

JEE(Main + Advanced) : NURTURE TEST SERIES/JOINT PACKAGE COURSE

Test Type : Full Syllabus PAPER-1

PART-1 : PHYSICS

ANSWER KEY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	B	B	B	D	B	A	A,B,C	A,C	A,B,C	A,C,D
	Q.	11	12								
SECTION-II	A.	B,C	A,C								
	Q.	1	2	3	4	5	6				
	A.	2.00	2.16 to 2.19	3.80	1.98 to 2.00	100.00	1.33				

SOLUTION

SECTION-I

1. Ans. (B)

Sol. $mg - T = ma$

$$T = ma \quad \therefore T = mg/2$$

$$a = g/2$$

2. Ans. (B)

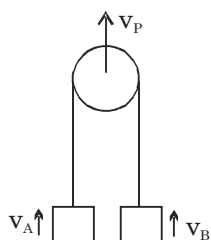
3. Ans. (B)

Sol. Relative acceleration of coin w.r.t. lift = $1 \text{ m/s}^2 \downarrow$

$$t = \sqrt{\frac{2h}{a_{\text{rel}}}} = \sqrt{\frac{2 \times 2}{1}} = 2 \text{ s}$$

4. Ans. (D)

Sol. $2\vec{v}_P = \vec{v}_A + \vec{v}_B$



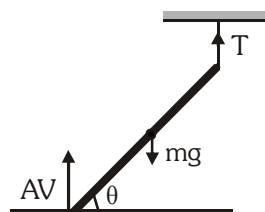
5. Ans. (B)

$$\text{Sol. } v_0 = \frac{2}{g} r^2 \frac{(8.5 - 0.8)g}{\eta}$$

$$nv_0 = \frac{2}{g} r^2 \frac{(2.5 - 0.8)g}{\eta}$$

$$n = 17/77$$

6. Ans. (A)



Sol.

$$Mg = N + T \quad \dots(1)$$

Torque about com will be zero.

$$\therefore N \times \frac{l}{2} \cos \theta = T \times \frac{l}{2} \cos \theta = 0$$

$$N = T$$

$$\therefore T = \frac{mg}{2}$$

7. Ans. (A,B,C)

Sol. Using conservation of mechanical energy and equation of continuity

$$\{\rho 2Ax\}g \left(H - \frac{x}{2} \right) = \frac{1}{2} \rho 4AH.v^2$$

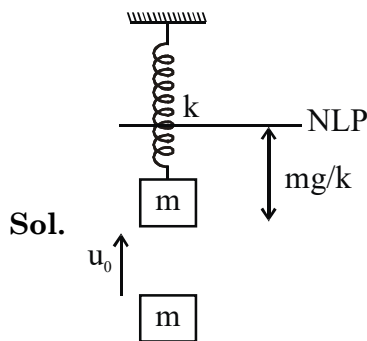
after differentiation we can get for $x = 0$,
 $a = g/2$

8. Ans. (A, C)

$$\text{Sol. Water equivalent} = \frac{m_{\text{obj.}} S_{\text{obj.}}}{S_{\text{water}}}$$

9. Ans. (A,B,C)

10. Ans. (A,C,D)



Sol.

So equilibrium position is change & maximum velocity at the new equilibrium position and new equilibrium position is $2mg/k$

11. Ans. (B,C)

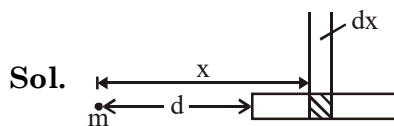
Sol. Due to wind the wavelength and speed of sound w.r.t. ground changes. The frequency & time period also remain unchanged.

12. Ans. (A,C)

Sol. A - Ground frame - No pseudoforce.
B - Non inertial frame - centrifugal is balanced by friction.

SECTION-II

1. Ans. 2.00



Sol.

$$f = \int_d^{\infty} \frac{Gk}{x} \frac{dx}{x^2}$$

2. Ans. 2.16 to 2.19

Sol. $y = 2t + t^2 - 2t^3$

$$v = \frac{dy}{dt} = 2 + 2t - 6t^2$$

$$a = \frac{dv}{dt} = 2 - 12t$$

$$a = 0 \Rightarrow 2 - 12t = 0; t = 1/6$$

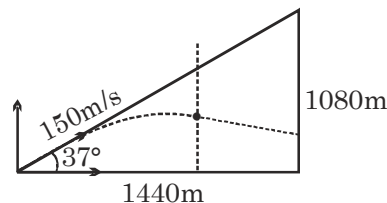
$$v \text{ at } t = \frac{1}{6} \text{ is } v = \frac{13}{6} \text{ m/s.}$$

