

JEE–MAIN EXAMINATION – APRIL 2026

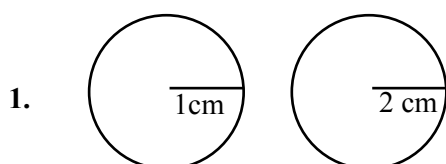
MEMORY BASED QUESTIONS

(HELD ON SATURDAY 04th APRIL 2026)

TIME : 9:00 AM TO 12:00 NOON

PHYSICS

TEST PAPER WITH SOLUTION



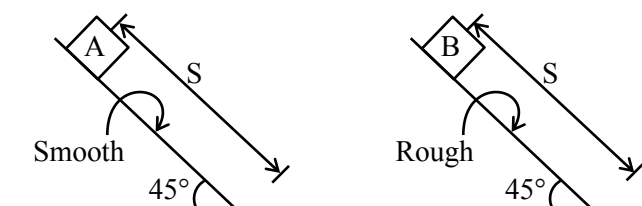
Find the work done in expanding the soap bubble from 1 cm to 2 cm. Surface tension is $\gamma = 7.2 \times 10^{-2}$ N/m

- (1) 542.6×10^{-6} J
- (2) 543.6×10^{-6} J
- (3) 542.6×10^{-5} J
- (4) 545.6×10^{-6} J

Ans. (1)

Sol. $W = \Delta U = 2\gamma [4\pi(2r)^2 - 4\pi r^2]$
 $W = 2 \times 7.2 \times 10^{-2} \times 4\pi [4r^2 - r^2]$
 $= 8\pi \times 7.2 \times 10^{-2} \times 3 \times (1 \times 10^{-2})^2$
 $W = 542.6 \times 10^{-6}$ J

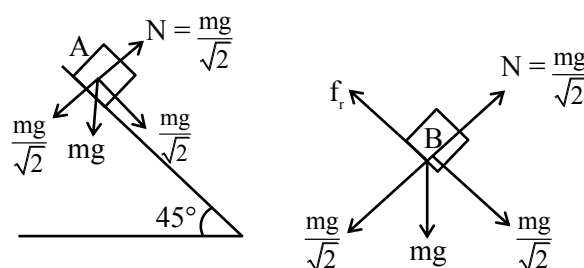
2. Two block A and B released from rest on two inclined plane of same inclination but one incline plane has rough surface as shown in figure. If block B takes 50% more time to reach bottom than A, find coefficient of friction (μ):



- (1) $\frac{5}{9}$
- (2) $\frac{13}{9}$
- (3) $\frac{3}{9}$
- (4) $\frac{7}{9}$

Ans. (1)

Sol.



$$a = \frac{g}{\sqrt{2}}$$

$$a = \frac{g}{\sqrt{2}} (1 - \mu)$$

$$S = \frac{1}{2} \left(\frac{g}{\sqrt{2}} \right) t^2$$

$$t_B = \sqrt{\frac{2\sqrt{2}S}{g(1-\mu)}}$$

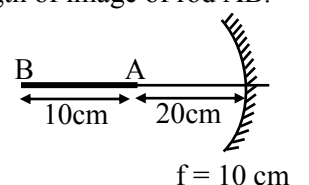
$$t_A = \sqrt{\frac{2\sqrt{2}S}{g}}$$

$$t_B = 1.5 t_A \Rightarrow t_B = \frac{3}{2} t_A$$

$$\frac{2\sqrt{2}S}{g(1-\mu)} = \frac{9}{4} \left(\frac{2\sqrt{2}S}{g} \right) \Rightarrow 1 - \mu = \frac{4}{9}$$

$$\mu = 1 - \frac{4}{9} = \frac{5}{9}$$

3. Find length of image of rod AB.



- (1) 10 cm
- (2) 5 cm
- (3) 15 cm
- (4) 20 cm

Ans. (2)

Sol. For A $u = -20$ cm, $f = -10$ cm
 $\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \therefore v = \frac{u \times f}{u - f} = -20$ cm

For B $u = -30$ cm, $f = -10$ cm

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$v = \frac{uf}{u - f} = -15$$
 cm

Length of image = $20 - 15 = 5$ cm

4. Nuclei A & B form a nucleus C. BE per nucleon for A, B & C are 3MeV, 7MeV & 6MeV. Energy produced in following is :



- (1) 12 MeV (2) 14 MeV
(3) 13 MeV (4) 15 MeV

Ans. (2)

Sol. Energy produced 'Q' is

$$\begin{aligned} Q &= BE(RHS) - BE(LHS) \\ &= 10 \times 6 - [2 \times 3 \times 3 + 4 \times 7] \\ &= 60 - [18 + 28] \\ Q &= 60 - 46 = 14 \text{ MeV} \end{aligned}$$

5. If force $\vec{F} = 2t\hat{i} + 3t^2\hat{j}$ and mass of particle $m = 2$ Kg then find power at $t = 2$ s if particle was initially at rest :

- (1) 54 watt (2) 58 watt
(3) 56 watt (4) 52 watt

Ans. (3)

Sol. $\vec{a} = \frac{\vec{F}}{m} = t\hat{i} + \frac{3t^2}{2}\hat{j}$

$$\int dv = \int a dt$$

$$\vec{v} \Rightarrow \frac{t^2}{2}\hat{i} + \frac{t^3}{2}\hat{j}$$

$$P \Rightarrow \vec{F} \cdot \vec{v} \Rightarrow t^3 + \frac{3}{2}t^5$$

at $t = 2$ s

$$P = 2^3 + \frac{3}{2} \times 2^5$$

$$= 8 + 3 \times 2^4$$

$$= 8 + 48$$

$$\Rightarrow 56 \text{ watt}$$

6. Two projectiles A & B are launched with same speed at angles 15° & 30° respectively. Find ratio of range A to range B.

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

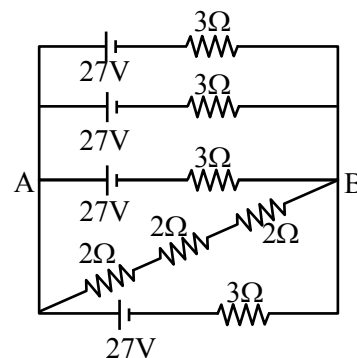
Ans. (2)

Sol. $\frac{R_A}{R_B} = \frac{u^2 \sin 2\theta_A / g}{u^2 \sin 2\theta_B / g}$

$$= \frac{\sin 2\theta_A}{\sin 2\theta_B} = \frac{\sin 30^\circ}{\sin 60^\circ} = \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}}$$

$$\frac{R_A}{R_B} = \frac{1}{\sqrt{3}}$$

7. Find voltage V_{AB} and i_{BA} ?

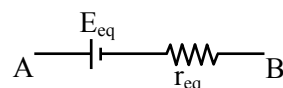


- (1) 24V, 2A (2) 24V, 1A
(3) 18V, 2A (4) 18V, 1A

Ans. (2)

Sol. Equivalent circuit :

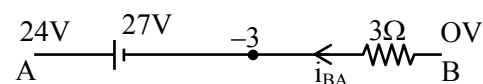
$$E_{eq} = \frac{\frac{27}{3} + \frac{27}{3} + \frac{27}{3} + \frac{0}{6} + \frac{27}{3}}{\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{6} + \frac{1}{3}}$$



$$= \frac{36}{9/6} = 24V$$

$$r_{eq} = \frac{1}{\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{6} + \frac{1}{3}} = \frac{2}{3} \Omega$$

$$i_{BA} = \frac{3}{3}$$



$$= 1A$$

8. In an AC circuit a resistor 100Ω , inductor 0.1mH and a capacitor are connected in series against on AC source 220V , 70Hz . If power factor of circuit is $\frac{1}{2}$ and $|X_L - X_C| = \sqrt{3}\alpha$ Find α .

- (1) $100\sqrt{3}$ (2) 100
(3) $\frac{100}{\sqrt{3}}$ (4) 1000

Ans. (2)

Sol. $\cos\phi = \frac{1}{2}$ $\phi = 60^\circ$

$$\therefore \tan\phi = \sqrt{3} = \frac{|X_L - X_C|}{R}$$

$$\therefore |X_L - X_C| = R\sqrt{3} = 100\sqrt{3}\Omega$$

$$\alpha = 100$$

9. A solid sphere of mass 'M' and radius 'R' is split into 2 pieces of masses $\frac{7M}{8}$ and $\frac{M}{8}$. Sphere of mass $\frac{7M}{8}$ is converted into a disc of radius $2R$ and thickness 't'. Its MOI becomes I_1 other piece is made into a solid sphere and its MOI becomes I_2 .

