MOTION IIT-JEE
(Where Faith Counts the Success)

TARGET IIT-JEE

HINT & SOLUTIONS

ANSWER KEY WITH SOLUTION

PAPER-II CLASS XI (DATE 23-02-10)

MATHEMATICS

SECTION (A)

1.	D	**2.**	C	**3.**	C	**4.**	C

SECTION (B)

1.	D	**2.**	A,B,C	**3.**	A,C,D	**4.**	A,C	**5.**	A,C

SECTION (D)

1. (A)–P, (B)–Q, (C)–Q, (D)–R **2.** (A)–S, (B)–P, (C)–R, (D)–Q

SECTION (E)

1.	3	**2.**	360	**3.**	5	**4.**	200	**5.**	126.	**6.**	2
7.	191	**8.**	7								

PHYSICS

SECTION - (A)

1.	C	**2.**	B	**3.**	B	**4.**	A

SECTION – (B)

1.	C	**2.**	A,C	**3.**	A,B	**4.**	A,B	**5.**	A

SECTION (D)

1. (A) $\rightarrow$ Q ; (B) $\rightarrow$ P ; (C) $\rightarrow$ R; (D) $\rightarrow$ R **2.** (A) $\rightarrow$ R,S ; (B) $\rightarrow$ R,S ; (C) $\rightarrow$ P,Q ; (D) $\rightarrow$ R,S

SECTION – (E)

1. 7 **2.** 5 m/s^2 **3.** 2 m/s **4.** 4 **5.** 0 **6.** 64 **7.** 2 **8.** 21

CHEMISTRY

SECTION - (A)

1.	D	**2.**	A	**3.**	B	**4.**	A

SECTION - (B)

1.	A,B,C,D	**2.**	A,B,C	**3.**	B,D	**4.**	A,B,D	**5.**	B,D

SECTION - (D)

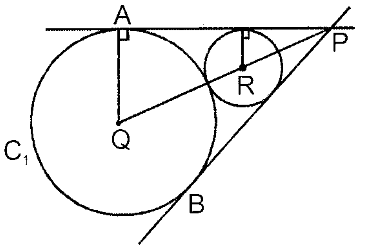
1. (A) $\rightarrow$ S ; (B) $\rightarrow$ (P) ; (C) $\rightarrow$ (Q), (D) $\rightarrow$ (R) **2.** (A)–R ; (B)–(S) ; (C)–(Q) ; (D)–(P)

SECTION – (E)

1. 6 **2.** 16 **3.** 21 **4.** 512 atm **5.** 18 cm **6.** 5 **7.** 9 **8.** 3

SECTION (A)

1. D



$AQ = 3+2\sqrt{2}$

$PQ = 3\sqrt{2}+4$

Let r be required radius

$3\sqrt{2}+4 = 3 + 2\sqrt{2} + r + r\sqrt{2}$

$\sqrt{2}+1 = r(1+\sqrt{2}) \Rightarrow r = 1$

2. C

f(1), f(3) < 0 for exactly one root

$\Rightarrow (2a + 6)(4a + 48) < 0$

$\Rightarrow - 12 < a < - 3$

3. C

$r_1r_2 + rr_3 = \frac{\Delta}{s-a}\cdot\frac{\Delta}{s-b} + \frac{\Delta}{s}\cdot\frac{\Delta}{s-c}$

$\Rightarrow \Delta^2\left[\frac{s(s-c)+(s-a)(s-b)}{s(s-a)(s-b)(s-c)}\right] = s^2 - sc + s^2 -$

$(a + b)s + ab = 2s^2 - s(a + b + c) + ab$

$= 2s^2 - 2s^2 + ab = ab$

4. C

$|x+1|^{\log_{(x+1)}(3+2x-x^2)} = (x-3)(|x|)$

log will be defined only when

$(x + 1) > 0$ $\quad$ $x + 1 \neq 1$ $\quad$ $3 + 2x - x^2 > 0$

$x > - 1$ $\quad$ $x \neq 0$ $\quad$ $x^2 - 2x - 3 < 0$

$(x - 3)(x + 1) < 0$

$x \in (-1, 3)$

so $x \in (-1, 0) \cup (0, 3)$

Case - I When $x \in (-1, 0)$

$(x+1)^{\log_{(x+1)}(3+2x-x^2)} = (x-3)(-x)$

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

No solution

Case - II $x \in (0, 3)$

$3 + 2x - x^2 = (x - 3)(x)$

$2x^2 - 5x - 3 = 0$

$(2x + 1)(x - 3) = 0$

$x = -\frac{1}{2}, 3$ No solution possible

SECTION (B)

