TECHNO INDIA GROUP PUBLIC SCHOOL

JEE MOCK TEST (Series II)

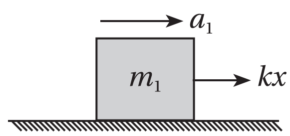
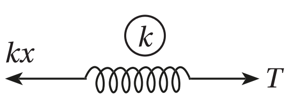
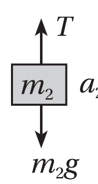
Paper Part – 4

Time : 3 hours **PHYSICS** F.M.: 300

ANSWERS

SECTION A

Section A consists of 20 questions of 4 mark each.

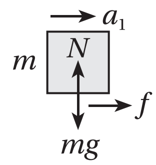
1.	① $y=(10\sin 30°)t-\frac{1}{2}\cdot\frac{g}{\sqrt{2}}\cdot t^2=0 \quad \Rightarrow t=\sqrt{2}$ s $\left[y=(u\sin\alpha)t-\frac{1}{2}\cdot(g\cos\theta)\cdot t^2 \text{ and put } y=0\right]$	
2.	② $a=\frac{1}{2}\frac{d(v^2)}{ds}=\frac{1}{2}\times\left(-\frac{2}{5}\right)=-0.2\ \text{m/s}^2$	
3.	③ $[k_B\theta]=\text{energy}=\text{ML}^2\text{T}^{-2}=[\alpha]\text{L} \qquad \therefore [\alpha]=\text{MLT}^{-2}$ $[\text{P}]=\frac{[\alpha]}{[\beta]}=\text{M}\cdot\frac{\text{L}}{\text{T}^2}\cdot\frac{1}{\text{L}^2}=\text{ML}^{-1}\text{T}^{-2} \qquad \therefore [\beta]=\frac{\text{MLT}^{-2}}{\text{ML}^{-1}\text{T}^{-2}}=\text{M}^0\text{L}^2\text{T}^0$	
4.	② $v_1\cos\theta_1=v_2\cos\theta_2 \qquad \therefore \frac{v_1}{v_2}=\frac{\cos 60°}{\cos 30°}=\frac{1}{\sqrt{3}}$	
5.	③ (after cut) $m_1a_1=kx$    $a_2=0$ (as initially before cut) $T=m_2g$ $kx=T$ $\therefore\ m_1a_1=kx=T=m_2g$ $a_1=\left(\frac{m_2}{m_1}\right)g$	

6. ③

Case (1):

$f = ma_1 \qquad f \le \mu N$

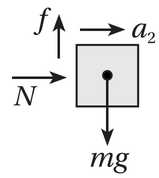
$ma_1 \le \mu mg \quad \Rightarrow \quad a_1 \le \mu g$



Case (2):

$N = ma_2 \qquad f \le \mu N$

$f = mg \quad \Rightarrow \quad mg \le \mu N \quad \Rightarrow \quad mg \le \mu m a_2 \quad \Rightarrow \quad a_2 \ge (g/\mu)$



7. ②

$(0.5 + 0.25)(20) \times (10\text{ N}) \cos 60° = W_1 = 15 \times 5 = 75$

$(0.25)(20) \times 10 \cos 60° = W_2 = 25\text{ J} \qquad 75 : 25 = 3 : 1$

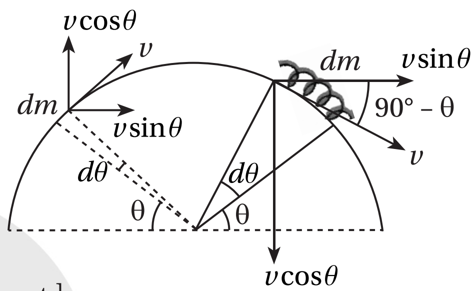
8. ④

$$\vec{p} = \frac{mv}{\pi}\int_0^{\pi} \sin\theta \, d\theta \cdot \hat{i} = \frac{2mv}{\pi} i$$

Note:

$$dm = \frac{m}{\pi R} \cdot R\, d\theta = \frac{m}{\pi} d\theta$$

$$d\vec{p} = \int (dm)(v \sin\theta \hat{i})$$ [$v\cos\theta$ part will be canceled out.]



9. ①

$v_1 = \sqrt{2 \times 10 \times 5} \quad \Rightarrow 10(-j)\text{ m/s} \qquad v_2 = \sqrt{2 \times 10 \times \frac{4}{5}} = 4\text{ m/s}(\hat{j})$

$\Delta\vec{p} = m(\vec{v_2} - \vec{v_1}) = 14\hat{j}\text{ kgm/s}$

10. ②

$mv_0 \cos\theta = (M + m)v \quad \Rightarrow v = \dfrac{mv_0 \cos\theta}{M + m}$

11. ①

Step 1: $\dfrac{GMm}{r^2} = m\omega^2 r$ and $\omega = \dfrac{2\pi}{T} \qquad \therefore T = 2\pi\sqrt{\dfrac{r^3}{GM}}$ … (1)

