

02/04/2025

Morning



Aakash

Medical | IIT-JEE | Foundations

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot-13, Sector-18, Udyog Vihar,
Gurugram, Haryana-122015

Answers & Solutions

Time : 3 hrs.

for

M.M. : 300

JEE (Main)-2025 (Online) Phase-2

(Mathematics, Physics and Chemistry)

IMPORTANT INSTRUCTIONS:

- (1) The test is of **3 hours** duration.
- (2) This test paper consists of 75 questions. Each subject (MPC) has 25 questions. The maximum marks are 300.
- (3) This question paper contains **Three Parts**. **Part-A** is Mathematics, **Part-B** is Physics and **Part-C** is Chemistry. Each part has only two sections: **Section-A** and **Section-B**.
- (4) **Section - A** : Attempt all questions.
- (5) **Section - B** : Attempt all questions.
- (6) **Section - A (01 - 20)** contains 20 multiple choice questions (MCQ) which have **only one correct answer**. Each question carries **+4 marks** for correct answer and **-1 mark** for wrong answer.
- (7) **Section - B (21 - 25)** contains 5 **Numerical value** based questions. The answer to each question should be rounded-off to the **nearest integer**. Each question carries **+4 marks** for correct answer and **-1 mark** for wrong answer.

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(MPC) | IIT-JEE | IIT-ISM

1000+ 99
PERCENTILERS
& ABOVE

4000+ 95
PERCENTILERS
& ABOVE

100
Percentile
in
Physics
& Maths



Shreyas Lohiya
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100
Percentile
in
Physics



Harsh Jha
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100
Percentile
in
Physics
& Chemistry



Devya Rustagi
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99.99
Percentile



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9. If the system of linear equations
 $3x + y + \beta z = 3$
 $2x + \alpha y - z = -3$
 $x + 2y + z = 4$
 has infinitely many solutions, then the value of $22\beta - 9\alpha$ is:

- (1) 43 (2) 49
 (3) 37 (4) 31

Answer (4)

Sol. $3x + y + \beta z = 3$

$$2x + \alpha y - z = -3$$

$$x + 2y + z = 4$$

has infinite solution

$$\Rightarrow \Delta = 0, \Delta_1 = \Delta_2 = \Delta_3$$

$$\Delta = 0 \Rightarrow \begin{vmatrix} 3 & 1 & \beta \\ 2 & \alpha & -1 \\ 1 & 2 & 1 \end{vmatrix} = 0$$

$$\Delta_2 = 0 \Rightarrow \begin{vmatrix} 3 & 3 & \beta \\ 2 & -3 & -1 \\ 1 & 4 & 1 \end{vmatrix} = 0$$

$$\Rightarrow 3(-3+4) - 3(2+1) + \beta(8+3) = 0$$

$$\Rightarrow 3 - 9 + 11\beta = 0$$

$$\Rightarrow \beta = \frac{6}{11}$$

$$\Delta_3 = 0 \Rightarrow \begin{vmatrix} 3 & 1 & 3 \\ 2 & \alpha & -3 \\ 1 & 2 & 4 \end{vmatrix} = 0$$

$$\Rightarrow 3(4\alpha + 6) - 1(8 + 3) + 3(4 - \alpha) = 0$$

$$12\alpha + 18 - 11 + 12 - 3\alpha = 0$$

$$9\alpha = -19$$

$$\alpha = \frac{-19}{9}$$

$$\therefore \boxed{22\beta - 9\alpha = 31}$$

10. The number of sequences of ten terms, whose terms are either 0 or 1 or 2, that contain exactly five 1s and exactly three 2s, is equal to:

- (1) 1820 (2) 2520
 (3) 360 (4) 45

Answer (2)

Sol. Exactly five 1s and exactly three 2s

\Rightarrow 2 zeros must be used

\Rightarrow 10 places to arrange 5 ones, 3 twos and 2 zeros

$$\Rightarrow \frac{10!}{2!3!5!} = 2520$$

11. Let $A = \begin{bmatrix} \alpha & -1 \\ 6 & \beta \end{bmatrix}$, $\alpha > 0$, such that $\det(A) = 0$ and $\alpha + \beta = 1$. If I denotes 2×2 identity matrix, then the matrix, $(I + A)^8$ is

(1) $\begin{bmatrix} 766 & -255 \\ 1530 & -509 \end{bmatrix}$

(2) $\begin{bmatrix} 257 & -64 \\ 514 & -127 \end{bmatrix}$

(3) $\begin{bmatrix} 4 & -1 \\ 6 & -1 \end{bmatrix}$

(4) $\begin{bmatrix} 1025 & -511 \\ 2024 & -1024 \end{bmatrix}$

Answer (1)

Sol. Let $|A| = 0 \Rightarrow \alpha\beta - (-6) = 0 \Rightarrow \alpha\beta = -6$

and $\alpha + \beta = 1 \Rightarrow \alpha, \beta$ are roots of the equation

$$x^2 - x - 6 = 0 \Rightarrow x = 3, -2. \text{ Since } \alpha > 0$$

$$\Rightarrow \alpha = 3, \beta = -2$$

$$\Rightarrow A = \begin{bmatrix} 3 & -1 \\ 6 & -2 \end{bmatrix} \Rightarrow I + A = \begin{bmatrix} 4 & -1 \\ 6 & -1 \end{bmatrix}$$

$$(I + A)^2 = \begin{bmatrix} 10 & -3 \\ 18 & -5 \end{bmatrix} \Rightarrow (I + A)^4 = \begin{bmatrix} 46 & -15 \\ 90 & -29 \end{bmatrix}$$

$$\Rightarrow (I + A)^8 = \begin{bmatrix} 766 & -255 \\ 1530 & -509 \end{bmatrix}$$

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Answer (2)

Sol. $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1, a > 0$

$$f'(x) = 6x^2 - 18ax + 12a^2 = 0$$

$$= 6(x^2 - 3ax + 2a^2)$$

$$= 6(x - a)(x - 2a) = 0$$

$x = a, 2a$

$\therefore x = a$ is point of maxima

$x = 2a$ is point of minima

$\therefore p = a, q = 2a$

$p^2 = q$ (Given)

$a^2 = 2a$

$\Rightarrow a = 2$

$f(x) = 2x^3 - 18x^2 + 48x + 1$

$f(3) = 37$

16. If $\theta \in [-2\pi, 2\pi]$, then the number of solutions of $2\sqrt{2}\cos^2\theta + (2 - \sqrt{6})\cos\theta - \sqrt{3} = 0$, is equal to

- (1) 10
- (2) 6
- (3) 8
- (4) 12

Answer (3)

Sol. $2\sqrt{2}\cos^2\theta + (2 - \sqrt{6})\cos\theta - \sqrt{3} = 0$

$$2\sqrt{2}\cos^2\theta + 2\cos\theta - \sqrt{6}\cos\theta - \sqrt{3} = 0$$

$$(2\cos\theta - \sqrt{3})(\sqrt{2}\cos\theta + 1) = 0$$

$\Rightarrow \cos\theta = \frac{\sqrt{3}}{2}$ or $\cos\theta = \frac{-1}{\sqrt{2}}$

$$\theta = \left\{ \frac{-11\pi}{6}, \frac{-5\pi}{4}, \frac{-3\pi}{4}, \frac{-\pi}{6}, \frac{\pi}{6}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{11\pi}{6} \right\}$$