3. Ans. 3.80

$$\text{Sol. } v_y \Big|_{t=10} = 10 \text{ m/s} \downarrow$$

$$s_y \Big|_{t=10} = 400 \text{ m}$$

$$s_x \Big|_{t=10} = 1200$$



$$t_2 = \frac{240}{120} = 2 \text{ sec}$$

$$s_y \Big|_{t_2} = 20 \downarrow$$

$$\text{Net } s = 400 - 20 = 380 \text{ m}$$

4. Ans. 1.98 to 2.00

$$\text{Sol. } T = 2\pi \sqrt{\frac{m\ell^2}{3k\ell^2}} = 2\pi \sqrt{\frac{m}{3k}}$$

$$\therefore T = 2 \text{ s}$$

5. Ans. 100.00

$$\text{Sol. } T = \mu(r\omega)^2$$

$$T = (0.1)(100)^2$$

$$T = 10^3 \text{ N}$$

$$V = \sqrt{\frac{10^3}{0.1}} = 100 \text{ m/s}$$

6. Ans. 1.33

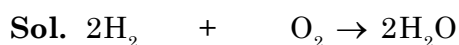
$$\text{Sol. } \frac{v_{\max}}{v_{\min}} = \frac{\left(\frac{V+V_0}{V}\right)v}{\left(\frac{V-V_0}{V}\right)v} = \frac{V+V_0}{V-V_0} = \frac{400}{300} = 1.33$$

PART-2 : CHEMISTRY
ANSWER KEY

	Q.	1	2	3	4	5	6	7	8	9	10
SECTION-I	A	A	C	C	B	A	C	A,C,D	A,D	A,B,C,D	A,C,D
	Q.	11	12								
	A	B,C,D	A,B,D								
SECTION-II	Q.	1	2	3	4	5	6				
	A	60.00	5.63	1.00	2.00	5.00	3.00				

SOLUTION
SECTION-I

1. Ans. (A)



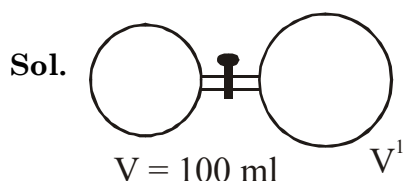
mol 2 1

mass 2×2 1×32 g

10 g 80 g

mol 5 $2.5 \text{ mol } 5 \times \frac{50}{100} \times 18$
= 45 gm

2 Ans. (C)



$$P \times 100 = \frac{40}{100} P \times V_t$$

$$V_t = 250 \text{ mL}$$

$$\text{So } V^1 = 150 \text{ mL}$$

3. Ans. (C)

4. Ans. (B)

5. Ans. (A)

6. Ans. (C)

7. Ans. (A,C,D)

8. Ans. (A,D)

Sol. (A) Fact

(B) Probability of finding an electron is nearly 90% in an orbital

(C) No of angular nodes are ℓ

(D) For 1s $|\Psi|^2$ is maximum at nucleus

9. Ans. (A,B,C,D)

Sol. Uub $\rightarrow$ 112

Group number $\rightarrow 112 - 100 = 12$ (d-block)

7th period element

All elements beyond uranium are transuranic elements

10. Ans. (A,C,D)

11. Ans. (B,C,D)

12. Ans. (A,B,D)

SECTION-II

1. Ans. (60.00)

Sol. $W = -P\Delta V = -25 \times 8$
= -200 bar·L
= -20 kJ

$$\Delta U = Q + W$$

$$= 80 - 20 = 60 \text{ kJ}$$

2. Ans. (5.63)

3. Ans. (1.00)

4. Ans. (2.00)

5. Ans. (5.00)

6. Ans. (3.00)

PART-3 : MATHEMATICS
ANSWER KEY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A	A	C	D	D	C	C	A,C	A,C,D	A,C	A,B
	Q.	11	12								
SECTION-II	A	A	A,B,C,D								
	Q.	1	2	3	4	5	6				
	A	819.00	4.00	16.00	256.00	0.22 or 0.23	14.00				

SOLUTION
SECTION-I

1. **Ans. (A)**

Sol. $5.2n(2n-1)(2n-2) = 52.n.(n-1)(n-2)$

$$\Rightarrow n^2 - 8n + 7 = (n-7)(n-1) = 0$$

$$\Rightarrow n = 1, 7, n \neq 1$$

$$\Rightarrow n = 7$$

2. **Ans. (C)**

Sol. Reverse alphabetic order

T R I A A

$$T \begin{array}{|c|c|c|c|} \hline & & & \\ \hline \end{array} \frac{4}{2} = 12 \text{ ways}$$

$$R \begin{array}{|c|c|c|c|} \hline & & & \\ \hline \end{array} \frac{4}{2} = 12 \text{ ways}$$

$$I \begin{array}{|c|c|c|c|} \hline & & & \\ \hline \end{array} \frac{4}{2} = 12 \text{ ways}$$

$$A \begin{array}{|c|c|c|c|} \hline T & & & \\ \hline \end{array} \frac{3}{1} = 6 \text{ ways}$$

$$A \begin{array}{|c|c|c|c|} \hline R & & & \\ \hline \end{array} \frac{3}{1} = 6 \text{ ways}$$