Step 2: by applying conservation of energy

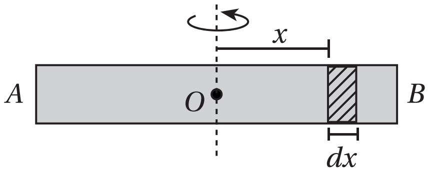
$$\frac{1}{2}m\left(\frac{dx}{dt}\right)^2 - \frac{GMm}{x} = -\frac{GMm}{r} \qquad \Rightarrow \left(\frac{dx}{dt}\right) = \left[\frac{2GM}{r}\left(\frac{r-x}{x}\right)\right]^{1/2}$$

$$\Rightarrow \left(\frac{2GM}{r}\right)^{1/2}\int_0^t dt = \int_0^r \left(\frac{x}{r-x}\right)^{1/2} dx$$ for integration use $x = r\sin^2\theta$

$$\Rightarrow \left(\sqrt{\frac{2GM}{r}}\right)t = \frac{\pi r}{2} \qquad t = \frac{\pi r}{2} \cdot \left[\frac{r}{2GM}\right]^{1/2}_{1/2}$$ … (2)

$$= \frac{\pi}{2}\left[\frac{r^3}{2GM}\right]^{1/2} = \frac{2\pi}{4\sqrt{2}} \cdot \left[\frac{r^3}{GM}\right]^{1/2} = \frac{T}{4\sqrt{2}}$$

12. ①



Volume of elementary portion $= A\,dx$

Mass of this element $m = (A\,dx)\rho$

Centripetal force $= m\omega^2 x$

The centripetal force also represents the pressure difference dp

$$A\,dp = m\omega^2 x = \{(A\,dx)\rho\}\omega^2 x$$

$$dp = \left(\frac{p}{RT}\right)\omega^2 x\,dx$$

$$\frac{dp}{p} = \left(\frac{\omega^2}{RT}\right)\int_0^x x\,dx$$

$$\log_e\left(\frac{p}{p_0}\right) = \frac{\omega^2 x^2}{2RT}$$

13. ②

Let $k = \dfrac{b-a}{L} = \dfrac{(r+dr)-r}{(x+dx)-x} = \dfrac{dr}{dx}$

$\dfrac{F}{A} = Y \cdot \dfrac{dl}{dx}$ $\qquad$ Y = Young's Modulus

$$dl = \frac{F}{y\pi r^2}dx = \frac{F}{y\pi r^2}\frac{dr}{k}$$

$$l = \int_a^b \frac{F}{y\pi R}\frac{dr}{r^2} = \frac{F}{y\pi k}\cdot\frac{(b-a)}{ab} = \frac{F}{y\pi}\frac{L}{(b-a)}\cdot\frac{(b-a)}{ab}$$

$$l = \frac{F(L)}{y\pi ab}$$

14. ③

$P = \dfrac{1}{2}\rho v^2$ $\qquad$ ($v \rightarrow$ speed of jet at B)

$F = PA = \dfrac{1}{2}\cdot r\rho A v^2 \;\Rightarrow F = \dfrac{1}{2}\rho\cdot\left(\dfrac{V}{st}\right)^2 A$ $\qquad$ discharge $= V = (sv)t$ $\qquad$ $\therefore v = \dfrac{V}{st}$

$$W = FL = \frac{1}{2}\cdot\rho\cdot\left(\frac{V}{st}\right)^2 AL = \frac{1}{2}\cdot\rho\cdot\frac{V^3}{s^2t^2}$$

15. ④

Difference of levels in the two arms $= x + x\cos\theta$

Change in pressure $= \Delta P = x(1+\cos\theta)\rho g$

$\therefore \Delta F = \text{restoring force} = (\Delta p)s = x(1+\cos\theta)\rho g s = -ma$

$$\therefore a = -\frac{x(1+\cos\theta)\rho g s}{m} = -\omega^2 x$$

$$\omega = \sqrt{\frac{(1+\cos\theta)\rho g s}{m}} = \frac{2\pi}{T}$$

$$\because T = 2\pi\sqrt{\frac{m}{(1+\cos\theta)\rho g s}}$$

16. ②

$$\cos 2\theta = 2\cos^2\theta - 1$$

$y = 2\cdot(\cos t + 1)\sin 1000t = 2\cos t\sin(1000)t + 2\sin 1000t$ [Formula : $2\sin A\cos B = \sin(A+B) + \sin(A-B)$]

$$y = \sin(1001)t + \sin(999t) + 2\sin(1000t)$$

17. ③

$$T = T_0 + \alpha\left(\frac{R^2T^2}{P^2}\right) \quad \Rightarrow P = \sqrt{\alpha}\cdot RT\left(T - T_0\right)^{-1/2} \quad \ldots (1)$$

$\frac{dp}{dT} = 0$ for minimum pressure

$\Rightarrow T = 2T_0$

$\therefore P_{\min} = 2R\sqrt{\alpha T_0}$

18. ①

$$P = -kA\cdot\frac{d\theta}{dr} = -k4\pi r^2\left(\frac{d\theta}{dr}\right)$$

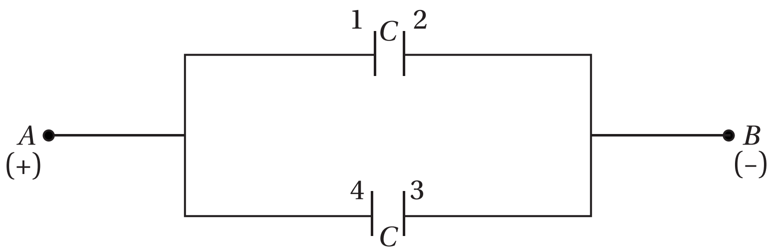
or, $d\theta = -\frac{p\,dr}{4\pi k r^2}$