1. D

It passes through a fixed point (3, 4)

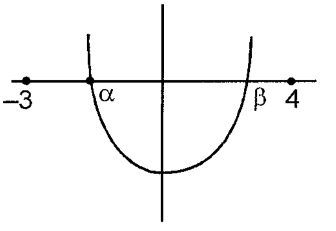
slope of line joining (3, 4) and (1, –2) is $\frac{-6}{-2} = 3$

$\therefore$ slope of required line $= -\frac{1}{3}$

equation is $y - 4 = -\frac{1}{3}(x-3)$

$x + 3y - 15 = 0$

2. A,B,C



$x^2 - 2ax + a^2 - 1 = 0$

$- 3 < \alpha, \beta < 4$

(i) $D \geq 0$

$4a^2 - 4(a^2 - 1) \geq 0$

$4 \geq 0$

(ii) $- 3 < a < 4$

(iii) 1, $f(-3) > 0$

$9 + 6a + a^2 - 1 > 0$

$a^2 + 6a + 8 > 0$

$(a + 2)(a + 4) > 0$

$a \in (-\infty, -4) \cup (-2, \infty)$

(iv) 1. $f(4) > 0$

$16 - 8a + a^2 - 1 > 0$

$(a - 3)(a - 5) > 0$

$a \in (-\infty, 3) \cup (5, \infty)$

$\therefore$ $a \in (-2, 3)$

$[a] = \{-2, -1, 0, 1, 2\}$

3. A,C,D

Coordinates of O are (5,3) and radius = 2

Equation of tangent at A (7, 3) is

$7x + 3y - 5(x + 7) - 3(y + 3) + 30 = 0$

i.e. $2x - 14 = 0$ $\quad$ i.e, $x = 7$

Equation of tangent at B(5,1) is

$5x + y - 5(x + 5) - 3(y + 1) + 30 = 0$

i.e. $- 2y + 2 = 0$ $\quad$ i.e, $y = 1$

$\therefore$ coordinate of C are (7, 1)

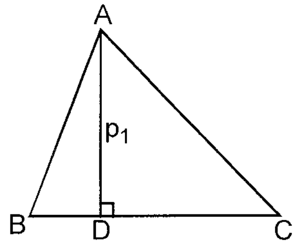
$\therefore$ area of OACB = 4

Equation of AB is $x - y = 4$ (radical axis)

Equation of the smallest circle is $(x - 7)(x - 5) + (y - 3)(y - 1) = 0$

i.e. $x^2 + y^2 - 12x - 4y + 38 = 0$

4. A,C



$\Delta = \frac{1}{2}$. BC. AD $= \frac{1}{2}a.p_1 \qquad \Rightarrow \frac{1}{p_1} = \frac{a}{2\Delta}$

similarly $\frac{1}{p_2} = \frac{b}{2\Delta}$ & $\frac{1}{p_3} = \frac{c}{2\Delta}$

$\therefore \frac{1}{p_1} + \frac{1}{p_2} + \frac{1}{p_3} = \frac{a+b+c}{2\Delta} = \frac{2s}{2\Delta} = \frac{s}{\Delta} = \frac{1}{r}$

again $\frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} = \frac{s-a}{\Delta} + \frac{s-b}{\Delta} + \frac{s-c}{\Delta}$

$= \frac{(s-a)+(s-b)+(s-c)}{\Delta}$

$= \frac{3s-(a+b+c)}{\Delta} = \frac{s}{\Delta} = \frac{1}{r}$

$\therefore \frac{1}{p_1} + \frac{1}{p_2} + \frac{1}{p_3} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} = \frac{1}{r}$

