

MOCK TEST

for

MHT-CET-2024

GENERAL INSTRUCTIONS :

1. MHT-CET consists of two papers, Paper-I contains 50 questions of Mathematics and Paper-II contains 100 questions of Physics & Chemistry.
2. Each correct answer carries 2 marks for Mathematics and 1 mark for Physics & Chemistry.
3. There will be no negative marking.
4. It is mandatory to use Blue/Black Ballpoint Pen to darken the appropriate circle in the answer sheet.
5. Mark should be dark and should completely fill the circle in the answer sheet.
6. Do not use white-fluid or any other rubbing material on answer sheet. No change in the answer once marked.
7. Rough work must not be done on the answer sheet.
8. Student cannot use log tables and calculators or any other material in the examination hall.
9. Before attempting the question paper, student should ensure that the test paper contains all pages and no page is missing.

PAPER-I : MATHEMATICS

Choose the correct answer :

- | | |
|---|--|
| <p>1. If $a^2 + b^2 + c^2 = 1$, then the range of $ab + bc + ca$ is</p> <p>(1) $[1, \infty)$ (2) $\left[-\frac{1}{2}, \infty\right)$</p> <p>(3) $\left(-\frac{1}{2}, 1\right)$ (4) $\left[-\frac{1}{2}, 1\right]$</p> <p>2. If $g[f(x)] = \sin x$ and $f[g(x)] = (\sin\sqrt{x})^2$, then</p> <p>(1) $f(x) = \sin x, g(x) = x$</p> <p>(2) $f(x) = \sin^2 x, g(x) = \sqrt{x}$</p> <p>(3) $f(x) = x^3, g(x) = \sin\sqrt{x}$</p> <p>(4) f and g cannot be determined</p> | <p>3. Value of $\left(\frac{1 + \tan^2 15^\circ}{1 - \tan^2 15^\circ}\right)$ equals</p> <p>(1) $\frac{\sqrt{3}}{2}$ (2) $\frac{-\sqrt{3}}{2}$</p> <p>(3) $\frac{2}{\sqrt{3}}$ (4) $\frac{-2}{\sqrt{3}}$</p> <p>4. The number of five digit with number that can be formed with the digits 2, 0, 4, 3 and 8 when repetition of digits are not allowed, is</p> <p>(1) 96 (2) 120</p> <p>(3) 144 (4) 14</p> |
|---|--|

5. $\int_0^{2\pi} \sin x + |\sin x| dx$ is equal to
 (1) 0 (2) 1
 (3) 4 (4) 8
6. The number of rectangles excluding squares from a rectangle of size 9×6 is
 (1) 945 (2) 108
 (3) 791 (4) 181
7. If $2\vec{a} - 3\vec{b} + \vec{c} = 0$, then the ratio in which C divides AB is
 (1) 3 : 2 internally (2) 3 : 2 externally
 (3) 2 : 3 internally (4) 2 : 3 externally
8. Modulus of $\left(\frac{3+5i}{3-6i}\right)$ is (where $i = \sqrt{-1}$)
 (1) $\sqrt{\frac{34}{5}}$ (2) $\sqrt{\frac{5}{34}}$
 (3) $\sqrt{\frac{45}{34}}$ (4) $\sqrt{\frac{34}{45}}$
9. If a function $f: R \rightarrow S$ defined as $f(x) = \sin x - \sqrt{3} \cos x + 1$ is onto, then S is equal to
 (1) $[-1, 3]$ (2) $[1, 3]$
 (3) $[0, 1]$ (4) $[-1, 1]$
10. If the lines $\frac{1-x}{3} = \frac{y-2}{2\alpha} = \frac{z-3}{2}$ and $\frac{x-1}{3\alpha} = \frac{1-y}{-1} = \frac{z-6}{-5}$ are perpendicular, then the value of α is
 (1) $\frac{-10}{7}$ (2) $\frac{10}{7}$
 (3) $\frac{7}{10}$ (4) $\frac{-7}{10}$
11. If $f(x) = \frac{2^x + 2^{-x}}{2}$, then $f(x+y) + f(x-y)$ is
 (1) $f(x) \cdot f(y)$ (2) $3f(x) \cdot f(y)$
 (3) $2f(x) \cdot f(y)$ (4) $f(x) + f(y)$
12. The most general value of θ satisfying the equation $(1 - 2\sin\theta)^2 + (\sqrt{3}\tan\theta + 1)^2 = 0$, is
 (1) $n\pi + (-1)^n \frac{\pi}{6}$ (2) $n\pi + \frac{5\pi}{6}$
 (3) $2n\pi + \frac{5\pi}{6}$ (4) $2n\pi + \frac{\pi}{6}$

13. Given that the equation $x^2 + (2a-1)x + a^2 = 0$ has two real positive roots, where a is an integer. If x_1 and x_2 are the roots, the value of $|\sqrt{x_1} - \sqrt{x_2}|$ is
 (1) 3 (2) 2
 (3) 1 (4) 0
14. In $\triangle ABC$
 $\frac{\cos^2 \frac{A}{2}}{a} + \frac{\cos^2 \frac{B}{2}}{b} + \frac{\cos^2 \frac{C}{2}}{c}$ is equal to
 (1) $\frac{a^2 + b^2 + c^2 + 3}{4abc}$ (2) $\frac{s^2}{2abc}$
 (3) $\frac{s^2}{4abc}$ (4) $\frac{3(a^2 + b^2 + c^2 - 1)}{4abc}$
15. The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if
 (1) $k = 0$ or -1 (2) $k = 1$ or -1
 (3) $k = 0$ or -3 (4) $k = 3$ or -3
16. If $8x^2 + (m+1)x + m - 7 = 0$ has two negative roots, then the set of the possible values of m , is
 (1) $(7, \infty)$ (2) $(-\infty, -7)$
 (3) $[7, \infty)$ (4) $(-\infty, \infty)$
17. Let $y = x^{x^{\dots}}$ then $x \frac{dy}{dx}$ is equal to
 (1) $\frac{y^2}{(1-y \log x)}$ (2) $\frac{y^2}{(1-y \log x)x}$
 (3) $\frac{y}{x(1-y \log x)}$ (4) $\frac{y}{1-y \log x}$
18. $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{r=1}^{2n} \frac{r}{\sqrt{n^2 + r^2}}$ is equal to
 (1) $1 + \sqrt{5}$ (2) $\sqrt{5} - 1$
 (3) $\sqrt{2} + 1$ (4) $\sqrt{2} - 1$
19. Order and degree of the differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + \sin y = 0$ are
 (1) Order = 1, degree = 1
 (2) Order = 1, degree is not defined
 (3) Order = 2, degree = 1
 (4) Order = 2, degree is not defined