$$\int_{\theta_1}^{\theta_2} d\theta = -\frac{p}{4\pi k}\int_{r_1}^{r_2}\frac{dr}{r^2}$$

$$\theta_1 - \theta_2 = \frac{p}{4\pi k}\cdot\frac{r_2 - r_1}{r_1\cdot r_2}$$

$$T = \frac{p}{4\pi k}\cdot\frac{(r_2 - r_1)}{R^2}$$

$$r_2 - r_1 = 4\pi k R^2 T / p$$

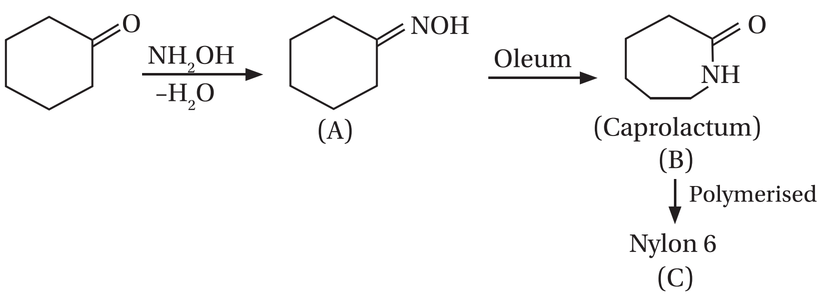
19.	③ $E=\frac{1}{4\pi\varepsilon_0}\cdot\frac{qz}{\left(R^2+z^2\right)^{3/2}}$ $E=0$ when $z=0$ direction of electric field will be away from the centre of ring.	
20.	② $C_{AB}=C+C=2C=\frac{2A\varepsilon_0}{d}$ 	
	SECTION B **Section B consists of 5 questions of 4 marks each.**	
21.	$\frac{t_1\cdot t_2}{t_1+t_2}=\frac{3\times 6}{9}=2$ min	
22.	$B_{net}=\frac{\mu_0}{4\pi}\cdot\left[\frac{2i_2}{b}-\frac{2i_1}{a}\right]=0$	
23.	$B_{11}=\frac{2M}{d^3}\left(\frac{\mu_0}{4\pi}\right)$; $B_1=\frac{M}{d^3}\cdot\frac{\mu_0}{4\pi}$ $B_{11}:B_1=2:1$	
24.	$e=B\cdot\frac{1}{2}\cdot\frac{r\cdot r\,d\theta}{dt}=\frac{1}{2}Br^2\frac{d\theta}{dt}=\frac{1}{2}\cdot Br^2\omega=\frac{1}{k}Br^2\omega$ $\therefore\ k=2$	
25.	$\sin i=\sqrt{2}\sin 30^\circ=\sqrt{2}\times\frac{1}{2}=\frac{1}{\sqrt{2}}$ $i=45^\circ$	

CHEMISTRY

SECTION A

Section A consists of 20 questions of 4 mark each.

26. ②



27. ③

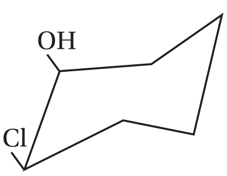
In solid N_2O_5 exist as $[NO_2^+]\,[NO_3^-]$ (nitronium nitrate)

For NO_2^+, $H=\frac{1}{2}(V+M-C+A)=\frac{1}{2}(5+0-1+0)=\frac{1}{2}\times 4=2 \Rightarrow sp$

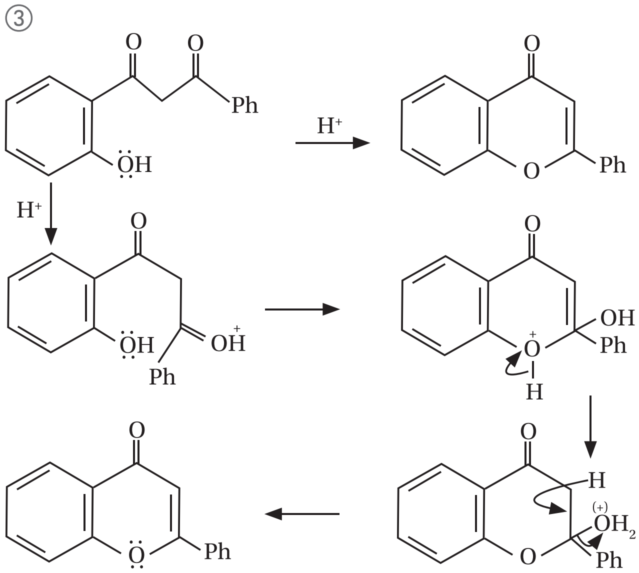
For NO_3^-, $H=\frac{1}{2}(5+0-0+1)=\frac{6}{2}=3 \Rightarrow sp^2$

28. ④

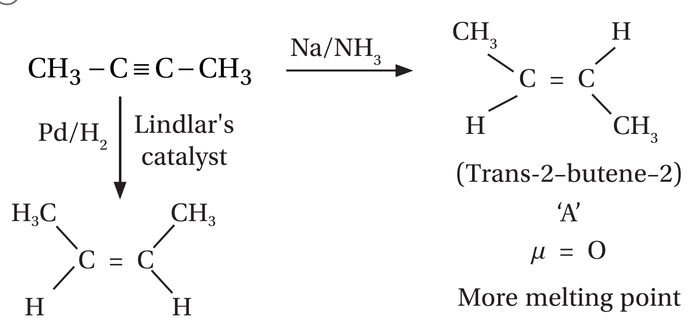
In 1, 2 disubstituted cyclohexane derivative neighbouring group participation occur only if groups are anti to each other.