5. A,C

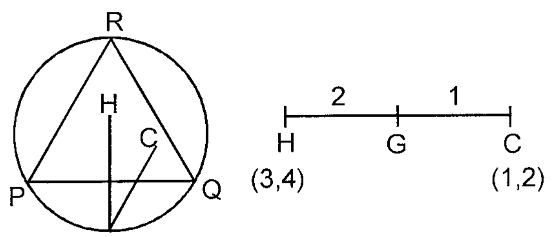


Image of orthocentre lies on circum circle. Let A be image of H in PQ. which is obtained from

$\frac{x-3}{1} = \frac{y-4}{-1} = -2\frac{(3-4+7)}{2}$

$x = 3 - 6,\ y = 4 + 6$

$A \equiv (-3, 10)$

radius of circum-circle $= \sqrt{16+64} = \sqrt{80}$

equation of circum - circle is $(x-1)^2 + (y-2)^2 = 80$

centoid $G \equiv \left(\frac{5}{3}, \frac{8}{3}\right)$

SECTION (D)

1. (A)–P, (B)–Q, (C)–Q, (D)–R

(A) $\frac{2\sin\frac{9x}{2}\cos\frac{x}{2}}{2-4\sin^2\frac{3x}{2}} \times \frac{\sin\frac{3x}{2}}{\sin\frac{3x}{2}} = \frac{2\sin\frac{9x}{2}\cos\frac{x}{2}\sin\frac{3x}{2}}{\sin\frac{9x}{2}}$

$2\cos\frac{x}{2}\sin\frac{3x}{2} = \sin x + \sin 2x$

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

$= (\cos x + 1)(2\cos x - 1)$

$= 2\cos^2 x + \cos x - 1 = \cos x + \cos 2x$

(C) $\frac{3\sin x - 4\sin^3 x + 2\sin x\cos x - \sin x}{2\sin x}$

$= \frac{2\sin x - 4\sin^3 x + 2\sin x\cos x}{2\sin x}$

$= 1 - 2\sin^2 x + \cos x = \cos x + \cos 2x$

(D) $\frac{\frac{\sin x}{\cos x} + \frac{\sin 2x}{\cos 2x}}{\frac{\sin 4x}{\cos 4x} - \frac{\sin x}{\cos x}} = \frac{\sin 3x\cos 4x}{\cos 2x\sin 3x}$

$= \frac{\cos 4x}{\sin 4x}\ \frac{\sin 4x}{\cos 2x} = 2\cot 4x \sin 2x$

2. (A)–S, (B)–P, (C)–R, (D)–Q

(A) $\tan x + \cot x + 1 = \cos\left(x + \frac{\pi}{4}\right)$

$\underbrace{\tan x + \cot x}_{\geq 2 \text{ or } \leq -2} = \underbrace{\cos\left(x+\frac{\pi}{4}\right) - 1}_{-2 \leq x \leq 0}$

$\Rightarrow$ equality holds when both are –2

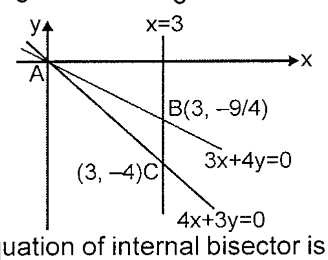
$\Rightarrow \cos\left(x+\frac{\pi}{4}\right) = -1 \Rightarrow x = \frac{3\pi}{4}$ or $\frac{11\pi}{4}$

$\Rightarrow$ sum of the solutions is $\frac{3\pi}{4} + \frac{11\pi}{4} = \frac{7\pi}{2} = k\pi$

$\Rightarrow k = 3.5$

(B) Equation of angle bisector of angle A

$\frac{3x+4y}{5} = \pm\frac{4x+3y}{5} \Rightarrow x = \pm y$



equation of internal bisector is $x = -y$

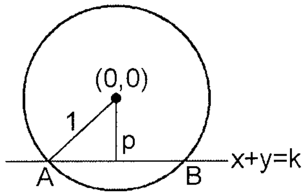
since h and k lie on the line $x = -y$

$\Rightarrow h + k = 0$

(C) $x + y = k$; $AB = 1$

$$p = \left|\frac{-k}{\sqrt{2}}\right|;\ 2\sqrt{1^2 - p^2} = 1$$

$$\Rightarrow 4(1 - p^2) = 1 \Rightarrow 4p^2 = 3$$



$$4.\frac{k^2}{2} = 3 \Rightarrow k^2 = \frac{3}{2} \Rightarrow k = \pm\sqrt{\frac{3}{2}} = \pm\frac{\sqrt{6}}{2}$$