20. If n is a positive integer, then
- $$\begin{vmatrix} {}^{n+2}C_n & {}^{n+3}C_{n+1} & {}^{n+4}C_{n+2} \\ {}^{n+3}C_{n+1} & {}^{n+4}C_{n+2} & {}^{n+5}C_{n+3} \\ {}^{n+4}C_{n+2} & {}^{n+5}C_{n+3} & {}^{n+6}C_{n+4} \end{vmatrix} =$$
- (1) 3 (2) -1
(3) -5 (4) -9
21. If z_1, z_2, z_3 are the vertices of an equilateral triangle with centroid z_0 , then $z_1^2 + z_2^2 + z_3^2 =$
- (1) z_0^2 (2) $2z_0^2$
(3) $3z_0^2$ (4) $9z_0^2$
22. The value of the expression $2(1+\omega)(1+\omega^2) + 3(2\omega+1)(2\omega^2+1) + 4(3\omega+1)(3\omega^2+1) + \dots + (n+1)(n\omega+1)(n\omega^2+1)$ is (ω is the cube root of unity)
- (1) $\frac{n^2(n+1)^2}{4}$ (2) $\left(\frac{n(n+1)}{2}\right)^2 + n$
(3) $\left(\frac{n(n+1)}{2}\right)^2 - n$ (4) None of these
23. $\sin 2^\circ + \sin 4^\circ + \sin 6^\circ + \dots + \sin 90^\circ$ is equal to
- (1) $\frac{1}{\sqrt{2}} \frac{\sin 44^\circ}{\sin 1^\circ}$ (2) $\frac{1}{\sqrt{2}} \frac{\cos 46^\circ}{\cos 1^\circ}$
(3) $\frac{1}{\sqrt{2}} \frac{\sin 46^\circ}{\sin 1^\circ}$ (4) $\frac{1}{\sqrt{2}} \frac{\cos 44^\circ}{\cos 1^\circ}$
24. If $a \sec \alpha - c \tan \alpha = d$ and $b \sec \alpha - d \tan \alpha = d$, then
- (1) $a^2 + c^2 = b^2 + d^2$ (2) $a^2 + d^2 = b^2 + c^2$
(3) $a^2 + b^2 = c^2 + d^2$ (4) $ab = cd$
25. If $2 \tan^2 x - 5 \sec x$ is equal to 1 for exactly 7 distinct values of $x \in \left[0, \frac{n\pi}{2}\right], n \in N$, then the greatest value of n is
- (1) 6 (2) 12
(3) 13 (4) 15
26. The number of solutions of the equation $x^3 + x^2 + 4x + 2 \sin x = 0$ in $x \in [0, 2\pi]$, is
- (1) 0 (2) 1
(3) 2 (4) 3
27. The angle between the line $\vec{r} = (\hat{i} + 2\hat{j} - \hat{k}) + \lambda(\hat{i} - \hat{j} + \hat{k})$, $\lambda \in R$ and the plane $\vec{r} \cdot (2\hat{i} - \hat{j} + \hat{k}) = 4$ is
- (1) $\cos^{-1} \frac{2\sqrt{2}}{3}$ (2) $\cos^{-1} \frac{1}{3}$
(3) $\cos^{-1} \frac{4}{5}$ (4) $\cos^{-1} \frac{3}{5}$
28. Maximum value of $3 \sin x - 4 \cos x + 5$ is
- (1) -5 (2) 0
(3) 5 (4) 10
29. Two dice are thrown together. The probability that at least one will show digit 6 is
- (1) $\frac{11}{36}$ (2) $\frac{5}{36}$
(3) $\frac{5}{11}$ (4) $\frac{1}{6}$
30. Two dice are thrown. The probability that the sum of numbers appearing is more than 9 is
- (1) $\frac{1}{4}$ (2) $\frac{1}{5}$
(3) $\frac{1}{6}$ (4) $\frac{1}{9}$
31. One card is drawn from each of two ordinary packs of 52 cards. The probability that at least one of them is a jack of heart is
- (1) $\frac{103}{(52)^2}$ (2) $\frac{51}{52}$
(3) $\frac{51}{(52)^2}$ (4) $\frac{1}{(52)^2}$
32. If the equation $ax^2 + 4xy + 5y^2 = 0$ represents two lines inclined at an angle π , then a is equal to
- (1) $-\frac{4}{5}$ (2) $\frac{4}{5}$
(3) 4 (4) 5
33. Complete general solution of $\sin^{12} x - \cot^4 x = 1$ is ($n \in I$)
- (1) $n\pi + \frac{\pi}{2}$ (2) $2n\pi + \frac{\pi}{2}$
(3) $n\pi + \frac{\pi}{4}$ (4) ϕ (No solution)
34. If \vec{b} and \vec{c} are two non-zero non-collinear vectors such that $\vec{a} \parallel (\vec{b} \times \vec{c})$, then $(\vec{a} \times \vec{b}) \cdot (\vec{a} \times \vec{c})$ is equal to
- (1) $|\vec{a}|^2 (\vec{b} \cdot \vec{c})$ (2) $\vec{b} \cdot \vec{c}$
(3) $\frac{\vec{a} \cdot \vec{a}}{\vec{b} \cdot \vec{c}}$ (4) Zero
35. If P is any arbitrary point on the circumcircle of the equilateral triangle of side length m units, then $|\vec{PA}|^2 + |\vec{PB}|^2 + |\vec{PC}|^2$ is always equal to
- (1) $2\sqrt{3}m^2$ (2) $\frac{4}{\sqrt{2}}m^2$
(3) $2m^2$ (4) m^4