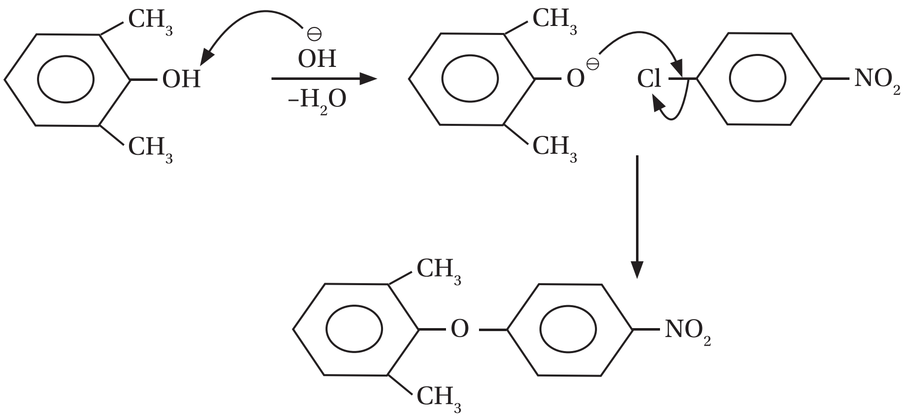
In  both are not in antiposition so no reaction.

29. ③



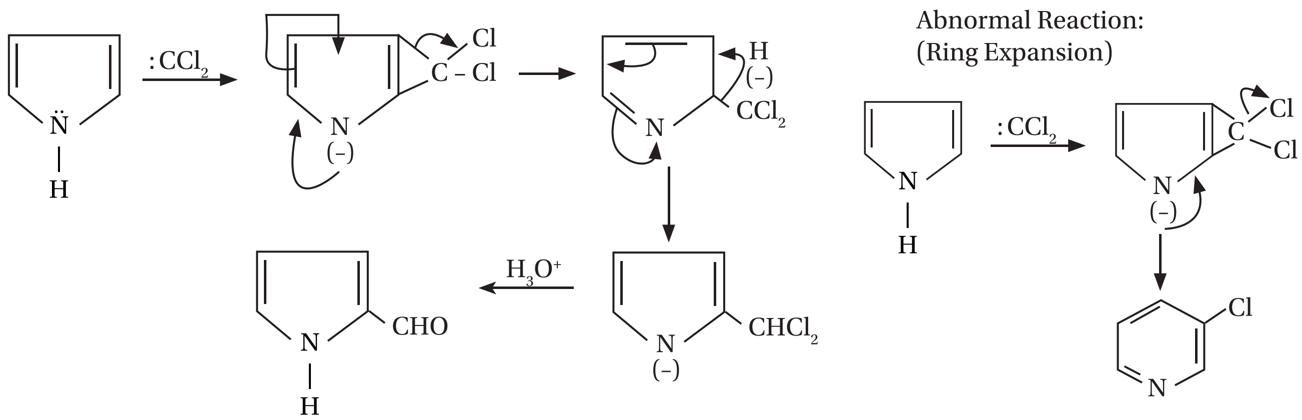
Cont.. 8

30.	② $$K(s)+\frac{1}{2}H_2(s)+\frac{1}{2}O_2(g)\longrightarrow KOH(s)\,;\,\Delta H=?$$ eq. (1) $K(s)+H_2O(l)\longrightarrow KOH(aq)+\frac{1}{2}H_2(8);\,\Delta H=-48\text{ KCal}$ eq. (2) $H_2(s)+\frac{1}{2}O_2(s)\longrightarrow H_2O(l)\,;\,OH=-68.4\text{ KCal}$ eq. (3) $KOH(s)+H_2O\longrightarrow KOH(aq)\,;\,OH=-14.0\text{ KCal}$ eq. (4) $KOH(aq)\longrightarrow KOH(s)+H_2O\,;\,OH=+14.0\text{ KCal}$ Now, eq. (1) + (2) + (4) $$K(s)+\frac{1}{2}H_2(s)+\frac{1}{2}O_2(s)\longrightarrow KOH(s)$$ $\therefore\ \Delta H=-48+(-68.4)+14.0$ $= -102.4$ KCal
31.	② $Na_2S_2O_3 \cdot 5H_2O$ solution is titrated with I_2 solution. Equivalent weight of $K_2Cr_2O_7=\frac{M}{6}=\frac{294.16}{6}=49.03$ Milliequivalent of $K_2Cr_2O_7=\frac{1}{25}\times 32\ =1.28$ $\therefore\ N_1V_1=\frac{32}{25}$ $N_1=\frac{32}{250}\ ;\ M=\frac{32}{250\times 6}=\frac{8}{375}$
32.	④  (Trans-2-butene-2) 'A' μ = O More melting point Cis butene–2 $\mu \neq$ O More boiling point
33.	④ All of these ①, ②, & ③ are correct.

