JEE–MAIN EXAMINATION – APRIL 2026
MEMORY BASED QUESTIONS

(HELD ON SUNDAY 05th APRIL 2026) **TIME : 9:00 AM TO 12:00 NOON**

PHYSICS	TEST PAPER WITH SOLUTION

1. If R = resistance, L = inductance, C = capacitance, then dimension $[ML^2T^{-4}A^{-2}]$ represents :-

(1) $\frac{R}{\sqrt{LC}}$ (2) $\frac{1}{R}\sqrt{\frac{L}{C}}$

(3) $R\sqrt{LC}$ (4) $\sqrt{RLC}$

Ans. (1)

Sol. Dimension of resistance

$$\Rightarrow [R] = \left[\frac{V}{I}\right] = ML^2T^{-3}A^{-2}$$

$\frac{1}{\sqrt{LC}}$ is angular frequency so $\omega = \frac{1}{\sqrt{LC}}$

$[\omega] = T^{-1}$

Thus, $\left[\frac{R}{\sqrt{LC}}\right] = ML^2T^{-3}A^{-2} \times T^{-1} = ML^2T^{-4}A^{-2}$

2. If speed of light is 2.12×10^8 m/s in medium of equilateral prism then find out minimum angle of deviation.

(1) 45° (2) 60°

(3) 30° (4) 53°

Ans. (3)

Sol. $$\mu = \frac{\sin\left[\frac{\delta_{min} + A}{2}\right]}{\sin\frac{A}{2}}$$

$$\mu = \frac{C}{V} = \frac{3\times10^8}{2.12\times10^8} = \sqrt{2}$$

$$\sqrt{2} = \frac{\sin\left[\frac{\delta_{min} + 60°}{2}\right]}{\sin 30°}$$

$$\sin\left[\frac{\delta_{min} + 60°}{2}\right] = \frac{1}{\sqrt{2}}$$

$\delta_{min} + 60° = 90° \Rightarrow \delta_{min} = 30°$

3. For ideal gas n : number of moles, C_V : molar specific heat at constant volume, γ = adiabatic exponent of gas, T_f : final temperature, T_i : initial temperature, R : gas constant.

Assertion : $nC_V(T_f - T_i) = \frac{nR}{\gamma - 1}(T_f - T_i)$

Reason : $\gamma = 1 + \frac{2}{f}$

(1) Both **Assertion** and **Reason** are true and **Reason** is the correct explanation of **Assertion**.

(2) Both **Assertion** and **Reason** are true but **Reason** is **NOT** the correct explanation of **Assertion**.

(3) **Assertion** true but **Reason** is false.

(4) **Assertion** is false but **Reason** is true.

Ans. (2)

Sol. Using theory.

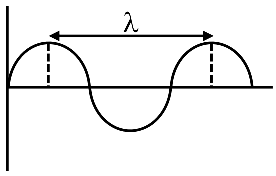
4. A travelling wave on string is given by the equation $y = 3\sin\left(100t + 0.018x + \frac{\pi}{6}\right)$, find the minimum distance (in m) between 2 crest.

(1) 349.06 (2) 625.75

(3) 475.56 (4) 175.75

Ans. (1)

Sol.



Minimum distance between two crest = λ

From equation $K = \frac{2\pi}{\lambda}$

$$0.018 = \frac{2\pi}{\lambda}$$

$$\lambda = \left(\frac{2\pi}{0.018}\right)$$

$\lambda = 349.06$ m

5. In hydrogen atom electron jump from state i to f. Radius of circular path of electron in state i & f are r_i & r_f, if $\frac{r_i}{r_f} = \frac{4}{1}$ and Rydberg constant R = 1.0976 × 10^7 m^{-1}, then find wavelength of emitted photon (in Å) (r_i & r_f are minimum possible radius).

Ans. **(1215)**

Sol. $\frac{1}{\lambda} = Rz^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$\frac{1}{\lambda} = 1.0973 \times 10^7 (1)^2 \left[\frac{1}{1} - \frac{1}{4}\right]$

λ = 1215 Å

6. If a metal rod has length ℓ and area of cross-section A, its Young's modulus is Y. What will happen to Y if length is doubled and area halved.

(1) Becomes double (2) Becomes four time
(3) Becomes halved (4) Remains same

Ans. **(4)**

Sol. Young's modulus is the property of material not depends on dimensions of material.

7. Two points A & B are 16 km from the surface of Earth. Point 'A' is above the surface of Earth while point 'B' is below the surface of Earth. Acceleration due to gravity at points A & B are g_A & g_B respectively. Then $\frac{g_A}{g_B}$ is :- (Take radius of Earth = 6400 km)

(1) 1 (2) $\frac{398}{399}$
(3) $\frac{399}{398}$ (4) $\frac{1}{2}$

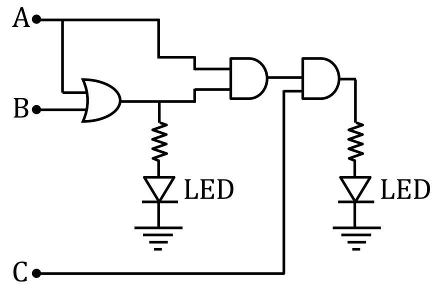
Ans. **(2)**

Sol. $g_A = g\left(1 - \frac{2h}{R_e}\right) = g\left(1 - \frac{2 \times 16}{6400}\right)$

$g_B = g\left(1 - \frac{d}{R_e}\right) = g\left(1 - \frac{16}{6400}\right)$

$$\frac{g_A}{g_B} = \frac{g\left(\frac{6400-32}{6400}\right)}{g\left(\frac{6400-16}{6400}\right)} = \frac{6368}{6384} = \frac{398}{399}$$

8. LED (light emitting diode) and logic gates circuit is given in figure.



For what combination of A, B and C both LED will glow?

(1) 101 (2) 100
(3) 010 (4) 001

Ans. **(1)**

Sol. For A = 1, B = 0 out put of OR gate is 1.

∴ LED 1 will glow

For C = 1, A = 1 & B = 1 or 0

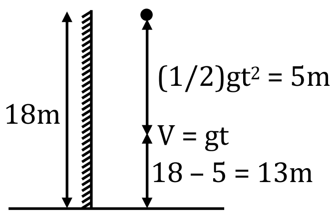
LED 2 will glow

9. A ball is dropped from a height 18 m above the ground. At any moment if magnitude of acceleration and velocity are same, then find its height above the ground at that instant.

(1) 15 m (2) 5 m
(3) 13 m (4) 2 m

Ans. **(3)**

Sol.



At any time t after it is released velocity V = gt

Acceleration of the ball remains constant = g

∴ Both will be equal at t = 1 sec

∴ Position of ball from ground will be (18 – 5) m

10. A charged particle is moving in a magnetic field $\vec{B} = (3\hat{i} + 2\hat{j})$ T with acceleration $\vec{a} = 4\hat{i} - \frac{x}{2}\hat{j}$ m/s^2, find x ?

Ans. (12)

Sol. $\vec{F}_B \propto (\vec{V} \times \vec{B})$

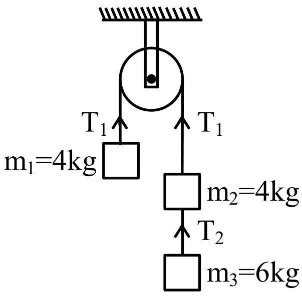
$\vec{F}_B \perp \vec{B}$

$\vec{a} \perp \vec{B} \rightarrow \vec{a} \cdot \vec{B} = 0$

$12 - x = 0$

$x = 12$

11. Find the ratio of T_1 & T_2

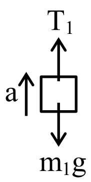


(1) $\frac{5}{3}$ (2) $\frac{3}{5}$

(3) $\frac{10}{12}$ (4) $\frac{12}{10}$

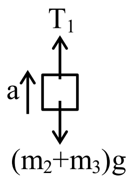
Ans. (1)

Sol.