36. If $|\vec{a} \times \vec{b}|^2 + (\vec{a} \cdot \vec{b})^2 = 144$ and $|\vec{a}| = 4$, then $|\vec{b}|$ is equals to
 (1) 16 (2) 8
 (3) 3 (4) 12
37. If $f(x) = \begin{cases} \frac{1}{e^x}, & \text{for } x \neq 0 \\ e^x - 1, & \text{for } x = 0 \end{cases}$, then $f(x)$ is
 (1) Continuous at $x = 0$
 (2) Discontinuous at $x = 0$
 (3) Both continuous and differentiable at $x = 0$
 (4) Not defined at $x = 0$
38. The equation of the circle which passes through the points (2, 3) and (4, 5) and the centre lies on the straight line $y - 4x + 3 = 0$, is
 (1) $x^2 + y^2 + 4x - 10y + 25 = 0$
 (2) $x^2 + y^2 - 4x - 10y + 25 = 0$
 (3) $x^2 + y^2 - 4x - 10y + 16 = 0$
 (4) $x^2 + y^2 - 14y + 8 = 0$
39. 6 girls and 5 boys sit together randomly in a row, the probability that no two boys sit together is
 (1) $\frac{6!5!}{11!}$ (2) $\frac{6!6!}{11!}$
 (3) $\frac{6!7!}{2!11!}$ (4) $\frac{5!7!}{2!11!}$
40. If the mean and variance of a binomial variate X are $\frac{7}{3}$ and $\frac{14}{9}$ respectively then probability that X takes values 6 or 7 is equal to
 (1) $\frac{1}{729}$ (2) $\frac{5}{729}$
 (3) $\frac{7}{729}$ (4) $\frac{13}{729}$
41. 50th derivative of $(x + 1)^{50}$ is equal to
 (1) 49! (2) 51!
 (3) 50! (4) 50 [51]⁴⁹
42. Four married couples are divided into 4 pairs randomly (A pair consists of a lady and a gentleman). The probability that exactly one of the so formed pairs is actually a couple is
 (1) $\frac{1}{2}$ (2) $\frac{1}{3}$
 (3) $\frac{1}{4}$ (4) $\frac{1}{6}$
43. $\int_1^2 \frac{\cos(\log x)}{x} dx$ is equal to
 (1) 1 (2) $\cos \log 2$
 (3) $\sin \log 2$ (4) $\frac{\pi}{x}$
44. The mean of 50 observations is 36. If its two observation 75 and 45 are deleted, then the mean of the remaining observations is
 (1) 35 (2) 36
 (3) 48 (4) 49
45. If a straight line passing through $P(3, 4)$ makes an angle $\pi/6$ with x -axis and meet the line $12x + 5y + 10 = 0$ at 'Q', then the length of PQ is
 (1) 13 (2) $\frac{1}{\sqrt{2}}$
 (3) $\frac{13\sqrt{2}}{6}$ (4) $\frac{112}{12\sqrt{3} + 5}$
46. A hyperbola passes through (2, 3) and has asymptotes $3x - 4y + 5 = 0$ and $12x + 5y - 40 = 0$, then the equation of its transverse axis is
 (1) $77x - 21y - 265 = 0$ (2) $21x - 77y + 265 = 0$
 (3) $21x - 77y - 265 = 0$ (4) $21x + 77y - 265 = 0$
47. If $f(x) = \tan x - \tan^3 x + \tan^5 x + \dots \infty$ with $0 < x < \frac{\pi}{9}$ then $\int_0^{\frac{\pi}{4}} f(x) dx$ is equal to
 (1) 1 (2) 0
 (3) $\frac{1}{4}$ (4) $\frac{1}{2}$
48. In $\triangle ABC$, $\Delta = a^2 - (b - c)^2$, then the value of $\tan A$ is
 (1) $\frac{8}{14}$ (2) $\frac{8}{13}$
 (3) $\frac{8}{15}$ (4) $\frac{8}{17}$
49. If $f(x) = \begin{cases} 1 & x \text{ is rational} \\ 2 & x \text{ is irrational} \end{cases}$, then
 (1) $f(x)$ is continuous in $R - I$
 (2) $f(x)$ is continuous in $R - Q$
 (3) $f(x)$ is continuous in R but not differentiable in R
 (4) $f(x)$ is neither continuous nor differentiable
50. The probability that in a family of 5 members exactly 2 members have birthday on sunday is
 (1) $\frac{12 \times 5^3}{7^5}$ (2) $\frac{10 \times 6^2}{7^5}$
 (3) $\frac{2}{5}$ (4) $\frac{10 \times 6^3}{7^5}$

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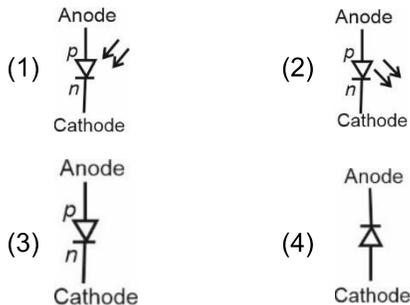
PAPER-II : PHYSICS & CHEMISTRY

- Alternating current of peak value $\left(\frac{2}{\pi}\right)$ ampere flows through the primary coil of the transformer. The coefficient of mutual inductance between primary and secondary coil is 1 H. The peak emf induced in secondary coil is (Frequency of AC = 50 Hz)

(1) 100 V (2) 200 V
(3) 300 V (4) 400 V
- Two wires having same length and material are stretched by same force. Their diameters are in the ratio 1 : 3. The ratio of strain energy per unit volume for these two wires (smaller to larger diameter) when stretched is

(1) 3 : 1 (2) 9 : 1
(3) 27 : 1 (4) 81 : 1
- When the observer moves towards the stationary source with velocity v_1 , the apparent frequency of emitted note is f_1 . When the observer moves away from the source with velocity v_1 , the apparent frequency is f_2 . If v is the velocity of sound in air and $\frac{f_1}{f_2} = 2$, then $\frac{v}{v_1} = ?$

(1) 2 (2) 3
(3) 4 (4) 5
- The schematic symbol of light emitting diode (LED) is



(1) (2)
(3) (4)
- Let a steel bar of length l , breadth b and depth d be loaded at the centre by a load W . Then the sag of bending of beam is ($Y =$ Young's modulus of material of steel)