34.	① 
35.	① $E_{cell} = E^{o}_{cell} - \frac{0.059}{2}\log\frac{(Zn^{++})}{(Cu^{++})}$ $= 1.18 + \frac{0.059}{2}\log\frac{(Cu^{++})}{(Zn^{++})}$ To make cell reaction spontaneous, E_{cell} = +ve, i.e. $\frac{0.059}{2}\log_{10}\frac{(Cu^{++})}{(Zn^{++})} > 1.18$ $\log_{10}[Cu^{++}] > \frac{2.36}{0.059}$ $\Rightarrow \log_{10}[Cu^{++}] > 40$ $\therefore (Cu^{++}) > 10^{-40}$
36.	② Energy of photon $= h\nu = h\frac{c}{\lambda}$ $= \frac{6.625\times10^{-34}\times3\times10^{8}}{5000\times10^{-10}}$ J $= 3.975 \times 10^{-19}$ J Energy emitted by bulb $= 150\times\frac{10}{100}$ J / S $150\times\frac{10}{100} = n\times3.975\times10^{-19}$ $\Rightarrow n = 3.77 \times 10^{19}$

37. ④

Normal Reaction:



38. ③

$$\wedge_m^o = \lambda^o_{Ag^+} + \lambda^o_{Cl} = x + y$$

$$\wedge_m^o = K.\times\frac{1000}{S} \Rightarrow S = \frac{K}{\wedge_m^o}\times 1000$$

$$\Rightarrow \frac{K}{(x+y)}1000$$

Solubility (S) in gm/litre

$= S \times 143.5$

$$S_1 = \frac{K\times 1000\times 143.5}{x+y}$$

39. ④

$$\log_{10}\left(\frac{K_L}{K_1}\right) = \frac{Ea}{2.303}R \quad \left[\frac{1}{T_1}-\frac{1}{T_2}\right]$$

$$\Rightarrow \log_{10}\left(\frac{4.5\times 10^7}{1.5\times 10^7}\right) = \frac{Ea}{2.303\times 8.34}\left[\frac{1}{323}-\frac{1}{373}\right]$$

$\Rightarrow$ Ea = 2.2×10^4 J$(\text{mole})^{-1}$

40. ④

$NaHCO_3$ reaction takes place with highly acidic groups like $-\overset{O}{\overset{\|}{C}}-OH$, $-SO_3H$ etc.

41. ③

$NaNO_3 \ : \ NaNO_3 \xleftarrow{\Delta} NaNO_2 + \frac{1}{2}O_2 \uparrow$

$Cu(NO_3)_2 \xrightarrow{\Delta} CuO + 2NO_2 \uparrow + \frac{1}{2}O_2 \uparrow$

$Hg(NO_3)_2 \xrightarrow{\Delta} Hg \downarrow + 2NO_2 \uparrow + \frac{1}{2}O_2 \uparrow$

$AgNO_3 \xrightarrow{\Delta} Ag + NO_2 \uparrow + \frac{1}{2}O_2 \uparrow$

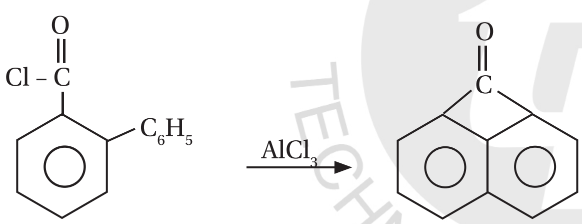
42. ④

$$\frac{P_A^o - P_A}{P_A^o} = x_B \Rightarrow \frac{W_2}{W_1 + W_2} = \frac{WM}{mW}$$

$$\Rightarrow \frac{0.04}{2.54} = \frac{5 \times 18}{m \times 80} \Rightarrow m = 70.3$$

43. ①

This is an example of intramolecular electrophilic substitution reaction.



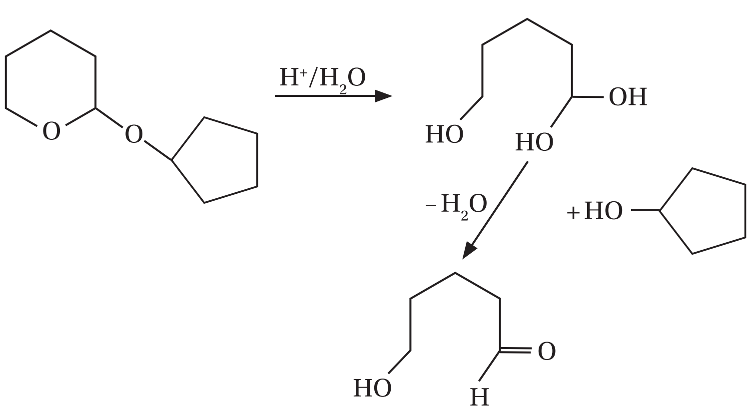
44. ①

$E^o_{cell} = 0.25 + 0.34 = 0.59V$

$E^o_{cell} = \frac{0.059}{2}\log K_C = 0.59$

$\therefore \ \log K_C = 20 \Rightarrow K_C = 10^{20}$

45. ③



SECTION B

Section B consists of 5 questions of 4 marks each.

