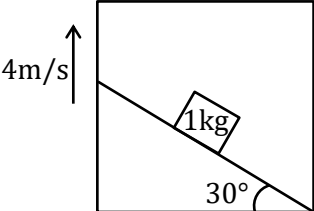
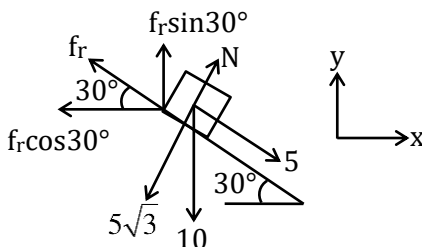


JEE–MAIN EXAMINATION – APRIL 2026

MEMORY BASED QUESTIONS

(HELD ON SUNDAY 05th APRIL 2026)

TIME : 3:00 PM TO 6:00 PM

PHYSICS	TEST PAPER WITH SOLUTION
1. If x gm of water at 50°C cools to 0°C, the heat released is H. If $(100 - x)$ gm of water at 50°C is completely vapourised, the heat required is also H. Find x. (1) 8 gm (2) 20 gm (3) 92.18 gm (4) 80 gm Ans. (3) Sol. x gm water $50^\circ\text{C} \longrightarrow 0^\circ\text{C}$ $H = mS\Delta T$ $H = x(1)(50 - 0)$ $H = 50x$... (1) $(100 - x)$ $50^\circ\text{C} \longrightarrow 100^\circ\text{C}$ (Steam) $H = (100 - x)(1)(100 - 50) + (100 - x)(540)$... (2) $(1) = (2)$ $50x = 5000 - 50x + 54000 - 540x$ $640x = 59000$ $x = 92.18$ gm 2. Friction is sufficient so that the block do not slide. Find work done by friction in 2 sec.  (1) 45 (2) 40 (3) 20 (4) 10 Ans. (3)	Sol.  $f_r = 5$ $(W_d)_f = (f_r)_y (\text{displacement})_y$ $(f_r)_y = f_r \sin 30^\circ = \frac{5}{2}$ $(\text{displacement})_y = 4 \times 2$ $(W_d)_{f_r} = \frac{5}{2} \times (4 \times 2) = 20$ 3. A wheel initially at rest is subjected to a uniform angular acceleration about its axis. In the first 2 sec it rotates through an angle θ_1 and in the next 2 sec it rotates an angle θ_2. Find the ratio of θ_2/θ_1. (1) 5 (2) 2 (3) 4 (4) 3 Ans. (4) Sol. In first 2 sec, $\theta_1 = \frac{1}{2}\alpha(2)^2$ $\theta_1 = 2\alpha$... (1) In first 4 sec, $\theta' = \frac{1}{2}\alpha(4)^2 = 8\alpha$... (2) In next 2 sec $\theta_2 = 8\alpha - 2\alpha = 6\alpha$ Ratio of $\frac{\theta_2}{\theta_1} = \frac{6\alpha}{2\alpha} = 3$

4. There is metallic ring of radius 20 cm placed in uniform unsteady field $B = (2t^2 + 2t + 3)T$ perpendicular to plane of ring. If resistance of ring is 2Ω , find induced current at $t = 2$ sec. $[\pi = 22/7]$

- (1) 0.63 Amp (2) 0.063 Amp
(3) 0.3 Amp (4) 6.3 Amp

Ans. (1)

Sol. $\varepsilon = \frac{d\phi}{dt} = A \frac{dB}{dt}$

$$\varepsilon = \pi(20 \times 10^{-2})^2 \times (4t + 2)$$

$$\varepsilon = 4\pi \times 10^{-2}(4t + 2)$$

$$\text{at } t = 2 \text{ sec}$$

$$\varepsilon = 0.4\pi$$

$$I = \frac{\varepsilon}{R} = \frac{0.4\pi}{2} = 0.2 \times \pi$$

$$= \frac{4.4}{7} = 0.628 \approx 0.63 \text{ Amp}$$

5. An electron travelling with velocity v in free space and when it enters a medium, its velocity is reduced by 20%. The de-Broglie wavelength of electron in the medium is $\alpha\lambda_0$, where λ_0 is de-Broglie wavelength in free space. The value of α is:-

- (1) 1.25 (2) 1.5
(3) 0.8 (4) 0.125

Ans. (1)

Sol. $v_0 \rightarrow v_0 - 0.2 v_0 = 0.8 v_0$

$$\lambda \propto \frac{1}{v}$$

$$\frac{\lambda_1}{\lambda_2} = \frac{v_2}{v_1} = 0.8$$

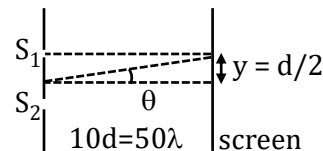
$$\lambda_2 = 1.25 \lambda_0$$

6. In YDSE setup slit separation is $d = 5\lambda$, where λ is wavelength of light and screen is placed at distance $D = 10d$. If maximum intensity is I_0 , find intensity at a point directly in front of one of the slit.

- (1) I_0 (2) $\frac{I_0}{3}$
(3) $\frac{I_0}{2}$ (4) $\frac{I_0}{6}$

Ans. (3)

Sol.



$$\text{Path difference } \Delta x = d \sin \theta$$

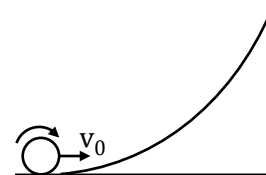
$$= \frac{dy}{\sqrt{\left(\frac{d}{2}\right)^2 + (10d)^2}}$$

$$\Delta x = \frac{d^2}{d\sqrt{1+400}} \approx \frac{d}{20} = \frac{5\lambda}{20} = \frac{\lambda}{4}$$

$$\Delta \phi = \frac{2\pi}{\lambda} \Delta x = \frac{2\pi}{\lambda} \times \frac{\lambda}{4} = \frac{\pi}{2}$$

$$I = I_0 \cos^2\left(\frac{\Delta \phi}{2}\right) = I_0 \cos^2\left(\frac{\pi}{4}\right) = \frac{I_0}{2}$$

7. If the rolling object reaches a maximum height $\frac{7V_0^2}{10g}$. What may be the object?



- (1) Solid sphere
(2) Ring
(3) Disc
(4) Hollow sphere

Ans. (1)

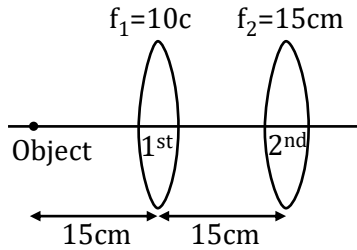
Sol. Using energy conservation

$$\frac{1}{2}mv_0^2 + \frac{1}{2}I_{\text{COM}} \times \left(\frac{v_0}{R}\right)^2 = mg \times \frac{7v_0^2}{10g}$$

$$I_{\text{CM}} \times \frac{1}{R^2} = \frac{2}{5}m$$

$$I_{\text{CM}} = \frac{2}{5}mR^2$$

8. Find distance of final image from 2nd lens.



- (1) 15 cm (2) ∞
(3) 7.5 cm (4) 30 cm

Ans. (3)

Sol. For 1st lens

$$u = -15 \text{ cm}; f = +15$$

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

$$\frac{1}{v} - \frac{1}{-15} = \frac{1}{10}$$

$$\frac{1}{v} = \frac{1}{10} - \frac{1}{15} = \frac{3-2}{30}$$

$$v = +30$$

For 2nd lens

$$u = +15; f = +15$$

$$\frac{1}{v} - \frac{1}{15} = \frac{1}{15}$$

$$\frac{1}{v} = \frac{1}{15} + \frac{1}{15} = \frac{2}{15}$$

$$v = \frac{15}{2} = 7.5 \text{ cm}$$

Final image is 7.5 cm right of 2nd lens.