(D) We have $x = \cos t - \sin t$, $y = \sin 2t$

$\Rightarrow x^2 = 1 - y \Rightarrow x^2 = -(y - 1)$

Clearly l (L.R.) = 1

SECTION (E)

1. **3**

Equation of circle is $x^2 + y^2 - ax - \frac{b}{2}y = 0$

Two chords from $\left(a, \frac{b}{2}\right)$ are bisected by x-axis.

Let mid-point of chord is $(x_1, 0)$, then equation of chord will be

$$xx_1 - \frac{1}{2}a(x + x_1) - \frac{b}{4}(y + 0) = x_1^2 - ax_1$$

Chord are drawn from $\left(a, \frac{b}{2}\right)$ so

$$ax_1 - \frac{a}{2}(a + x_1) - \frac{b}{4}\left(\frac{b}{2}\right) = x_1^2 - ax_1$$

or $x_1^2 - \frac{3a}{2}x_1 + \frac{a^2}{2} + \frac{b^2}{8} = 0$ ....(i)

As two such chords are possible

$\Rightarrow$ $D > 0$ of the equation (i)

$$\Rightarrow \frac{9a^2}{2} - 4\left(\frac{a^2}{2} + \frac{b^2}{8}\right) > 0$$

$$\frac{a^2}{4} > \frac{b^2}{2} \Rightarrow \frac{a^2}{b^2} > 2 \Rightarrow \frac{a}{b} > \sqrt{2}$$

According to question $\frac{a}{b} = 2$

2. **360**

(i) $U = 4! = 24$

(ii) Number of ways grouping of two persons equal to $\frac{4!}{2!\,2!\,2!} = 6$

$V = 6 \times {}^4C_2 \times 2! \times 2! = 144$

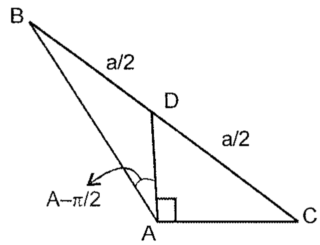
(iii) $W = {}^4C_1 \times 6 \times 4 \times 2 = 24 \times 8 = 192$

$U + V + W = 24 + 144 + 192 = 360$

3. **5**

In ΔABC

$\cos C = \frac{AC}{CD} \Rightarrow \cos C = \frac{2b}{a}$ ....(i)



By cosine formula in ΔABC

$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ and

$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$ ....(ii)

from (i) and (ii)

$\Rightarrow a^2 - c^2 = 3b^2$ ....(iii)

$$\therefore \cos A \cos C = \frac{b^2 + c^2 - a^2}{2bc} \times \frac{2b}{a}$$

$$= \frac{b^2 + c^2 - a^2}{ac} = \frac{3b^2 + 3(c^2 - a^2)}{3ac} = \frac{2(c^2 - a^2)}{3ac}$$

4. **200**

$$2000x^6 + \underbrace{100x^5 + 10x^3 + x}_{\text{a G.P.}} - 2 = 0$$

$$2000x^6 + \frac{x((10x^2)^3 - 1)}{10x^2 - 1} - 2 = 0$$

$$\frac{x(1000x^6 - 1)}{10x^2 - 1} = -2(1000x^6 - 1)$$

$$\therefore 1000x^6 - 1 = 0 \text{ or } \frac{x}{10x^2 - 1} = -2$$

$x^2 = \frac{1}{10}$ which is not given form or $x = -2(10x^2 - 1)$

$$20x^2 + x - 2 = 0$$

$$x = \frac{-1 \pm \sqrt{1 + 160}}{40} = \frac{-1 + \sqrt{161}}{40} \text{ or } \frac{-1 - \sqrt{161}}{40}$$

$\therefore m = -1$; $n = 161$; $r = 40$ $\quad m + n + r = 200$

5. ${}^9C_4 = 126$.