$\Rightarrow 8$ (solution)

17. For $\alpha, \beta, \gamma \in \mathbb{R}$, if $\lim_{x \rightarrow 0} \frac{x^2 \sin \alpha x + (\gamma - 1)e^{x^2}}{\sin 2x - \beta x} = 3$,

then $\beta + \gamma - \alpha$ is equal to

- (1) 4
- (2) 6
- (3) 7
- (4) -1

Answer (3)

Sol. At $x \rightarrow 0$

$\sin 2x - \beta x \rightarrow 0$

$\Rightarrow \frac{0}{0}$ form

$\Rightarrow (\gamma - 1)e^0 + 0\sin(\alpha x) \rightarrow 0$

$\Rightarrow (\gamma - 1) = 0$

$\Rightarrow \gamma = 1$

$\Rightarrow \lim_{x \rightarrow 0} \frac{x^2 \sin(\alpha x)}{(\sin 2x - \beta x)} = 3$

$$\Rightarrow \lim_{x \rightarrow 0} \frac{x^2 \left[\alpha x - \frac{(\alpha x)^3}{3!} + \frac{(\alpha x)^5}{5!} - \dots \right]}{(2x) - \frac{(2x)^3}{3!} + \frac{(2x)^5}{5!}} = 3$$

$$\Rightarrow \lim_{x \rightarrow 0} \frac{\alpha x^3 - \frac{\alpha^3 x^5}{3!} + \frac{\alpha^5 x^7}{5!} - \dots}{x(2 - \beta) - \frac{8x^3}{6} + \frac{2^5 \cdot x^5}{5!} - \dots} = 3$$

$\Rightarrow 2 - \beta = 0$ and $\frac{\alpha}{-8} = 3$

$\Rightarrow \beta = 2$

$\alpha = 3 \left(-\frac{8}{6} \right) = -4$

$\Rightarrow \gamma = 1, \beta = 2, \alpha = -4$

$\Rightarrow \beta + \gamma - \alpha = 7$

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18. Let one focus of the hyperbola $H: \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ be at $(\sqrt{10}, 0)$ and the corresponding directrix be $x = \frac{9}{\sqrt{10}}$. If e and l respectively are the eccentricity and the length of the latus rectum of H , then $9(e^2 + l)$ is equal to

- (1) 15 (2) 14
(3) 12 (4) 16

Answer (4)

Sol. $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

Directrix : $x = \frac{9}{\sqrt{10}} = \frac{a}{e}$... (i)

Focus : $(\sqrt{10}, 0) \equiv (ae, 0)$

$ae = \sqrt{10}$... (ii)

(i) \times (ii)

$\Rightarrow a^2 = 9 \Rightarrow a = 3$

Substitute in (ii)

$e = \frac{\sqrt{10}}{3}$

Now $e^2 = 1 + \frac{b^2}{a^2}$

$\frac{10}{9} = 1 + \frac{b^2}{a^2}$

$\Rightarrow \boxed{b=1}$

$l = \frac{2b^2}{a} = \frac{2 \times 1}{3} = \frac{2}{3}$

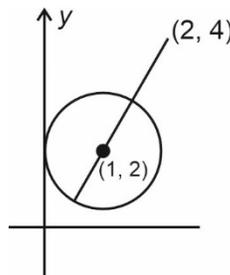
$a[e^2 + l] = 9 \left[\frac{10}{9} + \frac{2}{3} \right] = 10 + 6$

$= 16$

19. Let z be a complex number such that $|z| = 1$. If $\frac{2+k^2z}{k+\bar{z}} = kz$, $k \in \mathbf{R}$, then the maximum distance of $k + ik^2$ from the circle $|z - (1 + 2i)| = 1$ is

- (1) $\sqrt{5} + 1$ (2) 3
(3) $\sqrt{3} + 1$ (4) 2

Answer (1)



Sol.

$\frac{2+k^2z}{k+\bar{z}} = kz$

$\Rightarrow 2+k^2z = k^2z + k\bar{z}z$

$\Rightarrow 2+k|z|^2 \quad (z\bar{z} = |z|^2, |z|=1)$

$\Rightarrow \boxed{2=k}$

$\therefore k + k^2i = 2 + 4i$

\therefore The maximum distance is

$= \sqrt{(4-2)^2 + (2-1)^2} + \text{radius}$

$= \sqrt{(2)^2 + (1)^2} + 1$

$= \sqrt{5} + 1$

20. If \vec{a} is a nonzero vector such that its projections on the vectors $2\hat{i} - \hat{j} + 2\hat{k}$, $\hat{i} + 2\hat{j} - 2\hat{k}$ and \hat{k} are equal, then a unit vector along \vec{a} is

(1) $\frac{1}{\sqrt{155}}(7\hat{i} + 9\hat{j} + 5\hat{k})$

(2) $\frac{1}{\sqrt{155}}(7\hat{i} + 9\hat{j} - 5\hat{k})$

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$$(3) \frac{1}{\sqrt{155}}(-7\hat{i} + 9\hat{j} - 5\hat{k})$$

$$(4) \frac{1}{\sqrt{155}}(-7\hat{i} + 9\hat{j} + 5\hat{k})$$

Answer (1)

Sol. Projection of \vec{a} on \vec{v}

$$\begin{aligned} &= \frac{\vec{a} \cdot \vec{v}}{|\vec{v}|} \\ &\Rightarrow \frac{\vec{a} \cdot (2\hat{i} - \hat{j} + 2\hat{k})}{3} = \frac{\vec{a} \cdot \hat{k}}{1} = \frac{\vec{a} \cdot (\hat{i} + 2\hat{j} - 2\hat{k})}{3} \\ &\Rightarrow \vec{a} \cdot (2\hat{i} - \hat{j} - \hat{k}) = 0 \text{ and } \vec{a} \cdot (\hat{i} + 2\hat{j} - 5\hat{k}) = 0 \\ &\Rightarrow \vec{a} \perp (2\hat{i} - \hat{j} - \hat{k}) \text{ and } (\hat{i} + 2\hat{j} - 5\hat{k}) \\ &\Rightarrow \vec{a} \parallel (2\hat{i} - \hat{j} - \hat{k}) \times (\hat{i} + 2\hat{j} - 5\hat{k}) \\ &\Rightarrow \vec{a} = \pm k \begin{vmatrix} \hat{i} & -\hat{j} & \hat{k} \\ 2 & -1 & -1 \\ 1 & 2 & -5 \end{vmatrix} = \pm k (7\hat{i} + 9\hat{j} - 5\hat{k}) \\ &\Rightarrow \text{Unit vector will be } \frac{1}{\sqrt{155}}(7\hat{i} + 9\hat{j} + 5\hat{k}) \end{aligned}$$

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a thrice differentiable odd function satisfying $f'(x) \geq 0, f''(x) = f(x), f(0) = 0, f'(0) = 3$. Then $9f(\log_e 3)$ is equal to _____.