Find $\frac{I_1}{I_2}$:

- (1) 150 (2) 140
(3) 130 (4) 120

Ans. (2)

Sol. Volume of $\frac{7M}{8}$

$$\frac{7M}{8} = \rho \times \pi(2R)^2 \times t$$

$$\frac{7M}{8} = \frac{3M}{4\pi R^3} \times \pi(4R^2)t$$

$$t = \frac{7R}{24}$$

$$I_1 = \frac{1}{2} \left(\frac{7M}{8} \right) (2R)^2$$

$$M = \frac{4}{3} \pi R^3 \rho$$

$$\rho = \frac{3M}{4\pi R^3}$$

$$\frac{M}{8} = \frac{4}{3} \pi r^3 \times \rho$$

$$\frac{M}{8} = \frac{4}{3} \pi r^3 \times \frac{3M}{4\pi R^3}$$

$$r^3 = \frac{R^3}{8}$$

$$r = \frac{R}{2}$$

$$I_2 = \frac{2}{5} \left(\frac{M}{8} \right) \left(\frac{R}{2} \right)^2 = \frac{MR^2}{80}$$

$$\frac{I_1}{I_2} = \frac{7MR^2}{4 \times \frac{MR^2}{80}} = 140$$

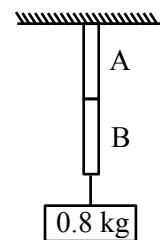
10. Length of rods are ℓ and 2ℓ respectively and their young's modulus are γ and 2γ respectively.

$$\ell = 0.314 \text{ m}$$

$$R = 0.2 \text{ mm (same)}$$

$$\gamma = 2 \times 10^9$$

Find total extension $\Delta\ell = ?$



- (1) 0.4 mm (2) 0.1 mm
(3) 0.2 mm (4) 0.3 mm

Ans. (3)

Sol. $\Delta\ell \Rightarrow \Delta\ell_1 + \Delta\ell_2$

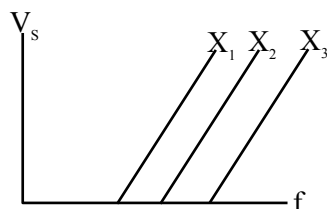
$$\Rightarrow \frac{Mg \cdot L_1}{A\gamma_1} + \frac{MgL_2}{A\gamma_2}$$

$$= \frac{Mg}{A} \left\{ \frac{L}{\gamma} + \frac{2L}{2\gamma} \right\} = \frac{2MgL}{\gamma}$$

$$\Rightarrow \frac{0.8 \times 10}{\pi \times 4 \times 10^{-6}} \left\{ \frac{2 \times 0.314}{2 \times 10^9} \right\}$$

$$= 2 \times 10^{-4} \text{ m} = 0.2 \text{ mm}$$

11. Graph shows stopping potential vs frequency of light incident. Choose the metal which will eject photoelectron with maximum kinetic energy for given frequency.



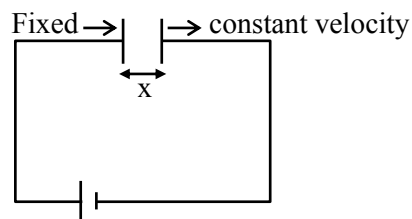
- (1) X_1
- (2) X_2
- (3) X_3
- (4) can't be predicted

Ans. (1)

Sol. $K_m = eV_s = E - \phi = hf - \phi$

The metal with highest stopping potential i.e. lowest threshold frequency will give maximum K.E. i.e, X_1 .

12. If right plate of parallel plate capacitor is pulled at constant velocity. Then the rate of change of energy stored in capacitor is proportional to :-



- (1) x^{-2}
- (2) x^{-3}
- (3) x^{-1}
- (4) x^2

Ans. (1)

Sol. Capacitance $= C = \frac{\epsilon_0 A}{x}$

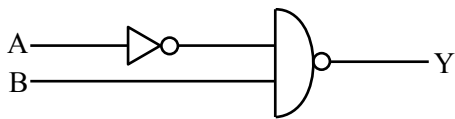
Energy stored $= U = \frac{1}{2} C v^2$

$U = \frac{1}{2} \frac{\epsilon_0 A}{x} v^2$

$\frac{dU}{dt} = \frac{1}{2} \epsilon_0 A v^2 \left(-\frac{1}{x^2} \right) \frac{dx}{dt}$

$\frac{dU}{dt} \propto \frac{1}{x^2}$

13. Two 4 bits binary numbers A = 1101 and B = 1010 are given in input logic. Find output y.



- (1) 1000
(2) 1101
(3) 0010
(4) 0111

Ans. (2)

Sol. $Y = \overline{\overline{A} \cdot B} = A + \overline{B}$

$A = 1101$

$B = 1010$

$\overline{B} = 0101$

$A + \overline{B} = 1101$

14. Resolving power of a telescope is 5×10^{-7} rad. If wavelength of incident light is 500 nm, then find diameter of aperture of telescope. ($\lambda = 500$ nm)

- (1) 1.22 (2) 4.66
(3) 2.33 (4) 0.56

Ans. (1)

Sol. $\lambda_0 \Rightarrow \frac{1.22\lambda}{D}$

$5 \times 10^{-7} = \frac{1.22 \times 500 \times 10^{-9}}{D}$

$D \Rightarrow 1.22$ m

15. An ideal gas has number of moles $n = 2$ initial volume V_0 and pressure $P = P_0 \left[1 + \left(\frac{V_0}{V} \right)^2 \right]^{-1}$ is going from A(initial) to B (final) state so that volume becomes $3V_0$ find out $T_A - T_B$.

- (1) $\frac{11P_0 V_0}{10R}$ (2) $\frac{5P_0 V_0}{11R}$
(3) $\frac{11P_0 V_0}{5R}$ (4) $\frac{10P_0 V_0}{11R}$

Ans. (1)

Sol. For $V = V_0$, $P = \frac{P_0}{2}$

$\frac{P_0}{2} \times V_0 = 2 \times R T_A$

$T_A = \frac{P_0 V_0}{4R}$

for $V = 3V_0$ $P = \frac{9P_0}{10}$

$\frac{9P_0}{10} \times 3V_0 = 2 \times R T_B$

$T_B = \frac{27P_0 V_0}{20R}$

So, $T_B - T_A$

$= \frac{11P_0 V_0}{10R}$

16. A slit of width 'a' is illuminated by the light of wavelength ' λ '. The linear separation between 1st and 3rd minima in the diffraction pattern produced on a screen placed at a distance 'D' from the slit is _____.

- (1) $\frac{3D\lambda}{a}$ (2) $\frac{3D\lambda}{2a}$
(3) $\frac{D\lambda}{a}$ (4) $\frac{2D\lambda}{a}$

Ans. (4)

Sol. For minima

$y = \frac{nD\lambda}{a}$; $n = \pm 1, \pm 2, \dots$

For 1st minima $y_1 = \frac{D\lambda}{a}$

For 3rd minima $y_3 = \frac{3D\lambda}{a}$

separation $= y_3 - y_1$

$= \frac{2D\lambda}{a}$

17. In a screw gauge when the circular scale is given five complete rotation, it moves linearly by 2.5 mm. If the circular scale has 100 divisions, the least count of screw gauge is (mm)

- (1) 1×10^{-2} (2) 5×10^{-3}
(3) 1×10^{-3} (4) 2×10^{-2}

Ans. (2)

Sol. Pitch $\Rightarrow \frac{2.5 \text{ mm}}{5} = 0.5 \text{ mm} = 5 \times 10^{-4} \text{ m}$

L.C. $\Rightarrow \frac{\text{Pitch}}{\text{No. of divisions}} = \frac{5 \times 10^{-4}}{100} \text{ m}$

$= 5 \times 10^{-6} \text{ m}$

$= 5 \times 10^{-3} \text{ mm}$

18. There is a spiral which has

$r_i = 3 \text{ cm}$, $r_{\text{ext}} = 6 \text{ cm}$, $I = 20 \text{ mA}$ and $N = 200$ where,

r_i : internal radius

r_{ext} : external radius

N : number of turns

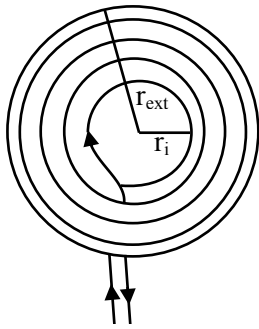
I : current

Find magnetic moment of the spiral :-

(1) $2.64 \times 10^{-2} \text{ Am}^2$ (2) $4.87 \times 10^{-2} \text{ Am}^2$

(3) $3.65 \times 10^{-2} \text{ Am}^2$ (4) $6.67 \times 10^{-2} \text{ Am}^2$

Ans. (1)



Sol.