6. **2**

Let $2^n - 1 = q$

$1, d_1, d_2, \ldots\ldots\ldots, d_k$ are

$1, 2, 2^2, \ldots\ldots\ldots\ 2^{n-1}, 2q, \ldots\ldots\ldots, 2^{n-1}q$

respectively.

So, $S = \frac{1}{1}+\frac{1}{d_1}+\frac{1}{d_2}+......+\frac{1}{d_k}$

$= \left[\frac{1}{1}+\frac{1}{2}+\frac{1}{2^2}+......+\frac{1}{2^{n-1}}\right]$

$+\frac{1}{q}\left[\frac{1}{1}+\frac{1}{2}+\frac{1}{2^2}+..........\frac{1}{2^{n-1}}\right]$

$\therefore S = \frac{(2^n-1)}{2^{n-1}}\left[1+\frac{1}{q}\right]$

$= \frac{(2^n-1)(q+1)}{q2^{n-1}} = \frac{(2^n-1)(2^n)}{(2^n-1)(2^{n-1})} = \frac{2^n}{2^{n-1}} = 2$

7. **191**

Members of club *A* who agree to merge = x
Members of club b who agree to merge = x + 1
Member of club C = y
2x + y = 23
Total fight
F = x(x+1) +xy+(x+1)y ....(i)
= x(x+1) +x(23–2x)+(x+1)(23–2x)
= $-3x^2+45x+23$

maximum value of F is $-\frac{D}{4a} = \frac{2301}{12} = 191.75$
maximum No. of fights = 191

8. **7**

If $\tan\alpha = \tan^3\frac{\theta}{2} \Rightarrow \frac{\sin\alpha}{\cos\alpha} = \frac{\sin^3\frac{\theta}{2}}{\cos^3\frac{\theta}{2}} = K(\text{say})$

Let $\sin\alpha = K\sin^3\frac{\theta}{2} \Rightarrow \cos\alpha = K.\cos^3\frac{\theta}{2}$

But $\sin^2\alpha + \cos^2\alpha = 1$

$K^2\left[\sin^6\frac{\theta}{2}+\cos^6\frac{\theta}{2}\right] = 1$

$\Rightarrow K^2 = \frac{1}{\left(\sin^6\frac{\theta}{2}+\cos^6\frac{\theta}{2}\right)}$

Again $\sin^{\frac{2}{3}}\alpha+\cos^{\frac{2}{3}}\alpha = K^{\frac{2}{3}}\left[\sin^2\frac{\theta}{2}+\cos^2\frac{\theta}{2}\right] = K^{\frac{2}{3}}$

$= \frac{1}{\left[\sin^6\frac{\theta}{2}+\cos^6\frac{\theta}{2}\right]^{\frac{1}{3}}} = \frac{1}{\left[\left(\sin^2\frac{\theta}{2}\right)^3+\left(\cos^2\frac{\theta}{2}\right)^3\right]^{\frac{1}{3}}}$

$= \frac{1}{\left[1-\frac{3}{4}\sin^2\theta\right]^{\frac{1}{3}}} = \frac{1}{\left[\frac{1}{4}+\frac{3}{4}\cos^2\theta\right]^{\frac{1}{3}}}$

$= \frac{1}{\left[\frac{1}{4}+\frac{3}{4}\left(\frac{m^2-1}{3}\right)\right]^{\frac{1}{3}}} = \frac{1}{\left[\frac{m^2}{4}\right]^{\frac{1}{3}}} = \left(\frac{2}{m}\right)^{\frac{2}{3}}.$

PHYSICS

SECTION - (A)

1. **C**

$\vec{v} = v_0\hat{i}+a\omega\sin\omega t\,\hat{j}+a\omega\cos\omega t\,\hat{k}$

$\frac{d\vec{r}}{dt} = \vec{v},\ \vec{r}-\vec{r}_0-\frac{5v_0\pi}{2\omega}\hat{i}+a\hat{j}+a\hat{k}$

$\vec{r} = a\hat{j}+a\hat{k},\ \left|\vec{r}\right| = a\sqrt{2}$

2. **B**

$C = C_v+\frac{R}{1-x} = \frac{3}{2}R+\frac{R}{2} = 2R$

$Q = nC\Delta T = n(2R)(3T) = 6\,PV$

3. **B**

When the block displaced towards left it executed SHM under action of springs on right and when it is on right of its intial position then it executed SHM due to the springs on left.