9. If across a resistance, voltage applied is $(20 \pm 0.2)V$ and current passing through it is $(10 \pm 0.1)A$. Find maximum error in resistance :

- (1) 0.04 (2) 0.05
(3) 0.06 (4) 0.07

Ans. (1)

Sol. $\frac{\Delta R}{R} = \frac{\Delta V}{V} + \frac{\Delta I}{I}$

$$V = IR$$

$$20 = 10R$$

$$R = 2\Omega$$

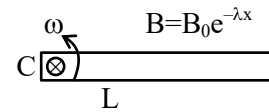
$$\frac{\Delta R}{2} = \frac{0.2}{20} + \frac{0.1}{10}$$

$$\frac{\Delta R}{2} = \frac{0.4}{20}$$

$$\Delta R = \frac{0.4}{10} = 0.04$$

$$\Delta R = 0.04$$

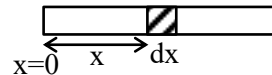
10. Magnetic field at a distance x from point C as shown in the figure on rod is $B_0 e^{-\lambda x}$, find induced emf between ends of metallic rod.



- (1) $B_0 \omega (1 - e^{-\lambda L} (1 + \lambda L)) / \lambda^2$
(2) $B_0 \omega (L - e^{-\lambda L} (1 + \lambda L)) / \lambda^2$
(3) $B_0 \omega (L - e^{-2\lambda L} (1 + \lambda L)) / \lambda^2$
(4) $B_0 \omega (2L - e^{-\lambda L} (1 + \lambda L)) / \lambda^2$

Ans. (1)

Sol. Small emf



$$d\varepsilon = B(\omega x) dx$$

$$= B_0 e^{-\lambda x} \omega x dx$$

$$= B_0 \omega \int x \cdot e^{-\lambda x} dx$$

$$= B_0 \omega \left(\frac{-e^{-\lambda x}}{\lambda^2} (\lambda x + 1) \right)_0^L$$

$$= \frac{B_0 \omega}{\lambda^2} (1 - e^{-\lambda L} (1 + \lambda L))$$

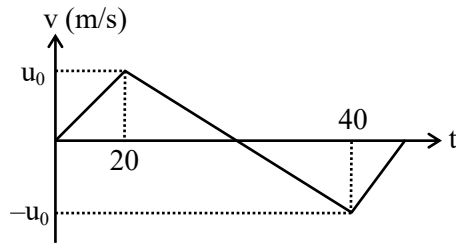
11. In PN Junction, P side have high doping and N side is lightly doped then

- (1) depletion layer has more region in P side
(2) depletion layer has more region in N side
(3) depletion layer has equal region in both side.
(4) There will be no depletion layer

Ans. (2)

Sol. Depletion layer always extends more in lightly doped semiconductor crystal.

12. Find magnitude of acceleration of particle at $t = 5$ sec. If velocity time graph is given as shown in figure.



- (1) $\frac{u_0}{20}$ (2) $\frac{u_0}{40}$
 (3) $\frac{u_0}{10}$ (4) u_0

Ans. (1)

Sol. Slope of v-t graph gives instantaneous acceleration

$$a = \left(\frac{dv}{dt} \right)_{\text{at 5 sec}}$$

$$a = \left(\frac{u_0}{20} \right)$$

13. In a RLC series circuit the value of R, L and C is given as $R = 50\Omega$; $L = 1.6$ H and $C = 40\mu\text{F}$. Find the value inductive reactance (X_L) at resonance

- (1) 50Ω (2) 100Ω
 (3) 200Ω (4) 400Ω

Ans. (3)

Sol. At resonance

$$X_L = X_C$$

$$\omega L = \frac{1}{\omega C}$$

$$\Rightarrow \omega = \frac{1}{\sqrt{LC}}$$

$$X_L = L\omega$$

$$= L \frac{1}{\sqrt{LC}} = \sqrt{\frac{L}{C}} = \sqrt{\frac{1.6}{40 \times 10^{-6}}}$$

$$= \sqrt{\frac{16 \times 10^6}{40 \times 10}} = 200\Omega$$

14. A rod has volume V and young's modulus Y is subjected to stress τ . Find elastic energy stored in the rod.

- (1) $\frac{1}{2} \frac{\tau^2 V}{Y}$ (2) $\frac{1}{2} \frac{\tau V}{Y}$
 (3) $\frac{1}{2} \frac{\tau V}{Y^2}$ (4) $\frac{1}{2} \frac{\tau V^2}{Y}$

Ans. (1)

Sol. $U = \frac{1}{2} \times \text{Stress} \times \text{Strain} \times \text{Volume}$

$$Y = \frac{\text{Stress}}{\text{Strain}}$$

$$\text{So, } U = \frac{1}{2} \times \frac{(\text{Stress})^2}{Y} \times \text{Volume}$$

$$U = \frac{1}{2} \times \frac{\tau^2 V}{Y}$$

15. Match the column according to dimensions

(A)	$\sqrt{\frac{GM}{C}}$	(1)	$M^{-1}L^2T^{-3/2}$
(B)	$\sqrt{\frac{h^2}{GC}}$	(2)	$M^0L^2T^{-3/2}$
(C)	$\sqrt{GMC}$	(3)	$M^{3/2}L^0T^0$
(D)	$\sqrt{\frac{GC}{M}}$	(4)	$LT^{-1/2}$

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

Ans. (3)

Sol. (A) $\sqrt{\frac{GM}{C}} = \frac{(M^{-1}L^3T^{-2})^{1/2}(M)^{1/2}}{(LT^{-1})^{1/2}} = LT^{-1/2}$

(B) $\sqrt{\frac{h^2}{GC}} = \frac{ML^2T^{-1}}{(M^{-1}L^3T^{-2})^{1/2}(LT^{-1})^{1/2}} = M^{3/2}L^0T^0$

(C) $\sqrt{GMC} = (M^{-1}L^3T^{-2})^{1/2}(M^{1/2})(LT^{-1})^{1/2} = M^0L^2T^{-3/2}$

(D) $\sqrt{\frac{GC}{M}} = \frac{(M^{-1}L^3T^{-2})^{1/2}(LT^{-1})^{1/2}}{M^{1/2}} = M^{-1}L^2T^{-3/2}$

16. Escape velocity on earth is $V_e = \sqrt{2gR}$. A planet of half the radius of earth and density is equal to that of earth the escape speed from that planet shall

be $\frac{V_0}{N}$ then N is :

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

Ans. (3)

Sol. $V_e = \sqrt{2gR} = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G}{R} \times \rho \times \frac{4}{3}\pi R^3}$

$V_e \propto R$

$\frac{V_1}{V_2} = \frac{R_1}{R_2}$

$\frac{V_e}{V_2} = \frac{R}{R/2}$

$\left\{ V_2 = \frac{V_e}{2} \right\}$

17. Match the column :

Column-I		Column-II	
(A)	$\sin^2 \omega t$	(P)	Non-periodic
(B)	$\cos(\omega t) + \cos(2\omega t)$	(Q)	Periodic but not SHM
(C)	$\sin^2(2\omega t)$	(R)	SHM with time period $\frac{\pi}{2\omega}$
(D)	$\cos(\pi + \omega t) + \cos(\omega t)$	(S)	SHM with time period $\frac{\pi}{\omega}$

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

Ans. (2)

Sol. (A) $\sin^2 \omega t \rightarrow$ SHM

$\omega t = \pi$

$t = \frac{\pi}{\omega}$ (time period)

(B) $\cos(\omega t) + \cos(2\omega t) \rightarrow$ not SHM

$\omega t = 2\pi$

$t = \frac{2\pi}{\omega}$ (time period)

(C) $\sin^2(2\omega t) \rightarrow$ SHM

$2\omega t = \pi$

$t = \frac{\pi}{2\omega}$ (time period)

(D) $\cos(\pi + \omega t) + \cos \omega t$

$= -\cos \omega t + \cos \omega t = 0$

Non-periodic

18. 8 small liquid drops combined to form a bigger drop. Surface tension of liquid is T. Find change in surface potential energy.