Answer (36)

Sol. $f'(x) \geq 0, f''(x) = f(x)$

Second order differential equation

$$f(x) = Ae^x + Be^{-x}$$

$$f(0) = 0 \Rightarrow A = -B$$

$$\Rightarrow f(x) = A(e^x - e^{-x})$$

$$f'(x) = Ae^x + Ae^{-x} = A(e^x + e^{-x})$$

$$f'(0) = 3 = A(e^0 + e^{-0}) = 2A \Rightarrow A = \frac{3}{2}$$

$$f(x) = \frac{3}{2}(e^x - e^{-x})$$

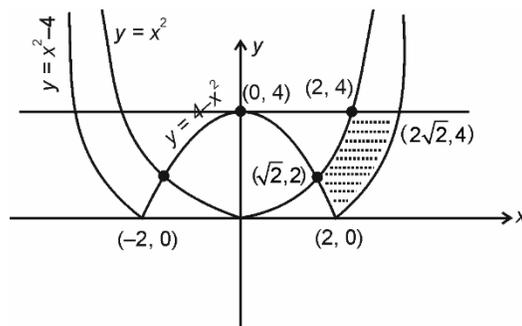
$$\begin{aligned} \text{If } (\ln 3) &= \frac{27}{2}(e^{\ln 3} - e^{-\ln 3}) = \frac{27}{2}\left(3 - \frac{1}{3}\right) = \frac{27}{2} \cdot \frac{8}{3} \\ &= 36 \end{aligned}$$

22. If the area of the region $\{(x, y) : |4 - x^2| \leq y \leq x^2, y \leq 4, x \geq 0\}$ is $\left(\frac{80\sqrt{2}}{\alpha} - \beta\right), \alpha, \beta \in \mathbb{N}$, then $\alpha + \beta$ is equal to _____.

Answer (22)

Sol. Area =

$$\int_{\sqrt{2}}^2 (x^2 - (4 - x^2)) dx + (2\sqrt{2} - 2) \times 4 - \int_2^{2\sqrt{2}} (x^2 - 4) dx$$



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$$= \left[\frac{2x^3}{3} - 4x \right]_{\sqrt{2}}^2 + 8\sqrt{2} - 8 - \left[\frac{x^3}{3} - 4x \right]_2^{2\sqrt{2}}$$

$$= \frac{40\sqrt{2}}{3} - 16$$

$$\Rightarrow \alpha = 6, \beta = 16 \Rightarrow \alpha + \beta = 22$$

23. Let $[\cdot]$ denote the greatest integer function. If

$$\int_0^3 \left[\frac{1}{e^{x-1}} \right] dx = \alpha - \log_e 2, \text{ then } \alpha^3 \text{ is equal to } \underline{\hspace{2cm}}.$$

Answer (8)

Sol. $I = \int_0^3 \left[\frac{1}{e^{x-1}} \right] dx = \int_0^{1-\ln 2} 2 dx + \int_{1-\ln 2}^1 dx + \int_1^3 0 dx$

$$= 2(1 - \ln 2) + (1 - (1 - \ln 2)) + 0 = 2 - \ln 2$$

$$\Rightarrow \alpha = 2 \Rightarrow \alpha^3 = 8$$

24. Three distinct numbers are selected randomly from the set $\{1, 2, 3, \dots, 40\}$. If the probability, that the selected members are in an increasing G.P., is

$$\frac{m}{n}, \text{gcd}(m, n) = 1, \text{ then } m + n \text{ is equal to } \underline{\hspace{2cm}}.$$

Answer (4949)

Sol.

Common ratio	Last triplet	Total
$r = 2$	10, 20, 40	10
$r = 3$	4, 12, 36	4
$r = 4$	2, 8, 32	2
$r = 5$	1, 5, 25	1
$r = 6$	1, 6, 36	1
	Total = 18	

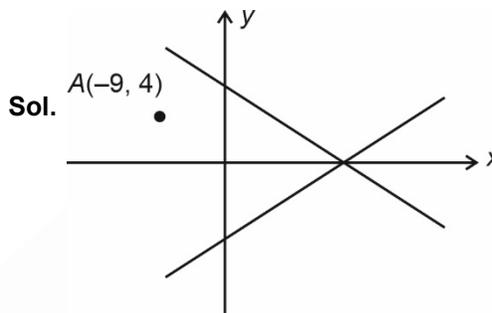
$$\text{Total choices} = {}^{40}C_3 = 9880$$

$$\text{Required probability} = \frac{18}{9880} = \frac{9}{4940} = \frac{m}{n}$$

$$m + n = 4949$$

25. The absolute difference between the squares of the radii of the two circles passing through the point $(-9, 4)$ and touching the lines $x + y = 3$ and $x - y = 3$, is equal to _____.

Answer (768)



$\therefore x + y = 3$ and $x - y = 3$ are tangents

\therefore Both circle centre will lie on x-axis

$$\therefore (x - a)^2 + y^2 = r^2$$

Hence centre is $C(\alpha, 0)$

$$r = \sqrt{(\alpha + 9)^2 + 16} \quad (1)$$

$$\text{Also } \left| \frac{\alpha - 3}{\sqrt{2}} \right| = r \quad (2)$$

$$\sqrt{(\alpha + 9)^2 + 16} = \left| \frac{\alpha - 3}{\sqrt{2}} \right|$$

$$\Rightarrow \alpha = -5 \text{ or } -37$$

$$r = \left| \frac{-5 - 3}{\sqrt{2}} \right| \text{ or } \left| \frac{-37 - 3}{\sqrt{2}} \right|$$

$$= 4\sqrt{2} \text{ or } 20\sqrt{2}$$

$$|r_1^2 - r_2^2| = |32 - 800| = 768$$

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PHYSICS

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

26. The battery of a mobile phone is rated as 4.2 V, 5800 mAh. How much energy is stored in it when fully charged?

- (1) 43.8 kJ (2) 48.7 kJ
 (3) 87.7 kJ (4) 24.4 kJ

Answer (3)

Sol. Energy stored in battery = $\frac{(\text{mAh}) \times V \times 3600}{1000}$
 $= \frac{5800 \times 4.2 \times 3600}{1000}$
 $= 87.7 \text{ kJ}$

27. A river is flowing from west to east direction with speed of 9 km h⁻¹. If a boat capable of moving at a maximum speed of 27 km h⁻¹ in still water, crosses the river in half a minute, while moving with maximum speed at an angle of 150° to direction of river flow, then the width of the river is

- (1) 112.5 m (2) 75 m
 (3) 300 m (4) 112.5 × √3 m

Answer (1)

Sol. $t = \frac{w}{v_b \cos(60)}$
 $w = t v_b \cos(60)$
 $= 30 \times 27 \times \frac{5}{18} \times \frac{1}{2}$
 $= 112.5 \text{ m}$

28. Moment of inertia of a rod of mass 'M' and length 'L' about an axis passing through its center and normal to its length is 'α'. Now the rod is cut into two equal parts and these parts are joined symmetrically to form a cross shape. Moment of inertia of cross about an axis passing through its center and normal to plane containing cross is

- (1) α/4 (2) α/2
 (3) α/8 (4) α

Answer (1)

Sol. $\alpha = \frac{ML^2}{12}$
 $I = \left(\frac{M}{2}\right)\left(\frac{L}{2}\right)^2 \times 2$
 $I = \frac{\alpha}{4}$

29. Considering Bohr's atomic model for hydrogen atom:

- (A) The energy of H atom in ground state is same as energy of He⁺ ion in its first excited state.
 (B) The energy of H atom in ground state is same as that for Li²⁺ ion in its second excited state.
 (C) The energy of H atom in its ground state is same as that of He⁺ ion for its ground state.
 (D) The energy of He⁺ ion in its first excited state is same as that for Li²⁺ ion in its ground state.