46. (n = 6)

At, $r = r_6$, $\psi^2 2s = 0$ So, $\left[2 - \frac{r_0}{3a_0}\right] = 0$

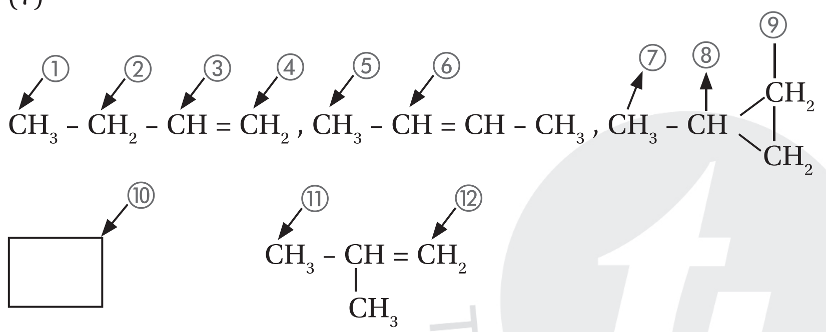
$r_0 = 6\ a_0$ $\Rightarrow$ n = 6

47. (7)

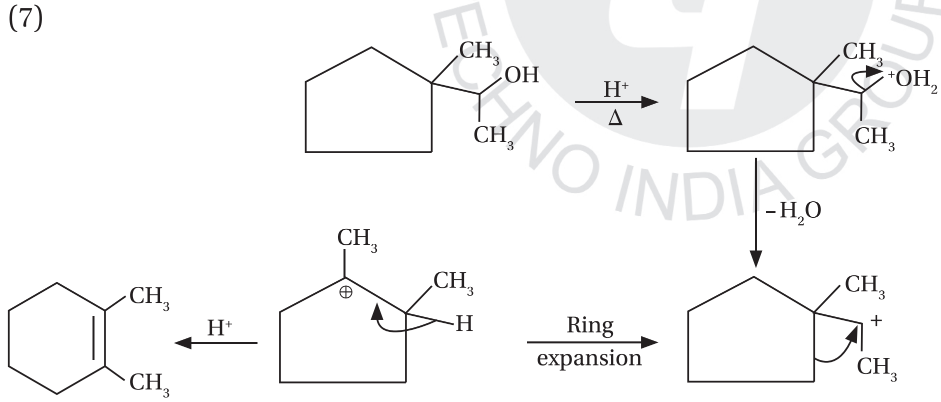
$2NO_3^{\ominus} + 16H^{\oplus} + 14e^{\ominus} \longrightarrow N_2H_4 + 6H_2O$;

For 1 mole of $NO_3^{\ominus}$ ion electron required = 7 moles

48. (7)



49. (7)



6C atoms in ring (six membered ring)

+1 π bond = 7

50. (3)

$$\left(\frac{t_2}{t_1}\right) = \left(\frac{a_1}{a_2}\right)^{n-1}$$

$$\Rightarrow\ 16 = \left(\frac{1}{\frac{1}{4}}\right)^{n-1}$$

$\Rightarrow$ n = 3, third order reaction

MATHEMATICS

SECTION A

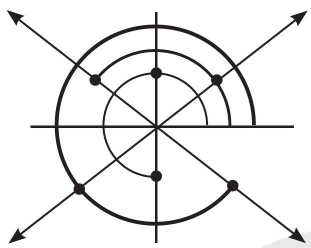
Section A consists of 20 questions of 4 mark each.

51. ④

$f(x) = -4\sin^3 x - 3\sin^2 x + 3\sin x + 5$

$f'(x) = -12\sin^2 x\cos x - 6\sin\cdot\cos x + 3\cos x$

$= -3\cos x\,(4\sin^2 x + 2\sin x - 1)$



$\cos x = 0$ → 2 solution

$4\sin^2 x + 2\sin - 1 = 0$

$\sin x = \dfrac{-1-\sqrt{5}}{4}, \quad \dfrac{-1+\sqrt{5}}{4}$

2 solution 2 solution

\# 6 solution.

52. ②

$$\left|\vec{a}+\vec{b}+\vec{c}\right|^2 = \left|-\vec{d}\right|^2$$

$$\Rightarrow 1+4+6+2\left(\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}\right) = 2$$

$$\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a} = -\frac{19}{2}$$

53. ①

For identity $a = b = c = 0$

$p^2 - 3p + 2 = 0 \cap (p-1)^2 = 0 \quad \cap p^2 - 4p + 3 = 0 \quad \Rightarrow p = 1$

54. ③

$$I = \int_0^{\pi/6} \frac{\sqrt{\cos 3x}}{\sin 3x + \sqrt{\cos 3x}}\,dx \qquad \text{.... (1)}$$

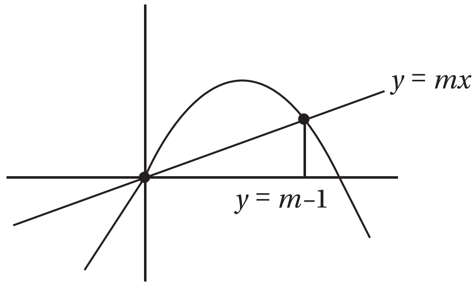
$$\left(u\sin g : \int_0^a f(x)dx = \int_0^a f(a-x)dx\right)$$