$dM = (dI)\pi r^2$

$= (IdN)\pi r^2$

$M = \int_i^f I \left(\frac{N}{r_{\text{ex}} - r_i} \right) dr \pi r^2$

$M = \frac{I\pi N}{r_{\text{ex}} - r_i} \left[\frac{r^3}{3} \right]_{r_i}^{r_{\text{ex}}}$

$M = \frac{I\pi N}{3(r_{\text{ex}} - r_{\text{in}})} (r_{\text{ex}}^3 - r_i^3)$

$M = \frac{20 \times 10^{-3} \times 3.14 \times 200 [6^3 - 3^3] 10^{-6}}{3[3] \times 10^{-2}}$

$M = \frac{2373.84 \times 10^{-6}}{9 \times 10^{-2}}$

$M = 263.76 \times 10^{-4}$

$M = 2.64 \times 10^{-2} \text{ Am}^2$

19. 2 forces are acting on a body:

$\vec{F}_1 = 3\hat{i} - 5\hat{j} + 2\hat{k}$

$\vec{F}_2 = 8\hat{i} + 2\hat{j} - 3\hat{k}$

and displacement of body is 25m along $3\hat{i} - 4\hat{j}$.

Find work done :-

(1) 225 Joule

(2) 200 Joule

(3) 125 Joule

(4) 325 Joule

Ans. (1)

Sol. $\vec{F}_{\text{net}} = \vec{F}_1 + \vec{F}_2$

$\vec{F}_{\text{net}} = 11\hat{i} - 3\hat{j} - \hat{k}$

$\vec{S} = 25 \frac{(3\hat{i} - 4\hat{j})}{5} = 15\hat{i} - 20\hat{j}$

work $= \vec{F} \cdot \vec{S}$

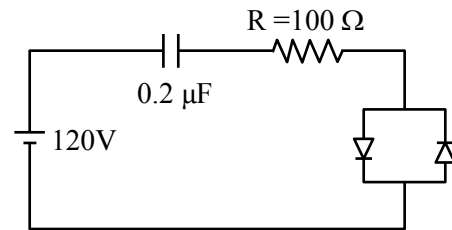
$= (11\hat{i} - 3\hat{j} - \hat{k}) \cdot (15\hat{i} - 20\hat{j})$

$= 165 + 60$

$= 225 \text{ Joule}$

20. Each diode in circuit has 10Ω resistance in forwards bias and infinite resistance in reverse.

Find time constant of circuit :



(1) $20 \mu\text{s}$

(2) $22 \mu\text{s}$

(3) $18 \mu\text{s}$

(4) $5 \mu\text{s}$

Ans. (2)

Sol. $\tau = RC$

$= 110 \times 0.2 \times 10^{-6}$

$= 22 \mu\text{s}$

21. Find final temperature of mixture of two gases. If one gas is at pressure P_1 , temperature T_1 , no. of moles n_1 & volume V_1 , and second gas is at pressure P_2 , temperature T_2 , no. of moles n_2 & volume V_2 . If final pressure is 'P' and Final volume is 'V'. Then find temperature of mixture.

$$(1) \frac{PV}{\frac{P_1 V_1}{T_1} + \frac{P_2 V_2}{T_2}}$$

$$(2) \frac{PV(T_1 + T_2)}{P_1 V_1 + P_2 V_2}$$

$$(3) \frac{(P_1 V_1 + P_2 V_2)(T_1 + T_2)}{PV}$$

$$(4) \frac{PV}{P_1 V_1} T_1 + \left(\frac{PV}{P_2 V_2} \right) T_2$$

Ans. (1)

Sol. $n = n_1 + n_2$

$$\therefore PV = nRT \quad \Rightarrow n = \frac{PV}{RT}$$

$$\frac{P(V)}{T_{\text{Final}}} = \frac{P_1 V_1}{T_1} + \frac{P_2 V_2}{T_2}$$

$$\frac{PV}{R T_f} = \frac{P_1 V_1}{R T_1} + \frac{P_2 V_2}{R T_2}$$

$$T_f = \frac{PV}{P_1 V_1 / T_1 + P_2 V_2 / T_2}$$

22. A particle is moving along x-axis where speed varies as $v^2 = 100 - x^2$. Determine time period :

$$(1) 4\pi$$

$$(2) 8\pi$$

$$(3) 2\pi$$

$$(4) \pi$$

Ans. (3)

Sol. $v^2 = 100 - x^2$

$$v = \sqrt{100 - x^2}$$

Comparing with

$$v = \omega \sqrt{A^2 - x^2}$$

$$\omega = 1$$

$$A = 10$$

$$\text{Time period (T)} = \frac{2\pi}{\omega} = 2\pi$$

JEE–MAIN EXAMINATION – APRIL 2026
MEMORY BASED QUESTIONS

(HELD ON SATURDAY 04th APRIL 2026)

TIME : 9:00 AM TO 12:00 NOON

CHEMISTRY	TEST PAPER WITH SOLUTION
1. Calculate number of moles of KMnO_4 needed to oxidise the mixture containing one mole each of FeC_2O_4, FeSO_4, $\text{Fe}_2(\text{C}_2\text{O}_4)_3$, $\text{Fe}_2(\text{SO}_4)_3$ in acidic medium Ans. (2) Sol. Meq. of KMnO_4 = Meq of $(\text{FeC}_2\text{O}_4 + \text{FeSO}_4 + \text{Fe}_2(\text{C}_2\text{O}_4)_3)$ $\text{moles} \times 5 = 1 \times 3 + 1 \times 1 + 1 \times 6$ $\text{moles} = \frac{10}{5}$ $\text{moles} = 2$ 2. Find the ratio of wave number ($\bar{\nu}$) of 1st line of Balmer series and Brackett series for Hydrogen-like species. (1) $\frac{1}{0.09}$ (2) $\frac{0.81}{5}$ (3) $\frac{5}{0.81}$ (4) 0.09 Ans. (3) Sol. $\bar{\nu}_1 = R_H (Z)^2 \left[\frac{1}{2^2} - \frac{1}{3^2} \right] \Rightarrow 1^{\text{st}} \text{ line of Balmer series}$ $\bar{\nu}_2 = R_H (Z)^2 \left[\frac{1}{4^2} - \frac{1}{5^2} \right] \Rightarrow 1^{\text{st}} \text{ line of Brackett series}$ $\Rightarrow \frac{\bar{\nu}_1}{\bar{\nu}_2} = \frac{500}{81}$ 3. The reaction follow 1st order reaction $\text{R} \rightarrow \text{P}$ Find the fraction of molecules dissociated in time t. $[\text{K}_1 = \text{Rate constant}]$ (1) $1 - e^{-\text{K}_1 t}$ (2) $1 + e^{-\text{K}_1 t}$ (3) $1 - e^{+\text{K}_1 t}$ (4) $e^{-\text{K}_1 t}$ Ans. (1) Sol. For 1st order reaction $a - x = ae^{-\text{K}_1 t}$ $\Rightarrow x = a[1 - e^{-\text{K}_1 t}]$ $\Rightarrow \frac{x}{a} = ' \alpha ' = 1 - e^{-\text{K}_1 t}$	4. For the reaction $\text{A} + \text{B} \rightleftharpoons \text{C} \quad \text{K}_p = 2.7 \times 10^{-5}$ Calculate K_p for the reaction $\frac{1}{3}\text{A} + \frac{1}{3}\text{B} \rightleftharpoons \frac{1}{3}\text{C}$ (1) 3×10^{-3} (2) $\frac{1}{3} \times 10^{-3}$ (3) 9×10^{-3} (4) 3×10^{-2} Ans. (4) Sol. $\text{A} + \text{B} \rightleftharpoons \text{C} \quad \text{K}_p = 2.7 \times 10^{-5}$ $\frac{1}{3}\text{A} + \frac{1}{3}\text{B} \rightleftharpoons \frac{1}{3}\text{C} \Rightarrow \text{K}'_p = (\text{K}_p)^{1/3}$ $\text{K}'_p = (2.7 \times 10^{-5})^{1/3}$ $\text{K}'_p = (27 \times 10^{-6})^{1/3}$ $\text{K}'_p = 3 \times 10^{-2}$ 5. Certain amount of non-volatile, non-electrolyte solute dissolved in 40g solvent, which decreases its vapour pressure from 760 torr to 750 torr. If Boiling pt of solvent and solution are 319.5 K and 320 K respectively. Find moles of solvent used (K_b of solvent = $0.3 \text{ K-Kg mol}^{-1}$): Ans. (5) Sol. $\frac{P^\circ - P_s}{P_s} = i \cdot \text{molality} \times \frac{(\text{M. solvent})}{1000}$ $\Delta T_b = i \cdot \text{K}_b \cdot \text{molality} \Rightarrow \text{molality} = \frac{0.5}{0.3}$ $(\text{Molecular Mass}) = \frac{600}{75} \text{ g}$ $\text{Moles} = \frac{40}{600 / 75} = 5$