Choose the **correct** answer from the options given below:

- (1) (A), (D) only (2) (A), (B) only
 (3) (A), (C) only (4) (B), (D) only

Answer (2)

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Sol. $E = -13.6 \frac{Z^2}{n^2} \text{ eV}$

E_{He^+} 1st excited state = -13.6 eV

$E_{\text{Li}^{2+}}$ 2nd excited state = -13.6 eV

(A), (B) are correct.

30. The equation for real gas is given by $\left(P + \frac{a}{V^2}\right)(V - b) = RT$, where P , V , T and R are the

pressure, volume, temperature and gas constant, respectively. The dimension of ab^{-2} is equivalent to that of

- (1) Strain
- (2) Compressibility
- (3) Planck's constant
- (4) Energy density

Answer (4)

Sol. $P \equiv \frac{a}{V^2}$

$a \equiv PV^2$

$b \equiv V$

$\frac{a}{b^2} \equiv P$

Dimensions of P is same as energy density.

31. The relationship between the magnetic susceptibility (χ) and the magnetic permeability (μ) is given by:

(μ_0 is the permeability of free space and μ_r is relative permeability)

- (1) $\chi = \mu_r + 1$
- (2) $\chi = \frac{\mu}{\mu_0} - 1$
- (3) $\chi = \frac{\mu_r}{\mu_0} + 1$
- (4) $\chi = 1 - \frac{\mu}{\mu_0}$

Answer (2)

Sol. $\mu = \mu_r \mu_0$

$\mu_r = (\chi + 1)$

$\mu = (\chi + 1) \mu_0$

$\chi = \left(\frac{\mu}{\mu_0} - 1\right)$

32. In an adiabatic process, which of the following statements is true?

- (1) The molar heat capacity is zero
- (2) The molar heat capacity is infinite
- (3) The internal energy of the gas decreases as the temperature increases
- (4) Work done by the gas equals the increase in internal energy

Answer (1)

Sol. In adiabatic process

$Q = 0 = nC\Delta T$

$\therefore C = 0$

33. Match List-I with List-II.

LIST-I		LIST-II	
(A)	Coefficient of viscosity	(I)	[ML ⁰ T ⁻³]
(B)	Intensity of wave	(II)	[ML ⁻² T ⁻²]
(C)	Pressure gradient	(III)	[M ⁻¹ LT ²]
(D)	Compressibility	(IV)	[ML ⁻¹ T ⁻¹]

Choose the **correct** answer from the options given below.

- (1) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)
- (2) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
- (3) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)
- (4) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)

Answer (1)

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Sol. $\eta \equiv \frac{F}{v} \equiv [ML^{-1}T^{-1}] \quad A \rightarrow IV$

$I \equiv \frac{P}{A} \equiv [MT^{-3}] \quad B \rightarrow I$

$\frac{dP}{dx} \equiv [ML^{-2}T^{-2}] \quad C \rightarrow II$

$K \equiv \frac{1}{P} \equiv [M^{-1}LT^2] \quad D \rightarrow III$

34. A light wave is propagating with plane wave fronts of the type $x + y + z = \text{constant}$. The angle made by the direction of wave propagation with the x-axis is

(1) $\cos^{-1}\left(\frac{2}{3}\right)$

(2) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

(3) $\cos^{-1}\left(\frac{1}{3}\right)$

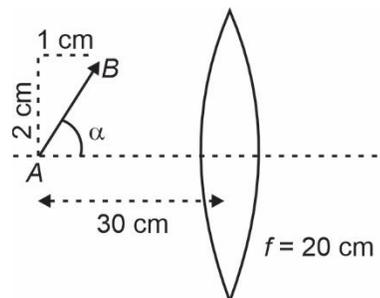
(4) $\cos^{-1}\left(\sqrt{\frac{2}{3}}\right)$

Answer (2)

Sol. Direction of propagation $\vec{A} = \hat{i} + \hat{j} + \hat{k}$

$$\begin{aligned} \text{Angle with x-axis} &= \cos^{-1}\left(\frac{A_x}{\sqrt{A_x^2 + A_y^2 + A_z^2}}\right) \\ &= \cos^{-1}\left(\frac{1}{\sqrt{3}}\right) \end{aligned}$$

35. A slanted object AB is placed on one side of convex lens as shown in the diagram. The image is formed on the opposite side. Angle made by the image with principal axis is



- (1) -45° (2) $-\alpha$
(3) $+45^\circ$ (4) $-\frac{\alpha}{2}$

Answer (1)

Sol. Image of A

$$\frac{1}{v_A} - \frac{1}{-30} = \frac{1}{20}$$

$$v_A = 60 \Rightarrow (60, 0)$$

$$m = \frac{v}{u} = \frac{60}{-30} = -2$$

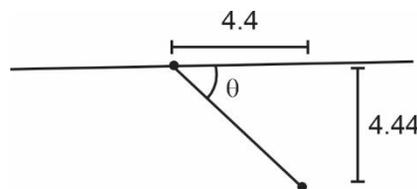
Image of B

$$\frac{1}{v_B} - \frac{1}{-29} = \frac{1}{20}$$

$$v_B = \frac{20 \times 29}{9} \Rightarrow 64.4$$

$$m = \frac{64.4}{-29} = -2.22$$

$$y_B = -2.22 \times 2 = -4.44$$



$$\theta \approx -45^\circ$$

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36. Let B_1 be the magnitude of magnetic field at centre of a circular coil of radius R carrying current I . Let B_2 be the magnitude of magnetic field at an axial distance 'x' from the center. For $x : R = 4, \frac{B_2}{B_1}$ is :

- (1) 16 : 25 (2) 25 : 16
(3) 64 : 125 (4) 4 : 5

Answer (3)

Sol. $B_1 = \frac{\mu_0 I}{2R}$

$x = \frac{3R}{4}$

$B_2 = \frac{\mu_0 I R^2}{2(R^2 + x^2)^{3/2}} = \frac{\mu_0 I R^2}{2\left(\frac{5R}{4}\right)^3}$

$= \frac{64}{125} \left(\frac{\mu_0 I}{2R}\right)$

$\frac{B_2}{B_1} = \frac{64}{125}$

37. A particle is subjected to two simple harmonic motions as:

$x_1 = \sqrt{7} \sin 5t$ cm and $x_2 = 2\sqrt{7} \sin\left(5t + \frac{\pi}{3}\right)$ cm

where x is displacement and t is time in seconds.