$T_1 - m_1g = m_1a$

$T_1 - 40 = 4a$



$(m_2+m_3)g - T_1 = (m_2 + m_3)a$

$100 - T_1 = 10a$

$T_1 - 40 = 4\left(\frac{100 - T_1}{10}\right)$

$T_1 + \frac{2}{5}T_1 = 40 + 40$

$\frac{7}{5}T_1 = 80$

$T_1 = \frac{80 \times 5}{7}$ N

$m_3g - T_2 = m_3a$

$60 - 6a = T_2$

$60 - \frac{6}{10}\left[100 - \frac{400}{7}\right] = T_2$

$60 - \frac{6}{70} \times 300 = T_2$

$\frac{420 - 180}{7} = T_2$

$T_2 = \frac{240}{7}$ N

$\frac{T_1}{T_2} = \frac{400}{240} = \frac{5}{3}$

12. In YDSE, β = 2.4 mm, where β is fringe width. If setup is dipped in medium of refractive index μ = 1.2 find new fringe width (in mm)

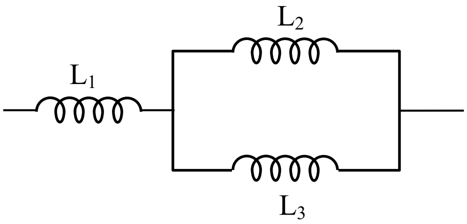
(1) 4 (2) 2

(3) 8 (4) 6

Ans. (2)

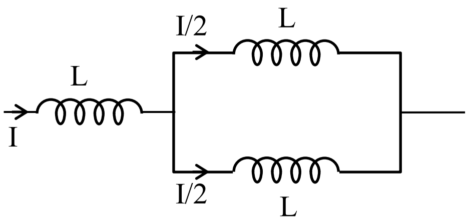
Sol. $\beta' = \frac{\beta}{\mu} = \frac{2.4}{1.2} = 2\text{mm}$

13. In the below diagram inductance $L_1 = L_2 = L_3$. Find the ratio of total energy stored in all inductors to energy stored in inductor L_2.



Ans. **(6)**

Sol.



$$L_{eq} = L + \frac{L}{2} = \frac{3L}{2}$$

$$\frac{E_2}{E_{total}} = \frac{\frac{1}{2}\times L\times\left(\frac{I}{2}\right)^2}{\frac{1}{2}\times\frac{3L}{2}\times I^2} = \frac{1/4}{3/2} = \frac{1}{6}$$

then, $\frac{E_{total}}{E_2} = \frac{6}{1}$

14. In a vernier calliper, 1 main scale division equals 1 mm and 9 MSD was divided into 10 equal parts by verneir scale. When nothing was present in the jaw, zero of verneir scale lies to the right of zero of main scale and 7^{th} division of vernier scale coincide with one of the main scale. Find zero error in the vernier calliper.

(1) 0.3 mm (2) 0.7 mm

(3) –0.3 mm (4) –0.07 mm

Ans. **(2)**

Sol. Since 9MSD = 10VSD

$\therefore$ L.C of vernier calliper = 0.1 mm

Since zero of vernier scale lies to the right of zero of main scale $\Rightarrow$ +ve zero error.

$\therefore$ zero error = +0.7mm

15. In an AC circuit with R & C having angular frequency ω has peak current I and if angular frequency is $\frac{\omega}{4}$ then peak current becomes $\frac{I}{3}$. Find the ratio of resistance and reactance at ω.

(1) $\sqrt{\frac{8}{7}}$ (2) $\sqrt{\frac{2}{7}}$

(3) $\sqrt{\frac{7}{8}}$ (4) $\sqrt{\frac{9}{8}}$

Ans. **(3)**

Sol. As we know that current in RLC circuit is given by

$$I = \frac{V}{Z} = \frac{V}{\left[R^2 + (X_L - X_C)^2\right]^{1/2}}$$

$$I = \frac{V_0}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$$

As circuit is RC

$$I_0 = \frac{V_0}{(R^2 + X_C^2)^{1/2}}$$

$$\frac{I_0}{3} = \frac{V_0}{[R^2 + (4X_C)^2]^{1/2}}$$

$$R^2 + (X_C)^2 = \frac{(R^2 + 16X_C^2)}{9}$$

$$\frac{8R^2}{9} = \frac{7X_C^2}{9}$$

$$\frac{R}{X_C} = \sqrt{\frac{7}{8}}$$

16. In a compound microscope objective and eyepiece are both biconvex lenses. If objective is cut into two half such that plano convex lens is made, now it is used as objective to get same magnification in normal adjustment the tube length should be changed by n times. Find n.

(1) 2 (2) 1/2
(3) 4 (4) 1/4

Ans. **(1)**

Sol. $m \Rightarrow \frac{L}{f_0} \times \frac{D}{f_e}$

After cutting objective lens $f_0' \Rightarrow 2f_0$

$$m' = \frac{L'}{2f_0} \times \frac{D}{f_e}$$

If m' = m

$$\frac{L}{f_0} \times \frac{D}{f_e} = \frac{L'}{2f_0} \times \frac{D}{f_e}$$

L' = 2L

17. Identify correct statements :

(1) Zeroth law of thermodynamics gives concept of temperature.

(2) In isothermal expansion $\Delta Q \neq \Delta W$

(3) 1^{st} law of thermodynamics gives concept of internal energy.

(4) Product of intensive and extensive properties is extensive.

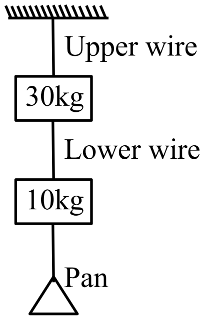
(5) Ratio of extensive property and mass is extensive.

(1) Statements 1 & 4 (2) Statements 1,3,4
(3) Statements 3,4,5 (4) Statements 1,2,3

Ans. **(1)**

Sol. True statement are 1 & 4

18. Upper wire has cross-section area 0.008 cm^2 and lower wire has area 0.004 cm^2. Find maximum mass of pan that can be connected without breaking any wire. Given breaking stress wire is $\sigma = 8 \times 10^8$ N/m^2.



(1) 22 kg (2) 24 kg
(3) 26 kg (4) 28 kg

Ans. **(1)**

Sol. Let mass of pan = m

Tension in lower wire = (10 + m)g

Stress in lower wire = $\frac{(10+m)g}{0.004 \times 10^{-4}}$

$$\frac{(10+m)g}{0.004 \times 10^{-4}} = 8 \times 10^8$$

$10 + m = 8 \times 10^7 \times 0.004 \times 10^{-4}$

10 + m = 32

m = 22 kg

Tension in upper wire = (40 + m)g

Stress in upper wire = $\frac{(40+m)g}{0.008 \times 10^{-4}}$

$$\frac{(40+m)g}{0.008 \times 10^{-4}} = 8 \times 10^8$$

(40 + m) = 64

m = 24

So the maximum mass than can be hanged without breaking is 22 kg

19. In a region where electric field exist as $\vec{E} = -E_0\hat{i}$. Initially at t = 0 velocity of particle of mass m is $4v_0\hat{i}$ then de-Broglie wavelength λ in terms of $\lambda_0 = \dfrac{h}{4mv_0}$ at time t is :

(1) $\lambda = \dfrac{h\lambda_0}{h + qE_0\lambda_0 t}$

(2) $\lambda = \dfrac{h\lambda_0}{h - qE_0\lambda_0 t}$

(3) $\lambda = \dfrac{h\lambda_0}{h + 2E_0 q\lambda_0 t}$

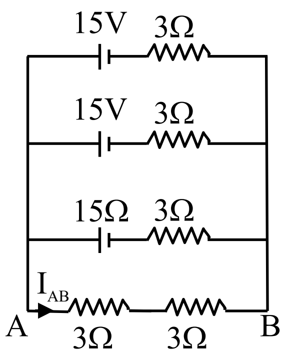
(4) $\lambda = \dfrac{h\lambda_0}{h + \dfrac{qE_0\lambda_0 t}{2}}$

Ans. (2)

Sol. $\lambda = \dfrac{h}{mv} = \dfrac{h}{m\left(4v_0 - \dfrac{qE_0}{m}t\right)} = \dfrac{h}{4mv_0 - qE_0 t}$

$= \dfrac{h}{\dfrac{h}{\lambda_0} - qE_0 t} = \dfrac{h\lambda_0}{h - qE_0\lambda_0 t}$

20. For the circuit shown below, find current across AB. (I_{AB})

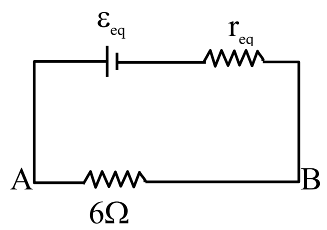


(1) $\dfrac{10}{7}$A (2) $\dfrac{13}{7}$A

(3) $\dfrac{11}{7}$A (4) $\dfrac{15}{7}$A

Ans. (4)

Sol. This circuit can be resolved to



$$\varepsilon_{eq} = \dfrac{\dfrac{15}{3} + \dfrac{15}{3} + \dfrac{15}{3}}{\dfrac{1}{3} + \dfrac{1}{3} + \dfrac{1}{3}}$$

$$= \dfrac{\dfrac{15}{3} \times 3}{\dfrac{1}{3} \times 3} = 15 \text{ volt}$$

$$\dfrac{1}{r_{eq}} = \dfrac{1}{3} + \dfrac{1}{3} + \dfrac{1}{3} = 1$$

$r_{eq} = 1$

$$I_{AB} = \dfrac{\varepsilon_{eq}}{6 + r_{eq}} = \dfrac{15}{1+6} = \dfrac{15}{7}\text{A}$$

21. Displacement current inside a capacitor of capacitance 6 μF is 4A. Find the rate of change of voltage across capacitor.