4. **A**

SECTION – (B)

1. **C**

$\frac{d^2a}{dt^2} = \frac{1}{m}\frac{d^2F}{dt^2} = \frac{1}{m}\left(2-\frac{kd^2k}{dt^2}\right)$

$= -\frac{k}{m}\left[a-\frac{2}{k}\right] = -\omega^2(a-a_0)$

2. **A,C**

3. **A,B**

$E_1 = e_1\sigma AT_1^4$
$E_2 = e_2\sigma AT_2^4$
given $E_1 = E_2$

$T_2 = \frac{T_1}{3} = 1934\,k$

$\lambda_1T_1 = \lambda_2T_2 \Rightarrow \lambda_2 = 3\lambda_1$
$\lambda_2-\lambda_1 = 1$
$\Rightarrow 3\lambda_1-\lambda_1 = 1$

$\Rightarrow \lambda_1 = \frac{1}{2}\mu m,\ \lambda_2 = 1.5\ \mu m$

4. **A,B**

speed of the pluse

$= \dfrac{\text{coefficient of } t}{\text{coefficient of } x} = 4 \text{ m/s}$ –ve direction

at $t = 0$

$y = \dfrac{8}{2+x^2} \Rightarrow y_{max}$ at $x = 0$

$y = \dfrac{8}{2} = 4$ m

5. **A**

$F = -\dfrac{dU}{dx} = -8 \sin 2x$

$a = \dfrac{F}{m} = -8 \sin 2x$

for small oscillations $\sin 2x \approx 2x$

i.e., $a = -16x$

since $a \propto -x$

Oscillations are simple harmonic in nature

$\therefore \; T = \sqrt{\left|\dfrac{x}{a}\right|} = 2\pi\sqrt{\dfrac{1}{16}} = \dfrac{\pi}{2}$ s

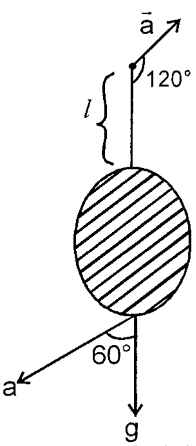
SECTION (D)

1. **(A) → Q ; (B) → P ; (C) → R; (D) → R**

2. **(A) → R,S ; (B) → R,S ; (C) → P,Q ; (D) → R,S**

SECTION – (E)

1. **7**



With respect to point O, the bob has two accelerations $\vec{a}$ and $\vec{g}$ at an angle of 60° as shown.

Net acceleration of bob

$= |\vec{g}'| = \sqrt{a^2 + g^2 + 2ag\cos 60^\circ}$

$= \sqrt{\left(\dfrac{g}{2}\right)^2 + g^2 + 2g\left(\dfrac{g}{2}\right)\left(\dfrac{1}{2}\right)} = g\sqrt{\dfrac{7}{4}}$

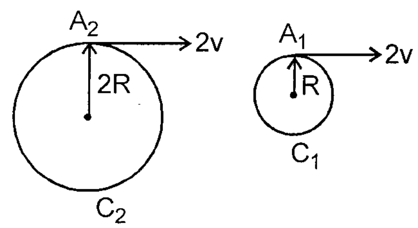
$T = 2\pi\sqrt{\dfrac{\ell}{g'}} \Rightarrow T = 2\pi\sqrt{\dfrac{2\ell}{\sqrt{7}g}}$

$n = 7$

2. 5 m/s^2

Hint α of the rod is zero.

3. 2 m/s



In the figure C_1 and C_2 are I C of two cylinders. In the absence of slipping between plank and cylinders, points A_1 and A_2 have same velcoity.