(1) $\frac{Wl^3}{2bd^3Y}$ (2) $\frac{Wl^3}{4bd^3Y}$
(3) $\frac{Wl^2}{2bd^3Y}$ (4) $\frac{Wl^3}{2bd^2Y}$
- Two identical parallel plate air capacitors are connected in series to a battery of emf V . If one of the capacitor is completely filled with dielectric material of constant K , then potential difference of the other capacitor will become

(1) $\frac{K}{V(K+1)}$ (2) $\frac{KV}{K+1}$
(3) $\frac{K-1}{KV}$ (4) $\frac{V}{K(K+1)}$

7. A galvanometer of resistance $30\ \Omega$ is connected to a battery of emf $2\ \text{V}$ with $1970\ \Omega$ resistance in series. A full scale deflection of 20 divisions is obtained in the galvanometer. To reduce the deflection to 10 divisions, the resistance in series required is

- (1) $4030\ \Omega$ (2) $4000\ \Omega$
 (3) $3970\ \Omega$ (4) $2000\ \Omega$

8. Two parallel plate air capacitors of same capacity C are connected in series to a battery of emf E . Then one of the capacitors is completely filled with dielectric material of constant K . The change in the effective capacity of the series combination is

- (1) $\frac{C}{2} \left[\frac{K-1}{K+1} \right]$ (2) $\frac{2}{C} \left[\frac{K-1}{K+1} \right]$
 (3) $\frac{C}{2} \left[\frac{K+1}{K-1} \right]$ (4) $\frac{C}{2} \left[\frac{K-1}{K+1} \right]^2$

9. If the electron in hydrogen atom jumps from second Bohr orbit to ground state and difference between energies of the two states is radiated in the form of photons. If the work function of the material is $4.2\ \text{eV}$, then stopping potential is

[Energy of electron in n^{th} orbit = $-\frac{13.6}{n^2}\ \text{eV}$]

- (1) $2\ \text{V}$ (2) $4\ \text{V}$
 (3) $6\ \text{V}$ (4) $5\ \text{V}$

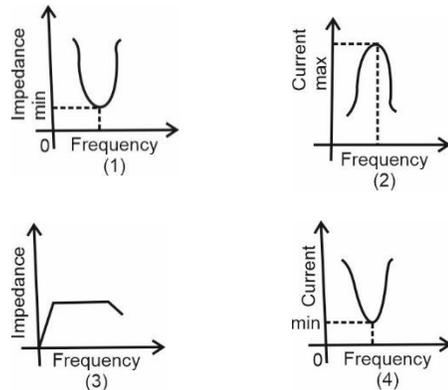
10. Photodiode is a device

- (1) Which is always operated in reverse bias
 (2) Which is always operated in forward bias
 (3) In which photo current is independent of intensity of incident radiation
 (4) Which may be operated in forward or reverse bias

11. In sonometer experiment, the string of length ' L ' under tension vibrates in second overtone between two bridges. The amplitude of vibration is maximum at

- (1) $\frac{L}{3}, \frac{2L}{3}, \frac{5L}{6}$ (2) $\frac{L}{8}, \frac{L}{4}, \frac{L}{2}$
 (3) $\frac{L}{2}, \frac{L}{4}, \frac{L}{6}$ (4) $\frac{L}{6}, \frac{L}{2}, \frac{5L}{6}$

12. Out of the following graphs, which graph shows the correct relation (graphical representation) for LC parallel resonant circuit.



- (1) 1 (2) 2
 (3) 3 (4) 4

13. According to de-Broglie hypothesis, the wavelength associated with moving electron of mass ' m ' is ' λ_e '. Using mass energy relation and Planck's quantum theory, the wavelength associated with photon is ' λ_p '. If the energy (E) of electron and photon is same, then relation between ' λ_e ' and ' λ_p ' is

- (1) $\lambda_p \propto \lambda_e$ (2) $\lambda_p \propto \lambda_e^2$
 (3) $\lambda_p \propto \sqrt{\lambda_e}$ (4) $\lambda_p \propto \frac{1}{\lambda_e}$

14. A disc of moment of inertia ' I_1 ' is rotating in horizontal plane about an axis passing through a centre and perpendicular to its plane with constant angular speed ' ω_1 '. Another disc of moment of inertia ' I_2 ' having zero angular speed is placed co-axially on a rotating disc. Now, both the discs are rotating with constant angular speed ' ω_2 '. The energy lost by the initial rotating disc is

- (1) $\frac{1}{2} \left[\frac{I_1 + I_2}{I_1 I_2} \right] \omega_1^2$ (2) $\frac{1}{2} \left[\frac{I_1 I_2}{I_1 - I_2} \right] \omega_1^2$
 (3) $\frac{1}{2} \left[\frac{I_1 - I_2}{I_1 I_2} \right] \omega_1^2$ (4) $\frac{1}{2} \left[\frac{I_1 I_2}{I_1 + I_2} \right] \omega_1^2$