(1) 6.6×10^5

(2) 5.2×10^5

(3) 1.3×10^6

(4) 2.4×10^6

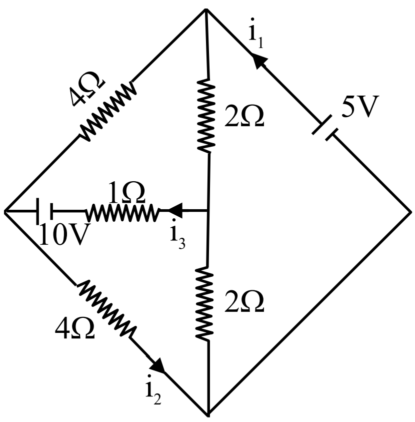
Ans. (1)

Sol. $i_d = C\dfrac{dV}{dt}$

$4 = 6 \times 10^{-6}\left(\dfrac{dV}{dt}\right)$

$\dfrac{dV}{dt} = 6.6 \times 10^5 \text{ volts}$

22.



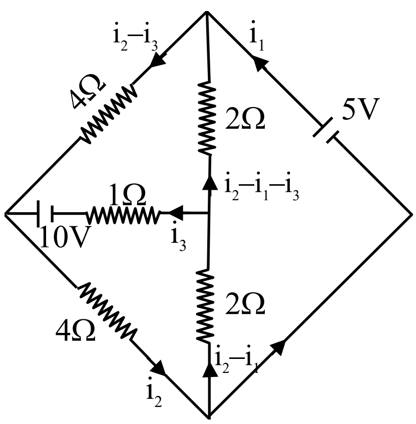
Correct option for this circuit is:

(1) Current $i_1 = \frac{15}{16}$ A (2) Current $i_2 = \frac{15}{8}$ A

(3) Current $i_3 = \frac{5}{4}$ A (4) Current $i_3 = \frac{5}{8}$ A

Ans. (2)

Sol.



$-2(i_2 - i_1 - i_3) - 4(i_2 - i_3) - 10\text{ V} + i_3 = 0$

$2i_1 - 6i_2 + 7i_3 = 10$ …(1)

$-2(i_2 - i_1) - i_3 + 10 - 4i_2 = 0$

$-2i_1 + 6i_2 + i_3 = 10$ …(2)

$5 - 4(i_2 - i_3) - 4i_2 = 0$

$8i_2 - 4i_3 = 5$ …(3)

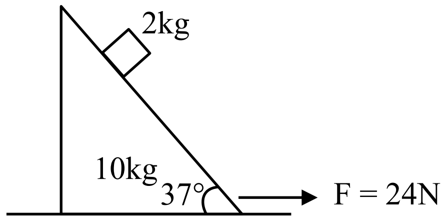
solving 1, 2, 3

$i_3 = \frac{5}{2}$

$i_2 = \frac{15}{8}$

$i_1 = \frac{15}{8}$

23. Find time taken by block to slide a distance 8.8 m w.r.t wedge (in sec). All surfaces are smooth.



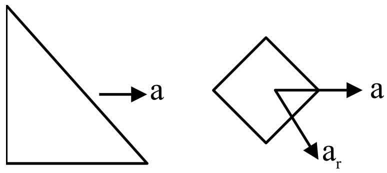
(1) 1.89 (2) 1.29

(3) 1.76 (4) 2

Ans. (1)

Sol. For system:

$24 = 10a + 2(a + a_r \cos 37°)$



$\Rightarrow 24 = 12a + \frac{8a_r}{5}$ …(1)

For block w.r.t wedge

$mg\sin 37° - ma\cos 37° = ma_r$

$6 - \frac{4}{5}a = a_r$ …(2)

solving (1) & (2)

$24 = 12\left(\frac{5}{4}(6 - a_r)\right) + \frac{8a_r}{5}$

$24 = 15(6 - a_r) + \frac{8a_r}{5}$

$a_r = \frac{66}{67/5} = 4.92\text{m/s}^2$

time taken:

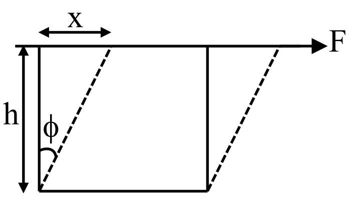
$S = \frac{1}{2} \times 4.92t^2$

$t = 1.89$ s

24. A cube of side length 5 cm having modulus of rigidity $10^5 N/m^2$. The top is pulled by a force 10 N, while the bottom is fixed. Find the displacement of upper surface of cube in (mm)

Ans. [2]

Sol.



$$\eta = \frac{F/A}{\phi} = \frac{Fh}{Ax}$$

$$x = \frac{Fh}{A\eta} = \frac{10 \times 5 \times 10^{-2}}{25 \times 10^{-4} \times 10^{5}} = \frac{1}{500} m$$

$\therefore$ x = 2 mm

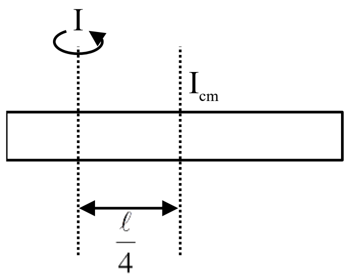
25. Moment of inertia of rod about an axis passing through point at distance $\frac{\ell}{4}$ from center and perpendicular to rod is- (The uniform rod is of mass m and length ℓ)

(1) $\frac{7m\ell^2}{48}$ (2) $\frac{3m\ell^2}{48}$

(3) $\frac{4m\ell^2}{48}$ (4) $\frac{m\ell^2}{48}$

Ans. (1)

Sol.



$$I = I_{cm} + md^2$$

$$\Rightarrow \frac{m\ell^2}{12} + \frac{m\ell^2}{16}$$

$$= \frac{4m\ell^2 + 3m\ell^2}{48}$$

$$= \frac{7m\ell^2}{48}$$

JEE–MAIN EXAMINATION – APRIL 2026
MEMORY BASED QUESTIONS

(HELD ON SUNDAY 05th APRIL 2026) **TIME : 9:00 AM TO 12:00 NOON**

CHEMISTRY	TEST PAPER WITH SOLUTION

1. For a first order reaction :

$A(g) \rightarrow B(g) + C(g)$

If initial pressure is P_0 and total pressure at time 't' is P_t. Then expression of rate constant 'K' is :

(1) $K = \frac{1}{t}\ell n\left(\frac{P_o}{P_0 - P_t}\right)$

(2) $K = \frac{1}{t}\ell n\left(\frac{P_o}{2P_0 - P_t}\right)$

(3) $K = \frac{1}{t}\ell n\frac{2P_o}{P_0 - P_t}$

(4) $K = \frac{1}{t}\ell n\frac{2P_o}{2P_0 - P_t}$

Ans. (2)

Sol.