The maximum acceleration of the particle is $x \times 10^{-2} \text{ ms}^{-2}$. The value of x is :

- (1) $5\sqrt{7}$
(2) $25\sqrt{7}$
(3) 125
(4) 175

Answer (4)

Sol. $\omega = 5$

$A = \sqrt{(\sqrt{7})^2 + (2\sqrt{7})^2 + 2 \times 2 \times 7 \cos\left(\frac{\pi}{3}\right)}$

$= 7$

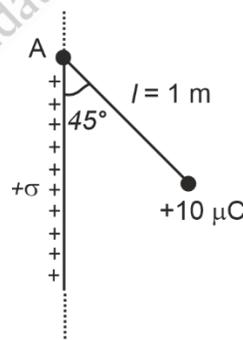
$a_{\text{max}} = \omega^2 A = 25 \times 7$

$= 175$

38. A small bob of mass 100 mg and charge $+10 \mu\text{C}$ is connected to an insulating string of length 1 m. It is brought near to an infinitely long non-conducting sheet of charge density ' σ ' as shown in figure. If string subtends an angle of 45° with the sheet at equilibrium the charge density of sheet will be.

{Given $\epsilon_0 = 8.85 \times 10^{-12} \frac{\text{F}}{\text{m}}$ and acceleration due to

gravity, $g = 10 \frac{\text{m}}{\text{s}^2}$ }



- (1) 17.7 nC/m²
(2) 885 nC/m²
(3) 0.885 nC/m²
(4) 1.77 nC/m²

Answer (4)

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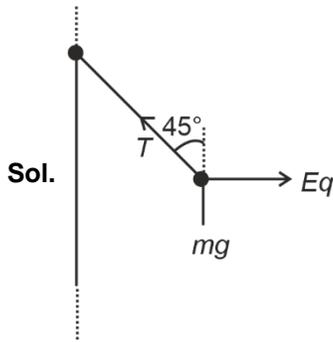
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$$T \cos 45 = Eq$$

$$T \sin 45 = mg$$

$$Eq = mg$$

$$E = \frac{mg}{q} = \frac{\sigma}{2\epsilon_0}$$

$$\sigma = \frac{2\epsilon_0 mg}{q}$$

$$= 1.77 \text{ nC/m}^2$$

39. A monochromatic light is incident on a metallic plate having work function ϕ . An electron, emitted normally to the plate from a point A with maximum kinetic energy, enters a constant magnetic field, perpendicular to the initial velocity of electron. The electron passes through a curve and hits back the plate at a point B . The distance between A and B is:
(Given: The magnitude of charge of an electron is e and mass is m , h is Planck's constant and c is velocity of light. Take the magnetic field exists throughout the path of electron)

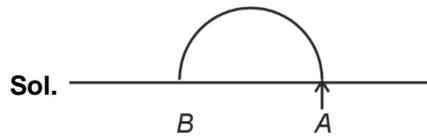
(1) $\sqrt{m\left(\frac{hc}{\lambda} - \phi\right)} / eB$

(2) $\sqrt{8m\left(\frac{hc}{\lambda} - \phi\right)} / eB$

(3) $2\sqrt{m\left(\frac{hc}{\lambda} - \phi\right)} / eB$

(4) $\sqrt{2m\left(\frac{hc}{\lambda} - \phi\right)} / eB$

Answer (2)



$$AB = 2R$$

$$R = \frac{vm}{Bq} = \frac{\sqrt{2mK}}{Be}$$

$$K = \left(\frac{hc}{\lambda} - \phi\right)$$

$$2R = \frac{2\sqrt{2m\left(\frac{hc}{\lambda} - \phi\right)}}{Be}$$

40. A point charge $+q$ is placed at the origin. A second point charge $+9q$ is placed at $(d, 0, 0)$ in Cartesian coordinate system. The point in between them where the electric field vanishes is:

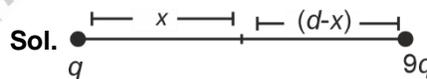
(1) $(d/4, 0, 0)$

(2) $(d/3, 0, 0)$

(3) $(3d/4, 0, 0)$

(4) $(4d/3, 0, 0)$

Answer (1)



$$\frac{9}{x^2} = \frac{2q}{(d-x)^2}$$

$$d-x = 3x$$

$$x = \frac{d}{4}$$

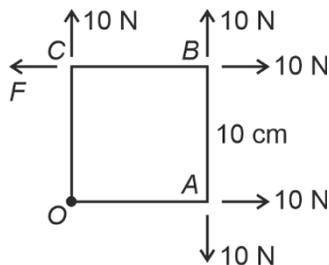
$$\therefore E = 0 \text{ at } (d/4, 0, 0)$$

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41. A square Lamina $OABC$ of length 10 cm is pivoted at 'O'. Forces act at Lamina as shown in figure. If Lamina remains stationary, then the magnitude of F is :



- (1) 0 (Zero)
(2) 10 N
(3) $10\sqrt{2}$ N
(4) 20 N

Answer (2)

Sol. For stationary, net torque about $O = 0$

$$-Fa + 10a - 10a + 10a = 0$$

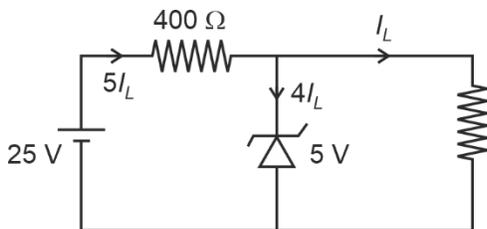
$$F = 10 \text{ N}$$

42. A zener diode with 5 V zener voltage is used to regulate an unregulated dc voltage input of 25 V. For a 400Ω resistor connected in series, the zener current is found to be 4 times load current. The load current (I_L) and load resistance (R_L) are :

- (1) $I_L = 20 \text{ mA}$; $R_L = 250 \Omega$
(2) $I_L = 0.02 \text{ mA}$; $R_L = 250 \Omega$
(3) $I_L = 10 \text{ mA}$; $R_L = 500 \Omega$
(4) $I_L = 10 \text{ A}$; $R_L = 0.5 \Omega$

Answer (3)

Sol.



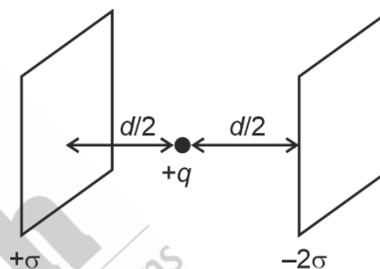
$$5I_L = \frac{(25 - 5)}{400} = \frac{1}{20} = 50 \text{ mA}$$

$$I_L = 10 \text{ mA}$$

$$5 = I_L R_L$$

$$R_L = \frac{5}{I_L} = \frac{5}{10 \times 10^{-3}} = 500 \Omega$$

43. Consider two infinitely large plane parallel conducting plates as shown below. Two plates are uniformly charged with a surface charge density $+\sigma$ and -2σ . The force experienced by a point charge $+q$ placed at the mid point between two plates will be :



- (1) $\frac{3\sigma q}{4\epsilon_0}$
(2) $\frac{\sigma q}{2\epsilon_0}$
(3) $\frac{3\sigma q}{2\epsilon_0}$
(4) $\frac{\sigma q}{4\epsilon_0}$

Answer (3)

$$\text{Sol. } E = \frac{2\sigma}{2\epsilon_0} + \frac{\sigma}{2\epsilon_0} = \frac{3\sigma}{2\epsilon_0}$$

$$F = Eq = \frac{3\sigma q}{2\epsilon_0}$$

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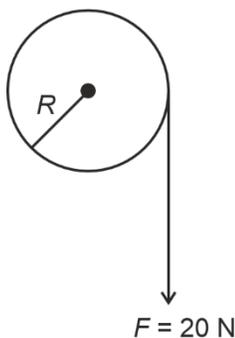