6. Solution of 5 ml, 0.1 M NH_3 added with 250 ml, 0.1M NH_4Cl solution. Calculate ($\text{pH} \times 10^{-2}$)
 $\text{pK}_b(\text{NH}_4\text{OH}) = 4.74$ ($\log 5 = 0.7$)

Ans. (756)

Sol. On mixing final volume = 255 ml

$$[\text{NH}_3] = \frac{5 \times 0.1}{255}$$

$$[\text{NH}_4\text{Cl}] = \frac{250 \times 0.1}{255}$$

$$\text{pOH} = \text{pK}_b + \log \frac{[\text{NH}_4\text{Cl}]}{[\text{NH}_3]}$$

$$\text{pOH} = 4.74 + \log \frac{250 \times 0.1}{5 \times 0.1}$$

$$\text{pOH} = 6.44$$

$$\text{pH} = 14 - 6.44 = 7.56$$

7. Calculate number of molecules and moles of SO_2 in its 1.479 lit at STP.

$$(1) 3.92 \times 10^{22}, 0.065 \quad (2) 3.92 \times 10^{23}, 0.65$$

$$(3) 1.96 \times 10^{22}, 0.033 \quad (4) 1.96 \times 10^{23}, 0.33$$

Ans. (1)

Sol. Moles = $\frac{1.479}{22.7} = 0.065$

$$\text{Molecules} = 0.065 \times N_A \\ = 3.92 \times 10^{22}$$

8. An ideal gas placed in a container at (P_1, V_1, T_1) and another ideal gas placed in different container at (P_2, V_2, T_2) are mixed at final pressure of P and final volume of V. Calculate final temperature.

$$(1) \left(\frac{T_1 T_2}{P_1 V_1 T_2 + P_2 V_2 T_1} \right) \cdot \frac{1}{PV}$$

$$(2) \left(\frac{T_1 T_2}{P_1 V_1 T_2 + P_2 V_2 T_1} \right) \cdot PV$$

$$(3) \left(\frac{P_1 V_1 T_2 + P_2 V_2 T_1}{T_1 T_2} \right) \cdot PV$$

$$(4) \left(\frac{P_1 V_1 + P_2 V_2}{T_1 T_2} \right) \cdot \frac{1}{PV}$$

Ans. (2)

Sol. By conservation of moles

$$n_1 + n_2 = n_f$$

$$\frac{P_1 V_1}{RT_1} + \frac{P_2 V_2}{RT_2} = \frac{PV}{RT_f}$$

$$T_f = \left(\frac{T_1 T_2}{P_1 V_1 T_2 + P_2 V_2 T_1} \right) \cdot PV$$

9. **Statement-1** : Heat capacity at constant volume is always greater than heat capacity at constant pressure.

Statement-2 : At constant volume as work done is zero, heat given to the chaotic motion is reflected by increase in temperature.

(1) Statement-1 and statement-2 both are correct.

(2) Statement-1 is correct but statement-2 is incorrect.

(3) Statement-1 is incorrect but statement-2 is correct.

(4) Both statement-1 and statement-2 are incorrect.

Ans. (3)

10. **Statement-1** : Under certain conditions, the covalency of oxygen can be upto 4. In SO_2 , the oxidation state of oxygen is -2 and in OF_2 the oxidation state of oxygen is $+2$.

Statement-2 : The anomalous behaviour of oxygen in 16th group is due to its small size and high electronegativity.

(1) Statement-1 and statement-2 both are correct.

(2) Statement-1 is correct but statement-2 is incorrect.

(3) Statement-1 is incorrect but statement-2 is correct.

(4) Both statement-1 and statement-2 are incorrect.

Ans. (1)

Sol. Oxygen can have covalency 4

In SO_2 ; O.S. of O = -2

In OF_2 ; O.S. of O = $+2$

Anomalous behaviour of oxygen is due to high EN and small size.

11. Anion X^- contains 45 neutrons & 36 electrons. The Atomic mass period number & state in which "X" exists is :

(1) Atomic mass : 80 ; Period number = 3; State = liquid

(2) Atomic mass : 35 ; Period number = 3; State = gas

(3) Atomic mass : 80 ; Period number = 4; State = liquid

(4) Atomic mass : 127 ; Period number = 5; State = Solid

Ans. (3)

Sol. X = Br ; Atomic mass = 80

Period 4

Br_2 exist as liquid.

12. Find the value of n , ℓ , m and s for 19^{th} e^- of Cr atom :

$$(1) n = 3 ; \ell = 2 ; m = 1 ; S = +\frac{1}{2}$$

$$(2) n = 4 ; \ell = 0 ; m = 0 ; S = +\frac{1}{2}$$

$$(3) n = 2 ; \ell = 1 ; m = 1 ; S = -\frac{1}{2}$$

$$(4) n = 3 ; \ell = 2 ; m = 0 ; S = 0$$

Ans. (2)

Sol. Cr $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

$\Rightarrow$ 19^{th} e^- belongs to 4s subshell

$$n = 4 ; \ell = 0 ; m = 0 ; s = +\frac{1}{2} \text{ or } -\frac{1}{2}$$

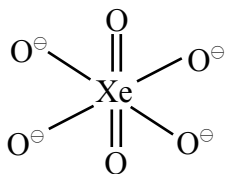
13. In the molecule XeO_6^{-4} ; total number of lone pairs and σ bond pairs on central atom Xe are :-

Ans. σ bond pair + lone pair = $6 + 0 = 6$

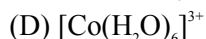
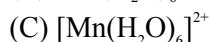
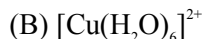
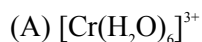
Sol. $\text{XeO}_6^{-4} \Rightarrow \text{Xe} = sp^3 d^2$ hybridized .

bond pair = 6 [σ bonds]

lone pair = 0



14. Column-I
Complex



Column-II

Spin only magnetic moment (in BM)

(P) 1.73

(Q) 3.87

(R) 0

(S) 5.93

Choose the correct match

(1) $A \rightarrow Q ; B \rightarrow P ; C \rightarrow S ; D \rightarrow R$

(2) $A \rightarrow P ; B \rightarrow Q ; C \rightarrow S ; D \rightarrow R$

(3) $A \rightarrow P ; B \rightarrow Q ; C \rightarrow R ; D \rightarrow S$

(4) $A \rightarrow Q ; B \rightarrow S ; C \rightarrow P ; D \rightarrow R$

Ans. (1)

Sol. $[\text{Cr}(\text{H}_2\text{O})_6]^{3+} \rightarrow 3$ unpaired e^- ; 3.87 BM

$[\text{Cu}(\text{H}_2\text{O})_6]^{2+} \rightarrow 1$ unpaired e^- ; 1.73 BM

$[\text{Mn}(\text{H}_2\text{O})_6]^{2+} \rightarrow 5$ unpaired e^- ; 5.91 BM

$[\text{Co}(\text{H}_2\text{O})_6]^{3+} \rightarrow 0$ unpaired e^- ; 0 BM

15. (A) Bond angle Cr–O–Cr in CrO_7^{2-} is 126°

(B) $\text{Na}_2\text{Cr}_2\text{O}_7$ is used as primary standard solution in titration.

(C) $\text{K}_2\text{Cr}_2\text{O}_7$ oxidises Fe^{2+} into Fe^{3+} in acidic medium.