	A	→	B	+	C
t = 0	P_0		–		–
t = t	$P_0 - x$		x		x

As given $(P_0 - x) + x + x = P_t$

$x = (P_t - P_0)$

$$K = \frac{1}{t}\ell n\frac{P_o}{P_0 - x} = \frac{1}{t}\ell n\frac{P_0}{P_0 - (P_t - P_0)}$$

$$K = \frac{1}{t}\ell n\frac{P_o}{2P_0 - P_t}$$

2. On heating 2.76 g of $Ag_2CO_3(s)$, some solid residue is left behind. Determine the mass of residue left.

(1) 2.16 g (2) 4.32 g

(3) 2.32 g (4) 1.08 g

Ans. (1)

Sol. $Ag_2CO_3(s) \xrightarrow{\Delta} 2Ag(s) + CO_2(g) + \frac{1}{2}O_2(g)$

2.76g

$\frac{1}{100}$ mol

Moles of Ag(s) = $\frac{2}{100}$ mol

Mass of residue = 2.16 g

3. Determine mole fraction of water in an aqueous solution of urea having 10% w/w urea.

(1) 0.967

(2) 0.086

(3) 0.323

(4) 0.867

Ans. (1)

Sol. Mass ratio = mol ratio × GMM ratio

$$\frac{10}{90} = \frac{n}{N} \times \frac{60}{18}$$

$$\frac{n}{N} = \frac{1}{30}$$

$$x_{H_2O} = \frac{W}{n+N} = \frac{30}{31} = 0.967$$

4. For reaction $A \rightleftharpoons B + C$

$\log K_P$	3.5	2.5	1.5
$\frac{1}{T}$ (K^{-1})	0.04	0.05	0.06

Calculate $\frac{\Delta H}{R}$ (in Kelvin) based on above data.

(In nearest integer)

Ans. (230)

Sol. Using formula

$$\log K_2 - \log K_1 = \frac{\Delta H}{2.303\,R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$3.5 - 2.5 = \frac{\Delta H}{2.303\,R}\ (0.05 - 0.04)$$

$$\frac{\Delta H}{R} = \frac{2.303}{0.01}$$

$$\frac{\Delta H}{R} = 230.3$$

5. If solubility of sparingly soluble salt $M_3A_2(s)$ is 'x' gm/litre and 'y' is the molar mass (in gm/mole) of salt, then determine the value of $\frac{[A^{3-}]}{K_{sp}}$.

(1) $\frac{1}{36}\frac{y^4}{x^4}$ (2) $\frac{1}{54}\frac{y^4}{x^4}$

(3) $\frac{1}{54}\frac{x^4}{y^4}$ (4) $\frac{1}{36}\frac{x^3}{y^3}$

Ans. **(2)**

$$M_3A_2(s) \rightleftharpoons 3M^{+2}(aq.) + 2A^{-3}(aq.)$$

Sol. Molarity $\frac{x}{y}$ — — ; — $3\,x/y$ $2\,x/y$

$K_{sp} = [M^{+2}]^3\,[A^{-3}]^2$

$K_{sp} = [3x/y]^3\,[2x/y]^2$

Ratio of $\frac{[A^{-3}]}{K_{sp}} = \frac{2x/y}{\left[\frac{3x}{y}\right]^3\left[\frac{2x}{y}\right]^2}$

$= \frac{1}{54}\frac{y^4}{x^4}$

6. Half life of first order reaction is 6.93 min. What is the time required (in min.) to complete 99% of reaction [$\ell n\,2 = 0.693$]

(1) 23.06 (2) 46.06

(3) 13.86 (4) 20.79

Ans. **(2)**

Sol. $t_{1/2} = \frac{\ell n2}{K} \Rightarrow K_1 = \frac{0.693}{6.93} \Rightarrow 0.1\ \text{min}^{-1}$

$t_{99\%} = \frac{1}{K}\ell n\left[\frac{A_0}{A_t}\right]$

$= \frac{1}{0.1}\ell n\left[\frac{100}{1}\right] \Rightarrow \frac{2\ell n10}{0.1}$

$= \frac{2\times 2.303}{0.1}$

$\Rightarrow$ 46.06 min

7. Three solutions (A, B and C) are prepared according to given diagrams

0.1M, 10 ml HCl(aq.) + 0.1M, 25 ml $Ca(OH)_2$(aq)	0.1M, 10 ml H_2SO_4(aq.) + 0.1M, 10 ml $Ca(OH)_2$(aq)	0.1M, 10 ml H_2SO_4(aq.) + 0.1M, 10 ml NaOH(aq)
Solution A	Solution B	Solution C

If pH of solutions A, B and C are respectively pH_1, pH_2 and pH_3 then correct option will be:

(1) $pH_3 < pH_2 < pH_1$ (2) $pH_3 > pH_2 > pH_1$

(3) $pH_3 > pH_1 > pH_2$ (4) $pH_1 < pH_3 < pH_2$

Ans. **1**

Sol. Solution-A

milli equivalent of HCl is = 1

milli equivalent of $Ca(OH)_2$ is = 5

so solution is basic

Solution-B

milli equivalent of H_2SO_4 is = 2

milli equivalent of $Ca(OH)_2$ is = 2

so solution is neutral

Solution-C

milli equivalent of H_2SO_4 is = 2

milli equivalent of NaOH = 1

so solution is acidic

8. From the following , number of compounds with sp^3d hybridisation are :

XeF_4 , $ICl_4^{\ominus}$, $ICl_2^{\ominus}$, $XeF_5^{\ominus}$, SF_4 , XeF_2 , ClF_3 , BrF_5 , $NH_4^{\oplus}$

Ans. **(4)**

Sol. XeF_4 : sp^3d^2

$ICl_4^{\ominus}$: sp^3d^2

$ICl_2^{\ominus}$: sp^3d

$XeF_5^{\ominus}$: sp^3d^3

SF_4 : sp^3d

XeF_2 : sp^3d

ClF_3 : sp^3d

BrF_5 : sp^3d^2

$NH_4^{\oplus}$: sp^3

9. Which of the following property about Interstitial compound is **INCORRECT**?

(1) They have high melting point, higher than those of pure metals.

(2) They retain metallic conductivity

(3) They are ionic in nature & are soft.

(4) They are chemically inert.

Ans. (3)

Sol. Interstitial compounds are very hard.

10. Statement I : Sodium and Potassium dichromate are used as a primary standard in redox titrations.

Statement II : Phenolphthalein is weakly basic in nature hence it dissociates in acidic medium.

(1) Both Statement I and Statement II are correct

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

(4) Both Statement I and Statement II are incorrect

Ans. (4)

Sol. $Na_2Cr_2O_7$ is hygroscopic in nature and is not used as primary standard.

Phenolphthalein is weak acid.

11. Consider the following statements

(A) Ground state electronic configuration of Cr is $[Ar]4s^1 3d^5$

(B) Size of $2p_x$ orbital is smaller than $3p_y$

(C) Heisenberg uncertainty principle is applicable only for electron.

(D) $(\text{Energy of 2s})_{\text{Hydrogen}} = (\text{Energy of 2s})_{\text{Lithium}}$

The correct statements are

(1) A & C

(2) B & D

(3) A & B

(4) C & D

Ans. (3)

Sol. E_{2s} (H) = E_{2s} (Li)

Heisenberg uncertainty principle is valid for all microscopic particles.

12. Statement I : An electron in e_g causes destabilization of 0.6 Δ_o and an electron in t_{2g} causes stabilization of 0.4 Δ_o as per CFT.

Statement II : All d-orbitals of transition elements are degenerate in absence of ligands but splitting occurs in presence of ligands.

(1) Both Statement I and Statement II are correct

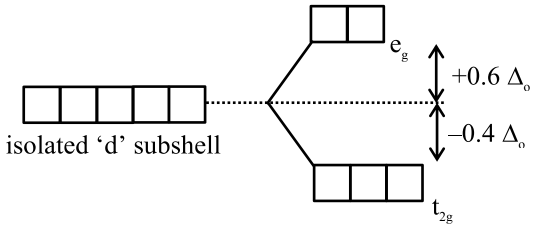
(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

(4) Both Statement I and Statement II are incorrect

Ans. (1)

Sol.



absence of ligands presence of ligands

13. Consider the statements.

(A) N–N > P–P (Bond energy of single bond)

(B) All oxidation states of N lying between +1 and +4 tend to disproportionate in acidic medium.

(C) Maximum covalency of nitrogen is 4

(D) Nitrogen can form d_π-p_π bond with itself and other elements.

(E) Nitrogen has maximum density in its group due to its small size.