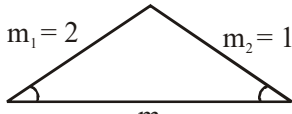
$$A \begin{array}{|c|c|c|c|} \hline I & & & \\ \hline \end{array} \frac{3}{1} = 6 \text{ ways}$$

$$A \begin{array}{|c|c|c|c|} \hline A & T & & \\ \hline \end{array} \frac{2}{1} = 2 \text{ ways}$$

$$\begin{array}{|c|c|c|c|c|} \hline A & A & R & T & I \\ \hline \end{array} = 1 \text{ way}$$

Hence 57th Rank.

3. **Ans. (D)**

Sol. $m_1 = 2$  $m_2 = 1$

$$\frac{m-2}{1+2m} = \frac{1-m}{1+m}$$

$$\Rightarrow (m^2 - m - 2) = -(2m^2 - m - 1)$$

$$3m^2 - 2m - 3 = 0$$

4. **Ans. (D)**

$$\text{Sol. } \sum_{k=1}^{100} i^{k!} + \sum_{k=1}^{100} \omega^{k!}$$

$$\sum_{k=1}^{100} i^{k!} = i^{1!} + i^{2!} + i^{3!} + i^{4!} + \dots + i^{100!}$$

$$= i - 1 + i^6 + 1 + 1 + 1 + \dots + 1 = i - 2 + 97 = i + 95.$$

$$\sum_{k=1}^{100} \omega^{k!} = \omega^{1!} + \omega^{2!} + \omega^{3!} + \omega^{4!} + \dots + \omega^{100!}$$

$$= \omega + \omega^2 + 1 + 1 + 1 + \dots + 1 = 97$$

$$\text{sum} = i + 95 + 97 = i + 192$$

5. **Ans. (C)**

$$\text{Sol. } \left[\frac{3}{5} + \frac{1}{100} \right] + \dots + \left[\frac{3}{5} + \frac{39}{100} \right] = 0$$

$$\left[\frac{3}{5} + \frac{40}{100} \right] + \dots + \left[\frac{3}{5} + \frac{139}{100} \right] = 100(1)$$

$$\left[\frac{3}{5} + \frac{140}{100} \right] + \dots + \left[\frac{3}{5} + \frac{150}{100} \right] = 11(2)$$

$$= 100 + 22 = 122$$

6. **Ans. (C)**

Sol. A(-1,2,3), B(4,a,1), C(b,8,5)

$$\text{DR}^s \text{ of } \overline{AB} = (5, a-2, -2), \text{DR}^s \text{ of } \overline{AC} = (b+1, 6, 2)$$

$$\Rightarrow -5 = b+1 \Rightarrow b = -6, a-2 = -6 \Rightarrow a = -4$$

$$\Rightarrow a = -4, b = -6$$

7. **Ans. (A,C)**

$$\text{Sol. } (5+2\sqrt{6})^{2n+1} + (5-2\sqrt{6})^{2n+1}$$

$$= 2 \left({}^{2n+1}C_0 \cdot 5^{2n+1} + {}^{2n+1}C_2 \cdot 5^{2n-1} \cdot (2\sqrt{6})^2 + \dots \right)$$

$$\dots + {}^{2n+1}C_{2n} \cdot 5 \cdot (2\sqrt{6})^{2n} \Big)$$

$$\Rightarrow I + f + f' = 10 \times \text{an integer} \dots (1),$$

$$\text{where } f' = (5-2\sqrt{6})^{2n+1} \text{ and } 0 < f' < 1$$

$$\text{also } 0 < f < 1$$

so $0 < f + f' < 2$

but $f + f'$ must be an integer

$$\Rightarrow f + f' = 1$$

$\therefore (1) \Rightarrow I = \text{a multiple of } 10 - 1 = \text{odd integer}$
and $I + 1 = \text{multiple of } 10$.