Angular velcoity of larger cylinder is $\dfrac{2v}{4R} = \dfrac{v}{2R}$

$$v_{CM} = (2R)\left(\dfrac{v}{2R}\right) = v$$

4. 4

$\dfrac{dl}{dt} \times \tan 37^\circ = v$

$\dfrac{dl}{dt} = \dfrac{4v}{3}$

5. **$\mu = 0$**

6. **x = 64**

Let m be the mass of the beads

By energy conservation

$mgh = \dfrac{1}{2}mv_1^2 + \dfrac{1}{2}mv_2^2$ ...(i)

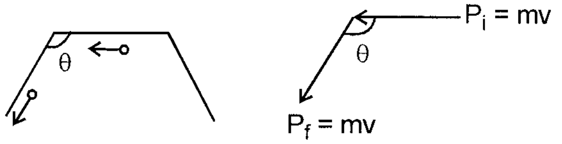
and $\dfrac{v_1}{v_2} = \dfrac{4}{3}$ .....(ii)

$v_1 = \dfrac{4\sqrt{2}}{5}, \quad v_2 = \dfrac{3\sqrt{2}}{5}$

$K.E = \dfrac{1}{2} \times 100 \times 10^{-3} \times \dfrac{16 \times 2}{25} = 64 \times 10^{-3}$ J

x = 64

7. **2**



$$\theta = \left(\pi - \frac{\pi}{2n}\right)$$

Impulse = change in linear momentum

Change in momentum

$$= \sqrt{(mv)^2 + (mv)^2 + 2(mv)(mv)\cos\theta}$$

$$= 2mv \sin\left(\frac{\pi}{2n}\right)$$

$= 2 \times 1 \times 2 \times 1/2 = 2$

8. **21**

For process AB $T_A = 300$ K, $T_B = 600$ K

$W = nR\Delta T = nR(T_B - T_A) = 300\ nR = 600\ R$

$$Q = n\,C_p\,\Delta T = 2 \times \frac{5}{2} R\,(300) = 1500\ R$$

For process BC $W = nRT \ln \frac{v_f}{v_i} = nRT \ln \frac{p_i}{p_f}$

$= nRT \ln 2 = 1200\ R \ln 2$

$Q = W = 1200\ R \ln 2$

For process CA

$$W = \int P dV = \int_{600}^{300} \frac{K}{T}\frac{2nRT}{K} dT = -2nR\,(300) = -1200\ R$$

$= -900\ R - 1200\ R = -21100\ R$

$$\eta = \frac{600R + 1200R\ln 2 - 1200R}{1500R + 1200R\ln 2}$$

$$= 1 - \frac{21}{12\ln 2 + 15} \Rightarrow x = 21$$

CHEMISTRY

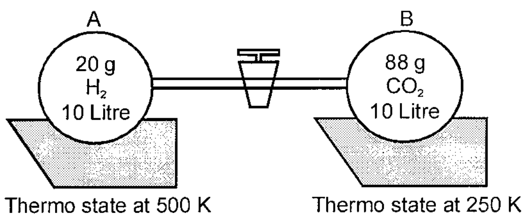
<u>SECTION - (B)</u>

1. **D**

2. **A**

The basicity order will be inversally proportional to resonance stability of lone pair.

3. **B**



No. of mole of H_2 in flask $A = \frac{20}{2} = 10$ mole

No. of mole of CO_2 in flask $B = \frac{88}{44} = 2$ mole

Now pressure of Gas in flask A

$PV = nRT$

$P_A \times 10 = 10 \times R \times 500$

$P_A = 500\ R$

Now pressure of Gas in flask B

$P_B \times 10 = 2 \times R \times 250$

$P_B = 50\ R$

Because flask A is on higher pressure that's why H_2 will flow from flask A to flask B.

Let suppose x mole of H_2 move from flask A to B.

So mole of H_2 remain in A

= (10 – x) and total mole in B = (2 + x)

Now after opening valve pressure of both flask become equal.

$n_A T_A = n_B T_B$

$(10 - x) \times 500 = (2 + x) \times 250$

$x = 6$

Composition of H_2 in $B = \frac{6}{8} \times 100 = 75\%$

4. **A**

$K_c = [CO_2] = 0.05$ mole/litre

so moles of $CO_2 = 6.50 \times 0.05$ moles

= 0.3250 moles

$$CaCO_3 \rightleftharpoons CaO + CO_2$$

1 mole of CO_2 = 1 mole of $CaCO_3$

0.3250 moles of CO_2 = 0.3250 moles of $CaCO_3$

= 0.3250 × 100 gm of $CaCO_3$ = 32.5 gm of $CaCO_3$

<u>SECTION - (B)</u>

1. **A,B,C,D**

Active Hydrogen takes part in tautomerism.