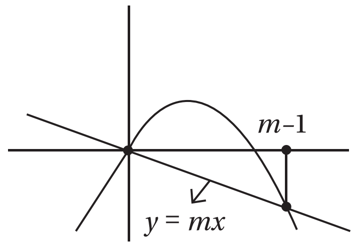
$$\cos 3\left(\frac{\pi}{6} - x\right) = \sin 3x$$

$$= \int_0^{\pi/6} \frac{\sqrt{\sin 3x}}{\sqrt{\cos 3x + \sqrt{\sin 3x}}}\,dx \qquad \text{... (2)}$$

$$(1) + (2): \quad 2I = \int_0^{\pi/6} dx = \frac{\pi}{6} \quad \Rightarrow I = \frac{\pi}{12}$$

55. ③





$$\left|\int_0^{m-1}\left(x-x^2\right)mx\,dx\right|=\frac{9}{2}$$

After solving we get two values of m.
m = – 2, 4

56. ①

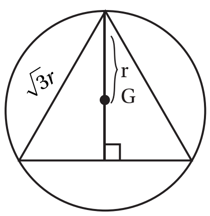
Using leibnitz Rule:

$$2y\cdot\frac{dy}{dx}e^{y^2}-1\cdot\tan x=\frac{1}{x}$$

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

$$\Rightarrow\frac{dy}{dx}=\left(\frac{x\tan x+1}{2ny}\right)e^{-y^2}$$

57. ③



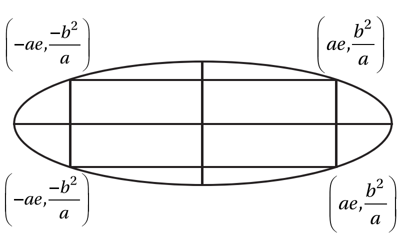
$$\frac{d}{dt}(2\pi r)=\pi$$

$$2\pi\cdot\frac{dr}{dt}=\pi\ \Rightarrow\frac{dr}{dt}=\frac{1}{2}$$

$$\frac{d}{dt}(3a)$$

$$=\frac{d}{dt}\left(3\cdot\sqrt{3}r\right)=3\sqrt{3}\cdot\frac{dr}{dt}=\frac{3\sqrt{3}}{2}$$

58. ②



$$Now,\ \ b^2=a^2\left(1-e^2\right)$$

$$=50^2\left(1-\frac{1}{4}\right)$$

$$=50^2\times\frac{3}{4}$$

$$Area=4b^2e$$

$$=4\times b^2\times\frac{1}{2}$$

$$=2b^2$$

$$=2\times50^2\times\frac{3}{4}=3750$$

59. ②

$|A| = 0$

$(\sin x + 4\cos x)\sin y + 3\cos y = \sqrt{26}$

It is possible if $(\sin x + 4\cos x)^2 + 9 = 26$

$\Rightarrow \cos x(15\cos x + 8\sin x) = 16$

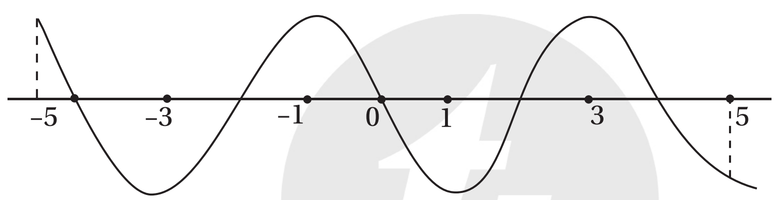
60. ①

$\frac{1}{x}\left[(1+x)^{101} - 1\right]$

Coeff of x^7 in $\frac{1}{x}\left[(1+x)^{101} - 1\right]$

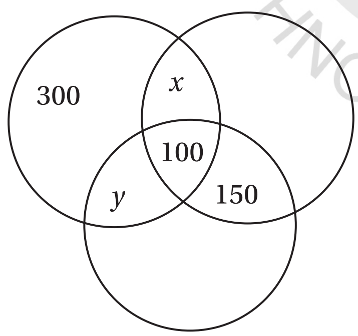
$= \text{Coeff of } x^8 \text{ in } (1 + x)^{101} = {}^{101}C_8 = {}^{101}C_{93}$

61. ①



$f(0) = 0$ ($\because$ $f(x)$ is odd function)
Minimum five real roots.

62. ②



$\underbrace{x + y} + 150$
$= 100 + 150$
$= 250$

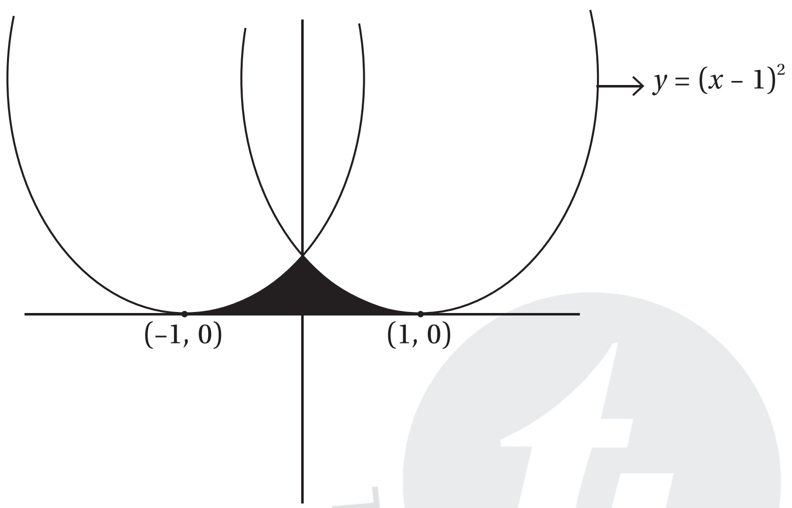
63. ③

(A) $A \cdot A^t = I \Rightarrow |A|\,|A^t| = |I| \Rightarrow |A|^2 = 1$ (True) always invertible.
$\Rightarrow |A| = \pm 1$
$\Rightarrow A^{-1}$ exit.