(D) CrO_4^{2-} and $\text{Cr}_2\text{O}_7^{2-}$ are interconvertible by changing PH.

Correct statements are :

(1) A, C, D only (2) B, C, D only

(3) A, B, C only (4) A, B, D only

Ans. (1)

Sol. $\text{K}_2\text{Cr}_2\text{O}_7$ is a good oxidising agent and bond angle of Cr–O–Cr bond in $\text{Cr}_2\text{O}_7^{2-}$ is 126°

$\text{Na}_2\text{Cr}_2\text{O}_7$ is not a primary standard.

In acidic medium $\text{Cr}_2\text{O}_7^{2-}$ exists and it get converted into CrO_4^{2-} in basic medium.

16. Match the column :

	Column-I (Reaction)		Column-II (Reagent)
(A)	Finkelstein reaction	(P)	$\text{NaI}/\text{Acetone}$
(B)	Swarts reaction	(Q)	Na/THF
(C)	Fittig reaction	(R)	$\text{Cu}_2\text{Cl}_2/\text{HCl}$
(D)	Sandmeyer reaction	(S)	SbF_3

Match correct reagents with given reactions :

(1) A-S ; B-Q ; C-P ; D-R

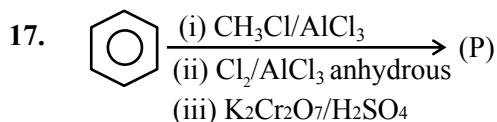
(2) A-P ; B-S ; C-Q ; D-R

(3) A-S ; B-Q ; C-R ; D-P

(4) A-Q ; B-P ; C-S ; D-R

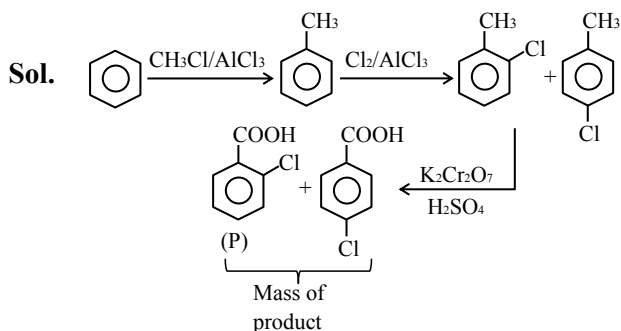
Ans. (2)

Sol. Theory based



When X gm of product P react with NaHCO_3 , $11.2 \text{ dm}^3 \text{ CO}_2$ gas at STP is obtained. Find out the mass of P in gram.

Ans. (78.25 gm)



$$\text{No. of P} = \frac{11.2}{22.4} = 0.5 \text{ mole}$$

$$M_{\text{C}_7\text{H}_5\text{O}_2\text{Cl}} = 156.5 \text{ gm}$$

$$W_{\text{P(C}_7\text{H}_5\text{O}_2\text{Cl)}} = 156.5 \times 2 = 78.25$$

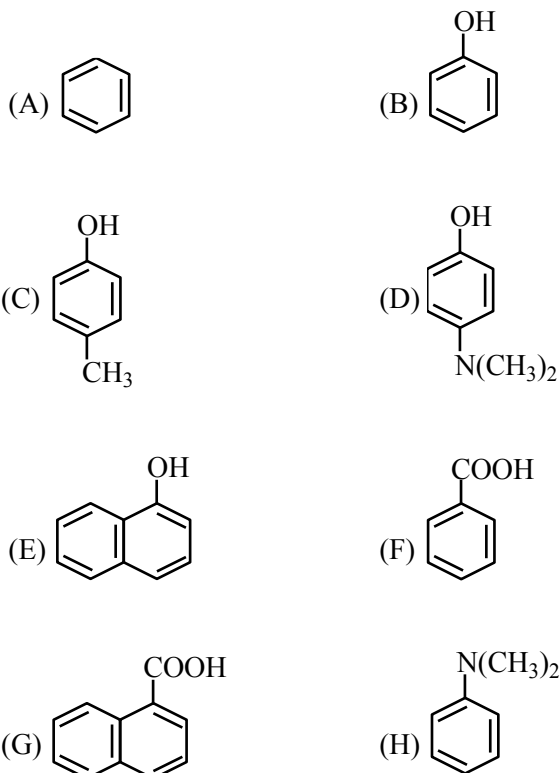
18. Arrange the following groups according to their decreasing order of electron withdrawing nature – COOH , $-\text{CN}$ and $-\text{NO}_2$

- (1) $-\text{CN} > -\text{NO}_2 > -\text{I} > -\text{COOH}$
- (2) $-\text{NO}_2 > -\text{CN} > -\text{COOH} > -\text{I}$
- (3) $-\text{COOH} > -\text{CN} > -\text{I} > -\text{NO}_2$
- (4) $-\text{I} > -\text{COOH} > -\text{NO}_2 > -\text{CN}$

Ans. (2)

Sol. Theory based

19. Soluble in aq. NaOH



(1) 4

(2) 5

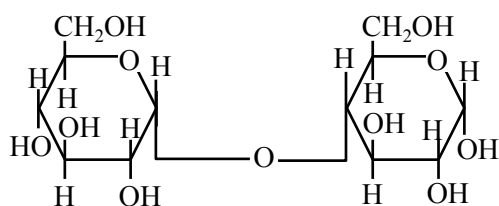
(3) 6

(4) 7

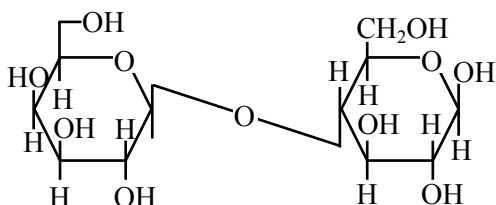
Ans. (3)

Sol. (B), (C), (D), (E), (F), (G)

20. **Statement-1** : Maltose is a non reducing sugar



Statement-2 : Lactose is a reducing sugar.



- (1) Both statement 1 and statement 2 are correct
 (2) Statement 1 is correct and statement 2 is incorrect
 (3) Statement 1 is incorrect and statement 2 is correct.
 (4) Both statement 1 and statement 2 are incorrect

Ans. (3)

Sol. Maltose and lactose both have anomeric OH group so both are reducing sugar

21. Match the column-I with column-II :

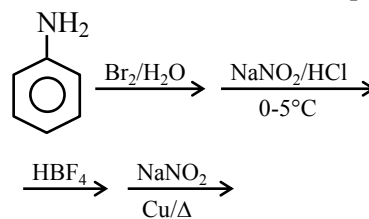
	Column-I (Name of amino acid)		Column-II (One letter code)
(A)	Arginine	(P)	K Essential
(B)	Lysine	(Q)	R Essential
(C)	Aspartic acid	(R)	D Non essential
(D)	Glutamic acid	(S)	E Non essential

- (1) A-P ; B-Q ; C-R ; D-S
 (2) A-Q ; B-P ; C-R ; D-S
 (3) A-Q ; B-P ; C-S ; D-R
 (4) A-R ; B-S ; C-P ; D-Q

Ans. (2)

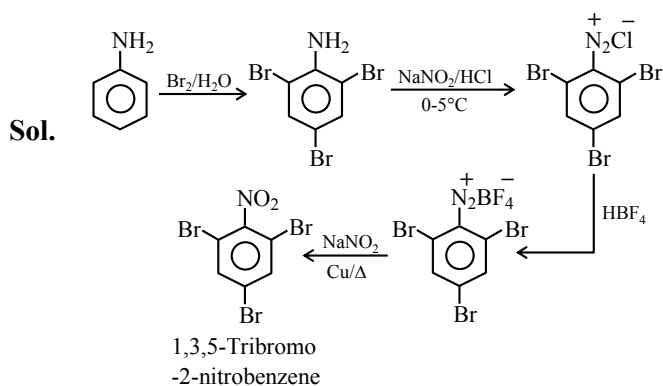
Sol. Arginine (R) and Lysine (K) are essential amino acid on the other hand Aspartic acid (D) and Glutamic acid (E) are Non-essential amino acid.