15. A metal rod of length ' L ' and cross-sectional area ' A ' is heated through ' $T^\circ\text{C}$ '. What is the force required to prevent the expansion of the rod lengthwise (symbols have their usual meaning)
- (1) $\left(\frac{YA\alpha T}{1-\alpha T}\right)$
 (2) $\frac{YA\alpha T}{1+\alpha T}$
 (3) $\frac{(1-\alpha T)}{YA\alpha T}$
 (4) $\frac{(1+\alpha T)}{YA\alpha T}$
16. In Young's double experiment, in air interference pattern second minimum is observed exactly in front of one slit. The distance between the two coherent source is ' d ' and the distance between source and screen is ' D '. The wavelength of light source used is
- (1) $\frac{d^2}{D}$ (2) $\frac{d^2}{2D}$
 (3) $\frac{d^2}{3D}$ (4) $\frac{d^2}{4D}$
17. Two light waves of intensities ' I_1 ' and ' I_2 ' having same frequency pass through same medium at a time in same direction and interface. The sum of the minimum and maximum intensities is
- (1) $(I_1 + I_2)$ (2) $2(I_1 + I_2)$
 (3) $(\sqrt{I_1} + \sqrt{I_2})$ (4) $(\sqrt{I_1} - \sqrt{I_2})$
18. An alternating voltage $e = 200\sqrt{2} \sin(100 t)$ volt is connected to $1 \mu\text{F}$ capacitor through a.c. ammeter. The reading of ammeter is
- (1) 5 mA (2) 10 mA
 (3) 15 mA (4) 20 mA
19. In non-uniform circular motion, the ratio of tangential to radius acceleration is (r = radius of circle, v = speed of the particle, α = angular acceleration)
- (1) $\frac{\alpha^2 r^2}{v}$ (2) $\frac{\alpha^2 r}{v^2}$
 (3) $\frac{\alpha r^2}{v^2}$ (4) $\frac{v^2}{r^2 \alpha}$
20. If M_z = magnetization of a paramagnetic sample, B = external magnetic field, T = absolute temperature, C = curie constant then according to Curie's law in magnetism, the correct relation is
- (1) $M_z = \frac{T}{CB}$ (2) $M_z = \frac{CB}{T}$
 (3) $C = \frac{M_z B}{T}$ (4) $C = \frac{T^2}{M_z B}$
21. A sphere of mass ' m ' moving with velocity ' v ' collides head-on another sphere of same mass which is at rest. The ratio of final velocity of second sphere to the initial velocity of the first sphere is (e is coefficient of restitution and collision is inelastic)
- (1) $\frac{e-1}{2}$ (2) $\frac{e}{2}$
 (3) $\frac{e+1}{2}$ (4) e
22. An alternating electric field of frequency ' f ' is applied across the dees (radius R) of a cyclotron to accelerate protons (mass m). The operating magnetic field ' B ' used and kinetic energy of the proton beam produced by it are respectively (e = charge on proton)
- (1) $\frac{2\pi mf}{e}, 2\pi^2 mf^2 R^2$ (2) $\frac{2\pi^2 mf}{e^2}, 4\pi^2 mf^2 R^2$
 (3) $\frac{\pi mf}{e}, \pi^2 mf^2 R^2$ (4) $\frac{2\pi^2 m^2 f^2}{e}, 2\pi^2 mf^2 R^2$

23. A ray of light is incident normally on a glass slab of thickness 5 cm and refractive index 1.6. The time taken to travel by the ray from source till slab is same as the time taken by it to travel through glass slab. The distance of source from the glass slab is
- (1) 4 cm (2) 8 cm
(3) 12 cm (4) 16 cm
24. Magnetic susceptibility for a paramagnetic and diamagnetic materials is respectively
- (1) Small, positive and small, positive
(2) Large, positive and small, negative
(3) Small, positive and small, negative
(4) Large, negative and large, positive
25. The moment of inertia of a ring about an axis passing through the centre and perpendicular to its plane is ' I '. It is rotating with angular velocity ' ω '. Another identical ring is gently placed on it so that their centres coincide. If both the rings are rotating about the same axis then loss in kinetic energy is
- (1) $\frac{I\omega^2}{2}$
(2) $\frac{I\omega^2}{4}$
(3) $\frac{I\omega^2}{6}$
(4) $\frac{I\omega^2}{8}$
26. A bomb at rest explodes into 3 parts of same mass. The momentum of two parts is $-3P\hat{i}$ and $2P\hat{j}$ respectively. The magnitude of momentum of the third part is
- (1) P (2) $5P$
(3) $11P$ (4) $\sqrt{13}P$
27. When source of sound moves towards a stationary observer, the wavelength of sound received by him
- (1) Decrease while frequency increase
(2) Remains the same whereas frequency increases
(3) Increases and frequency also increases
(4) Decreases while frequency remains the same
28. A body is thrown from the surface of the earth with velocity ' u ' m/s. The maximum height in m above the surface of the earth upto which it will reach is (R = radius of earth, g = acceleration due to gravity)
- (1) $\frac{u^2R}{2gR - u^2}$ (2) $\frac{2u^2R}{gR - u^2}$
(3) $\frac{u^2R^2}{2gR^2 - u^2}$ (4) $\frac{u^2R}{gR - u^2}$
29. Heat energy is incident on the surface at the rate of 10000 J/min. If coefficient of absorption is 0.8 and coefficient of reflection is 0.1 then heat energy transmitted by the surface in 5 minutes is
- (1) 1000 J
(2) 5000 J
(3) 7000 J
(4) 9000 J
30. Let $x = \left[\frac{a^2b^2}{c} \right]$ be the physical quantity. If the percentage error in the measurement of physical quantities a , b and c is 2, 3 and 4 percent respectively then percentage error in the measurement of x is
- (1) 7% (2) 14%
(3) 21% (4) 28%

31. Two coils have a mutual inductance of 0.01 H. The current in the first coil changes according to equation $i = 5\sin 200 \pi t$. The maximum value of e.m.f. induced in the second coil is

- (1) 10π volt (2) 0.1π volt
 (3) π volt (4) 0.01π volt

32. Bohr model is applied to a particle of mass ' m ' and charge ' q ' moving in a plane under the influence of a transverse magnetic field ' B '. The energy of the charged particle in the n^{th} level will be ($h = \text{Planck's constant}$)

- (1) $\frac{2nhqB}{\pi m}$ (2) $\frac{nhqB}{2\pi m}$
 (3) $\frac{nhqB}{4\pi m}$ (4) $\frac{nhqB}{\pi m}$

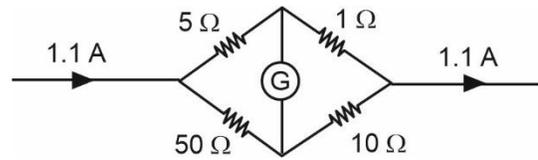
33. For a metallic wire, the ratio of voltage to corresponding current is

- (1) Independent of temperature
 (2) Increases with rise in temperature
 (3) Increases or decreases with rise in temperature depending upon the metal
 (4) Decreases with rise in temperature

34. The kinetic energy of a revolving satellite (mass m) at a height equal to thrice the radius of the earth (R) is

- (1) $\frac{mgR}{8}$
 (2) $\frac{mgR}{16}$
 (3) $\frac{mgR}{2}$
 (4) $\frac{mgR}{4}$