- (1) $32 \pi r^2 T$ (2) $16 \pi r^2 T$
 (3) $8 \pi r^2 T$ (4) $6 \pi r^2 T$

Ans. (2)

Sol. $U_i = 8[T(4\pi r^2)]$

$U_i = 32\pi r^2 T \quad \dots(i)$

$U_f = T[4\pi R^2]$

$\therefore$ volume is conserved

$8\left(\frac{4}{3}\pi r^3\right) = \frac{4}{3}\pi R^3$

$R = 2r$

$\therefore U_f = T[4\pi(2r)^2]$

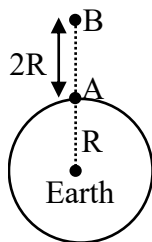
$U_f = 16\pi r^2 T \quad \dots(ii)$

$|\Delta U| = U_i - U_f$

$= 32 \pi r^2 T - 16\pi r^2 T$

$|\Delta U| = 16\pi r^2 T$

19. Find ratio of potential energy of a body at point A to point B for the figure shown.

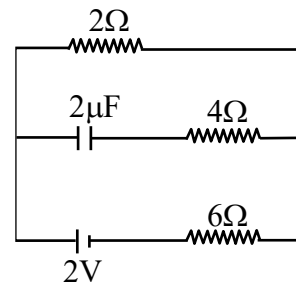


Ans. (3)

Sol. $U = -\frac{Gm_1m_2}{r}$

$\frac{U_A}{U_B} \Rightarrow \frac{-\frac{GM_e m}{R}}{-\frac{GM_e m}{3R}} = \frac{3}{1}$

20.



Find the voltage across capacitor in steady state.

- (1) 1V (2) 0.5V
 (3) 3/2V (4) 4V

Ans. (2)

Sol. At steady state current in capacitor branch is zero and voltage across capacitor is equal to voltage across 2Ω resistor.

$V_c = V_{2\Omega} = \left(\frac{2}{2+6}\right) \times 2$

$V_c = 0.5 \text{ V}$

21. **Assertion:** EM radiation when falls on a surface then it exerts pressure.

Reason: Radiation has no rest mass.

- (1) A & R both are correct and R is correct explanation of A
 (2) A & R both are correct but R is not correct explanation of A
 (3) A is correct but R is incorrect
 (4) A is incorrect but R is correct

Ans. (2)

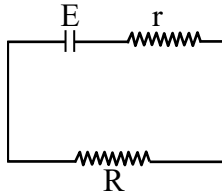
Sol. Theory

22. Figure shows a circuit consisting of cell of emf E & internal resistance r connected in series with external resistance R .

When $R = 5\Omega$ then $i = 1\text{A}$ and

When $R = 2\Omega$ then $i = 2\text{A}$

Find r . (in ohm)



Ans. (1)

Sol. Ohm's law $V = IR$

$$E = 1(5 + r) \quad \dots(1)$$

$$E = 2(2 + r) \quad \dots(2)$$

$$2(2 + r) = 1(5 + r)$$

$$4 + 2r = 5 + r$$

$$r = 1\Omega$$

23. A thin convex lens and a thin concave lens are kept coaxially in contact. Choose the correct option.

- (1) Focal length is changed when the positions of lens are interchanged
- (2) behaves as a convex lens when (f of convex $> f$ of concave)
- (3) behaves as a concave lens (f of concave $> f$ of convex)
- (4) behaves as a convex when (f of convex $< f$ of concave)

Ans. (4)

Sol. let f convex $= +f_1$

$$f \text{ concave} = -f_2$$

$$\frac{1}{f_{eq}} = \frac{1}{f_1} - \frac{1}{f_2}$$

$$f_{eq} = \left(\frac{f_1 f_2}{f_2 - f_1} \right)$$

of $|f_2| > |f_1|$ then f_{eq} is +ve act like convex

of $|f_2| < |f_1|$ then f_{eq} is -ve act like concave

24. Find binding energy of ${}^{12}_6\text{C}$. Given mass of proton (m_p) = 1.0078 u and mass of neutron (m_n) = 1.0087 u

$$(1) 92.19 \text{ MeV}$$

$$(2) 80.20 \text{ MeV}$$

$$(3) 85.19 \text{ MeV}$$

$$(4) 100.19 \text{ MeV}$$

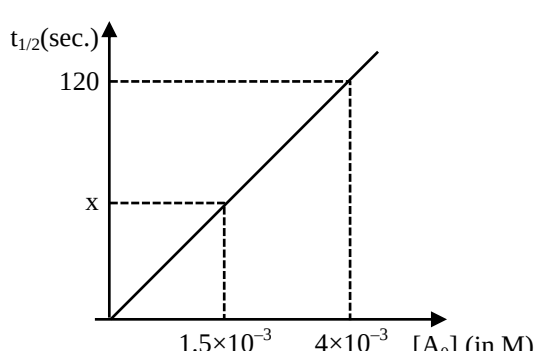
Ans. (1)

$$\begin{aligned} \text{Sol. B.E.} &= (Zm_p + (A-Z)m_n - M_{\text{Atom}})c^2 \\ &= (6 \times 1.0078 + 6 \times 1.0087 - 12) \times 931.5 \text{ MeV} \\ &= 92.19 \text{ MeV} \end{aligned}$$

JEE–MAIN EXAMINATION – APRIL 2026
MEMORY BASED QUESTIONS

(HELD ON SUNDAY 05th APRIL 2026)

TIME : 3:00 PM TO 6:00 PM

CHEMISTRY	TEST PAPER WITH SOLUTION		
1. In 1 litre aqueous solution 20 g of Haemoglobin is present at 300 K. This solution has height difference of 80 mm, when separated from pure water through S.P.M. If density of solution is 1000 kg/m^3, then calculate molar mass of Haemoglobin in kg/mol. (use : $g = 10 \text{ m/s}^2$) Ans. (62) Sol. $\pi = CRT = \rho gh$ $\frac{20 / \text{GMM}}{1 \text{ litre} \times 10^{-3}} \times 8.314 \times 300$ $= 80 \times 10^{-3} \times 1000 \times 10$ $\text{GMM} = \frac{20 \times 8.314 \times 300}{800} \times 1000$ $\text{GMM} = 62355 \text{ g/mol}$ $= 62.355 \text{ kg/mol}$	3. Determine the order of molar heat capacity (C_m) of $\text{Br}_2(\ell)$, Cu(s) and He(g) at 298 K and 1 atm. (1) $\text{Br}_2(\ell) > \text{He(g)} > \text{Cu(s)}$ (2) $\text{Br}_2(\ell) > \text{Cu(s)} > \text{He(g)}$ (3) $\text{He(g)} > \text{Br}_2(\ell) > \text{Cu(s)}$ (4) $\text{Cu(s)} > \text{Br}_2(\ell) > \text{He(g)}$ Ans. (2) Sol. Data based. 4. 20 gm Zn is treated with 50 ml, 50% (w/w) H_2SO_4 solution ($d = 1.3 \text{ g/ml}$). The volume of H_2 gas evolved at STP is. (At wt. of Zn = 65) (1) 6.81 L (2) 7.22 L (3) 3.4 L (4) 1.46 L Ans. (1) Sol. Mass of $\text{H}_2\text{SO}_4 = \frac{50 \times 1.3}{98} \times \frac{50}{100} = \frac{32.5}{98}$ $\text{Zn(s)} + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq.}) + \text{H}_2(\text{g})$ <table><tr><td>$\frac{20}{65}$</td><td>$\frac{32.5}{98}$</td></tr></table> Moles of H_2 formed = 0.3 Volume of $\text{H}_2 = 0.3 \times 22.7 = 6.81 \text{ L}$. 5. For the reaction $\text{A} \longrightarrow \text{Product}$ Following graph is observed between half life ($t_{1/2}$) & initial conc. of A. Then find the value of 'x' 	$\frac{20}{65}$	$\frac{32.5}{98}$
$\frac{20}{65}$	$\frac{32.5}{98}$		

Ans. (45)

Sol. $t_{1/2} \propto [A_0]^{1-n}$

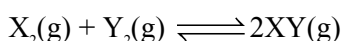
According to graph $n = 0$

$$\therefore t_{1/2} \propto A_0$$

$$\frac{120}{x} = \frac{4 \times 10^{-3}}{1.5 \times 10^{-3}}$$

$$\Rightarrow x = \frac{120 \times 3}{8} = 45 \text{ sec.}$$

6. For the given reaction : _



following data table is provided at 600K.