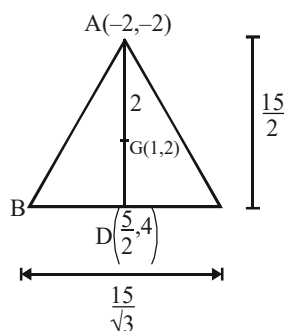
Also, the integer next above $(5 + 2\sqrt{6})^{2n+1}$
is $I + f + f'$, divisible by 10

$$\text{Now } I - 1 = \frac{f}{1 - f} = \frac{f}{f'} \Rightarrow If' = f + f'$$

I. $f' = 1$ (not true)

8. **Ans. (A,C,D)**

Sol. In an equilateral triangle all centre
corncides

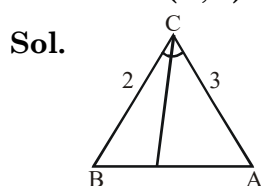


$$r = \frac{\Delta}{s} = \frac{\frac{\sqrt{3}}{4} a^2}{\frac{3a}{2}} = \frac{1}{2\sqrt{3}} a = \frac{\sqrt{5}}{2.3} = \frac{5}{2}$$

$$\text{area} = \Delta = \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \cdot \frac{225}{3} = \frac{225}{4\sqrt{3}}$$

$$\text{equation of BC is } (y - 4) = -\frac{3}{4} \left(x - \frac{5}{2} \right)$$

9. **Ans. (A,C)**



$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$= 13 - 6 = 7$$

Now, length of internal
angle bisector through vertex

$$C = \frac{2ab}{a+b} \cos \frac{C}{2} = \frac{12}{5} \times \frac{\sqrt{3}}{2} = \frac{6\sqrt{3}}{5} \therefore (A)$$

& length of median through vertex C is

$$\frac{1}{2} \sqrt{2a^2 + 2b^2 - c^2} = \frac{1}{2} \sqrt{26 - 7} = \frac{\sqrt{19}}{2} \therefore (C)$$

10. **Ans. (A,B)**

$$\text{Sol. } f(x) = \frac{(x-1)(x-2)}{(x+3)(x-2)} = \frac{x-1}{x+3}, x \neq 2$$

$\therefore f(x)$ can not take the value 1

and $f(2)$ i.e. $\frac{1}{5}$

11. **Ans. (A)**

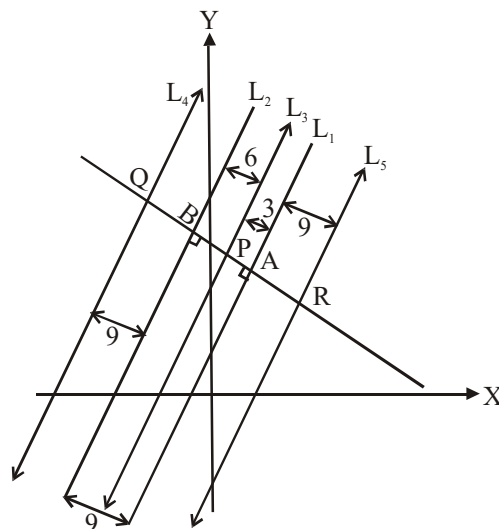
$$\text{Sol. } a^2 = b^2 (1 - e_1^2) \text{ and } b^2 = a^2 (e_2^2 - 1)$$

Multiplying $1 = (1 - e_1^2) (e_2^2 - 1)$

$$(e_1^2 - 1) (e_2^2 - 1) + 1 = 0.$$

12. **Ans. (A,B,C,D)**

Sol.



SECTION-II

1. **Ans. 819.00**

$$\text{Sol. } xy = 2^3 3^4 5^6 (x + y)$$

or $xy - Sx - Sy + S^2 = S^2$ (where $S = 2^3 \cdot 3^4 \cdot 5^6$)

$$\Rightarrow (x - S) (y - S) = 2^6 3^8 5^{12}$$

So, number of positive integral solution

$$= (6 + 1) \cdot (8 + 1) \cdot (12 + 1)$$

$$= 7 \times 9 \times 13 = 819$$

2. **Ans. 4.00**

$$\text{Sol. } AM \geq GM$$

$$\frac{\frac{1}{x} + x^2 + x^3 + \frac{1}{x^4}}{4} \geq \left(\frac{1}{x} \cdot x^2 \cdot x^3 \cdot \frac{1}{x^4} \right)^{1/4}$$

$$\frac{1}{x} + x^2 + x^3 + \frac{1}{x^4} \geq 4$$

3. **Ans. 16.00**

$$\text{Sol. } \tan(3\pi \cos \theta) = \tan \left(\frac{\pi}{2} - 2\pi \sin \theta \right)$$

$$3\pi \cos \theta = n\pi + \frac{\pi}{2} - 2\pi \sin \theta$$

$$3\cos\theta + 2\sin\theta = \frac{2n+1}{2} \quad n \in \mathbb{I}$$

$$-\sqrt{13} \leq \frac{2n+1}{2} \leq \sqrt{13}$$

$$-7.21 \leq 2n+1 \leq 7.21$$

$$-8.21 \leq 2n \leq 6.21$$

$$n = -4, -3, -2, -1, 0, 1, 2, 3$$

these are 8 values of n

& for every n there will be 2 values of θ .

so total 16 values of θ .

