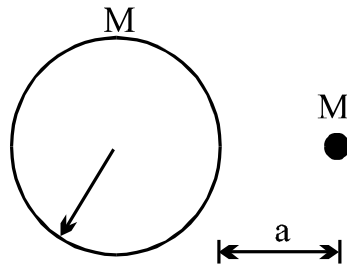


PART-I PHYSICS

1. A ball is thrown vertically down with velocity of 5m/s. With what velocity should another ball be thrown down after 2 seconds so that it can hit the 1st ball in 2 seconds
(a) 40 m/s (b) 55 m/s (c) 15 m/s (d) 25 m/s
 2. The coefficients of thermal expansion of steel and a metal X are respectively 12×10^{-6} and 2×10^{-6} per°C. At 40°C, the side of a cube of metal X was measured using a steel vernier callipers. The reading was 100 mm. Assuming that the calibration of the vernier was done at 0°C, then the actual length of the side of the cube at 0°C will be
(a) > 100 mm (b) < 100 mm
(c) = 100 mm (d) data insufficient to conclude
 3. Two cubes of size 1.0 m sides, one of relative density 0.60 and another of relative density = 1.15 are connected by weightless wire and placed in a large tank of water. Under equilibrium the lighter cube will project above the water surface to a height of
(a) 50 cm (b) 25 cm (c) 10 cm (d) zero
 4. A particle of mass M is at a distance from surface of a thin spherical shell of equal mass and having radius a.
(a) Gravitational field and potential both are zero at centre of the shell.
-

Rough work

- (b) Gravitational field is zero not only inside the shell but at a point outside the shell also.
- (c) Inside the shell, gravitational field alone is zero.
- (d) Neither gravitational field nor gravitational potential is zero inside the shell.



5. A ball is thrown vertically downwards with velocity from a height h . After colliding with the ground it just reaches the starting point. Coefficient of restitution is
- (a) $1/\sqrt{2}$ (b) $1/2$ (c) 1 (d) $\sqrt{2}$
6. A vessel of volume 0.02 m^3 contains a mixture of hydrogen and helium at 20°C and 2 atmospheric pressure. The mass of mixture is 5 gms. Find the ratio of mass of hydrogen to that of helium in the mixture.
- (a) $1 : 2$ (b) $1 : 3$ (c) $2 : 3$ (d) $3 : 2$

Rough work

7. The resultant amplitude due to superposition of two waves $y_1 = 5\sin(\omega t - kx)$ and $y_2 = 5\cos(\omega t - kx + 150^\circ)$
- (a) 5 (b) $5\sqrt{3}$ (c) $5\sqrt{2-\sqrt{3}}$ (d) $5\sqrt{2+\sqrt{3}}$
8. A man is standing on a rough ($\mu = 0.5$) horizontal disc rotating with constant angular velocity of 5 rad/sec. At what distance from centre should he stand so that he does not slip on the disc?
- (a) $R < 0.2\text{m}$ (b) $R > 0.2\text{ m}$
(c) $R > 0.5\text{ m}$ (d) $R > 0.3\text{ m}$
9. A square sheet of edge length L and uniform mass per unit area σ is used to form a hollow cylinder. The moment of inertia of this cylinder about the central axis is
- (a) $\frac{2\sigma L^4}{\pi^2}$ (b) $\frac{\sigma L^4}{4\pi^2}$ (c) πL^2 (d) $\frac{\sigma L^4}{3\sqrt{2}\pi^2}$
10. A plank with a small block on top of it is under going vertical SHM. Its period is 2 sec. The minimum amplitude at which the block will separate from plank is:
- (a) $\frac{10}{\pi^2}$ (b) $\frac{\pi^2}{10}$ (c) $\frac{20}{\pi^2}$ (d) $\frac{\pi}{10}$
-

Rough work

PART-II CHEMISTRY

11. Number of nodal planes in the d_{xy} orbital is
(a) 1 (b) 2
(c) 0 (d) 4
12. A sample of 4.50 mg of unknown alcohol is added to CH_3MgBr when 1.68 mL of CH_4 at STP is obtained. The unknown alcohol is
(a) methanol (b) ethanol
(c) 1-propanol (d) 1-butanol
13. Which of the following element is not a 'd' block element.
(a) Hg (b) Au (c) Sn (d) Ag
14. For $\text{Na}_2\text{S}_4\text{O}_6$ sodium tetrathionate molecule which one is correct
(a) Oxidation number of S is +2
(b) Oxidation state of S is +2.5
(c) 2 sulphur atoms are in zero oxidation state and remaining two are in +5 oxidation state
(d) Oxidation state and oxidation number of S atom is same here
15. Which of the following gas molecules has the largest mean free path?
(a) H_2 (b) N_2
(c) O_2 (d) Cl_2
-

Rough work

16. Which of the following molecules can act as both oxidizing as well as reducing agent?
(a) NH_3 (b) $\text{H}_2\text{S}_2\text{O}_3$ (c) $\text{H}_2\text{S}_4\text{O}_6$ (d) B & C are correct

17. How many different angles are possible for PCl_5 ?
(a) 1 (b) 2 (c) 3 (d) 4

18. **Statement-1:** In sp^3d hybridisation for TBP geometry only d_z^2 orbital is the most suitable among all other d-orbitals.

Statement-2: All d-orbitals are degenerate.