The incorrect statements are :

(1) A, B & D

(2) A, D & E

(3) B, C & E

(4) A, C & E

Ans. (2)

Sol. $(B.E.)_{P-P} > (B.E.)_{N-N}$

Nitrogen cannot form d_π-p_π bond

Nitrogen has least density in its group

14. Compare the energy of orbitals for multielectronic species :

(A) $n = 3, \ell = 0, m = 0$

(B) $n = 3, \ell = 1, m = -1$

(C) $n = 4, \ell = 2, m = 0$

(D) $n = 3, \ell = 2, m = 1$

(1) A > B > C > D (2) A > B > D > C

(3) C > B > D > A (4) C > D > B > A

Ans. (4)

Sol. Energy of orbitals can be compared by $(n + \ell)$ rule

A : $n = 3, \ell = 0 \Rightarrow (n + \ell) = 3$

B : $n = 3, \ell = 1 \Rightarrow (n + \ell) = 4$

C : $n = 4, \ell = 2 \Rightarrow (n + \ell) = 6$

D : $n = 3, \ell = 2 \Rightarrow (n + \ell) = 5$

Energy order : C > D > B > A

15. **Statement-I :** The electronegativity order in F, O, N is F > O > N.

Statement-II : Oxidation state of "O" in OF_2 is +2 and in Na_2O is –2.

Choose the correct option.

(1) Both statement-I & statement-II are correct.

(2) Both statement-I & statement-II are incorrect.

(3) Statement-I is correct & statement-II is incorrect.

(4) Statement-I is incorrect & statement-II is correct.

Ans. (1)

Sol.

Element	Electronegativity
F	4.0
O	3.5
N	3.0

OF_2 has "O" in +2 oxidation state

Na_2O has "O" in –2 oxidation state.

16. Select the correct statements :

(a) Glucose has 2 anomeric forms.

(b) Both forms have difference in configuration at C_1 carbon.

(c) α-form has more melting point than β-form

(d) Specific rotation of α-form is +19° and β-from has +112°.

(e) α-form crystalises at 307° and β-form crystallise at 371°.

(1) b, c is correct

(2) a, b and e is correct

(3) a, b is correct

(4) a, b, d, e is correct

Ans. (4)

Sol. Theory based

17. 0.4 gm organic compound is subjected to estimation of sulphur by carius method. In the process 0.6 gm of $BaSO_4$ was formed. Find % of sulphur (nearest integer)

Ans. **(21)**

Sol. Moles of $BaSO_4$ formed = $\frac{0.6}{233}$ = moles of S

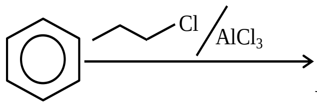
$$N_s = \frac{0.6}{233}$$

$$W_s = \frac{0.6}{233} \times 32$$

$$\% \text{ of S} = \frac{\frac{0.6 \times 32}{233}}{.4} \times 100$$

= 20.6

18.



(x)
Major product

Mark correct statement(s) for above given reaction.

(a) One of the intermediate is form due to rearrangement.

(b) Major product is n-propylbenzene.

(c) Polysubstitution of substrate is also possible.

(d) Electron releasing group decreases rate of reaction.

(1) b and d are correct

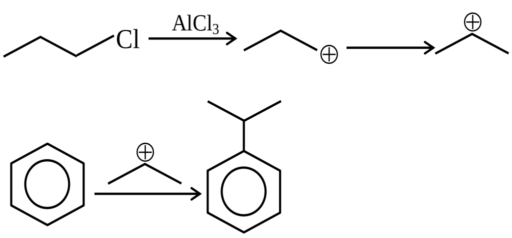
(2) a and c are correct

(3) b and c are correct

(4) a and d are correct.

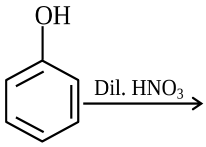
Ans. **(2)**

Sol.



Major product

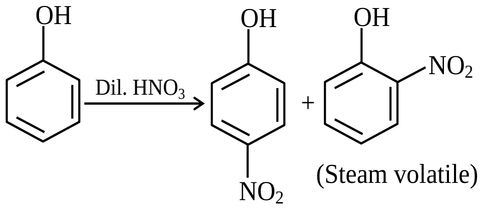
19.



% increase in oxygen in steam volatile product with respect to phenol is ________ 10^{-1}%.

Ans. **(175)**

Sol.



% oxygen in phenol = $\frac{16}{94} \times 100$ = 17.02%

% oxygen in o-Nitrophenol ($C_6H_5NO_3$)

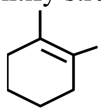
Molecular mass = $C_6H_5NO_3$ = 139 g/m

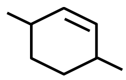
$= \frac{48}{139} \times 100 = 34.53\%$

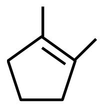
% increase = (34.53 – 17.02) = 17.5

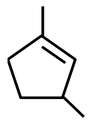
17.5×10^{-1} = 175 Answer

20. Hydrocarbon (P) on reductive ozonolysis gives product which gives +ve iodoform test and on acidification it gives product given below, then identify structure of (P)

(1) 

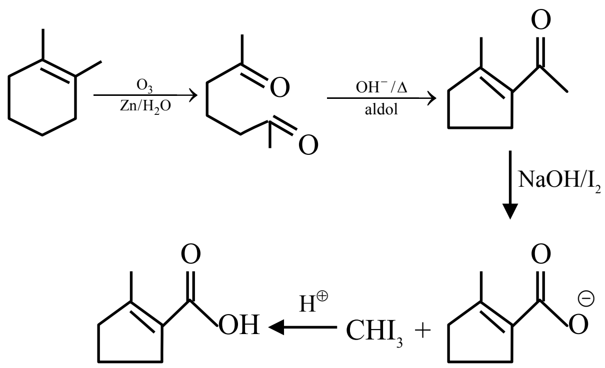
(2) 

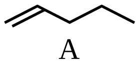
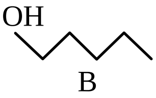
(3) 

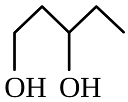
(4) 

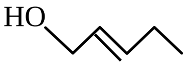
Ans. **(1)**

Sol.

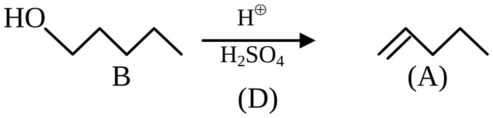


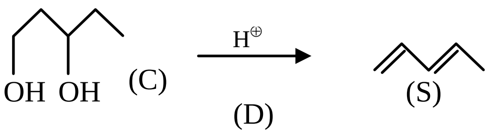
21.  is formed when  reacts with reagent (R).

When  (C) reacts with (R) the formed product will be (S).

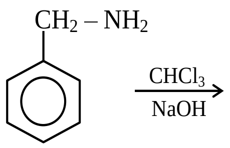
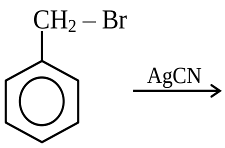
D	(S)
(1) PCC	
(2) PCC	
(3) conc H_2SO_4/H_3PO_4	
(4) conc H_2SO_4	

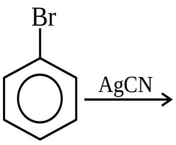
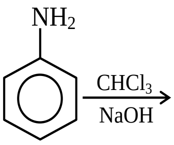
Ans. **(3)**

Sol. 



22. Which amongs the following will give benzyl isocyanide as a major product.

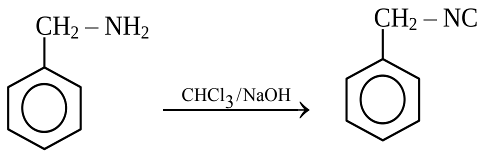
(i)  (ii) 

(iii)  (iv) 

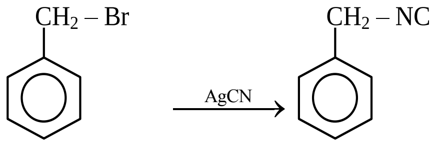
(1) i & ii (2) ii & iii

(3) I & iii (4) ii & iv

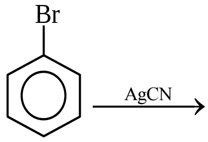
Ans. **(1)**

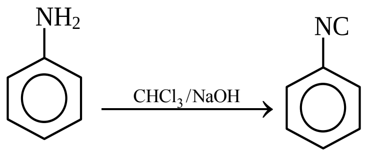
Sol. (1) 

Benzyl isocyanide

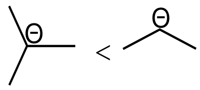
(2) 

Benzyl isocyanide

(3)  No reaction

(4) 

Phenyl isocyanide

23. **Statement-1 :**  < $CH_3-\overset{\ominus}{C}H_2 < \overset{\ominus}{C}H_3$

Stability is in increasing order of carbanion.