4. **Ans. 256.00**

Sol. $[\sec 36^\circ \operatorname{cosec} 18^\circ (-\operatorname{cosec} 18^\circ)(-\sec 36^\circ)]^2$

$$= [\sec^2 36^\circ \operatorname{cosec}^2 18^\circ]^2$$

$$= \left[\frac{4}{\sqrt{5}+1} \times \frac{4}{\sqrt{5}-1} \right]^4 = 256$$

5. **Ans. 0.22 or 0.23**

Sol. $P(A) - P(A \cap B) = \frac{1}{3}$ &

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) = \frac{11}{15}$$

$$\Rightarrow P(B) = \frac{6}{15} = \frac{2}{5}$$

$$P(A) - P(A)P(B) = \frac{1}{3} \Rightarrow P(A) = \frac{5}{9}$$

$$\Rightarrow P(A \cap B) = P(A)P(B) = \frac{2}{5} \times \frac{5}{9} = \frac{2}{9}$$

6. **Ans. 14.00**

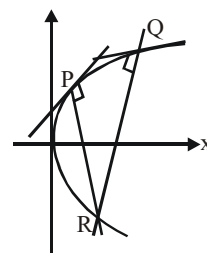
Sol. Let $P(t_1^2, 2t_1)$

$Q(t_2^2, 2t_2)$ and $(t_3^2, 2t_3)$

where $t_1 t_2 = 2$ and $t_1 + t_2 + t_3 = 0$

centroid of $\Delta^{\text{le}} PQR$ is

$$\left(\frac{(t_1^2 + t_2^2 + t_3^2)}{3}, \frac{2(t_1 + t_2 + t_3)}{3} \right)$$



i.e. $\left(\frac{t_1^2 + t_2^2 + t_3^2}{3}, 0 \right) \equiv (8, 0)$

$$\Rightarrow t_1^2 + t_2^2 + t_3^2 = 24$$

$$\Rightarrow (t_1 + t_2 + t_3)^2 - 2\{t_1 t_2 + t_2 t_3 + t_3 t_1\} = 24$$

$$\Rightarrow t_3(-t_3) = -14$$

$$\Rightarrow t_3^2 = 14$$

JEE(Main + Advanced) : NURTURE TEST SERIES/JOINT PACKAGE COURSE

Test Type : Full Syllabus PAPER-2

PART-1 : PHYSICS

ANSWER KEY

SECTION-I	Q.	1	2	3	4	5	6
	A.	B,D	B,D	A,C,D	A,B,C,D	A,B,C,D	A,C,D
SECTION-II	Q.	1	2	3	4	5	6
	A.	2.00	5.00	6.00	6.00	5.00	0.50
SECTION-III	Q.	1	2	3	4	5	6
	A.	6	5	4	8	3	3

SOLUTION

SECTION-I

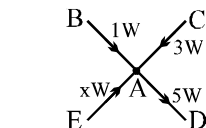
1. Ans. (B,D)

2. Ans. (B,D)

Sol. A absorbs more heat
hole in B expands due to isotropic expansion.

3. Ans. (A, C, D)

Sol. Heat flow



At A

$$x + 1 + 3 = 5$$

$$x = 1$$

Heat in flows from E

$$\therefore T_E > T_A$$

$$\therefore T_C > T_A > T_D$$

$$T_B - T_A = T_E - T_A$$

$$\therefore T_B = T_E$$

4. Ans. (A,B,C,D)

5. Ans. (A, B, C, D)

Sol. At node $\cos(10\pi x) = 0$ & at antinode $\cos(10\pi x) = 1$

$$\& \omega = 50\pi, k = 10\pi \& v = \frac{\omega}{k}, k = \frac{2\pi}{\lambda}$$

6. Ans. (A,C,D)

$$\text{Sol. } a = 6\hat{i} - 8\hat{j} \quad \vec{a}_t = 6\hat{i} \quad \vec{a}_c = -8\hat{j} \Rightarrow \frac{v^2}{r} = 8$$

$$\Rightarrow v = 4 \Rightarrow \vec{v} = 4\hat{i}$$

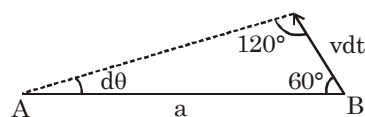
$$\omega = \frac{v}{r} = 2,$$

$$a_t = r\alpha \Rightarrow \alpha = 3\hat{k}$$

SECTION-II

1. Ans. 2.00

Sol.