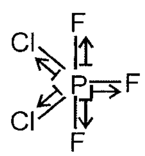
2. **A, B, C**

(A) Due to back bonding in vacant d-orbital of Si by N, $(SiH_3)_3N$ is weaker base than $(CH_3)_3N$

(B) Due to hydrogen bonding KHF_2 give K^+ & HF_2^- ions.

(C) In H_2O_2 due to lp – lp repulsions, O – O bond length is more

(D) In PCl_2F_3 all bond dipole moment not cancels out at equatorial position



3. **B,D**

Given $K_c < 2$ therefore in case of B and C

$$K_C = \frac{2 \times 4}{6} = \frac{4}{3}$$

and concentration of PCl_3 and Cl_2 together will decrease or increase as reaction can go in the forward or backward direction.

4. **A, B,D**

$$(V_{rms})_{N_2} = (V_{rms})_{O_2}$$

$$\sqrt{\frac{3RT_{N_2}}{M_{N_2}}} = \sqrt{\frac{3RT_{O_2}}{M_{O_2}}} \qquad \frac{T_{N_2}}{M_{N_2}} = \frac{T_{O_2}}{M_{O_2}}$$

Then V_{av} and V_{mps} is also same

$$d_{N_2} = \frac{P_{N_2}M_{N_2}}{RT_{N_2}}, \quad d_{O_2} = \frac{P_{O_2}M_{O_2}}{RT_{O_2}}$$

if $P_{N_2} = P_{O_2}$ then $d_{N_2} = d_{O_2}$

5. **B,D**

SECTION - (D)

1. **(A) → S ; (B) → (P) ; (C) → (Q), (D) → (R)**

More active Hydorgen, hydrogen bonding give more enol content.

2. **(A)–R ; (B)–(S) ; (C)–(Q) ; (D)–(P)**

SECTION – (E)

1. **6**

2. **16**

For n = 4, there are four subshells with l = 0, l = 1, l = 2, l = 3, designated as *s*, *p*, *d* and *f*.

l	Subshell	*m* values	Number of orbitals (2*l* + 1)
0	*s*	0	1
1	*p*	+1, 0, –1	3
2	*d*	+2, +1, 0, –1, –2	5
3	*f*	+3, +2, +1, 0, –1, –2, –3	7
		Total	16

That is, there are 16 orbitals in the shell with n = 4.

3. **21**

Let the wt. of SO_3 be x gram therefore the wt. of H_2SO_4 will be (0.5 – x)

$SO_3 + H_2O \rightarrow H_2SO_4$

x/80 x/80

total moles of $H_2SO_4 = \frac{(0.5 - x)}{98} + \frac{x}{80}$

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

Total mole of NaOH used = $2\left[\frac{0.5 - x}{98} + \frac{x}{80}\right]$

$= 26.7 \times 0.4 \times 10^{-3}$

$\Rightarrow x = 0.1031$

$$\% \ SO_3 = \frac{0.1039}{0.5} \times 100 = 20.72 \ \%$$

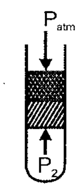
4. **0.512 atm**

If S_2 is in gaseous state, we have

	$S_8(g) \rightleftharpoons$	$4S_2(g)$
Initial press.	1 atm	0
Press. at equilibrium	(1 – 0.2) atm	(4 × 0.2) atm
	= 0.8 atm	= 0.8 atm

$$\therefore \quad K_p = \frac{(p_{S_2})^4}{p_{S_8}} = \frac{(0.8)^4}{0.8} = 0.512$$

5. **18 cm**



P_1 = 75 cm of Hg,

$$P_2 = 75 + 10 + \frac{20.4 \times 10}{13.6} = 100 \text{ cm of Hg}$$

$\Rightarrow$ 75 × 24 = 100 × x

x = 18 cm

6. **5**

7. **9**

8. **3**