22. IUPAC Name of formed compound :

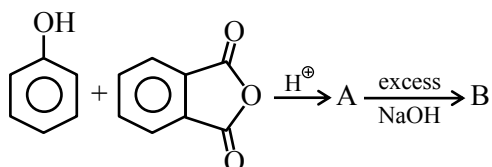


- (1) 2,4,6-Tribromo-1-nitrobenzene
 (2) 4-Bromonitrobenzene
 (3) 1,3,5-Tribromo-2-nitrobenzene
 (4) 1,3,5-Tribromofluorobenzene

Ans. (3)



23. Consider following reaction :

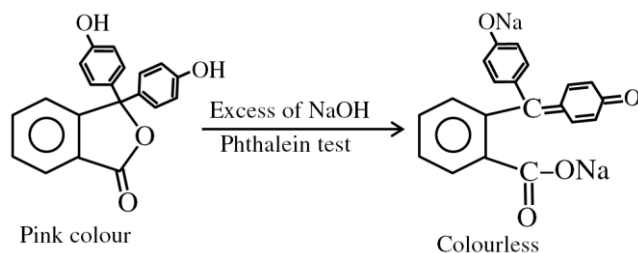


What is the colour of final compound B ?

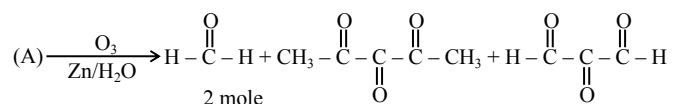
- (1) Violet (2) Red
 (3) Colourless (4) Pink

Ans. (3)

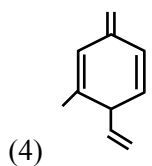
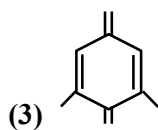
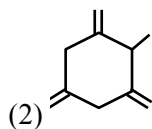
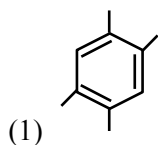
Sol. A is Phenolphthalein



24.

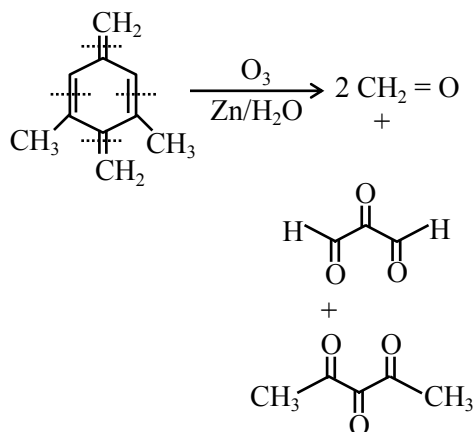


Identify the structure of compound A.



Ans. (3)

Sol.



25. 2 gm of organic compound on heating with AgNO_3 in Carius method, 3.36 gm of AgBr was obtained. How many no. of carbons atoms are present in empirical formula ?

(% of carbon in organic compound is 26.7%)

Ans. (5)

Sol. $n_{\text{Br}} = \frac{3.36}{(108 + 80)}$

r = no. of Br atoms in organic compound

$$n_{\text{organic compound}} = \frac{3.36}{(108 + 80) \times x} = \frac{2}{M}$$

$$M = \frac{2 \times 188 \times x}{3.36}$$

$$M = \frac{1}{2} \times x$$

(x is integer)

$$W_c = \frac{112 \times x \times 26.7}{100} = 30 \times x$$

$$n_c = \frac{30 \times x}{12} = 2.5 \times x$$

take $x = 2$, $n_c = 5$

JEE–MAIN EXAMINATION – APRIL 2026
MEMORY BASED QUESTIONS

(HELD ON SATURDAY 04th APRIL 2026)

TIME : 9:00 AM TO 12:00 NOON

MATHEMATICS	TEST PAPER WITH SOLUTION
1. If $\vec{a}_R = \tan \theta_R \hat{i} + \hat{j}$ & $\vec{b}_R = \hat{i} - \cot \theta_R \hat{k}$ where $\theta_R = \frac{2^{R-1}\pi}{2^N+1}$ then the value of $\frac{\sum_{R=1}^N \vec{a}_R ^2}{\sum_{R=1}^N \vec{b}_R ^2}$ is (1) 1 (2) 2 (3) 3 (4) 4 Ans. (1) Sol. $\vec{a}_R ^2 = \sec^2 \theta_R$ $\vec{b}_R ^2 = \operatorname{cosec}^2 \theta_R$ $S = \frac{\sec^2 \frac{\pi}{2^N+1} + \sec^2 \frac{2\pi}{2^N+1} + \dots + \sec^2 \frac{2^{N-1}\pi}{2^N+1}}{\operatorname{cosec}^2 \frac{\pi}{2^N+1} + \operatorname{cosec}^2 \frac{2\pi}{2^N+1} + \dots + \operatorname{cosec}^2 \frac{2^{N-1}\pi}{2^N+1}}$ $S = \frac{\sec^2 \frac{\pi}{2^N+1} + \sec^2 \frac{2\pi}{2^N+1} + \dots + \sec^2 \frac{2^{N-1}\pi}{2^N+1}}{\sec^2 \frac{2^{N-1}\pi}{2^N+1} + \dots + \sec^2 \frac{\pi}{2^N+1}} = 1$ 2. Let A is a matrix of order 3 such that $A = -4$ then, the value of $\left \operatorname{adj}(\operatorname{adj}(2\operatorname{adj}A)^{-1}) \right$ is (1) $\frac{1}{2^{26}}$ (2) $\frac{1}{2^{27}}$ (3) $\frac{1}{2^{28}}$ (4) $\frac{1}{2^{29}}$ Ans. (3) Sol. $\left \operatorname{adj}(\operatorname{adj}(2\operatorname{adj}A)^{-1}) \right$ $= \left (2\operatorname{adj}A)^{-1} \right ^4$ $= \frac{1}{ 2\operatorname{adj}A ^4} = \frac{1}{(2^3)^4 \operatorname{adj}A ^4}$ $= \frac{1}{2^{12} (-4)^8} = \frac{1}{2^{28}}$	3. If $A = \frac{\sin 3^\circ}{\cos 9^\circ} + \frac{\sin 9^\circ}{\cos 27^\circ} + \frac{\sin 27^\circ}{\cos 81^\circ}$ and $B = \tan 81^\circ - \tan 3^\circ$, find $\frac{B}{A}$ (1) 2 (2) 4 (3) 6 (4) 8 Ans. (1) Sol. Consider $E = \frac{\sin \theta}{\cos 3\theta} \Rightarrow E = \frac{2 \sin \theta \cos \theta}{2 \cos 3\theta \cos \theta}$ $\Rightarrow E = \frac{\sin 2\theta}{2 \cos 3\theta \cos \theta} \Rightarrow E = \frac{\sin(3\theta - \theta)}{2 \cos 3\theta \cos \theta}$ $\Rightarrow E = \frac{1}{2} [\tan 3\theta - \tan \theta]$ $\therefore A = \frac{1}{2} [\tan 9^\circ - \tan 3^\circ + \tan 27^\circ - \tan 9^\circ + \tan 81^\circ - \tan 27^\circ]$ $\therefore A = \frac{1}{2} [\tan 81^\circ - \tan 3^\circ]$ $\therefore \frac{B}{A} = 2$ 4. If $f(x) = \min \{2x^2 + 3, 6x\} + x-1 \cos\left(x^2 - \frac{1}{4}\right)$ then the number of points of non derivability of $f(x)$ is/are (1) 1 (2) 2 (3) 3 (4) 4 Ans. (3) Sol. $x-1 \cos\left(x^2 - \frac{1}{4}\right)$ is non derivable at $x = 1$

for $\min \{2x^2 + 3, 6x\}$

$$\therefore 2x^2 + 3 = 6x$$

$$\Rightarrow 2x^2 - 6x + 3 = 0$$

$$\Rightarrow x = 3 \pm \sqrt{3}$$

$\therefore$ 2 points of non derivability for this part

Hence there are three points of non derivability.