35. The current in 1Ω resistor in the following circuit is

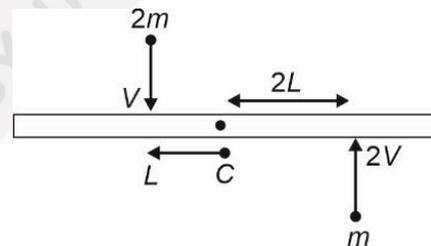


- (1) 1 A (2) 0.5 A
 (3) 1.1 A (4) 0.8 A

36. A telescope has large diameter of the objective. Then its resolving power is

- (1) Independent of the diameter of the objective
 (2) Low
 (3) Zero
 (4) High

37. A uniform rod of length ' $6L$ ' and mass ' $8m$ ' is pivoted at its centre ' C '. Two masses ' m ' and ' $2m$ ' with speed $2V$, V as shown strikes the rod and stick to the rod. Initially the rod is at rest. Due to impact, if it rotates with angular velocity ' ω ', then ' ω ' will be



- (1) $\frac{V}{5L}$ (2) Zero
 (3) $\frac{8V}{6L}$ (4) $\frac{11V}{3L}$

38. The magnitude of magnetic induction at a point on the axis at a large distance (r) from the centre of circular coil of ' n ' turns, and area ' A ' carrying current (I) is given by

- (1) $B_{\text{axis}} = \frac{\mu_0}{4\pi} \cdot \frac{nA}{lr^3}$ (2) $B_{\text{axis}} = \frac{\mu_0}{4\pi} \cdot \frac{2nIA}{r^3}$
 (3) $B_{\text{axis}} = \frac{\mu_0}{4\pi} \cdot \frac{2nI}{Ar^3}$ (4) $B_{\text{axis}} = \frac{\mu_0}{4\pi} \cdot \frac{nIA}{r^3}$

39. A metal sphere of radius 'R' and density ' ρ_1 ' is dropped in a liquid of density ' σ ' moves with terminal velocity 'V'. Another metal sphere of same radius and density ' ρ_2 ' is dropped in the same liquid, its terminal velocity will be

(1) $V \left[\frac{(\rho_2 + \sigma)}{(\rho_1 + \sigma)} \right]$

(2) $V \left[\frac{(\rho_1 + \sigma)}{(\rho_2 + \sigma)} \right]$

(3) $V \left[\frac{(\rho_2 - \sigma)}{(\rho_1 - \sigma)} \right]$

(4) $V \left[\frac{(\rho_1 - \sigma)}{(\rho_2 - \sigma)} \right]$

40. If α is the coefficient of performance of a refrigerator and ' Q_1 ' is heat released to the hot reservoir, then the heat extracted from the cold reservoir ' Q_2 ' is

(1) $\frac{\alpha Q_1}{\alpha - 1}$

(2) $\frac{\alpha - 1}{\alpha} Q_1$

(3) $\frac{\alpha Q_1}{1 + \alpha}$

(4) $\frac{1 + \alpha}{\alpha} Q_1$

41. A electromagnetic wave going through vacuum is described by $E = E_0 \sin(kx - \omega t)$, $B = B_0 \sin(kx - \omega t)$. Which of the following equations is true?

(1) $E_0 k = B_0 \omega$

(2) $E_0 \omega = B_0 k$

(3) $E_0 B_0 = \omega k$

(4) None of these

42. A carnot engine whose low temperature reservoir is at 7°C has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of the high temperature reservoir be increased? (Pick the approximate values)

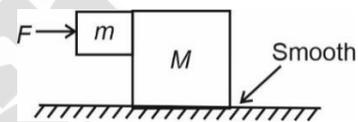
(1) 840 K

(2) 280 K

(3) 560 K

(4) 380 K

43. The two blocks $m = 10 \text{ kg}$ and $M = 50 \text{ kg}$ are free to move as shown. The coefficient of static friction between the blocks is 0.5 and there is no friction between M and the ground. A minimum horizontal force F is applied to hold m against M that is equal to



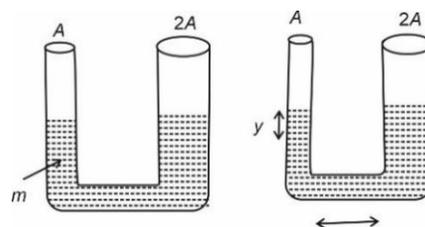
(1) 100 N

(2) 50 N

(3) 240 N

(4) 180 N

44. A U-tube is of non-uniform cross-section. The area of cross sections of two sides of tube are A and $2A$ (see fig). It contains non-viscous liquid of mass m . The liquid is displaced slightly and free to oscillate. Its time period of oscillations is



(1) $T = 2\pi \sqrt{\frac{m}{3\rho g A}}$

(2) $T = 2\pi \sqrt{\frac{m}{2\rho g A}}$

(3) $T = 2\pi \sqrt{\frac{m}{\rho g A}}$

(4) None of these

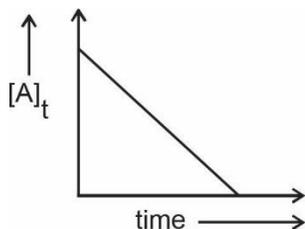
45. A circular coil carrying current has radius ' R '. At a point ' P ' on the axis of the coil, the value of magnetic induction is $\left(\frac{1}{8}\right)^{th}$ of its value at the centre of the coil. The distance of point ' P ' from the centre of the coil is
- (1) $\frac{R}{2\sqrt{3}}$
 - (2) $\left(\frac{2}{\sqrt{3}}\right)R$
 - (3) $\frac{2}{\sqrt{3}}$
 - (4) $\sqrt{3}R$
46. The half life of a radioactive substance is 20 minutes. The approximate time interval $(t_2 - t_1)$ between the time t_2 when $\left(\frac{2}{3}\right)^{rd}$ of it is decayed and time t_1 when $\left(\frac{1}{3}\right)^{rd}$ of it has decayed is (in minutes)
- (1) 7
 - (2) 20
 - (3) 14
 - (4) 28
47. In Young's double slit experiment, 8th maximum with wavelength ' λ_1 ' is at a distance ' d_1 ' from the central maximum and 6th maximum with wavelength ' λ_2 ' is at a distance ' d_2 ' from the central maximum. Then $\frac{d_1}{d_2}$ is equal to
- (1) $\frac{4\lambda_1}{3\lambda_2}$
 - (2) $\frac{4\lambda_2}{3\lambda_1}$
 - (3) $\frac{3\lambda_1}{4\lambda_2}$
 - (4) $\frac{3\lambda_2}{4\lambda_1}$
48. A circular coil carrying current of radius 5 cm has 500 turns of a wire. The approximate value of the coefficient of self induction of the coil will be ($\mu_0 = 4\pi \times 10^{-7}$ SI units)
- (1) 50×10^{-3} millihenry
 - (2) 25 millihenry
 - (3) 25×10^{-3} millihenry
 - (4) 50 millihenry
49. The frequency of two tuning forks A and B are respectively 1.5% more and 2.5% less than that of the tuning fork C . When forks A and B are sounded together, 12 beats are produced in 1 second. The frequency of tuning fork C is
- (1) 300 Hz
 - (2) 240 Hz
 - (3) 200 Hz
 - (4) 360 Hz
50. A perfect gas has volume ' V ' and pressure ' P '. According to kinetic theory of gases, if the total translational kinetic energy of all the molecules of the gas is equal to $\frac{3}{2} PV$, the gas is
- (1) Polyatomic only
 - (2) Diatomic only
 - (3) Monoatomic only
 - (4) Monoatomic, diatomic and polyatomic
51. Which of the following oxo-acids of sulphur has peroxide linkage?
- (1) H_2SO_3
 - (2) H_2SO_5
 - (3) $H_2S_2O_8$
 - (4) Both (2) and (3)