	$\Delta_f H(\text{kJ/mol})$	$S_m(\text{J/K-mol})$
X_2	80	140
Y_2	8	250
XY	42	200

Calculate $\Delta_r G$ at 600 K.

$$(1) -10 \text{ kJ/mol} \quad (2) -100 \text{ kJ/mol}$$

$$(3) -2 \text{ kJ/mol} \quad (4) +2 \text{ kJ/mol}$$

Ans. (1)

Sol. $\Delta_r G = \Delta_r H - T \Delta_r S$

$$\Delta_r H = (2 \times 42 - 80 - 8) = -4 \text{ kJ/mol}$$

$$\Delta_r S = (400 - 250 - 140) = +10 \text{ J/K.mol}$$

$$\Delta_r G = -4000 - 600 \times (10)$$

$$= -10,000 \text{ J/mol} = -10 \text{ kJ/mol}$$

7. Silver rod is dipped in aq. Solution of AgNO_3 of unknown concentration and Zn rod is dipped in 1M ZnSO_4 aq. solution. Both these containers are connected to form a galvanic cell showing emf of 1.6V. Calculate value of $\log_{10}[\text{Ag}^+]$.

$$E^\circ_{\text{Ag}^+/\text{Ag(s)}} = 0.8\text{V} \quad E^\circ_{\text{Zn}^{2+}/\text{Zn(s)}} = -0.76\text{V}$$

$$\left[\text{use } \frac{2.303RT}{F} = 0.059 \right]$$

$$(1) \frac{5.9}{4}$$

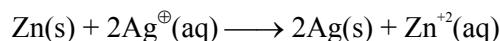
$$(2) \frac{4}{5.9}$$

$$(3) \frac{2}{5.9}$$

$$(4) \frac{8}{5.9}$$

Ans. (2)

Sol. Cell Reaction :



$$E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.059}{n} \log(Q)$$

$$1.6 = 1.56 - \frac{0.059}{2} \log \frac{1}{(\text{Ag}^+)^2}$$

$$0.04 = +0.059 \log[\text{Ag}^+]$$

$$\log[\text{Ag}^+] = \frac{4}{5.9}$$

8. Molar conductivity and conductance of an electrolytic solution are $123.5 \text{ Scm}^2/\text{mole}$ and 0.19 S respectively. Concentration of solution is $x\%$ w/w, then find the value of x .

(cell constant = 1.3 S cm^{-1} ; density of solution = 1 gm/ml ; molar mass of electrolyte = 75 g/mole)

Ans. (15)

$$\text{Sol. } \Lambda_m = \frac{(G \times G^*) \times 1000}{M}$$

$$123.5 = \frac{0.19 \times 1.3 \times 1000}{M}$$

$$M = 2$$

$\therefore$ 1 L solution contains 2 mole electrolyte

$$\% \text{ w/w} = \frac{2 \times 75}{1000 \times 1} \times 100 = 15$$

9. For the complex ion with configurations d^3 , d^4 (low spin), d^5 (high spin), d^7 (low spin) and d^6 (high spin), the total number of unpaired electrons is _____.

Ans. (15)

Sol. $d^3 \rightarrow 3$ unpaired electrons

d^4 (low spin) $\rightarrow 2$ unpaired electrons

d^5 (high spin) $\rightarrow 5$ unpaired electrons

d^7 (low spin) $\rightarrow 1$ unpaired electrons

d^6 (high spin) $\rightarrow 4$ unpaired electrons

10. Specie "X" is dissolved in H_2SO_4 and reacts with SO_2 to give green color solution. The specie "X" is

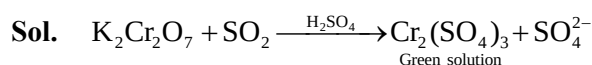
(1) KMnO_4

(2) $\text{K}_2\text{Cr}_2\text{O}_7$

(3) $\text{Pb}(\text{CH}_3\text{COO})_2$

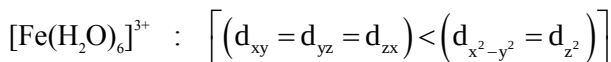
(4) KI

Ans. (2)

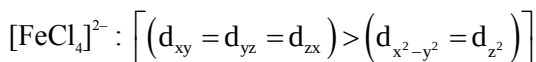


11. Statement I : Aluminium reacts with excess of NaOH to form $[\text{Al}(\text{OH})_6]^{3-}$

Statement II : For the complex



and for the complex



- (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. (3)

Sol. $\text{Al} + \text{NaOH} (\text{excess}) \rightarrow \text{Na}[\text{Al}(\text{OH})_4]$

$[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ is octahedral complex. Energy of $t_{2g} < e_g$

$[\text{FeCl}_4]^{2-}$ is tetrahedral complex. Energy of $t_2 > e$

12. Statement I : Of the following set of oxides $[\text{Al}_2\text{O}_3, \text{Cr}_2\text{O}_3]$; $[\text{CO}, \text{N}_2\text{O}]$; $[\text{Na}_2\text{O}, \text{V}_2\text{O}_3]$; $[\text{Cl}_2\text{O}_7, \text{Mn}_2\text{O}_7]$ number of sets having the same nature of oxides (basic, acidic, neutral or amphoteric) are 4.

Statement II : Of the given oxides, Na_2O , Al_2O_3 , CO , Cl_2O_7 ; the most basic and acidic oxides are Na_2O and Cl_2O_7 .

- (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. $\text{Al}_2\text{O}_3, \text{Cr}_2\text{O}_3$: Amphoteric

$\text{CO}, \text{N}_2\text{O}$: Neutral

$\text{Na}_2\text{O}, \text{V}_2\text{O}_3$: Basic

$\text{Cl}_2\text{O}_7, \text{Mn}_2\text{O}_7$: Acidic

13. Statement I : $\text{ClO}_4^\ominus$, $\text{ICl}_4^\ominus$, $\text{IBr}_2^\ominus$ are tetrahedral, square planar and linear respectively.

Statement II : $[\text{Fe}(\text{CN})_6]^{4-}$ is d^2sp^3 hybridized.

- (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. $\text{ClO}_4^\ominus$ is tetrahedral

$\text{ICl}_4^\ominus$ is square planar

$\text{IBr}_2^\ominus$ is linear.

$[\text{Fe}(\text{CN})_6]^{4-} : \text{Fe}^{+2} - \text{SFL} \Rightarrow d^2sp^3$ hybridized.

14. Consider the following statements.

(A) If two orbitals are having same value of “ $n+l$ ”

then the orbital having lower value of ‘ n ’ will have lower energy.

(B) If atomic number increases then energy of orbital belonging to a particular shell increases.

(C) Among 4s, 5d, 6f and 5p orbitals, none of these orbitals have two radial nodes.

(D) Size of $2p_x$ orbital is less than $3p_x$ orbital.

Which of the following statements are correct.

- (1) A and B are correct
- (2) B and D are correct
- (3) A and D are correct
- (4) B and C are correct

Ans. (3)

Sol. Atomic number increases ; energy of orbital belonging to particular shell decreases.

Orbital Radial node

4s	3
5d	2
6f	2
5p	3

15. If r_A and r_B are the radii of elements A and B respectively. Element A and B are covalently bonded. What will be the bond length and total length of molecule.