$$\frac{a}{\sin 120^\circ} = \frac{vdt}{\sin(d\theta)} \approx \frac{vdt}{d\theta}$$

$$\frac{2}{\sqrt{3}}a = \frac{v}{\omega}$$

$$a_c = v\omega = \frac{v \cdot \sqrt{3}v}{2a} = \frac{\sqrt{3}}{2} \frac{v^2}{a}$$

2. Ans. 5.00

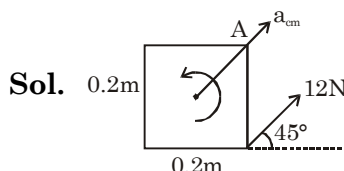
$$\text{Sol. } F = \left(\frac{10}{2}\right)(10)^2 \left(\frac{3 \times 0.8}{8}\right) = 150N$$

3. Ans. 6.00

$$\text{Sol. } \sin \theta_m = \frac{m_1}{m_2} = \frac{1}{2}$$

$$\theta_m = 30^\circ$$

4. Ans. 6.00



Sol.

$$12 = 6a_{cm} \Rightarrow a_{cm} = 2$$

$$12 \cdot \frac{\ell}{\sqrt{2}} = \frac{1}{6} \times 6(\ell^2)\alpha \Rightarrow \alpha = \frac{6\sqrt{2}}{\ell}$$

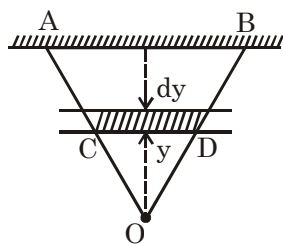
$$\vec{a}_A = \vec{a}_{A/cm} + \vec{a}_{cm/g}$$

$$|\vec{a}_A| = \sqrt{a_{cm}^2 + \left(\frac{\alpha \ell}{\sqrt{2}}\right)^2} = \sqrt{2^2 + 6^2} = \sqrt{40}$$

$$= 2\sqrt{10} \text{ m/s}^2$$

5. **Ans. 5.00**

Sol.



$$\text{Weight of OCD} = m \left(\frac{y}{\ell} \right)^3 g$$

$$\text{Stress at CD} = \frac{m \left(\frac{y}{\ell} \right)^3 g}{\pi \left(\frac{y}{\ell} R \right)^2}$$

$$\frac{\text{Elastic potential energy}}{\text{Volume}} = \frac{1}{2} \frac{1}{Y} \left[\frac{m \left(\frac{y}{\ell} \right)^3 g}{\pi \left(\frac{y}{\ell} R \right)^2} \right]^2$$

$$\begin{aligned} \text{Total elastic energy} &= \frac{1}{2} \frac{1}{Y} \int_0^\ell \left[\frac{mg}{\pi R^2} \left(\frac{y}{\ell} \right) \right]^2 \cdot \pi \left(\frac{y}{\ell} R \right)^2 dy \\ &= \frac{m^2 g^2 \ell}{10 \pi R^2 Y} \end{aligned}$$

6. **Ans. 0.50**

$$\text{Sol. } |\hat{a} + \hat{b}| = 2 \times 1 \times \cos \frac{\theta}{2}$$

$$|\hat{a} - \hat{b}| = 2 \times 1 \times \sin \frac{\theta}{2}$$

$$2 \sin \left(\frac{\theta}{2} \right) = 2 \cos \left(\frac{\theta}{2} \right) \times \frac{1}{\sqrt{3}}$$

$$\tan \left(\frac{\theta}{2} \right) = \frac{1}{\sqrt{3}} = \tan 30^\circ$$

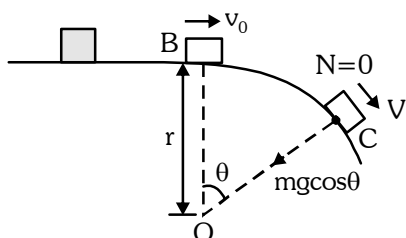
$$\theta = 60^\circ$$

$$\hat{a} \cdot \hat{b} = 1 \times 1 \times \cos 60 = 0.50$$

SECTION-III

1. **Ans. 6**

Sol.