52. In rock salt type of crystal AB, if C is introduced in all tetrahedral voids without causing distortion, then formula of compound is
- (1) ABC (2) ABC_2
 (3) A_4B_4C (4) ABC_8
53. If aqueous solution of H_2SO_4 contain 98% (w/w) H_2SO_4 and the density of solution is 1.5 g/cm^3 , then calculate the molarity of solution.
- (1) 10 M (2) $\frac{1}{10}$ M
 (3) 15 M (4) $\frac{1}{18}$ M
54. Units of rate constant for first and zero order reaction in terms of molarity 'M' are respectively
- (1) s^{-1}, Ms^{-1} (2) s^{-1}, M
 (3) Ms^{-1}, s^{-1} (4) M, s^{-1}
55. Calculate the relation between ΔH and ΔU when solid benzoic acid is completely oxidized in the presence of oxygen at 27°C and 1 atm pressure.
- (1) $\Delta H = \Delta U$
 (2) $\Delta H = \Delta U + 150R$
 (3) $\Delta H = \Delta U - 150R$
 (4) $\Delta H = \Delta U + 300R$
56. The numerical value of $(\Delta H - \Delta E)$ for the combustion of ethene at 300 K is
- (1) -1200 cal
 (2) -2500 cal
 (3) 1500 cal
 (4) 275 cal
57. Two moles of ideal gas expanded isothermally and reversibly from 1 litre to 10 litre at 300 K. The heat change for process is
- (1) 11.4 kJ (2) -11.4 kJ
 (3) 0 kJ (4) 4.8 kJ
58. What is the number of precipitable halide ions in $[Pt(NH_3)Cl_2Br]Cl$?
- (1) 2 (2) 3
 (3) 4 (4) 1
59. The value of $E^\circ_{M^{2+}/M}$ is positive in
- (1) Cu (2) Fe
 (3) Ti (4) All of these
60. Which of the following is correct for electrolytic cell?
- (1) Anode is $-ve$ charge
 (2) Oxidation occurs at cathode
 (3) Reduction occurs at cathode
 (4) Chemical energy is converted into electrical energy
61. What volume of 0.8 M solution contain 0.1 mole of the solute?
- (1) 100 ml (2) 125 ml
 (3) 500 ml (4) 62.5 ml
62. For the given reaction, the rate can be expressed as:
- $$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$
- (1) $r = -\frac{d[N_2]}{dt} = -3\frac{d[H_2]}{dt} = +2\frac{d[NH_3]}{dt}$
 (2) $r = \frac{-d[N_2]}{dt} = \frac{-1}{3}\frac{d[H_2]}{dt} = +\frac{1}{2}\frac{d[NH_3]}{dt}$
 (3) $r = \frac{d[N_2]}{dt} = \frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$
 (4) $r = \frac{d[N_2]}{dt} = \frac{3}{1}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

63. Half life periods of reaction at initial concentration of 0.1 M and 0.01 M are 10 and 100 minutes respectively. The order of reaction is

- (1) Zero (2) 1
(3) 2 (4) 3

64. For the given zero order graph, slope is



- (1) $\frac{k}{2.303}$ (2) $\frac{-k}{2.303}$
(3) k (4) $-k$

65. The number of water molecules in a drop of water, if 1 ml of water has 20 drops and A is Avogadro number, is

- (1) $0.5 A/18$ (2) $0.05 A$
(3) $0.5 A$ (4) $0.05 A/18$

66. The kinetic energy of electron in second Bohr orbit of hydrogen atom is [a_0 is Bohr radius]

- (1) $\frac{h^2}{4\pi^2 m a_0^2}$
(2) $\frac{h^2}{16\pi^2 m a_0^2}$
(3) $\frac{h^2}{32\pi^2 m a_0^2}$
(4) $\frac{h^2}{64\pi^2 m a_0^2}$

67. Hybridization state of phosphorus in P_4 is

- (1) sp^2 (2) sp^3
(3) sp (4) sp^3d

68. Bayer's process is used for the purification of _____ metal ore.

- (1) Al (2) Ni
(3) Mg (4) Fe

69. The hybridisation of silicon and its covalency in silica are

- (1) sp , 2 (2) sp^2 , 3
(3) sp^3 , 4 (4) sp^3d^2 , 6

70. Which of the following is correct order of boiling point?

- (1) $NH_3 > PH_3 > AsH_3 > SbH_3$
(2) $H_2O > H_2S > H_2Se > H_2Te$
(3) $HF > HI > HBr > HCl$
(4) All of these