- (1) $[r_A + r_B]$; $[2(r_A + r_B)]$
- (2) $[r_A + r_B]$; $[(r_A + r_B)]$
- (3) $[\frac{1}{2}(r_A + r_B)]$; $[(r_A + r_B)]$
- (4) $[\frac{1}{2}(r_A + r_B)]$; $[2(r_A + r_B)]$

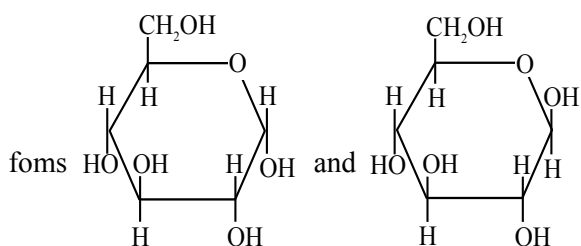
Ans. (1)

Sol. According to NCERT

Bond length = $r_A + r_B$

Overall length = $2(r_A + r_B)$

16. **Statement-I :** Glucose exists in two anomeric



Statement-II : In open chain structure at C-3, C-4, C-5 glucose and fructose have identical configuration.

- (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)

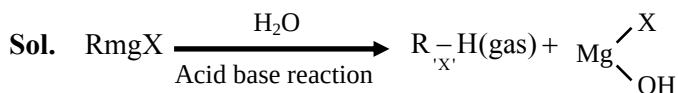
Sol. α -D-Glucose and β -D-Glucose are anomers.

At C-3, C-4 and C-5 are identical configuration in glucose and fructose.

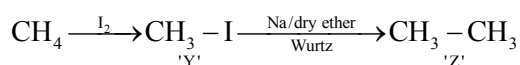
17. Grignard reagent RmgX reacts with water and releases a gas 'X' which has volume $1.4 \text{ dm}^3/\text{g}$ at 1 atm, 273K.

'X' reacts with I_2 and form 'Y' which reacts with Na in presence of dry ether to form 'Z'. Find the molecular mass of 'Z'.

Ans. (30)



(value of R is $-\text{CH}_3$) volume $1.4 \text{ dm}^3/\text{g}$
Molecular mass = 16



Molecular mass of Z = 30

18. **Statement-I :** Benzamide on reaction with $\text{Br}_2 + \text{NaOH}$ gives benzyl amine.

Statement-II : On nitration of aniline meta product is form more than its ortho product.

- (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. (3)

Sol. Benzamide gives aniline with $\text{Br}_2 + \text{NaOH}$.

19. Match the column

Column-I		Column-II	
(P)	Simple distillation	(1)	For steam volatile compound
(Q)	Fractional distillation	(2)	For liquid having nature of decomposition at its B.P.
(R)	Steam distillation	(3)	Between two liquids having low difference in boiling point
(S)	Distillation under reduced pressure	(4)	Between two liquids having high difference in boiling point

(1) P → 4, Q → 3, R → 1, S → 2

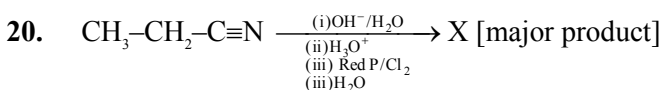
(2) P → 1, Q → 2, R → 3, S → 4

(3) P → 4, Q → 3, R → 2, S → 1

(4) P → 1, Q → 3, R → 2, S → 4

Ans. (1)

Sol. Theory based



IUPAC name of major product will be-

(1) 2-chloro propanoic acid

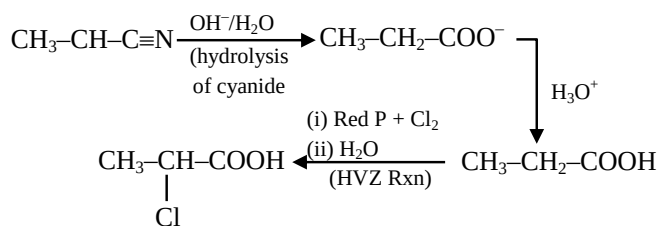
(2) 3-chloro propanoic acid

(3) propanoyl chloride

(4) 2-hydroxy propanoic acid

Ans. (1)

Sol.



21. Which compound has total molecular mass of 72 with three primary carbons.

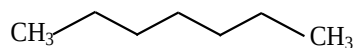
(1) n-Heptane

(2) 2,2-Dimethylbutane

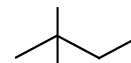
(3) 1,1-Dimethylcyclopropane

(4) 2-Methylbutane

Ans. (4)



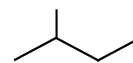
Sol. 2 primary carbons



4 primary carbons



2 primary carbons



3 primary carbons

22. Find stability order of following alkenes

(a) Cis-but-2-ene

(b) 2,3-Dimethylbut-2-ene

(c) 2-Methylbut-2-ene

(d) Propene

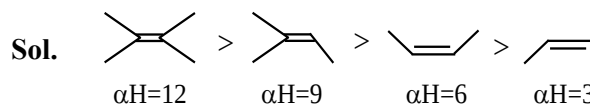
(1) b > a > d > c

(2) b > c > a > d

(3) a > c > b > d

(4) b > a > c > d

Ans. (2)



Stability $\propto$ Total number of H for hyperconjugation.

23. Which of the following statement is incorrect regarding tertiary structure of protein?

(1) With change in pH tertiary structure of protein does not get disrupted.

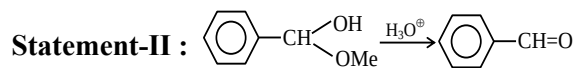
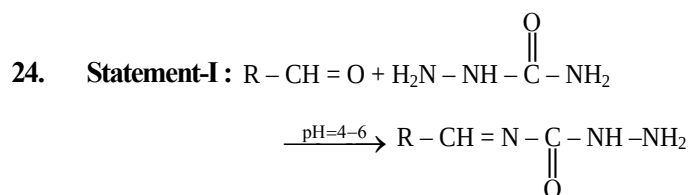
(2) Tertiary structure stabilize by H-bonding, disulphide linkage, Van der Waals forces and Coulombic forces

(3) Tertiary structure is globular as well as fibrous

(4) Amino acid which are connected to each other and oriented in folding form is related to tertiary structure.

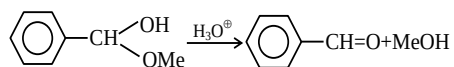
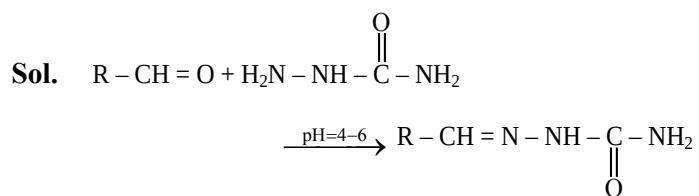
Ans. (1)

Sol. On changing pH tertiary structure of protein is disrupted and amino acids are intact only by peptide linkage.