$$-\Delta U = \Delta K$$

$$mg r (1 - \cos \theta) = \frac{1}{2} m (v^2 - v_0^2) \quad \dots (1)$$

$$mg \cos \theta = \frac{mv^2}{r} \quad \dots (2)$$

2. **Ans. 5**

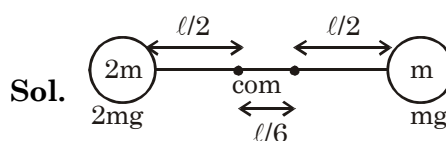
Sol. Assume $a = 4z$

$$y = \frac{16M \times 2z - M \left(\frac{3z}{2} + \frac{5z}{2} + \frac{7z}{2} \right)}{13M}$$

3. **Ans. 4**

Sol. Apply COM

4. **Ans. 8**



Sol.

$$mg \frac{\ell}{2} = \left(2m \frac{\ell^2}{4} + \frac{m \ell^2}{4} \right) \alpha$$

$$\alpha = \frac{mg \ell / 2}{\frac{3m \ell^2}{4}} = \frac{2g}{3\ell}$$

$$a_{\text{com}} = \frac{\ell}{6} \times \frac{2g}{3\ell} = \frac{g}{9}$$

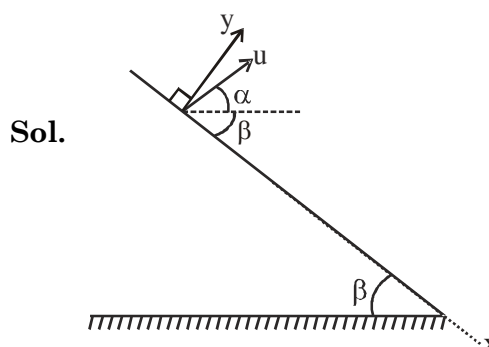
$$3mg - F = 3m(g/9)$$

$$= \frac{8mg}{3} = F \Rightarrow F = 8 \times \left(\frac{50}{1000} \right) \times \frac{10}{3} = \frac{4}{3}$$

$$= 6F = 8$$

5. **Ans. 3**

6. **Ans. 3**



Sol.

$$u_B \cos(\alpha + \beta) = u_A$$

$$\cos(\alpha + \beta) = \frac{1}{2}$$

$$\alpha + \beta = \frac{\pi}{3}$$

PART-2 : CHEMISTRY
ANSWER KEY

SECTION-I	Q.	1	2	3	4	5	6
	A.	A,C,D	B,C,D	A,B,C	B,C,D	A,B,D	A,C,D
SECTION-II	Q.	1	2	3	4	5	6
	A.	43.00	0.01	3.00	3.00	2.00	9.00
SECTION-III	Q.	1	2	3	4	5	6
	A.	7	6	9	0	5	3

SOLUTION
SECTION-I

1. Ans. (A, C, D)

Sol. $n(\text{FeSO}_4 \cdot 6\text{H}_2\text{O}) = \frac{2.6 \times 10^3}{260} = 10$

number of O-atom = $10 \times 10 \times N_A$

moles of H-atom = 10×12

molecules of H_2O = $10 \times 6 \times N_A$

moles of electron in SO_4^{2-} = $10 \times 1 \times 50$

2. Ans. (B,C,D)

Sol. Real gases can be liquified at critical temperature or below by application of pressure.

3. Ans. (A,B,C)

4. Ans. (B,C,D)

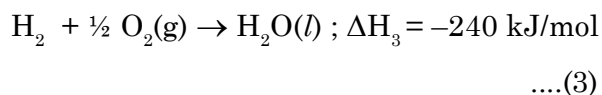
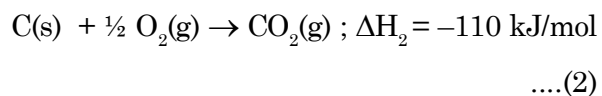
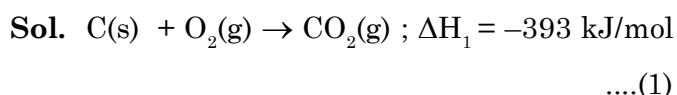
Sol. In alkalimetals down the group hardness decreases due to decrease in metallic bond strength.

5. Ans. (A,B,D)

6. Ans. (A,C,D)

SECTION-II

1. Ans. (43.00)



$\Delta_r H = 393 - 110 - 240 = 393 - 350 = 43 \text{ kJ/mol}$

2. Ans. (0.01)

3. Ans. (3.00)

4. Ans. (3.00)

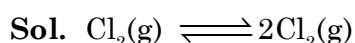
5. Ans. (2.00)