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44. A cord of negligible mass is around the rim of a wheel supported by spokes with negligible mass. The mass of wheel is 10 kg and radius is 10 cm and it can freely rotate without any friction. Initially the wheel is at rest. If a steady pull of 20 N is applied on the cord, the angular velocity of the wheel, after the cord is unwound by 1 m, would be :



- (1) 10 rad/s
- (2) 20 rad/s
- (3) 30 rad/s
- (4) 0 rad/s

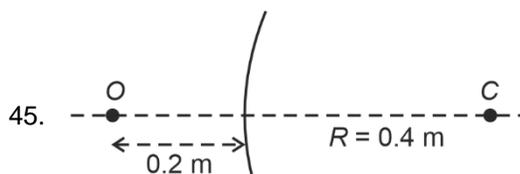
Answer (2)

Sol. $W = F.S = 20 \times 1 = 20 \text{ J}$

$$20 \text{ J} = \frac{1}{2} (MR^2) \omega^2$$

$$20 = \frac{1}{2} \times 10 \times \frac{1}{100} \times \omega^2$$

$$\omega = 20 \text{ rad/s}$$



Medium 1 $n_1 = 1$ Medium 2 $n_2 = 1.5$

A spherical surface separates two media of refractive indices 1 and 1.5 as shown in figure. Distance of the image of an object 'O', is

(C is the center of curvature of the spherical surface and R is the radius of curvature)

- (1) 0.4 m left to the spherical surface
- (2) 0.24 m left to the spherical surface
- (3) 0.24 m right to the spherical surface
- (4) 0.4 m right to the spherical surface

Answer (1)

Sol. For spherical surfaces

$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

$$\frac{1.5}{v} - \frac{1}{-0.2} = \frac{0.5}{0.4}$$

$$v = -0.4 \text{ m}$$

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

46. A person travelling on a straight line moves with a uniform velocity v_1 for a distance x and with a uniform velocity v_2 for the next $\frac{3}{2}x$ distance. The average velocity in this motion is $\frac{50}{7}$ m/s. If v_1 is 5 m/s then $v_2 = \underline{\hspace{2cm}}$ m/s.

Answer (10)

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Sol.
$$v_{\text{avg}} = \frac{x + \frac{3x}{2}}{\frac{x}{5} + \frac{3x}{2v_2}} = \frac{50}{7}$$

$$v_2 = 10 \text{ m/s}$$

47. γ_A is the specific heat ratio of monoatomic gas A having 3 translational degrees of freedom. γ_B is the specific heat ratio of polyatomic gas B having 3 translational, 3 rotational degrees of freedom and 1 vibrational mode. If $\frac{\gamma_A}{\gamma_B} = \left(1 + \frac{1}{n}\right)$, then the value of n is _____.

Answer (3)

Sol.
$$\gamma = 1 + \frac{2}{f}$$

$$f_A = 3, \Rightarrow \gamma_A = \frac{5}{3}$$

$$f_B = 3 + 3 + 2 = 8, \quad \gamma_B = 1 + \frac{2}{8} = \frac{5}{4}$$

$$\frac{\gamma_A}{\gamma_B} = \frac{4}{3}$$

$$\therefore n = 3$$

48. A vessel with square cross-section and height of 6 m is vertically partitioned. A small window of 100 cm² with hinged door is fitted at a depth of 3 m in the partition wall. One part of the vessel is filled completely with water and the other side is filled with the liquid having density $1.5 \times 10^3 \text{ kg/m}^3$. What force one needs to apply on the hinged door so that it does not get opened?

(Acceleration due to gravity = 10 m/s²)

Answer (150)

Sol.
$$F = (P_2 - P_1)A$$

$$= gh(\rho_2 - \rho_1)A$$

$$= 10 \times 3 \times 500 \times 100 \times 10^{-4}$$

$$= 150 \text{ N}$$

49. If the measured angular separation between the second minimum to the left to the central maximum and the third minimum to the right of the central maximum is 30° in a single slit diffraction pattern recorded using 628 nm light, then the width of the slit is _____ μm .

Answer (6)

Sol. 2nd minima $\Rightarrow \theta_1 = \left(\frac{2\lambda}{a}\right)$

3rd minima $\Rightarrow \theta_2 = \frac{3\lambda}{a}$

$$\theta_1 + \theta_2 = \frac{\pi}{6}$$

$$\frac{5\lambda}{a} = \frac{\pi}{6}$$

$$a = \frac{30\lambda}{\pi} = \frac{30 \times 0.628}{3.14} = 6 \mu\text{m}$$

50. A steel wire of length 2 m and Young's modulus $2.0 \times 10^{11} \text{ Nm}^{-2}$ is stretched by a force. If Poisson ratio and transverse strain for the wire are 0.2 and 10^{-3} respectively, then the elastic potential energy density of the wire is _____ $\times 10^5$ (in SI units).

Answer (25)

Sol.
$$U = \frac{1}{2} \times y \times (\text{longitudinal strain})^2$$

$$\sigma = \left| \frac{\text{transverse strain}}{\text{longitudinal strain}} \right|$$

Longitudinal strain = $\frac{10^{-3}}{0.2} = 5 \times 10^{-3}$

$$U = \frac{1}{2} \times 2 \times 10^{11} \times 25 \times 10^{-6}$$

$$= 25 \times 10^5 \text{ J/m}^3$$

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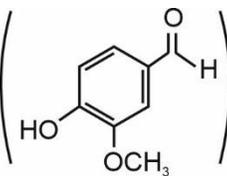
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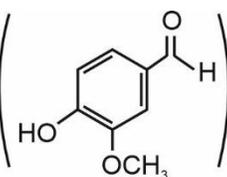
SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

51. Given below are two statements:

Statement (I) : Vanillin  will react with NaOH and also with Tollen's reagent.

Statement (II) : Vanillin  will undergo self aldol condensation very easily.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both **Statement I** and **Statement II** are correct
- (2) Both **Statement I** and **Statement II** are incorrect
- (3) **Statement I** is correct but **Statement II** is incorrect
- (4) **Statement I** is incorrect but **Statement II** are correct

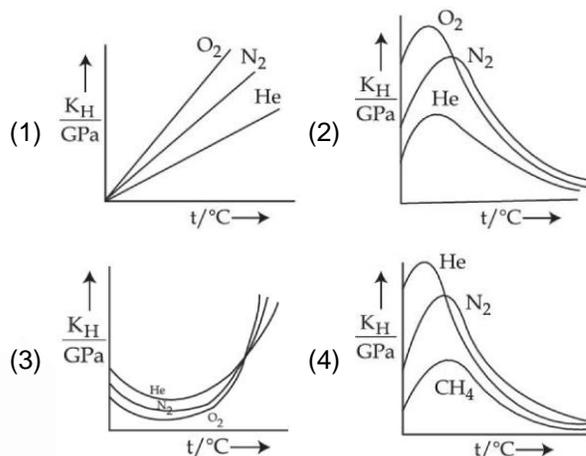
Answer (3)

Sol. Vanillin will react with NaOH to give Cannizzaro reaction.