- (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. (3)



JEE–MAIN EXAMINATION – APRIL 2026
MEMORY BASED QUESTIONS

(HELD ON SUNDAY 05th APRIL 2026)

TIME : 3:00 PM TO 6:00 PM

MATHEMATICS	TEST PAPER WITH SOLUTION
1. A bag contains 5 red balls, 6 blue balls and 4 black balls (balls of same colour are considered to be distinct). The number of ways in which 8 balls can be selected if atleast two balls of each colour is there, is (1) 4250 (2) 3650 (3) 3200 (4) 4100 Ans. (4) Sol. Red – 5 Blue – 6 Black – 4 Reqd. No. of ways $= {}^5C_2 \times {}^6C_2 \times {}^4C_4 + {}^5C_2 \times {}^6C_3 \times {}^4C_3 + {}^5C_2 \times {}^6C_4 \times {}^4C_2$ $+ {}^5C_3 \times {}^6C_2 \times {}^4C_3 + {}^5C_3 \times {}^6C_3 \times {}^4C_2 + {}^5C_4 \times {}^6C_2 \times {}^4C_2$ $= 10 \times 15 \times 1 + 10 \times 20 \times 4 + 10 \times 15 \times 6 +$ $10 \times 15 \times 4 + 10 \times 20 \times 6 + 5 \times 15 \times 6$ $= 150 + 800 + 900 + 600 + 1200 + 450$ $= 4100$ 2. Consider a parabola $y^2 = 8x$. The directrix of parabola cuts x-axis at A and PQ is a focal chord of parabola. If slope of PA = $\frac{3}{5}$ and abscissa of P is greater than 1, then the area of ΔAQP is (1) 40 (2) $\frac{69}{2}$ (3) $\frac{80}{3}$ (4) 23 Ans. (3) Sol. Let $P(2t^2, 4t) \Rightarrow Q\left(\frac{2}{t^2}, \frac{4}{t}\right)$ given $m_{PA} = \frac{4t}{2t^2 + 2} = \frac{3}{5}$ $20t = 6t^2 + 6$ $3t^2 - 10t + 3 = 0$	$t = 3, \frac{1}{3}$ but $t > 1$ (given) $\Rightarrow P(18, 12), Q\left(\frac{2}{9}, \frac{4}{3}\right)$ $A = \frac{1}{2} \begin{vmatrix} 1 & -2 & 0 \\ 1 & 18 & 12 \\ 1 & \frac{2}{9} & \frac{4}{3} \end{vmatrix} = \frac{80}{3}$ 3. Let $A_1, A_2, A_3, \dots, A_{49}$ be 49 AM's between 49 and 149. Then the mean of A_1, A_{25}, A_{47} and A_{49} is (1) 110 (2) 120 (3) 130 (4) 140 Ans. (1) Sol. $49, A_1, A_2, \dots, A_{49}, 149$ are in A.P. Common difference $d = \frac{149 - 49}{50} = 2$ $\frac{A_1 + A_{25} + A_{47} + A_{49}}{4}$ $= \frac{51 + 99 + 143 + 147}{4} = 110$ 4. If $3^a + 3^{-a}, f(a)$ and $2^{1+a} + 2^{1-a}$ are in A.P. If α is the minimum value of $f(x)$, then the value of $\int_{\ln(\alpha-1)}^{\ln \alpha} \frac{dx}{e^{2x} - e^{-2x}}$ is (1) $\frac{1}{2} \ln\left(\frac{4}{3}\right)$ (2) $\frac{1}{4} \ln\left(\frac{4}{3}\right)$ (3) $\frac{1}{2} \ln \frac{8}{9}$ (4) $\frac{1}{4} \ln \frac{8}{9}$ Ans. (1) Sol. $f(a) = \frac{3^a + 3^{-a} + 2^{1+a} + 2^{1-a}}{2}$ $\Rightarrow f(a) = \frac{3^a + \frac{1}{3^a} + 2\left(2^a + \frac{1}{2^a}\right)}{2}$

$$\therefore f(a)_{\min} = 3 \text{ at } a = 0$$

$$\therefore \alpha = 3$$

$$I = \int_{\ell n 2}^{\ell n 3} \frac{dx}{e^{2x} - e^{-2x}} \Rightarrow I = \int_{\ell n 2}^{\ell n 3} \frac{e^{2x} dx}{(e^{2x})^2 - 1}$$

$$e^{2x} = t$$

$$\Rightarrow I = \frac{1}{2} \int_4^9 \frac{dt}{t^2 - 1} \Rightarrow I = \frac{1}{2} \left[\ln \left| \frac{t-1}{t+1} \right| \right]_4^9$$

$$I = \frac{1}{2} \left(\ln \frac{4}{5} - \ln \frac{3}{5} \right) \Rightarrow I = \frac{1}{2} \left(\ln \frac{4}{3} \right)$$

5. Let $\overrightarrow{OP} = \vec{a}$, $\overrightarrow{OQ} = \vec{b}$. If R be a point on OP such that $5\overrightarrow{OR} = \overrightarrow{OP}$ and M be a point on OQ such that $5\overrightarrow{RM} = \overrightarrow{OQ}$, then $\overrightarrow{PM}$ is equal to (where O is origin)

$$(1) \frac{4\vec{b} - \vec{a}}{5} \quad (2) \frac{\vec{b} - 4\vec{a}}{5}$$

$$(3) \frac{5\vec{b} - \vec{a}}{4} \quad (4) \frac{\vec{b} - 5\vec{a}}{4}$$

Ans. (2)

$$\text{Sol. } \overrightarrow{OR} = \frac{\vec{a}}{5}; \quad 5\overrightarrow{RM} = \overrightarrow{OQ}$$

$$\Rightarrow \vec{b} = 5(\overrightarrow{OM} - \overrightarrow{OR})$$

$$\Rightarrow \vec{b} = 5\left(\overrightarrow{OM} - \frac{\vec{a}}{5}\right)$$

$$\Rightarrow \overrightarrow{OM} = \frac{\vec{b} + \vec{a}}{5}$$

$$\overrightarrow{PM} = \overrightarrow{OM} - \overrightarrow{OP}$$

$$= \frac{\vec{b} + \vec{a}}{5} - \vec{a} = \frac{1}{5}(\vec{b} - 4\vec{a})$$

6. If $S = \{\theta : \theta \in [-\pi, \pi], \cos \theta \cos \frac{5\theta}{2} = \cos 7\theta \cos \frac{7\theta}{2}\}$,

then $n(S)$ is equal to

$$(1) 17 \quad (2) 19$$

$$(3) 21 \quad (4) 23$$

Ans. (2)

$$\text{Sol. } \cos \theta \cos \frac{5\theta}{2} = \cos 7\theta \cos \frac{7\theta}{2}$$

$$\cos \frac{7\theta}{2} + \cos \frac{3\theta}{2} = \cos \frac{21\theta}{2} + \cos \frac{7\theta}{2}$$

$$\cos \frac{21\theta}{2} - \cos \frac{3\theta}{2} = 0$$

$$-2 \sin 6\theta \sin \frac{9\theta}{2} = 0$$

$$\sin 6\theta = 0$$

$$\theta = 0, \pm \frac{\pi}{6}, \pm \frac{2\pi}{6}, \dots, \pm \frac{5\pi}{6}, \pm \pi \quad (13 \text{ solutions})$$

$$\sin \frac{9\theta}{2} = 0$$

$$\theta = \pm \frac{2\pi}{9}, \pm \frac{4\pi}{9}, \pm \frac{8\pi}{9} \quad (6 \text{ more solutions})$$

Total = 19 solutions

7. In a cricket team A and B can be chosen as captain, probability of A is to be chosen as captain is 0.6, and that of B is 0.4, if A is chosen as a captain then probability of winning team is 0.8 and that of B is 0.7 then total probability of winning of team is ?

$$(1) 0.76$$

$$(2) 0.67$$

$$(3) 0.78$$

$$(4) 0.87$$

Ans. (1)

$$\text{Sol. } P(\text{Win}) = P(A \cap \text{Win}) + P(B \cap \text{Win})$$

$$= (.6)(.8) + (.4)(.7) = .76$$

8. Let $y(x)$ is the solution of differential equation

$$\sqrt{\tan x} dy = (\sec^3 x - y(\tan x)^{3/2}) dx \text{ and}$$

$$y(\pi/4) = \frac{6\sqrt{2}}{5} \text{ then the value of } y\left(\frac{\pi}{3}\right) \text{ is}$$

$$(1) \frac{8}{5}.3^{1/4}$$

$$(2) \frac{8}{3}.3^{1/4}$$

$$(3) \frac{8}{5}.5^{1/4}$$

$$(4) \frac{7}{5}.3^{1/4}$$

Ans. (1)