5. If $\int_{-2}^2 ([\sin x] + |x \sin x|) dx = 2 \sin 2 - 4 \cos 2 - \beta$

then the value of $|\beta|$ where $[\cdot]$ is GIF is

(1) 4

(2) 12

(3) 16

(4) 20

Ans. (2)

Sol. $\int_{-2}^2 [\sin x] dx + 2 \int_0^2 x \sin x dx$

$$2(-2 \cos 2 + \sin 2) - 4$$

$$\text{So } \beta = 4$$

6. Consider the differential equation

$$\frac{dy}{dx} = (x^2 + x + 1)(y^2 - y + 1)$$

If $y(0) = \frac{1}{2}$ then the value of $2(y(1)) - 1$ is

(1) $\sqrt{3} \tan\left(\frac{11\sqrt{3}}{12}\right)$ (2) $\sqrt{3} \tan\left(\frac{12\sqrt{3}}{17}\right)$

(3) $\sqrt{2} \tan\left(\frac{11\sqrt{3}}{12}\right)$ (4) $\sqrt{2} \tan\left(\frac{12\sqrt{3}}{11}\right)$

Ans. (1)

Sol. $\frac{dy}{y^2 - y + 1} = (x^2 + x + 1) dx$

$$\frac{dy}{\left(y - \frac{1}{2}\right)^2 + \left(\frac{\sqrt{3}}{2}\right)^2} = (x^2 + x + 1) dx$$

$$\frac{2}{\sqrt{3}} \tan^{-1} \left(\frac{y - \frac{1}{2}}{\frac{\sqrt{3}}{2}} \right) = \frac{x^3}{3} + \frac{x^2}{2} + x + C$$

$$\frac{2}{\sqrt{3}} \tan^{-1} \left(\frac{2y - 1}{\sqrt{3}} \right) = \frac{x^3}{3} + \frac{x^2}{2} + x + C$$

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

$$\frac{2}{\sqrt{3}} \tan^{-1} \left(\frac{2y - 1}{\sqrt{3}} \right) = \frac{x^3}{3} + \frac{x^2}{2} + x$$

put $x=1$

$$\frac{2}{\sqrt{3}} \tan^{-1} \left(\frac{2y - 1}{\sqrt{3}} \right) = \frac{1}{3} + \frac{1}{2} + 1 = \frac{2+3+6}{6} = \frac{11}{6}$$

$$\tan^{-1} \left(\frac{2y - 1}{\sqrt{3}} \right) = \frac{11\sqrt{3}}{12}$$

$$\frac{2y - 1}{\sqrt{3}} = \tan \left(\frac{11\sqrt{3}}{12} \right)$$

$$\Rightarrow 2y(1) - 1 = \sqrt{3} \tan \left(\frac{11\sqrt{3}}{12} \right)$$

7. The domain of $f(x) = \cos^{-1} \left(\frac{4x + 2[x]}{3} \right)$ (where $[x]$

denotes greatest integer function) is

(1) $\left[-\frac{1}{4}, \frac{3}{4}\right]$ (2) $\left[-\frac{3}{4}, \frac{1}{4}\right]$

(3) $\left[-\frac{3}{4}, -\frac{1}{4}\right]$ (4) $\left[\frac{1}{4}, \frac{3}{4}\right]$

Ans. (1)

Sol. $-1 \leq \frac{4x + 2[x]}{3} \leq 1$

$$4x + 3 + 2[x] \geq 0$$

$$4x + 2[x] - 3 \leq 0$$

$$2[x] \geq -4x - 3$$

$$2[x] \leq 3 - 4x$$

$$x \in \left[-\frac{1}{4}, \infty\right) \dots (1)$$

$$x \in \left(-\infty, \frac{3}{4}\right] \dots (2)$$

$$(1) \cap (2)$$

$$x \in \left[-\frac{1}{4}, \frac{3}{4}\right]$$

8. If Z be a complex number such that

$$|Z + 2| = |Z - 2| \text{ and } \arg \left(\frac{Z-3}{Z+1} \right) = \frac{\pi}{4} \text{ then the}$$

value of $|Z|^2$ is :

- (1) 7 (2) 8
(3) 9 (4) 10

Ans. (3)

Sol. $|Z + 2| = |Z - 2|$

$$\Rightarrow x = 0$$

$$\arg \frac{Z-3}{Z+1} = \frac{\pi}{4}$$

$$\arg \frac{(x+iy)-3}{(x+iy)+1} = \frac{\pi}{4}$$

$$x = 0$$

$$\arg \frac{(-3+iy)(1-iy)}{1+y^2} = \frac{\pi}{4}$$

$$\Rightarrow \frac{-3+y^2}{y+3} = 1$$

$$y^2 - y - 6 = 0$$

$$y = 3, -2$$

$$Z = 3i, -2i$$

$$\Rightarrow |Z|^2 = 9 \text{ or } 4$$

9. If coefficient of x^3 in $(1+x)^3 + (1+x)^4 + \dots$

$$(1+x)^{99} + (1+kx)^{100} \text{ is } \binom{100}{3} \left(\frac{101}{4} - 43n \right) \text{ then the}$$

value of $(k^3 + 43n)$ is :

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

Ans. (1)

$$\text{Sol. } {}^3C_3 + {}^4C_3 + {}^5C_3 + \dots + {}^{99}C_3 + {}^{100}C_3 k^3 \\ = {}^{100}C_3 \left(\frac{101}{4} - 43n \right)$$

$${}^{100}C_4 + {}^{100}C_3 k^3 = {}^{100}C_3 \left(\frac{101}{4} - 43n \right)$$

$${}^{100}C_4 + {}^{100}C_3 k^3 = {}^{101}C_4 - {}^{100}C_3 \cdot 43n$$

$${}^{100}C_3 (43n + k^3) = {}^{101}C_4 - {}^{100}C_4$$

$${}^{100}C_3 (43n + k^3) = {}^{100}C_3$$

$$k^3 + 43n = 1$$

10. If $S = \{A : A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}, A^2 - 4A + 3I = \text{Null matrix, } a, b, c, d, \in \{0, 1, 2, 3, 4\} \text{ \& } \text{Tr}(A) = 4\}$

Then the number of element of set S is/are :

- (1) 19 (2) 18
(3) 17 (4) 15

Ans. (1)

Sol. $ad - bc = 3 ; a + d = 4$

$$\boxed{C-1} \quad a = 0, d = 4 ; bc = -3 \text{ Not possible}$$

$$\boxed{C-2} \quad a = 1, d = 3 ; bc = 0$$

↓

$$\text{No. of matrix} = 2 \times (5^2 - 4^2)$$

$$\boxed{C-3} \quad a = 2, ; bc = 1$$

↓

$$\text{No. of matrix} = 1$$

$$\text{Total} = 2 \times 9 + 1 = 19$$

11. Let $y = \tan^{-1}\left(\frac{3\cos x - 4\sin x}{4\cos x + 3\sin x}\right) + \tan^{-1}\left(\frac{x}{1+\sqrt{1+x^2}}\right)$.

Then the value of $\frac{dy}{dx}$ at $x = \frac{\sqrt{3}}{2}$ is :

- (1) $-\frac{5}{7}$ (2) $\frac{3}{7}$
(3) $-\frac{3}{2}$ (4) $\frac{5}{7}$

Ans. (1)

Sol. $y = \tan^{-1}\left[\frac{\frac{3}{4} - \tan x}{1 + \frac{3}{4}\tan x}\right] + \tan^{-1}\left[\frac{x}{1+\sqrt{1+x^2}}\right]$

Put $\tan^{-1}x = \theta$

$$\tan^{-1}\left[\frac{\tan \theta}{1 + \sec \theta}\right] = \tan^{-1}\frac{\sin \theta}{1 + \cos \theta}$$

$$\tan^{-1}\tan\frac{\theta}{2} = \frac{\theta}{2} = \frac{\tan^{-1}x}{2}$$

$$y = \tan^{-1}\frac{3}{4} - \tan^{-1}(\tan x) + \frac{\tan^{-1}x}{2}$$

$$y = \tan^{-1}\frac{3}{4} - x + \frac{\tan^{-1}x}{2}$$

$$\frac{dy}{dx} = -1 + \frac{1}{2(1+x^2)}$$

$$\left.\frac{dy}{dx}\right|_{\frac{\sqrt{3}}{2}} = -1 + \frac{1}{2\left(1+\frac{3}{4}\right)} = -1 + \frac{2}{7} = -\frac{5}{7}$$

12. Let mean and median of 9 observations 8, 13, a, 17, 21, 51, 103, b, 67 are 40 and 21 respectively where $a > b$. If mean deviation about median is 26 then $2a$ is :-

- (1) 130 (2) 131
(3) 51 (4) 40

Ans. (2)