Vanillin also gives Tollen's reagent test.

Vanillin does not undergo self aldol as it does not have α H-atom.

52. Which of the following graph correctly represents the plots of K_H at 1 bar for gases in water versus temperature?



Answer (4)

Sol. At low temperatures value of K_H first increases with temperature, passes through maximum and then decreases.

53. A solution is made by mixing one mole of volatile liquid A with 3 moles of volatile liquid B. The vapour pressure of pure A is 200 mm Hg and that of the solution is 500 mm Hg. The vapour pressure of pure B and the least volatile component of the solution, respectively, are

- (1) 600 mm Hg, B
- (2) 600 mm Hg, A
- (3) 1400 mm Hg, A
- (4) 1400 mm Hg, B

Answer (2)

Sol. $p_{\text{total}} = p_A^{\circ} x_A + p_B^{\circ} x_B$

$$500 = 200 \left(\frac{1}{4} \right) + p_B^{\circ} \left(\frac{3}{4} \right)$$

$$2000 = 200 + 3p_B^{\circ}$$

$$p_B^{\circ} = 600$$

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- (1) Both **Statement-I** and **Statement-II** are correct
- (2) **Statement-I** is correct but **Statement-II** is incorrect
- (3) Both **Statement-I** and **Statement-II** are incorrect
- (4) **Statement-I** is incorrect but **Statement-II** is correct

Answer (1)

Sol. When $\Delta_0 < P \Rightarrow$ No pairing

\Rightarrow High spin complex

When $\Delta_0 > P \Rightarrow$ Pairing

\Rightarrow Low spin complex

Statement-I is correct

In tetrahedral complexes, $\Delta_t < P$

\Rightarrow High spin complexes are generally observed

\Rightarrow Low spin complexes are rarely observed

\Rightarrow Statement-II is correct

59. A molecule with the formula AX_4Y has all its elements from p-block. Element A is rarest, monoatomic, non-radioactive from its group and has the lowest ionization enthalpy value among A, X and Y. Elements X and Y have first and second highest electronegativity values respectively among all the known elements. The shape of the molecule is:

- (1) Trigonal bipyramidal
- (2) Square pyramidal
- (3) Octahedral
- (4) Pentagonal planar

Answer (2)

Sol. A is xenon

X is fluorine

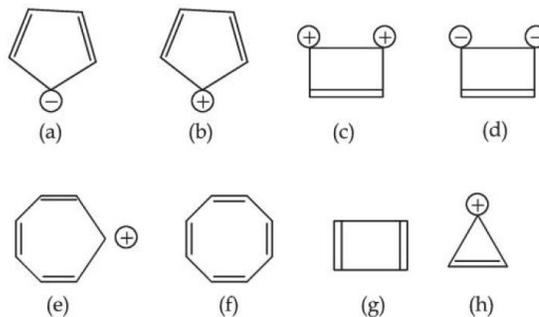
Y is oxygen

$XeOF_4$

Shape : Square pyramidal

Hybridisation : sp^3d^2

60.



Designate whether each of the following compounds is aromatic or not aromatic.

- (1) a, b, c, d aromatic and e, f, g, h not aromatic
- (2) e, g aromatic and a, b, c, d, f, h not aromatic
- (3) a, c, d, e, h aromatic and b, f, g not aromatic
- (4) b, e, f, g aromatic and a, c, d, h not aromatic

Answer (3)

Sol. a, c, d, e, f \Rightarrow aromatic

b, f, g - Not aromatic

61. An optically active alkyl halide C_4H_9Br [A] reacts with hot KOH dissolved in ethanol and forms alkene [B] as major product which reacts with bromine to give dibromide [C]. The compound [C] is converted into a gas [D] upon reacting with alcoholic $NaNH_2$. During hydration 18 gram of water is added to 1 mole of gas [D] on warming with mercuric sulphate and dilute acid at 333 K to form compound [E]. The IUPAC name of compound [E] is:

- (1) Butan-1-al
- (2) But-2-yne
- (3) Butan-2-one
- (4) Butan-2-ol

Answer (3)

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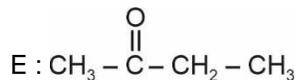
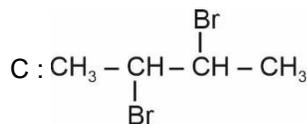
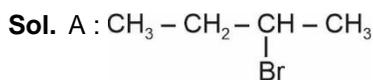
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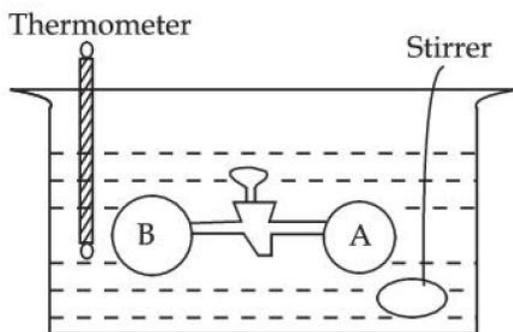
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E is Butan-2-one

62.



Two vessels A and B are connected via stopcock. The vessel A is filled with a gas at a certain pressure. The entire assembly is immersed in water and is allowed to come to thermal equilibrium with water. After opening the stopcock the gas from vessel A expands into vessel B and no change in temperature is observed in the thermometer. Which of the following statement is **true**?

- (1) $dq \neq 0$
- (2) $dw \neq 0$
- (3) $dU \neq 0$
- (4) The pressure in the vessel B before opening the stopcock is zero

Answer (4)

Sol. The pressure in the vessel B before opening the stopcock is zero because $dT = 0$. Therefore,

$$dq = 0$$

$$dw = 0$$

$$dU = 0$$

63. If equal volumes of AB_2 and XY (both are salts) aqueous solutions are mixed, which of the following combination will give a precipitate of AY_2 at 300 K?

(Given K_{sp} (at 300 K) for $\text{AY}_2 = 5.2 \times 10^{-7}$)

- (1) $2.0 \times 10^{-2} \text{ M AB}_2, 2.0 \times 10^{-2} \text{ M XY}$
- (2) $2.0 \times 10^{-4} \text{ M AB}_2, 0.8 \times 10^{-3} \text{ M XY}$
- (3) $3.6 \times 10^{-3} \text{ M AB}_2, 5.0 \times 10^{-4} \text{ M XY}$
- (4) $1.5 \times 10^{-4} \text{ M AB}_2, 1.5 \times 10^{-3} \text{ M XY}$

Answer (1)

Sol. For precipitation

$$[\text{A}^{2+}] [\text{Y}^-]^2 \geq 5.2 \times 10^{-7}$$

In option (1)

$$[\text{A}^{2+}] = 10^{-2} \text{ M}$$

$$[\text{Y}^-] = 10^{-2} \text{ M}$$

$$[\text{A}^{2+}] [\text{Y}^-]^2 = 10^{-6} \text{ which is greater than } 5.2 \times 10^{-7}$$

64. On complete combustion 1.0g of an organic compound (X) gave 1.46 g of CO_2 and 0.567 g of H_2O . The empirical formula mass of compound (X) is _____g.