Sol. $\frac{dy}{dx} + y \tan x = \frac{\sec^3 x}{\sqrt{\tan x}}$

IF = $e^{\int \tan x dx} = \sec x$

$y \sec x = \int \frac{\sec^4 x}{\sqrt{\tan x}} dx$

$y \sec x = \int \frac{(1 + \tan^2 x)}{\sqrt{\tan x}} \sec^2 x dx$

$\tan x = t$

$y \sec x = 2\sqrt{\tan x} + \frac{2}{5}(\tan x)^{5/2} + c$

$y \left(\frac{\pi}{4} \right) = \frac{6\sqrt{2}}{5}$

$\frac{6\sqrt{2}}{5} \times \sqrt{2} = 2 + \frac{2}{5} + c \Rightarrow \frac{12}{5} = \frac{12}{5} + c$

$\Rightarrow c = 0$

$y(\pi/3) = \frac{8}{5} \cdot 3^{1/4}$

9. If Z_1 and Z_2 are roots of equation $Z^2 + 4Z - (1 + 12i) = 0$, where $Z \in$ complex number, then the value of $|Z_1|^2 + |Z_2|^2$ is

- (1) 34 (2) 37
(3) 42 (4) 45

Ans. (1)

Sol. $Z^2 + 4Z - (1 + 12i) = 0$

$\Rightarrow Z = \frac{-4 \pm \sqrt{16 + 4(1 + 12i)}}{2}$

$\Rightarrow Z = -2 \pm \sqrt{5 + 12i}$

$\Rightarrow Z = -2 \pm (3 + 2i)$

$\Rightarrow Z = 1 + 2i, -5 - 2i$

$\therefore |Z_1|^2 + |Z_2|^2$

$= 5 + 29$

$= 34$

10. Let $f(x) = \lim_{y \rightarrow 0} \frac{(1 - \cos(xy)) \tan(xy)}{y^3}$ then the

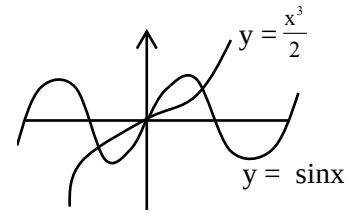
number of point of intersection of $f(x) = \sin x$ is

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

Ans. (3)

Sol. $f(x) = \lim_{y \rightarrow 0} \frac{(1 - \cos(xy))}{(xy)^2} \times \frac{\tan(xy)}{xy} \times \frac{x^3}{1}$

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



No. of point of intersection = 3

11. If $f(x)$ satisfy the equation

$f(x) = \int_1^x f(t) dt + (1 - x)(\log_e x - 1) + e$

then $f(f(1))$ is equal to

- (1) $1 - e^{2-e}$ (2) $1 + e^{2+e}$
(3) $1 + e^e$ (4) $1 - e^{2+e}$

Ans. (3)

Sol. $f(x) = \int_1^x f(t) dt + (1 - x)(\log_e x - 1) + e$

$f'(x) = f(x) - (\log_e x - 1) + \frac{(1 - x)}{x}$

$\frac{dy}{dx} - y = \frac{1}{x} - \log_e x$

IF = e^{-x}

solution is $y e^{-x} = \int e^{-x} \left(\frac{1}{x} - \log_e x \right) dx$

$y e^{-x} = \int \left(\frac{e^{-x}}{x} \right) dx - \int e^{-x} \log_e x dx$

$y e^{-x} = e^{-x} \log_e x + c$

$f(x) = y = \log_e x + ce^x$

$f(1) = e = ce \Rightarrow c = 1$

$f(x) = \log_e x + e^x$

$f(1) = e$

$f(f(1)) = f(e) = 1 + e^e$

12. If α, β are the roots of the equation $x^2 - 4x + p = 0$ and γ, δ are the roots of the equation $x^2 - x + q = 0$.

When $\alpha, \beta, \gamma, \delta$ form a GP with positive common ratio. then the value of $(p + q)$ equals

- (1) $\frac{22}{9}$ (2) $\frac{33}{9}$
(3) $\frac{21}{9}$ (4) $\frac{34}{9}$

Ans. (4)

Sol. $\alpha = a, \beta = ar, \gamma = ar^2, \delta = ar^3$

$$\begin{aligned}a + ar &= 4 \\ ar^2 + ar^3 &= 1\end{aligned}$$

$$r = \frac{1}{2}, a = \frac{8}{3}$$

$$\begin{aligned}p + q &= a^2 r + a^2 r^5 \\ &= \frac{34}{9}\end{aligned}$$

13. A line $L : x + y = 0$ is given. Two lines L_1 & L_2 are passing through $(-1, -1)$ inclined at an angle of 45° from line L . Reflection of lines L_1 and L_2 in line $2y + x = 1$ is $ax + by = 9$ and $cx + dy = 1$ then the value of $|ad + bc|$ is equal to

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

Ans. (1)

Sol. $\tan 45^\circ = \left| \frac{m+1}{1-m} \right|$

$$\Rightarrow \pm 1 = \frac{m+1}{1-m}$$

$\Rightarrow m = 0$ & one line is perpendicular to x axis.

$$L_1 : x = -1, L_2 : y = -1$$

Now taking mirror image of $x + 1 = 0$ in $x + 2y = 1$

$$A' : \frac{x+1}{1} = \frac{y+1}{2} = \frac{-2(-1-2-1)}{1^2+2^2}$$

$$x = \frac{3}{5}, y = \frac{11}{5} \quad A' \left(\frac{3}{5}, \frac{11}{5} \right)$$

$$\text{line} = 3x - 4y + 7 = 0$$

Now taking mirror image of $y + 1 = 0$ in $x + 2y = 1$

$$A'' : \frac{x+1}{1} = \frac{y+1}{2} = \frac{-2(-1-2-1)}{1^2+2^2}$$

$$x = \frac{3}{5}, y = \frac{11}{5}$$

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

$$\text{line} : (y+1) = \frac{\left(\frac{11}{5} + 1 \right)}{\left(\frac{3}{5} - 3 \right)} (x-3)$$

$$4x + 3y = 9$$

comparing $4x + 3y = 9$ with $ax + by = 9$ &

$$3x - 4y = -7 \text{ with } cx + dy = 1$$

$$a = 4 \quad b = 3 \quad c = \frac{-3}{7} \quad d = \frac{4}{7}$$

$$|ad + bc| = \left| 4 \times \left(\frac{4}{7} \right) + (3) \left(\frac{-3}{7} \right) \right| = 1$$

14. The coefficient of x^2 in the binomial expansion of

$$\left(2x^2 + \frac{1}{x}\right)^{10} \text{ is}$$

- (1) 3360 (2) 2360
(3) 3260 (4) 3380

Ans. (1)

$$\begin{aligned} \text{Sol. } T_{r+1} &= {}^{10}C_r (2x^2)^{10-r} (1/x)^r \\ &= {}^{10}C_r 2^{10-r} x^{20-2r-r} \\ &= {}^{10}C_r 2^{10-r} x^{20-3r} \\ \Rightarrow 20-3r &= 2 \end{aligned}$$

$$r = 6$$

So required coefficient is ${}^{10}C_6 2^4$

15. If the sum of the first 10 terms of the series

$$\frac{1}{1+4 \times 1^4} + \frac{2}{1+4 \times 2^4} + \frac{3}{1+4 \times 3^4} + \dots \text{ is } \frac{m}{n} \text{ (where}$$

m, n are coprime), then $(m+n)$ is

- (1) 264 (2) 276 (3) 284 (4) 256

Ans. (2)

$$\begin{aligned} \text{Sol. } T_r &= \frac{r}{1+4r^4} = \frac{r}{4r^4+4r^2+1-4r^2} = \frac{r}{(2r^2+1)^2-(2r)^2} \\ &= \frac{r}{(2r^2+2r+1)(2r^2-2r+1)} \end{aligned}$$

$$S_{10} = \frac{1}{4} \left(\frac{1}{1} - \frac{1}{221} \right) = \frac{55}{221} = \frac{m}{n}$$

$$\therefore m+n = 276$$

16. Let focii of a hyperbola are $(3,5)$ and $(3,-4)$. If eccentricity 'e' of the hyperbola satisfies the equation $3e^2 - 11e + 6 = 0$, then the length of the latus rectum of the hyperbola is