Sol. $\frac{8+13+a+17+21+51+103+b+67}{9} = 40$

$$a + b + 280 = 360 \Rightarrow a + b = 80 \quad \dots\dots(1)$$

$$8, 13, 17, b, 21, 51, a, 67, 103 \quad (a > b)$$

$$\text{Mean deviation} = \frac{\sum |x_i - M|}{n}$$

$$\Rightarrow \frac{\sum |x_i - 21|}{9} = 26$$

$$\Rightarrow \frac{1}{9}(13+8+4+21-b+0+30+a-21+46+82) = 26$$

$$\Rightarrow a - b = 51 \quad \dots(2)$$

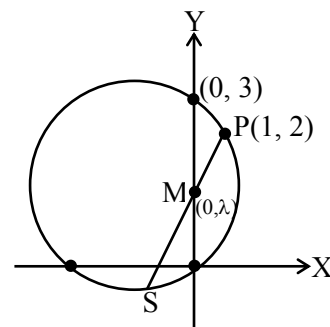
$$(1) + (2) \Rightarrow 2a = 131$$

13. A circle $x^2 + y^2 + x - 3y = 0$ passes through P(1, 2) if 2 chords (PS & PR) drawn from P are bisected by y-axis, then mid point of RS is (α, β) , find $6(\alpha + \beta)$

- (1) 3 (2) 5
(3) 4 (4) 7

Ans. (1)

Sol.



chord PS bisected by y-axis

at point M(0, λ)

$$\therefore S(-1, 2\lambda - 2)$$

Which satisfy equation of circle

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

$$\Rightarrow \lambda = 1 \quad \& \quad \lambda = \frac{5}{2}$$

Therefore two such chord PS & PR will exist

$$\text{When } \lambda = 1 \Rightarrow S(-1, 0)$$

$$\text{When } \lambda = \frac{5}{2} \quad R(-1, 3)$$

$$\therefore \text{Mid point of R \& S will be } \left(-1, \frac{3}{2}\right)$$

$$\therefore \alpha = -1, \beta = \frac{3}{2}$$

$$\therefore 6(\alpha + \beta) = 3$$

14. Let $A = \{1, 2, 3, 4, 5\}$ and $B = \{a, b, c\}$ then total number of functions from A to B which are not onto are

- (1) 84 (2) 93
(3) 100 (4) 54

Ans. (2)

Sol. Total into function $= 3 \times 2^5 - 3$

15. Find number of ways of arranging 4 Boys & 3 Girls such that all girls are not together :

- (1) 4430 (2) 4445
(3) 4320 (4) 4431

Ans. (3)

Sol. 4B, 3G

Total – when all girls are together

$$\square - \underline{5} \times \underline{3}$$

$$7 \times 6 \underline{5} - \underline{5} \times \underline{3}$$

$$6 \times \underline{5} \times 6 = 36 \times 120 = 4320$$

16. If Latus rectum of parabola $y^2 = 4kx$ and ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \text{ coincide then the value of } e^2 + 2\sqrt{2} \text{ is,}$$

where e is eccentricity of ellipse

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

Ans. (2)

Sol. LR $x = ae$ & $x = k$

$$k = ae \quad \frac{b^2}{a} = 2k$$

$$b^2 = 2a^2e$$

$$\frac{b^2}{a^2} = 2e$$

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

$$e^2 + 2e - 1 = 0$$

$$e = \sqrt{2} - 1$$

$$e^2 = 3 - 2\sqrt{2}$$

$$e^2 + 2\sqrt{2} = 3$$

17. If $L_1 : x - y = 0$, $L_2 : y = -3x$, L_3 is obtuse angle bisector of L_1 & L_2 and L_4 is $x + 3 = 0$.

A is point of intersection of L_4 & L_1

B is point of intersection of L_4 & L_2

C is point of intersection of L_4 & L_3

Then the value of $\frac{(BC)^2}{(AC)^2}$

- (1) 4 (2) 5
(3) 6 (4) 7

Ans. (2)

Sol. $L_3 : \frac{x-y}{\sqrt{2}} = \frac{y+3x}{\sqrt{10}}$

$$\Rightarrow L_3 : x - y = \frac{y + 3x}{\sqrt{5}}$$

Pt. A $(-3, -3)$

B $(-3, 9)$

$$C \left(-3, \frac{3(3 - \sqrt{5})}{1 + \sqrt{5}} \right)$$

$$BC = \left| \frac{9 - 3\sqrt{5} - 9 - 9\sqrt{5}}{1 + \sqrt{5}} \right| = \frac{12\sqrt{5}}{1 + \sqrt{5}}$$

$$AC = \left| \frac{9 - 3\sqrt{5} + 3 + 3\sqrt{5}}{1 + \sqrt{5}} \right| = \frac{12}{1 + \sqrt{5}}$$

$$\frac{BC}{AC} = \sqrt{5}$$

$$\Rightarrow \frac{BC^2}{AC^2} = 5$$

18. In an A.P. first term is $\frac{10}{3}$ and first 30 terms are non-negative such that sum of first 30 terms $= (T_{30})^3$, then d is equal to

(where T_n is n^{th} term of A.P., and d is the common difference of A.P.)

- (1) $\frac{3}{87}$ (2) $\frac{5}{87}$
(3) $\frac{7}{87}$ (4) $\frac{9}{87}$

Ans. (2)

Sol. $a = \frac{10}{3} : S_{30} = (T_{30})^3$

$$\frac{30}{2} \left[2 \times \frac{10}{3} + 29d \right] = \left[\frac{10}{3} + 29d \right]^3$$

$$15 \left(\frac{20}{3} + 29d \right) = \left(\frac{10}{3} + 29d \right)^3$$

$$15 \left(\frac{10}{3} + \frac{10}{3} + 29d \right) = \left(\frac{10}{3} + 29d \right)^3$$

By observation $\frac{10}{3} + 29d = 5$

$$29d = 5 - \frac{10}{3} = \frac{5}{3}$$

$$d = \frac{5}{87}$$

- 19.** If $f(x)$ is a non-constant polynomial satisfying $f(x) = f'(x)f''(x)$ and $f(0) = 0$.

Then the value of $\int_0^2 f(x)dx + f'(2) + f''(2)$ is :

- (1) $\frac{14}{9}$ (2) $\frac{14}{11}$
(3) $\frac{11}{14}$ (4) $\frac{9}{14}$

Ans. (1)

Sol. $n = n - 1 + n - 2 \Rightarrow n = 3$

$$f(x) = ax^3 + bx^2 + cx$$

$$f(x) = f'(x) f''(x)$$

$$(ax^3 + bx^2 + cx) = (3ax^2 + 2bx + c) (6ax + 2b)$$

$$x^3 : a = 18a^2 \Rightarrow a = \frac{1}{18}$$

$$x^2 : b = 6ab + 12ab$$

$$x : c = 4b^2 + 6ac \Rightarrow \frac{2C}{3} = 4b^2 \Rightarrow b^2 = \frac{c}{6}$$

$$\text{const} : bc = 0 \Rightarrow b = c = 0$$

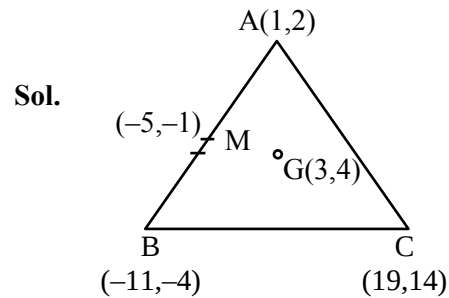
$$\int_0^2 f(x)dx + f'(2) + f''(2)$$

$$\int_0^2 ax^3 dx + 12a + 12a = 4a + 24a = 28a = \frac{28}{18} = \frac{14}{9}$$

- 20.** Let in a ΔABC , given that $A \equiv (1,2)$, mid-point of AB is $(-5, -1)$ and centroid is $(3,4)$ then circumcentre is (α, β) , then the value of $21(\alpha + \beta)$ is :

- (1) 305 (2) 315
(3) 351 (4) 350

Ans. (2)



Now we can find the circumcenter of ΔABC as $(-26, 41)$

$$\therefore \text{Value of } 21(-26 + 41) = 315$$

- 21.** If a coin is tossed 8 times and probability of getting exactly 3 heads in first 6 tosses and exactly 2 tails in last 5 tosses is p then $64p$ is

Ans. (7)

Sol. -----

HHH TTT -- $\times$

--- --- --

$$2H, 1T \quad 1H, 2T \quad 2H \rightarrow 3 \times 3 = 9$$

--- --- --

$$1H, 2T \quad 2H, 1T \quad 1T, 1H \rightarrow 3 \times 3 \times 2 = 18$$

--- --- --

$$3T \quad 3H \quad 2T \rightarrow 1$$

$$\text{Now, } p = \frac{28}{2^8} = \frac{7}{64}$$

$$\therefore 64p = 7$$