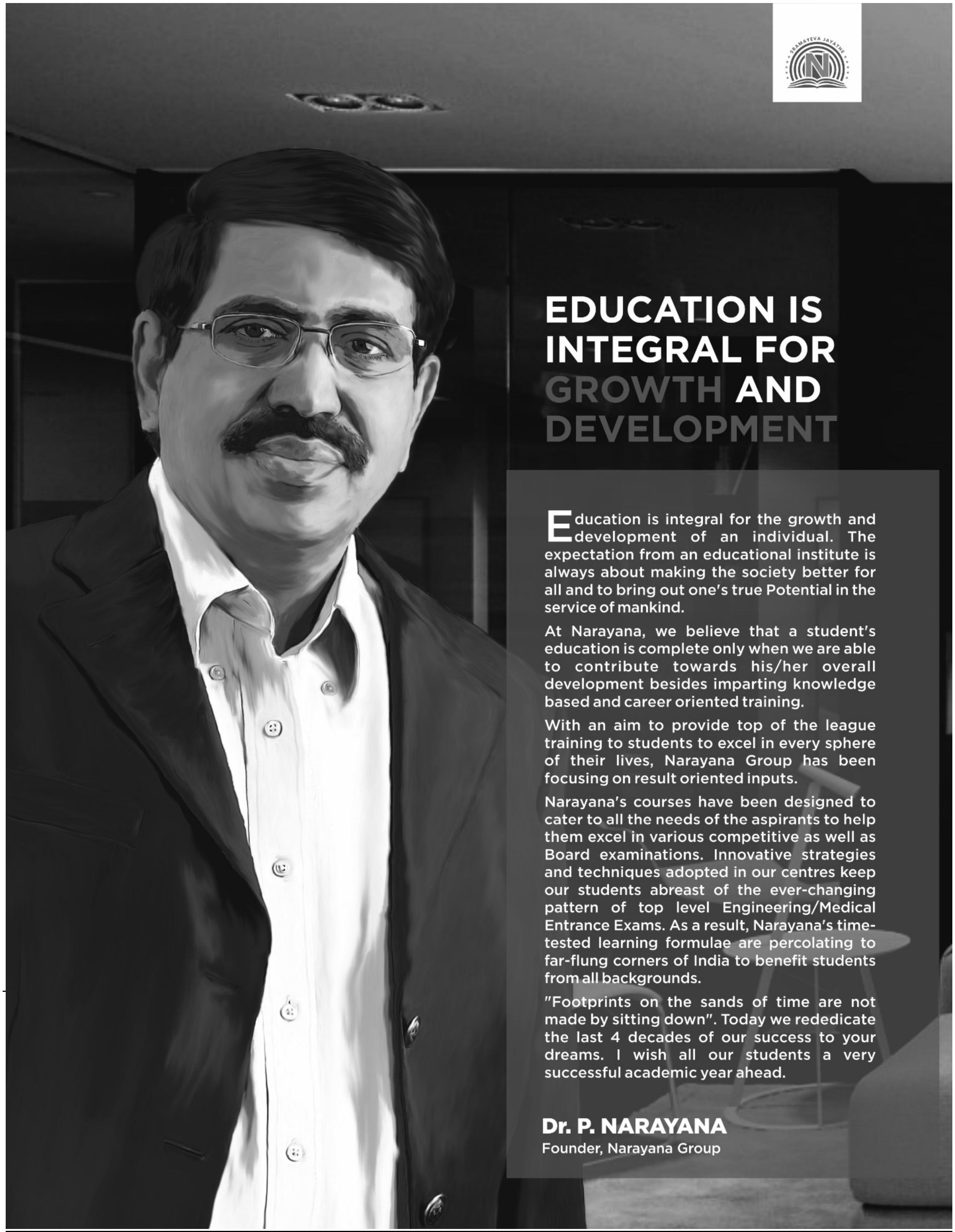
NAME OF THE STUDENT : ____________________

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

MATHEMATCS

1. Let R be set of points inside a rectangle of sides a and b (a, b > 1) with two sides along the positive direction of X-axis and Y-axis, then

(A) $R=\{(x,y):0\le x\le a, 0\le y<b\}$ (B) $R=\{(x,y):0\le x<a, 0\le y\le b\}$

(C) $R=\{(x,y):0\le x\le a, 0<y<b\}$ (D) $R=\{(x,y):0<x<a, 0<y<b\}$

2. If set $A=\{1,3,5,7,9\}$ and set $B=\{2,3,5,7,11\}$ then $A\Delta B$ is equal to

(A) {3, 5, 7} (B) {1, 2} (C) {9, 11} (D) {1, 2, 9, 11}

3. cos 24° + cos 55° + cos 125° + cos 204° =

(A) – 1 (B) 0 (C) 1 (D) 2

4. The expression $\frac{\tan A}{1-\cot A}+\frac{\cot A}{1-\tan A}$ can be written as

(A) sin A cos A + 1 (B) sec A cosec A + 1

(C) tan A + cot A (D) sec A + cosec A

5. Let two numbers have arithmetic mean 9 and geometric mean 4. Then these numbers are the roots of the quadratic equation:

(A) $x^2-18x-16=0$ (B) $x^2-18x+16=0$

(C) $x^2+18x-16=0$ (D) $x^2+18x+16=0$

6. If the sum of the three numbers in A.P. is 24 and their product is 440, then common difference of the A.P. can be

(A) 3 (B) 2 (C) 5 (D) –5

Space for rough work

7. The distance between the lines 3x + 4y = 9 and 6x + 8y + 15 = 0 is

(A) $\frac{3}{10}$ (B) $\frac{33}{10}$ (C) $\frac{33}{5}$ (D) None of these

8. If $\lim_{x\to 1}\frac{x^4-1}{x-1}=\lim_{x\to k}\frac{x^3-k^3}{x^2-k^2}$, find the value of k.

(A) 8/3 (B) 7/3 (C) 5/3 (D) 3/2

9. The number of real solutions of $x-\frac{1}{x^2-4}=2-\frac{1}{x^2-4}$ is

(A) 0 (B) 1 (C) 2 (D) infinite

10. For all complex numbers z of the form $1+i\alpha, \alpha \in R$, if $z^2 = x+iy$, then

(A) $y^2-4x+2=0$ (B) $y^2+4x-4=0$ (C) $y^2-4x-4=0$ (D) $y^2+4x+2=0$

11. Let $R=\{(3,3),(5,5),(9,9),(12,12),(5,12),(3,9),(3,12),(3,5)\}$ be a relation on the set $A=\{3,5,9,12\}$. Then, R is:

(A) R does not have an inverse (B) R is not a one to one function

(C) R is an onto function (D) R is not a function

12. The mean age of 25 teachers in a school is 40 years. A teacher retires at the age of 60 years and a new teacher is appointed in his place. If now the mean age of the teachers in this school is 39 years, then the age (in years) of the newly appointed teacher is:

(A) 25 (B) 30 (C) 35 (D) 40

13. The mean of 5 observations is 5 and their variance is 124. If three of the observations are 1, 2 and 6, then the mean deviation from the mean of the data is:

(A) 2.5 (B) 2.6 (C) 2.8 (D) 2.4

Space for rough work

PHYSICS

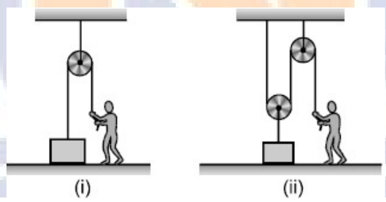
14. At a metro station, a girl walks up a stationary escalator in time t_1. If she remains stationary on the escalator, then the escalator take her up in time t_2. The time taken by her to walk up on the moving escalator will be

(A) $\frac{(t_1+t_2)}{2}$ (B) $\frac{t_1 t_2}{(t_2-t_1)}$ (C) $\frac{t_1 t_2}{(t_2+t_1)}$ (D) t_1-t_2

15. The displacement of a body along X-axis depends on time as $\sqrt{x}=t+1$. Then the velocity of body

(A) increases with time (B) decreases with time
(C) independent of time (D) None of these

16. In the figure shown, a person wants to raise a block lying on the ground to a height h. In both the cases, if time required is the same, then in which case he has to exert more force. Assume pulleys and strings are light.



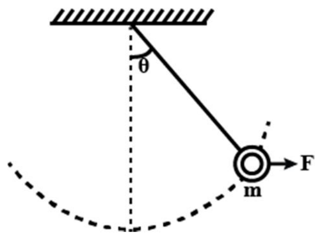
(A) (i) (B) (ii)
(C) Same in both (D) Cannot be determined

17. A block of mass m is placed on a smooth plane inclined at an angle θ with the horizontal. The force exerted by the plane on the block has a magnitude

(A) mg (B) $mg\sec\theta$ (C) $mg\cos\theta$ (D) $mg\sin\theta$

Space for rough work

18. An object of mass m is tied to a string of length L and a variable horizontal force is applied to it which starts at zero and gradually increases until the string makes an angle θ with the vertical. Work done by the force F is:



(A) $mgL(1-\sin\theta)$ (B) mgL

(C) $mgL(1-\cos\theta)$ (D) $mgL(1+\cos\theta)$

19. A stone tied to string of length l is whirled in a vertical circle with the other end of the string as the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of the change in velocity as it reaches a position, where the string is horizontal (g being acceleration due to gravity) is:

(A) $\sqrt{2(u^2-gl)}$ (B) $\sqrt{u^2-gl}$

(C) $u-\sqrt{u^2-2gl}$ (D) $\sqrt{2gl}$

20. In a one dimensional collision between two identical particles A and B, B is stationary and A has momentum ρ before impact. During impact, B gives an impulse J to A. Then, coefficient of restitution between the two is

(A) $\frac{2J}{\rho}-1$ (B) $\frac{2J}{\rho}+1$

(C) $\frac{J}{\rho}+1$ (D) $\frac{J}{\rho}-1$

Space for rough work

21. The moment of inertia of a solid sphere about its tangential axis.

(A) $\frac{2}{5}MR^2$ (B) $\frac{7}{5}MR^2$

(C) $\frac{2}{3}MR^2$ (D) $\frac{5}{3}MR^2$

22. The moment of inertia of a uniform cylinder of length l and radius R about its perpendicular bisector is I. What is the ratio l/R such that the moment of inertia is minimum?

(A) $\frac{\sqrt{3}}{2}$ (B) 1

(C) $\frac{3}{\sqrt{2}}$ (D) $\sqrt{\frac{3}{2}}$

23. From a solid sphere of mass M and radius R, a cube of maximum possible volume is cut. Moment of inertia of cube about an axis passing through its centre and perpendicular to one of its faces is

(A) $\frac{MR^2}{32\sqrt{2}\pi}$ (B) $\frac{4MR^2}{9\sqrt{3}\pi}$

(C) $\frac{MR^2}{16\sqrt{2}\pi}$ (D) $\frac{4MR^2}{3\sqrt{3}\pi}$

Space for rough work

24. A solid sphere of radius R has moment of inertia I about its geometrical axis. It is melted into a disc of radius r and thickness t. If it's moment of inertia about the tangential axis (which is perpendicular to plane of the disc), is also equal to I, then the value of r is equal to

(A) $\frac{2}{\sqrt{15}}R$ (B) $\frac{2}{\sqrt{5}}R$

(C) $\frac{3}{\sqrt{15}}R$ (D) $\frac{\sqrt{3}}{\sqrt{15}}R$

Space for rough work

CHEMISTRY

25. The equivalent weight of $MnSO_4$ is M/2 when it change into

(A) $KMnO_4$ (B) K_2MnO_4 (C) MnO_2 (D) MnO

26. Molecular mass of a compound having empirical formula C_2H_5O is 90. Molecular formula is:

(A) C_2H_5O (B) $C_3H_6O_8$ (C) $C_4H_{10}O_2$ (D) $C_5H_{14}O$

27. Principal, azimuthal and magnetic quantum are respectively related to

(A) shape, size and orientation (B) size, shape andorientation

(C) size,orientation and shape (D) None of these

28. Consider the following sets of quantum numbers:

	n	*l*	m	s
(i)	3	0	0	+1/2
(ii)	2	2	1	+1/2
(iii)	4	3	– 2	– 1/2
(iv)	1	0	– 1	– 1/2
(v)	3	2	3	+1/2

Space for rough work

Which of the given sets of quantum number is possible?

(A) (i), (ii), (iii) and (iv) (B) (ii), (iii) and (v)

(C) (i) and (iii) (D) (ii), (iii) and (iv)

29. The correct order of positive electron gain enthalpy $\left(\Delta_{eg}H\right)$ of the halogen atom is

(A) F < Cl < Br < I (B) Cl < F < Br < I

(C) I < Br < Cl < F (D) Cl < Br < I < F

30. Which of the following has the largest ionic radius?

(A) Na^+ (B) Cs^+ (C) Li^+ (D) Mg^+

31. The pair having similar geometry is

(A) PCl_3, NH_3 (B) $BeCl_2, H_2O$

(C) CH_4, BH_3 (D) IF_5, PF_5

32. Which of the following hybridization corresponds to trigonal bipyramidal geometry?

(A) sp^3 (B) sp^2 (C) sp^2d (D) sp^3d

Space for rough work

33. The paramagnetic property of the oxygen molecule is due to the presence of unpaired electrons present in

(A) $(\sigma 2p_x)^1$ and $(\sigma * 2p_x)^1$ (B) $(\sigma 2p_x)^1$ and $(\pi 2p_y)^1$

(C) $(\pi * 2p_y)^1$ and $(\pi * 2p_x)^1$ (D) $(\pi * 2p_y)^1$ and $(\pi 2p_y)^1$

34. The oxidation number of chromium, in potassium dichromate $(K_2Cr_2O_7)$, is

(A) + 2 (B) + 6

(C) + 4 (D) + 8

35. Bond angle in H_2O_2 is

(A) 97° (B) 91°

(C) 94.8° (D) 99.8°

Space for rough work