Statement-2 : Allylic and benzylic carbanion stability is based on inductive effect and not an resonance effect.

(1) Both Statement I and Statement II are correct

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

(4) Both Statement I and Statement II are incorrect

Ans. **(2)**

Sol. Allylic and benzylic carbanion are stabilized by resonance.

JEE–MAIN EXAMINATION – APRIL 2026
MEMORY BASED QUESTIONS

(HELD ON SUNDAY 05th APRIL 2026) **TIME : 9:00 AM TO 12:00 NOON**

MATHEMATICS	TEST PAPER WITH SOLUTION

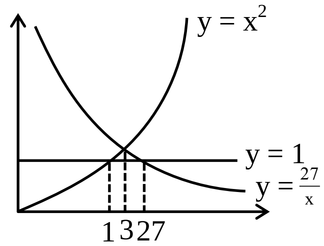
1. The area enclosed between the region given by $xy \le 27$ & $1 \le y \le x^2$ is

(1) $54\,\ell n\,3 - \frac{52}{3}$ (2) $52\,\ell n\,3 - \frac{52}{3}$

(3) $54\,\ell n\,2 - \frac{54}{3}$ (4) $52\,\ell n\,2 - \frac{52}{3}$

Ans. (1)

Sol.



Area $= \int_1^3 (x^2 - 1)dx + \int_3^{27}\left(\frac{27}{x} - 1\right)dx$

$= \left[\frac{x^3}{3} - x\right]_1^3 + \left[27\ell nx - x\right]_3^{27}$

$= \frac{26}{3} - 2 + 27\,\ell n\,9 - 24$

$= 27\,\ell n\,9 - \frac{26 \times 2}{3}$

$= 54\,\ell n\,3 - \frac{52}{3}$

2. If f(x) satisfy the relation $f\left(\frac{x+y}{3}\right) = \frac{f(x)+f(y)}{3}$ & $f'(0) = 3$, then the minimum value of $g(x) = 3 + e^x f(x)$ is

(1) $\frac{3(e-1)}{e}$ (2) $\frac{(e-1)}{e}$

(3) $\frac{(e-1)}{3}$ (4) $\frac{e(e-1)}{3}$

Ans. (1)

Sol. $f\left(\frac{x+y}{3}\right) = \frac{f(x)+f(y)}{3}$, put x = y = 0

$f(0) = \frac{2f(0)}{3}$

$\Rightarrow f(0) = 0$......(1)

$f'\left(\frac{x+y}{3}\right) \cdot \frac{1}{3} = \frac{1}{3}f'(x)$

put x = 0

$f'\left(\frac{y}{3}\right)\frac{1}{3} = \frac{1}{3} \times 3$

$f'\left(\frac{y}{3}\right) = 3$

put y = 3x

$f'(x) = 3$

integrate both sides

$f(x) = 3x + c$

from eq. (1)

$f(0) = 0$

$\Rightarrow f(x) = 3x$

Now

$g(x) = 3 + e^x \cdot 3x$

$g'(x) = 3[e^x + x \cdot e^x]$

$= 3e^x(x + 1)$

$g'(x) = 0$, at $x = -1$

$(g(x))_{min} = 3 + e^{-1}(-3)$

$= 3\left[1 - \frac{1}{e}\right] = \frac{3(e-1)}{e}$

3. Let S_n is the sum of first n terms of an A.P. If $S_n = 3n^2 + 5n$, then the sum of square of first 10 terms of the given A.P. is

(1) 15220 (2) 14220

(3) 15320 (4) 15110

Ans. (1)

Sol. $S_n = 3n^2 + 5n$

$T_n = S_n - S_{n-1}$

$= 3(n^2 - (n-1)^2) + 5(n - (n-1))$

$= 3(2n - 1) + 5$

$= 6n + 2$

$$\sum_{n=1}^{10}(6n+2)^2 = \sum 36n^2 + \sum 4 + \sum 24n$$

$$= 36 \times \frac{10\times 11\times 21}{6} + 4 \times 10 + 24\ \frac{10\times 11}{2}$$

$= 15220$

4. A and B play a tennis match which will not result in a draw. The player who wins 5 rounds first, will be the winner of the match then the number of ways such that A can win the match is

(1) 126 (2) 252

(3) 63 (4) 216

Ans. **(1)**

Sol. required ways = ${}^9C_5 = 126$

5. If α, β are the roots of quadratic equation $ax^2 + bx + c = 0$ and $|\alpha - \beta| = \sqrt{11}$, $\alpha + \beta = 3i$, then the value of $(\alpha^3 - \beta^3)^2$ is

(1) 167 (2) 176

(3) 716 (4) 617

Ans. **(2)**

Sol. $|\alpha - \beta| = \sqrt{11}$

$\Rightarrow \alpha^2 + \beta^2 - 2\alpha\beta = 11$

$\alpha + \beta = 3i \Rightarrow \alpha^2 + \beta^2 + 2\alpha\beta = -9$

$\Rightarrow \alpha\beta = -5$

Now, $E = (\alpha^3 - \beta^3)^2$

$= (\alpha - \beta)^2 (\alpha^2 + \beta^2 + \alpha\beta)^2$

$$= \left(\sqrt{11}\right)^2 \left((\alpha+\beta)^2 - 2\alpha\beta + \alpha\beta\right)^2$$

$= 11(-9 - (-5))^2$

$= 176$

6. Consider

x_i	5	6	8	11	13
f_i	4	8	2	3	9

then mean deviation about mean is

(1) 4.23 (2) 5.23

(3) 2.32 (4) 3.23

Ans. **(4)**

Sol. $$\text{M.D.} = \frac{\sum f_i |x_i - \bar{x}|}{\sum f_i}$$

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

$$= \frac{20 + 48 + 16 + 33 + 117}{26}$$

$$= \frac{234}{26} = 9$$

$$\text{M.D.} = \frac{4(4) + 8(3) + 2(1) + 3(2) + 9(4)}{26}$$

$$= \frac{16 + 24 + 2 + 6 + 36}{26}$$

$$= \frac{84}{26} = 3.23$$

7. If $S_1 : x^2 + y^2 - 6x - 8y + 21 = 0$ and

$S_2 : x^2 + y^2 + 6x + 8y + \lambda = 0$

then the distance of centre of S_2 to the farthest point on S_1 is

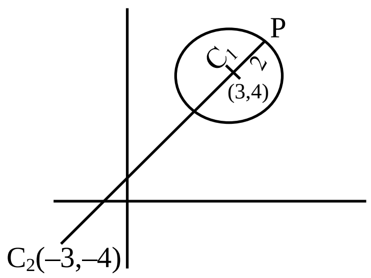
(1) 10 (2) 11

(3) 12 (4) 13

Ans. **(3)**

Sol. $S_1 : C_1 (3,4)\ r = 2$

$S_2 : C_2 (-3, -4)$



$C_1C_2 = 10$

So $C_2P = 12$

8. If $\alpha = \frac{\pi}{4} + \sum_{p=1}^{11} \tan^{-1}\left(\frac{2^{p-1}}{1+2^{2p-1}}\right)$

then the value of $\tan(\alpha)$ is

(1) 2^9 (2) 2^{10}

(3) 2^{11} (4) 2^{12}

Ans. **(3)**

Sol. $\alpha = \frac{\pi}{4} + \sum_{p=1}^{11} \tan^{-1}\left(\frac{2^{p-1}}{1+2^{2p-1}}\right)$

$= \frac{\pi}{4} + \sum_{p=1}^{11} \tan^{-1}\left(\frac{2^p - 2^{p-1}}{1+2^p 2^{p-1}}\right)$

$= \frac{\pi}{4} + \sum_{p=1}^{11} (\tan^{-1}\left(2^p\right) - \tan^{-1}(2^{p-1}))$

$= \frac{\pi}{4} + \tan^{-1}\left(2^{11}\right) - \tan^{-1}(2^0) = 2^{11}$

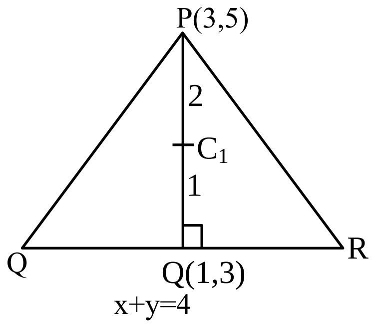
9. Consider an equilateral ΔPQR, where $P(3,5)$ and QR is $x + y = 4$. If the orthocentre of ΔPQR is (α,β), then $9(\alpha + \beta)$ is equal to

(1) 46 (2) 48

(3) 50 (4) 52

Ans. **(2)**

Sol.