- (1) 20 (2) 24 (3) 18 (4) 26

Ans. (2)

Sol. $S_1(3,5)$ & $S_2(3,-4)$

$$\therefore S_1 S_2 = 2ae$$

$$\Rightarrow 9 = 2ae \quad \dots(1)$$

$$\text{and } \therefore 3e^2 - 11e + 6 = 0$$

$$\Rightarrow e = 3, e = \frac{2}{3} < 1 \text{ (rejected)}$$

$$\text{From (1) } a = \frac{3}{2}$$

$$\Rightarrow LR = 2 \cdot \frac{b^2}{a} = 2a(e^2 - 1) = 3[9 - 1] = 24$$

17. Let $A = \{2, 3\}$ and $B = \{5, 6\}$, then the number of relations from $A \times B$ to $A \times B$ are

- (1) 2^{12} (2) 2^{14} (3) 2^{16} (4) 2^{18}

Ans. (3)

$$\text{Sol. } n(A \times B) = 2 \times 2 = 4$$

$$\text{Number of relations} = 2^{4 \times 4} = 2^{16}$$

18. If distance of point $(a, 2, 5)$ from image of point

$$(1, 2, 7) \text{ in the line } \frac{x}{1} = \frac{y-1}{1} = \frac{z-2}{2} \text{ is 4, then sum}$$

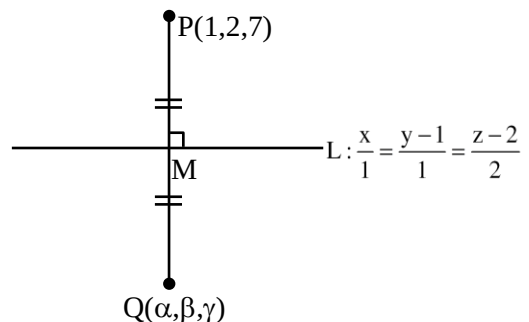
of all possible values of a is

- (1) 4 (2) 5 (3) 6 (4) 8

Ans. (3)

$$\text{Sol. } PQ \perp L \Rightarrow (\alpha-1) + (\beta-2) + 2(\gamma-7) = 0$$

$$\Rightarrow \alpha + \beta + 2\gamma = 17 \quad \dots(1)$$



M is mid point of PQ which will satisfy L

$$\frac{\alpha+1}{2} = \frac{\frac{\beta+2}{2}-1}{1} = \frac{\frac{\gamma+7}{2}-2}{2}$$

$$\Rightarrow \frac{\alpha+1}{2} = \frac{\beta}{2} = \frac{\gamma+3}{4}$$

$$\Rightarrow \alpha+1 = \beta \quad \dots(2)$$

$$\text{and } 2\beta = \gamma+3 \quad \dots(3)$$

$$\Rightarrow \alpha = 3, \beta = 4, \gamma = 5$$

$$\text{Distance from } (a, 2, 5) \text{ is } = \sqrt{(a-3)^2 + 4 + 0} = 4$$

$$(a-3)^2 + 4 = 16 \Rightarrow a^2 - 6a - 3 = 0 \Rightarrow \text{sum of values of } a = 6$$

19. Let $f(x) + 3f\left(\frac{\pi}{2} - x\right) = \sin x$ & maximum value of f is α . If area bounded between $g(x) = x^2$ & $h(x) = \beta x^3$ ($\beta > 0$) is α^2 , then $30\beta^3$ is equal to
 (1) 14 (2) 16 (3) 20 (4) 22

Ans. (2)

$$\text{Sol. } f(x) + 3f\left(\frac{\pi}{2} - x\right) = \sin x \quad \dots(1)$$

$$\text{Put } x \rightarrow \frac{\pi}{2} - x$$

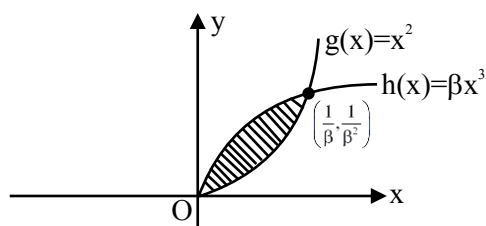
$$\Rightarrow f\left(\frac{\pi}{2} - x\right) + 3f(x) = \cos x \quad \dots(2)$$

From (1) & (2)

$$f(x) = \frac{1}{8}(3\cos x - \sin x)$$

$$f_{\max} = \frac{\sqrt{10}}{8}$$

$y = g(x)$ & $y = h(x)$ intersect as shown in the figure



$$\therefore \text{Area bounded} = \Delta = \left| \int_0^{\frac{1}{\beta}} (\beta x^3 - x^2) dx \right|$$

$$= \frac{1}{12\beta^3} = \alpha^2 \text{ (given)}$$

$$\Rightarrow 30\beta^3 = 16$$

SECTION-B

$$1. \text{ Let } f(n) = \begin{vmatrix} n & -1 & -5 \\ -2n^2 & 3(2k+1) & 2k+1 \\ -3n^3 & 3k(2k+1) & 3k(k+2)+1 \end{vmatrix}$$

$$\text{If } \sum_{n=1}^k f(n) = 98 \text{ then find } k.$$

Ans. (3)

$$\text{Sol. } f(n) = \begin{vmatrix} n & -1 & -5 \\ -2n^2 & 3(2k+1) & 2k+1 \\ -3n^3 & 3k(2k+1) & 3k(k+2)+1 \end{vmatrix}$$

$$\sum_{n=1}^k f(n) = \begin{vmatrix} \frac{k(k+1)}{2} & -1 & -5 \\ -2 \frac{k(k+1)(2k+1)}{6} & 3(2k+1) & 2k+1 \\ -3 \frac{k^2(k+1)^2}{4} & 3k(2k+1) & 3k(k+2)+1 \end{vmatrix} = 98$$

$$\Rightarrow \frac{k(k+1)(2k+1)}{2} \cdot \frac{7}{3} = 98$$

$$\Rightarrow k(k+1)(2k+1) = 84$$

$$\Rightarrow k = 3$$

2. A 3rd order square matrix M satisfy

$$M \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}; M \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix} \text{ \& } M \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} -1 \\ 1 \\ 2 \end{pmatrix}.$$

$$\text{If } M \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 2 \\ 4 \\ 7 \end{pmatrix}, \text{ then } x + y + z \text{ is}$$

Ans. (3)

$$\text{Sol. Let } M = \begin{bmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{bmatrix}$$

$$M \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \Rightarrow a_1 = 1, b_1 = 2, c_1 = 3$$

Similarly $a_2 = 0, b_2 = 1, c_2 = 2$

& $a_3 = -1, b_3 = 1, c_3 = 2$

$$M \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 2 \\ 4 \\ 7 \end{pmatrix}$$

$$\Rightarrow x + 0y - z = 2$$

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

$$3x + 2y + 2z = 7$$

$$\Rightarrow D = -1, D_1 = -1, D_2 = -3, D_3 = 1$$

$$x = 1, y = 3, z = -1$$

$$x + y + z = 3$$

3. $A = \{1, 4, 7\}, B = \{2, 3, 8\}$ let R be a relation defined as $\{(a_1, b_1), (a_2, b_2)\} \in (A \times B) \times (A \times B): (a_2 + b_1) | (a_1 + b_2)\}$ then find number of relations.

Ans. (18)

Sol.

A / B	2	3	8
1	3	4	9
4	6	7	12
7	9	10	15

These are possible sum of $a_i + b_j$

Now $b_1 + a_2$ divides $a_1 + b_2$

So,

$a_1 + b_2$	$a_2 + b_1$	No. of pairs
15	3, 15	2
12	3, 4, 6, 12	4
10	10	1
9	3, 9	6
7	7	1
6	3, 6	2
4	4	1
3	3	1
		18

Number of relations = 18