(Given molar mass in g mol^{-1} C : 12, H : 1, O : 16)

- (1) 30
- (2) 60
- (3) 15
- (4) 45

Answer (1)

Sol. % by mass of C = 39.8

% by mass of H = 6.3

% by mass of O = 53.9

Empirical formula = CH_2O

Empirical formula mass of (X) = 30 g

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- (1) $r > q > p > s$ (2) $p > q > r > s$
 (3) $p > r > q > s$ (4) $q > p > r > s$

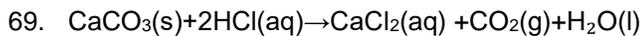
Answer (2)

Sol. Order of Hydrolysis

Acid chloride > Anhydride > Ester > Amide

$p > q > r > s$

Option (2) is correct

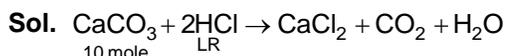


Consider the above reaction, what mass of CaCl_2 will be formed if 250 mL of 0.76 M HCl reacts with 1000 g of CaCO_3 ?

(Given: Molar mass of Ca, C, O, H and Cl are 40, 12, 16, 1 and 35.5 g mol^{-1} , respectively)

- (1) 3.908 g (2) 2.636 g
 (3) 10.545 g (4) 5.272 g

Answer (3)



Moles of $\text{CaCl}_2 = \frac{0.250 \times 0.76}{2}$

Mass of $\text{CaCl}_2 = \frac{0.250 \times 0.76}{2} \times 111 = 10.545 \text{ g}$

70. Identify the correct statement among the following:

- (1) All naturally occurring amino acids except glycine contain one chiral centre.
 (2) Glutamic acid is the only amino acid that contains a $-\text{COOH}$ group at the side chain.
 (3) Amino acid, cysteine can easily undergo dimerisation due to the presence of free SH group.
 (4) All naturally occurring amino acids are optically active.

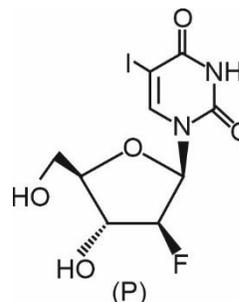
Answer (3)

Sol. Amino acid, cysteine can easily undergo dimerisation due to free SH group.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

71. 0.1 mol of the following given antiviral compound (P) will weigh _____ $\times 10^{-1} \text{ g}$



(Given : molar mass in g mol^{-1} H : 1, C : 12, N : 14, O : 16, F : 19, I : 127)

Answer (372)

Sol. Formula of compound (P)

$= \text{C}_9\text{O}_5\text{FIN}_2\text{H}_{10}$

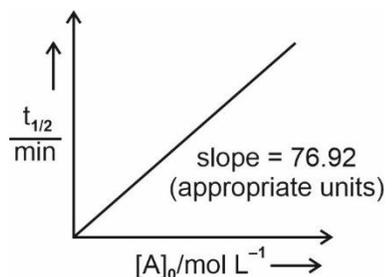
Molar mass of (P)

$= 372 \frac{\text{gm}}{\text{mole}}$

0.1 mole mass = 37.2 g

$= 372 \times 10^{-1} \text{ g}$

72. For the reaction $\text{A} \rightarrow \text{products}$.



The concentration of A at 10 minutes is _____ $\times 10^{-3} \text{ mol L}^{-1}$ (nearest integer).

The reaction was started with 2.5 mol L^{-1} of A.

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Answer (2435)

Sol. $t_{1/2} \propto [A_0] \Rightarrow$ zero order reaction

$$\frac{1}{2k} = 76.92$$

$$k = \frac{1}{2 \times 76.92} = 6.5 \times 10^{-3}$$

$$C_t = C_0 - kt$$

$$C_t = (2.5) - (6.5 \times 10^{-3})(10)$$

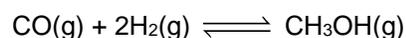
$$= 2.5 - 6.5 \times 10^{-2}$$

$$= 2.435$$

$$= 2435 \times 10^{-3}$$

Nearest integer = 2435

73. Consider the following equilibrium,



0.1 mol of CO along with a catalyst is present in a 2 dm³ flask maintained at 500 K. Hydrogen is introduced into the flask until the pressure is 5 bar and 0.04 mol of CH₃OH is formed. The K_p^0 is $___ \times 10^{-3}$ (nearest integer).

Given : $R = 0.08 \text{ dm}^3 \text{ bar K}^{-1} \text{ mol}^{-1}$

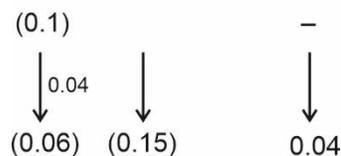
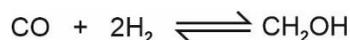
Assume only methanol is formed as the product and the system follows ideal gas behaviour.

Answer (74)

Sol. n_{total} at equilibrium : $\frac{5 \times 2}{(0.08) \times 500}$

$$= 0.250$$

$$\text{Moles of CH}_3\text{OH} = 0.04$$



$$P_{\text{CH}_3\text{OH}} = \frac{(0.04) \times (0.08) \times 500}{2} = 0.8 \text{ bar}$$

$$P_{\text{H}_2} = 3 \text{ bar}$$

$$P_{\text{CO}} = 1.2 \text{ bar}$$

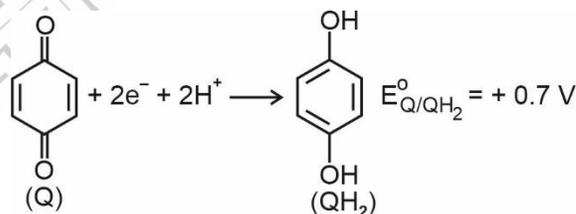
$$K_p = \frac{0.8}{(1.2)(3)^2} = 0.07407 = 74.07 \times 10^{-3}$$

74. Consider the following electrochemical cell at standard condition.



$$E_{\text{cell}} = +0.4 \text{ V}$$

The couple QH₂/Q represents quinhydrone electrode, the half cell reaction is given below :



$$\left[\text{Given : } E_{\text{Ag}^+/\text{Ag}}^0 = +0.8 \text{ V and } \frac{2.303 RT}{F} = 0.06 \text{ V} \right]$$

The pK_b value of the ammonium halide salt (NH₄X) used here is $______$. (nearest integer)

Answer (6)

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Sol. $E_{\text{cell}}^0 = 0.8 - 0.7 = 0.1 \text{ V}$

$E_{\text{cell}} = 0.4 \text{ V}$

$0.4 = 0.1 - \frac{0.06}{1} \log[H^+]$

$0.3 = 0.06 \text{ pH}$

$\text{pH} = 5$

$5 = 7 - \left(\frac{\text{p}K_b + \log C}{2} \right)$

$\text{p}K_b + \log 0.01 = 4$

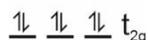
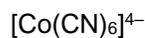
$\text{p}K_b - 2 = 4$

$\text{p}K_b = 6$

75. A transition metal (M) among Mn, Cr, Co and Fe has the highest standard electrode potential (M^{3+}/M^{2+}). It forms a metal complex of the type $[M(\text{CN})_6]^{4-}$. The number of electrons present in the e_g orbital of the complex is _____.

Answer (1)

Sol. $E_{M^{3+}/M^{2+}}^0$ is highest for Co



No. of e^- s in e_g orbital = 1



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