$Q : \frac{x-3}{1} = \frac{y-5}{1} = -\frac{(3+5-4)}{1+1}$

$Q(1, 3)$

So orthocentre is $\left(\frac{2+3}{3}, \frac{6+5}{3}\right)$

$\left(\frac{5}{3}, \frac{11}{3}\right)$

So $9(\alpha + \beta) = 3(16) = 48$

10. If $\lim_{x\to 0} \frac{1-\cos(\alpha x)\cos((\alpha+1)x)\cos((\alpha+2)x)}{\sin((\alpha+1)x)^2} = 2$

Then the product of all possible values of α is

(1) 1 (2) -1

(3) 2 (4) -2

Ans. **(2)**

Sol. $\lim_{x\to 0} \frac{1-\cos\alpha x.\cos((\alpha+1)x)\cos((\alpha+2)x)}{(\alpha+1)^2 x^2}$

By using L.H. Rule we get

$\Rightarrow \frac{1}{2}(\alpha+1)^2[\alpha^2 + (\alpha+1)^2 + (\alpha+2)^2] = 2$

$\alpha^2 + (\alpha + 1)^2 + (\alpha + 2)^2 = 4(\alpha + 1)^2$

$\alpha^2 + (\alpha + 2)^2 = 3(\alpha + 1)^2$

$\Rightarrow \alpha^2 + 2\alpha - 1 = 0$

Product $= -1$

11. On a postcard one of the two words either KANPUR or ANANTPUR is written. If only two consecutive letters AN are visible on the postcard, then the probability that the written word is ANANTPUR, is

(1) $\frac{3}{17}$ (2) $\frac{10}{17}$

(3) $\frac{2}{17}$ (4) $\frac{4}{17}$

Ans. **(2)**

Sol. $P(I) : \frac{1}{2}$ $P(A/I) \to \frac{1}{5}$

$P(II) : \frac{1}{2}$ $P(A/II) \to \frac{2}{7}$

$\therefore$ Reqd. Prob $= \frac{\frac{1}{2}\times\frac{2}{7}}{\frac{1}{2}\times\frac{1}{5}+\frac{1}{2}\times\frac{2}{7}} = \frac{\frac{2}{7}\times 5}{\frac{17}{7}} = \frac{10}{17}$

12. Consider differential equation

$$\sin\left(\frac{y}{x}\right)\frac{dy}{dx}+1=\frac{y}{x}\sin\left(\frac{y}{x}\right),\ y(1)=\frac{\pi}{2}$$

and $\alpha=\cos\left(\frac{y(e^{12})}{e^{12}}\right)$. Let r be the radius of the circle $x^2 + y^2 - 2px + 2py + \alpha + 2 = 0$ (where $\alpha \le 6$) then the number of integral values of 'p' is

(1) 11 (2) 12

(3) 13 (4) 15

Ans. **(1)**

Sol. $\sin\frac{y}{x}\frac{dy}{dx}=\frac{y}{x}\sin\frac{y}{x}-1$

put $y = tx \Rightarrow \frac{dy}{dx}=t+x\frac{dt}{dx}$

$\sin t\left(t+x\frac{dt}{dx}\right)=t\sin t-1$

$x\sin t\frac{dt}{dx}+1=0$

$\sin t\,dt+\frac{dx}{x}=0$

$\Rightarrow -\cos t + \ell nx = C$

$\Rightarrow -\cos\left(\frac{y}{x}\right) + \ell nx = C$

$y(1)=\frac{\pi}{2} \Rightarrow C = 0$

$\Rightarrow \cos\left(\frac{y}{x}\right)=\ell nx$

$\cos\left(\frac{y(e^{12})}{e^{12}}\right)=12 \Rightarrow \alpha = 12$

$x^2 + y^2 - 2px + 2py + 14 = 0$

$r=\sqrt{p^2+p^2-14}$

$\Rightarrow r \le 6 \Rightarrow r^2 \le 36$

$2p^2 - 14 \le 36$

$p^2 \le 25$

$p \in [-5, 5]$

13. If system of equations (in variable x, y, z):

$x - 2y + tz = 0$

$3x + 5y + t^2z = 0$

$6x + ty + f(t)z = 0$

have infinitely many solutions (where f(t) represents real function) then

(1) y = f(t) is strictly increasing

(2) y = f(t) is strictly decreasing

(3) y = f(t) is decreasing

(4) y = f(t) is increasing

Ans. **(1)**

Sol. $\begin{vmatrix} 1 & -2 & t \\ 3 & 5 & t^2 \\ 6 & t & f(t) \end{vmatrix}=0$

$1(5f(t) - t^3) + 2(3f(t) - 6t^2) + t(3t - 30) = 0$

$f(t)=\frac{t^3+9t^2+30t}{11}$

$f'(t)=\frac{1}{11}(3t^2+18t+30)$

$D < 0$

So function is strictly increasing

14. If tanA and tanB are roots of equation $x^2 - 2x - 5 = 0$, then the value of

$10\left(\sin^2\left(\frac{A+B}{2}\right)\right)$ is

(1) $5+\frac{3}{2}\sqrt{10}$ (2) $10+\frac{3}{2}\sqrt{10}$

(3) $5-\frac{3}{2}\sqrt{10}$ (4) $10-\frac{3}{2}\sqrt{10}$

Ans. **(3)**

Sol. $x^2 - 2x - 5 = 0$

$\tan A + \tan B = 2;\quad \tan A\tan B = -5$

$\therefore\ \tan(A+B)=\frac{2}{1-(-5)}=\frac{1}{3}$

$\Rightarrow\ \cos(A+B)=\frac{3}{\sqrt{10}}$

$\therefore\ 10\left(\sin^2\left(\frac{A+B}{2}\right)\right)=\frac{10}{2}(1-\cos(A+B))$

$=5\left(1-\frac{3}{\sqrt{10}}\right)$

15. If $\vec{r}\times\vec{a}+\vec{a}\times b=0$, $\vec{a}=\sqrt{7}\hat{i}+\hat{j}+\hat{k}$, $b=\hat{j}-2\hat{k}$ and $\vec{r}.\vec{a}=0$, then the value of $|3\vec{r}|^2$ is

(1) 46 (2) 40

(3) 42 (4) 44

Ans. (4)

Sol. $\vec{r}\times\vec{a}-\vec{b}\times\vec{a}=\vec{0}$

$(\vec{r}-\vec{b})\times\vec{a}=\vec{0}$

$\vec{r}-\vec{b}=\lambda\vec{a}$

$\vec{r}=\vec{b}+\lambda\vec{a}$

$\vec{r}.\vec{a}=0 \Rightarrow \vec{a}.\vec{b}+\lambda|\vec{a}|^2=0$

$$\lambda=-\frac{\vec{a}.\vec{b}}{|\vec{a}|^2}=-\frac{(1-2)}{9}=\frac{1}{9}$$

$$\vec{r}=\vec{b}+\frac{\vec{a}}{9}$$

$$|3\vec{r}|^2=9|\vec{r}|^2=9\left(b^2+\frac{a^2}{81}+\frac{2(\vec{a}.\vec{b})}{9}\right)=44$$

16. The value of $\sum_{n=1}^{10}\frac{528}{n(n+1)(n+2)}$ is equal to

(1) 130 (2) 260 (3) 65 (4) 120

Ans. (1)