71. Which of the following pairs of hydrides can exhibit polymeric structure?

- (1) BeH_2, MgH_2 (2) LiH, BeH_2
(3) LiH, MgH_2 (4) All of these

72. The inversion temperature of hydrogen is

Given

$$a = 0.244 \text{ atm L}^2 \cdot \text{mol}^{-2}$$

$$b = 0.027 \text{ L mol}^{-1}$$

- (1) 440 (2) 220
(3) 110 (4) 330

73. Which of the following is known as oil of vitriol?

- (1) HNO_3
(2) H_2SO_4
(3) $CuSO_4 \cdot 5H_2O$
(4) H_2CO_3

74. Which of the following will have highest acidic strength?
- (1) HClO (2) HClO₂
(3) HClO₃ (4) HClO₄
75. $\text{Cl}_2 + \text{NaOH}(\text{Cold and dilute}) \longrightarrow \text{NaCl} + \text{A} + \text{H}_2\text{O}$;
"A" will be
- (1) NaClO₃ (2) NaOCl
(3) NaClO₅ (4) NaClO₄
76. What is the shape of BrF₃?
- (1) See-saw (2) T-shape
(3) Octahedral (4) Trigonal planar
77. Which of the following is fat soluble vitamin?
- (1) B (2) C
(3) D (4) B₁₂
78. Which of the following does not belong to first transition series?
- (1) Ni (2) W
(3) Cr (4) Mn
79. $\text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{O}_2 + \text{H}^+ \longrightarrow$ blue colour compound formed is
- (1) CrO₃ (2) CrO₅
(3) CrO₄²⁻ (4) Cr⁺³
80. Which among the following is incorrect combination?
- (1) Antihistamine - Brompheniramine
(2) Narcotic Analgesic - Morphine
(3) Dettol - Mixture of chloro xyleneol + terpineol
(4) Butylated hydroxy toluene - Antipyretic
81. Primary valency of Ni in [Ni(CO)₄] is
- (1) Zero (2) +2
(3) +4 (4) +6
82. The molecule ML_x is planar with six pairs of electrons around 'M' in valency shell. Value of x is
- (1) 6 (2) 2
(3) 4 (4) 3
83. Which of the compound is optically active?
- (1) [Co(en)₃]⁺³
(2) Trans [Co en(NH₃)₄]⁺³
(3) Trans [Co(en)₂(H₂O)₂]⁺³
(4) All of these
84. Reactivity order of alkyl halide for S_N1 reaction is
- (1) R - F > R - Cl > R - Br > R - I
(2) R - I > R - Br > R - Cl > R - F
(3) R - Cl > R - I > R - F > R - Br
(4) R - Br > R - Cl > R - F > R - I
85. $\text{CH}_3\text{CHO} \xrightarrow[\text{H}_3\text{O}^+]{\text{CH}_3\text{MgBr}} \text{A}$
 $\downarrow \text{NaBH}_4$
B
- Then A and B are
- (1) A secondary alcohol and B primary alcohol
(2) A and B are primary alcohol
(3) A and B are secondary alcohol
(4) A secondary alcohol and B tertiary alcohol
86. Which of the following does not give Tollen's test?
- (1) C₂H₂ (2) HCHO
(3) CH₃CHO (4) 2-Butyne
87. Which of the following can't be prepared by Williamson's synthesis?
- (1) Methoxy benzene
(2) Methyl tert-butyl ether
(3) Benzyl-p-Nitro phenyl ether
(4) Di tertiary butyl ether

88. The reactivity order of following towards nucleophilic addition reaction is



- (1) I > II > III
- (2) III > II > I
- (3) I > III > II
- (4) II > III > I

89. By oxidation of cumene (in presence of O_2), which of the following is produced as a side product?

- (1) Acetone
- (2) Acetaldehyde
- (3) Acetic acid
- (4) Ethanol

90. In Reimer-Tiemann reaction the electrophile is

- (1) $:\text{CH}_2$
- (2) $:\text{CCl}_2$
- (3) $\overset{\oplus}{\text{C}}\text{H}_2$
- (4) $\overset{-}{\text{C}}\text{H}_2$

91. IUPAC name of $\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_3$

is

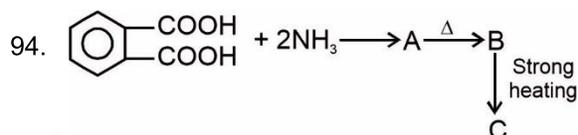
- (1) Diethyl ether
- (2) Ethoxy ethane
- (3) Butanone
- (4) Butanol

92. Which of the following does not give Friedel-Crafts alkylation?

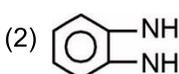
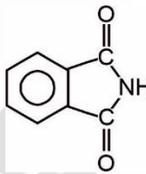
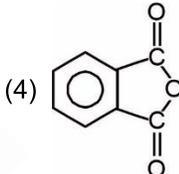
- (1) Benzene
- (2) Toluene
- (3) Cumene
- (4) Aniline

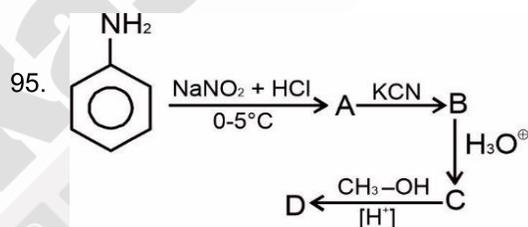
93. 3-phenyl propene on reaction with HBr gives (as major product)

- (1) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}(\text{Br})\text{CH}_3$
- (2) $\text{C}_6\text{H}_5\text{CH}(\text{Br})\text{CH}_2\text{CH}_3$
- (3) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
- (4) $\text{C}_6\text{H}_5\text{CH}(\text{Br})\text{CH}=\text{CH}_2$

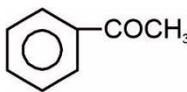
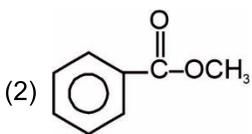
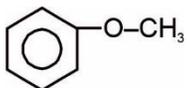
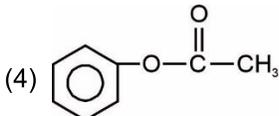


then C is

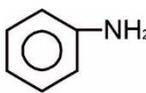
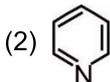
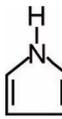
- (1) 
- (2) 
- (3) 
- (4) 



What is D ?

- (1) 
- (2) 
- (3) 
- (4) 

96. Which of the following amine is most basic?

- (1) 
- (2) 
- (3) 
- (4) 