- (a) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(b) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(c) Statement-1 is true, statement-2 is false.
(d) Statement-1 is false, statement-2 is true.

19. **Statement-1:** Zn is a transition element.

Statement-2: Zn and Zn^{2+} both are having completely filled d-orbitals in their ground state.

- (a) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
-

Rough work

- (b) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
- (c) Statement-1 is true, statement-2 is false.
- (d) Statement-1 is false, statement-2 is true

20. How many lone pairs of electrons are there in NCl_3 ?

- (a) 1 (b) 4 (c) 10 (d) 20

Rough work

PART-III MATHEMATICS

21. The 10th term of the sequence $\sqrt{3}, \sqrt{12}, \sqrt{27}, \dots$ is.

- (a) $\sqrt{243}$ (b) $\sqrt{300}$
(c) $\sqrt{363}$ (d) $\sqrt{432}$

22. For an A.P., $T_2 + T_5 - T_3 = 10$, $T_2 + T_9 = 17$, then common difference is?

- (a) 0 (b) 1
(c) -1 (d) 13

23. For the equation $3x^2 + px + 3$, $p > 0$ if one of the root is square of the other, then p is equal to.

- (a) 1 (b) 1/3 (c) 3 (d) 2/3

24. If $\sin \alpha, \cos \alpha$ are the roots of the equation $ax^2 + bx + c = 0$, then

- (a) $a^2 - b^2 + 2ac = 0$ (b) $(a - c)^2 = b^2 + c^2$
(c) $a^2 + b^2 - 2ac = 0$ (d) $a^2 + b^2 + 2ac = 0$

25. If the sum of squares of the roots of the equation $x^2 - (a - 2)x - (a + 1) = 0$ is least, then the value of a is

- (a) 0 (b) 1
(c) 2 (d) -2

Rough work

26. The exponent of 3 in $100!$ is,
(a) 33 (b) 44 (c) 48 (d) 52
27. How many even numbers of 3 different digits can be formed from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9 (repetition is not allowed)
(a) 224 (b) 280 (c) 324 (d) none of these
28. In a circus there are ten cages for accommodating ten animals. Out of these four cages are so small that five out of 10 animals cannot enter into them. In how many ways will it be possible to accommodate ten animals in these ten cages?
(a) 66400 (b) 86400 (c) 96400 (d) none of these
29. If the ratio of the 7th term from the beginning to the seventh term from the end in the expansion of $\left(\sqrt[3]{2} + \frac{1}{\sqrt[3]{3}}\right)^x$ is $\frac{1}{6}$, then x is
(a) 9 (b) 6 (c) 12 (d) none of these
30. In the expansion of $\left(2x + \frac{1}{3x^2}\right)^9$, the term independent of x is
(a) ${}^9C_3 8$ (b) $\frac{1792}{9}$ (c) ${}^9C_3 64$ (d) ${}^9C_3 \frac{1}{81}$
-

Rough work

31. If the slope of a line passing through the point $A(3,2)$ be $3/4$, then the points on the line which are 5 units away from A, are
(a) $(5,5),(-1,-1)$ (b) $(7,5),(-1,-1)$ (c) $(5,7),(-1,-1)$ (d) $(7,5),(1,1)$
32. If the middle points of the sides BC, CA and AB of the triangle ABC be $(1, 3)$, $(5, 7)$ and $(-5, 7)$, then the equation of the side AB is
(a) $x - y - 2 = 0$ (b) $x - y + 12 = 0$
(c) $x + y - 12 = 0$ (d) None of these
33. The sides AB, BC, CD and DA of a quadrilateral are $x + 2y = 3, x = 1, x - 3y = 4, 5x + y + 12 = 0$ respectively. The angle between diagonals AC and BD is
(a) 45° (b) 60° (c) 90° (d) 30°
34. If $f(x) = \cos^2 x + \sec^2 x$, then
(a) $f(x) < 1$ (b) $f(x) = 1$
(c) $1 < f(x) < 2$ (d) $f(x) \geq 2$
35. If $\sin x + \operatorname{cosec} x = 2$, then $\sin^n x + \operatorname{cosec}^n x$ is equal to
(a) 2 (b) 2^n (c) 2^{n-1} (d) 2^{n-2}
36. $\tan \theta \sin\left(\frac{\pi}{2} + \theta\right) \cos\left(\frac{\pi}{2} - \theta\right) =$
(a) 1 (b) 0 (c) $\frac{1}{\sqrt{2}}$ (d) None of these
-

Rough work

37. A tree is broken by wind, its upper part touches the ground at a point 10 meters from the foot of the tree and makes an angle of 45° with the ground. The total length of tree is

- (a) 15 metres (b) 20 metres (c) $10(1 + \sqrt{2})$ metres (d) $10\left(1 + \frac{\sqrt{3}}{2}\right)$ metres

38. $\lim_{x \rightarrow 0} \frac{(1 - \cos 2x) \sin 5x}{x^2 \sin 3x} =$

- a) $\frac{10}{3}$ (b) $\frac{3}{10}$ (c) $\frac{6}{5}$ (d) $\frac{5}{6}$

39. $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x^3} =$

- (a) $\frac{1}{2}$ (b) $-\frac{1}{2}$ (c) $\frac{2}{3}$ (d) None of these

40. The equivalent function of $\log x^2$ is

- (a) $2 \log x$ (b) $2 \log |x|$ (c) $|\log x^2|$ (d) $(\log x)^2$

Rough work