Sol. Let $T_n=\frac{1}{n(n+1)(n+2)}=\frac{1}{2}\left[\frac{(n+2)-n}{n(n+1)(n+2)}\right]$

$$T_n=\frac{1}{2}\left[\frac{1}{n(n+1)}-\frac{1}{(n+1)(n+2)}\right]$$

$$T_1=\frac{1}{2}\left[\frac{1}{1.2}-\frac{1}{2.3}\right]$$

$$T_2=\frac{1}{2}\left[\frac{1}{2.3}-\frac{1}{3.4}\right]$$

$\vdots$

$$T_{10}=\frac{1}{2}\left[\frac{1}{10.11}-\frac{1}{11.12}\right]$$

$$S=\frac{1}{2}\left[\frac{1}{2}-\frac{1}{11.12}\right]$$

$$\text{Final sum}=\frac{528}{2}\left[\frac{1}{2}-\frac{1}{11.12}\right]$$

= 132 – 2 = 130

17. The value of $\int_0^\infty \frac{\ell n x}{x^2+4}dx$ is equal to

(1) $\frac{\pi\ell n2}{4}$ (2) $\frac{\pi\ell n2}{2}$

(3) $\frac{\pi\ell n4}{3}$ (4) $\frac{3\pi\ell n2}{4}$

Ans. (1)

Sol. Put x = 2t $\Rightarrow$ dx = 2dt

$$I=\int_0^\infty \frac{\ell n2t}{4t^2+4}(2dt)=\frac{1}{2}\int_0^\infty \frac{\ell n2+\ell nt}{t^2+1}dt$$

$$=\frac{1}{2}\int_0^\infty \frac{\ell n2}{t^2+1}dt+\frac{1}{2}\int_0^\infty \frac{\ell nt}{t^2+1}dt$$

$$\left[\frac{\ln 2}{2}\tan^{-1}t\right]_0^\infty+I_1$$

$$= \frac{\ell n 2}{2} \cdot \frac{\pi}{2} + I_1$$

$$I_2 = \frac{1}{2}\int_0^{\infty} \frac{\ell n t}{t^2+1} dt \qquad t = \frac{1}{u} \Rightarrow dt = -\frac{du}{u^2}$$

$$= \frac{1}{2}\int_{\infty}^{0} \frac{\ell n(1/u)}{\frac{1}{u^2}+1}\left(-\frac{du}{u^2}\right)$$

Add $\Rightarrow I_1 = 0$

$$I = \frac{\pi \ell n 2}{4}$$

18. Let p(x, y) is a variable point on the circle $x^2 + y^2 - 6x - 8y + 21 = 0$, then the maximum possible distance of p from the vertex of $y^2 + 6y + x + 13 = 0$ is

(1) $7+2\sqrt{2}$ (2) $2+7\sqrt{2}$

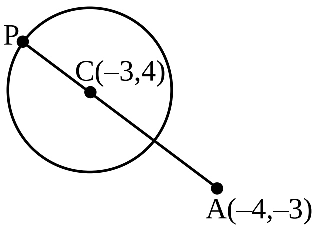
(3) $4+7\sqrt{2}$ (4) $3+2\sqrt{2}$

Ans. **(2)**

Sol. Centre : C(3,4) & r = 2

Parabola $(y + 3)^2 = -(x + 4)$

Vertex is A(–4,–3)



$$AP_{max} = AC + r = \sqrt{49+49} + 2 = \sqrt{98} + 2$$

$$= 2 + 7\sqrt{2}$$

19. Let f : A $\to$ A be function, where A ={1, 2, 3, 4, 5, 6}. The number of one-one functions such that

f(1) $\le$ 3, f(3) $\le$ 4 and f(2) + f(3) = 5, is

(1) 20 (2) 18 (3) 36 (4) 24

Ans. **(3)**

Sol. f(1) = 1, 2, 3 f(3) = 1, 2, 3, 4

f(1) = 1 f(3) = 2, f(2) = 3 $\to$ 6

f(3) = 3, f(2) = 2 $\to$ 6

f(1) = 2 f(3) = 1, f(2) = 4 $\to$ 6

f(3) = 4, f(2) = 1 $\to$ 6

f(1) = 3 f(3) = 1, f(2) = 4 $\to$ 6

f(3) = 4, f(2) = 1 $\to$ 6

Total = 36

20. The value of $I = \int_{\pi/6}^{\pi/3} \frac{4 - \text{cosec}^2 x}{\cos^4 x} dx$ is

(1) $\frac{32\sqrt{3}}{3}$ (2) $\frac{32\sqrt{3}}{9}$

(3) $\frac{64\sqrt{3}}{3}$ (4) $\frac{64\sqrt{3}}{9}$

Ans. **(2)**

Sol. $= \int_{\pi/6}^{\pi/3} \frac{4}{\cos^4 x} dx - \int_{\pi/6}^{\pi/3} \frac{\text{cosec}^2 x}{\cos^4 x} dx$

$$= \int_{\pi/6}^{\pi/3} \frac{4}{\cos^4 x} dx - \left[-\frac{\cot x}{\cos^4 x} - \int_{\pi/6}^{\pi/3} (-\cot x)\frac{-4}{\cos^5 x}(-\sin x)\, dx\right]$$

$$= \left.\frac{\cot x}{\cos^4 x}\right|_{\frac{\pi}{6}}^{\frac{\pi}{3}}$$

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

$$= \frac{16}{\sqrt{3}} - \frac{\sqrt{3}.16}{9} = \frac{16}{\sqrt{13}} - \frac{16}{3\sqrt{3}} = \frac{16}{\sqrt{13}}\left(1 - \frac{1}{3}\right)$$

$$\frac{32}{3\sqrt{3}} = \frac{32\sqrt{3}}{9}$$

21. If $3\sin^2 t - 12\sin t - 3 = p$, then the sum of all integral values of 'p' such that the equation has at least one real root, is

(1) –75 (2) –60

(3) –65 (4) –72

Ans. **(1)**

Sol. $3\sin^2 t - 12\cos t - 3 = p$

$\Rightarrow -3\cos^2 t - 12\cos t = p$

$\Rightarrow\ 3\cos^2 t + 12\cos t + p = 0$

$\Rightarrow\ \cos t = \dfrac{-12 \pm \sqrt{144-12p}}{6}$

$\Rightarrow\ \cos t = -2 \pm \sqrt{4 - p/3}$

But $-1 \le \cos\ t \le 1$

$\Rightarrow\ -1 \le -2 + \sqrt{4-p/3} \le 1$

$1 \le \sqrt{4 - \dfrac{p}{3}} \le 3$

$1 \le 4 - \dfrac{p}{3} \le 9$

$-3 \le -\dfrac{p}{3} \le 5$

$-15 \le p \le 9$

Sum = – 15 – 14………..+9

= –10 – 11 – 12………–15

= –75

SECTION-B

1. In the expansion of $\left(\dfrac{1}{x^3} - x^4\right)^n$, if sum of coefficient of x^7 & x^{14} is zero, then find n.

Ans. (21)

Sol. General term = ${}^nC_r \left(\dfrac{1}{x^3}\right)^{n-r} (-x^4)^r$

$= {}^nC_r\,(-1)^r\,x^{7r-3n}$

Coeff. of $x^7 \Rightarrow 7r_1 - 3n = 7 \Rightarrow r_1 = \dfrac{7+3n}{7}$

Coeff. of $x^{14} \Rightarrow 7r_2 - 3n = 14 \Rightarrow r_2 = \dfrac{14+3n}{7}$

Now, ${}^nC_{\frac{7+3n}{7}}(-1)^{\frac{7+3n}{7}} + {}^nC_{\frac{14+3n}{7}}(-1)^{\frac{7+3n}{7}} = 0$

Possible if $\left(\dfrac{7+3n}{7}\right) + \left(\dfrac{14+3n}{7}\right) = n$

$\dfrac{21+6n}{7} = n \Rightarrow n = 21$

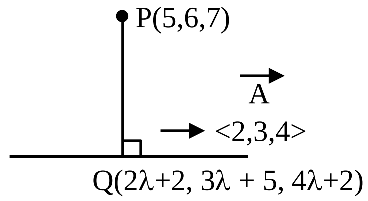
2. Find square of the distance of the point (5, 6, 7) from the line $\dfrac{x-2}{2} = \dfrac{y-5}{3} = \dfrac{z-2}{4}$

Ans. (6)

Sol. $\overrightarrow{PQ} \cdot \vec{A} = 0$

$\Rightarrow (2\lambda - 3)2 + (3\lambda - 1)3 + (4\lambda - 5)4 = 0$

$\Rightarrow \lambda = 1$



Point Q = (4, 8, 6)

$PQ^2 = 6$