(B) $A^t = -A$
$|A^t| = |-A| \Rightarrow |A| = -|A| \Rightarrow 2|A| = 0 \Rightarrow |A| = 0$ non invertible (True)

(C) $A^2 = A \Rightarrow |A|^2 = |A|$
$\Rightarrow |A|(|A| - 1) = 0$
$\Rightarrow |A| = 0$, or $|A| = 1$ not always invertible. (False)

(D) $A^2 = I \Rightarrow |A| = \pm 1$ True always invertible (true)

64.	① $(\lambda, 5-\lambda)$ be any point on the line. Equation of chord of contact T = 0 $\lambda x + y(5-\lambda) = 2$ $\Rightarrow (5y-2) + \lambda(x-y) = 0$ $\Rightarrow y = \frac{5}{2}$ and $x = y = \frac{5}{2}$ $\therefore$ Point of intersection is $\left(\frac{5}{2}, \frac{5}{2}\right)$
65.	②  $I = 2\int_0^1 (x-1)^2 = \frac{2}{3}$
66.	② $\frac{T_n}{t_n} = \frac{A+(n-1)D}{a+(n-1)d} = \frac{n+1}{3n-2}$ put $n = 3 \Rightarrow \frac{S_5}{s_5} = \frac{4}{7}$
67.	② $\sigma^2(an+b) = a^2\sigma^2$ (For variance) $\overline{y} = \overline{(ax+b)} = a\overline{x} + b$ (for Mean) } Variance = 2^2a^2, Mean = $2\overline{x}$
68.	④ $ydx + xdy + \sin x\cos^2(xy)\,dx + \sin y\cos^2(xy)\,dy = 0$ $\Rightarrow \frac{d(xy)}{\cos^2(xy)} + \sin x dx + \sin y dy = 0$ $\Rightarrow \tan(xy) - \cos x - \cos y = c$
69.	③ $4t_1t_2 = 9$; $4(t_1 + t_2) = b$ $b^2 = 16(t_1+t_2)^2 = 16\left[(t_1-t_2)^2 + 4t_1t_2\right] = 16(t_1-t_2)^2 + 144 > 144$ $b > 12 \Rightarrow b_{min} = 13$

70. ③

$$x^2 - 2|x| \ge 0 \ \cap -1 \le \frac{x}{4} \le 1$$

$$\Rightarrow x = 0,\ -2 \le x \cup x \ge 2 \quad \cap -4 \le x \le 4$$

$$\Rightarrow [-4,-2] \cup \{0\} \cup [2,4]$$

SECTION B

Section B consists of 5 questions of 4 marks each.

71. (5)

$$\frac{x^2 \frac{1}{x^4} + \frac{1}{x^4} + x^3 + \frac{ax}{3} + \frac{ax}{3} + \frac{ax}{3}}{7} \ge \left(\frac{a^3}{27}\right)$$

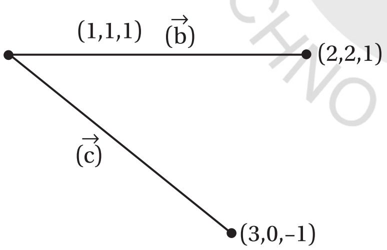
$$\Rightarrow 7\left(\frac{a^3}{27}\right)^{\frac{1}{7}} = 9 - b \ \Rightarrow a = 3, b = 2$$

72. (2)

$$\frac{b}{a} = \frac{1}{\sqrt{3}} = e$$

$$\frac{1}{e^2} + \frac{1}{(e')^2} = 1 \ \Rightarrow (e')^2 = 4 \ \Rightarrow e' = 2$$

73. (9)



$$\vec{a} = \lambda\hat{i} + 2\hat{j} + \hat{k}$$

$$\left[\vec{a}\ \vec{b}\ \vec{c}\right] = 0$$

$$\Rightarrow \begin{vmatrix} -1 & 0 & 0 \\ -2 & 3 & 2 \\ \lambda & 2-\lambda & 1 \end{vmatrix} = 0 \Rightarrow \lambda = \frac{1}{2} \Rightarrow 18\lambda = 9$$

74. Using Baye's theorem.

$$\text{Required prob} = \frac{\frac{2}{6}\times 1}{\frac{3}{6}\times 0 + \frac{1}{6}\times\frac{1}{2} + \frac{2}{6}\times 1} = \frac{4}{5}$$

$\therefore a + b = 4 + 5 = 9$

75. (2)

$$\frac{x-5}{3-5} = \frac{y-1}{\beta-1} = \frac{z-\alpha}{1-\alpha}$$

$$\frac{-5}{-2} = \frac{\frac{17}{2}-1}{\beta-1} = \frac{\frac{-13}{2}-\alpha}{1-\alpha} \ \Rightarrow \alpha = 6, \beta = 4$$

$$\alpha - \beta = 6 - 4 = 2$$