6. Ans. (9.00)

SECTION-III

1. Ans. (7)

2. Ans. (6)



$t = 0 \quad P_0 \quad \text{—}$

$t = t \quad P_0 - P_0 \alpha \quad 2P_0 \alpha$

$\Rightarrow P_0 - P_0 \alpha + 2P_0 \alpha = 15$

$\Rightarrow P_0 (1 + \alpha) = 15$

$P_0 (1.5) = 15 \Rightarrow P_0 = 10$

$K_{eq} = \frac{(2P_0 \alpha)^2}{(P_0 - P_0 \alpha)} = \frac{100}{5} = 20$

$\Delta G^\circ = -RT \ln K_{eq}^\circ$

$= - \frac{2}{1000} \times 1000 \ln 20P_0(20)$

$= - 2 \ln 20 = 6$

3. Ans. (9)

4. Ans. (0)

5. Ans. (5)

6. Ans. (3)

PART-3 : MATHEMATICS

ANSWER KEY

SECTION-I	Q.	1	2	3	4	5	6
	A	A,C	A,B,C	B,C,D	B,C	A,C	A,B,D
SECTION-II	Q.	1	2	3	4	5	6
	A	-3.14	0.06 or 0.07	15.00	24.00	7.71	-0.33 or -0.34
SECTION-III	Q.	1	2	3	4	5	6
	A	5	0	4	2	0	8

SOLUTION

SECTION-I

1. Ans. (A,C)

Sol. $z = i\alpha$

$$\Rightarrow (c - \alpha^2 a) + i(b\alpha - \alpha^3) = 0$$

$$\alpha \neq 0 \Rightarrow \alpha^2 = b \Rightarrow c = ab$$

$$\& z = \pm i\sqrt{b}$$

2. Ans. (A,B,C)

Sol. $a \cos x - \cos 2x = 2a - 7$

$$(4\cos x - a)^2 = (a - 8)^2$$

$$4\cos x = 8 \text{ (rejected) or } \cos x = \frac{a}{2} - 2 \in [-1, 1]$$

$$\Rightarrow a \in [2, 6]$$

3. Ans. (B,C,D)

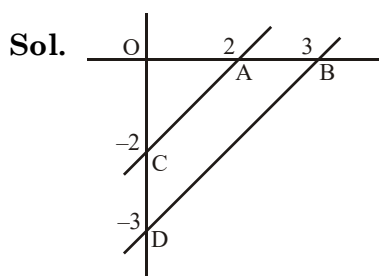
Sol. $\frac{1}{p_1} + \frac{1}{p_2} + \frac{1}{p_3} = 1, 2b = a + c$

$$\Rightarrow \frac{a}{2\Delta} + \frac{b}{2\Delta} + \frac{c}{2\Delta} = 1 \Rightarrow \frac{3b}{2\Delta} = 1$$

$$\Rightarrow \frac{2\Delta}{b} = 3$$

$$p_2 = 3$$

4. Ans. (B,C)



$$(x - y)^2 - 5(x - y) + 6 = 0$$

$$x - y = 2; x - y = 3$$

$$\text{Area ABDC} = \frac{1}{2}(3^2) - \frac{1}{2}(2^2) = \frac{5}{2}$$

& $OA \cdot OB = OC \cdot OD \Rightarrow ABDC$ are concyclic.

5. Ans. (A,C)

Sol. $S_1 \equiv x^2 + y^2 - 2x - 4y - 4 = 0$

$$S_2 \equiv x^2 + y^2 - 8x - 12y + 36 = 0$$

Intersection point of direct common tangent is $(-8, -10)$

equation of line AB is $T = 0 \Rightarrow 3x + 4y = 8$

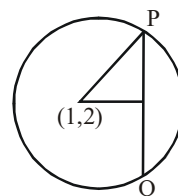
Let equation of $S_3 = 0$ is $(x^2 + y^2 - 2x - 4y - 4) + \lambda(3x + 4y - 8) = 0$

$$\therefore AB \text{ is diameter} \Rightarrow \lambda = \frac{6}{25}$$

required circle $25x^2 + 25y^2 - 32x - 76y - 148 = 0$

equation of common chord is $6x + 8y - 40 = 0$

$$PQ = 2\sqrt{9 - \left(\frac{18}{10}\right)^2} = \frac{24}{5}$$



6. Ans. (A,B,D)

Sol. (A) $\uparrow N \uparrow G \uparrow I \uparrow N \uparrow R \uparrow - \uparrow G \uparrow I \uparrow R \uparrow \boxed{NN} \uparrow$

(B) $\boxed{E} \boxed{N} \boxed{G} \boxed{I} \boxed{N} \boxed{E} \boxed{E} \boxed{R} - \boxed{E} \boxed{} \boxed{N}$

$$\frac{\frac{7}{22}}{\frac{6}{2}} = 900$$

(C) Get A $\equiv$ words starting with. E
Set B $\equiv$ words ending with N
Total - $n(A \cup B)$

$$(D) \frac{\frac{8}{42}}{\frac{4}{2}} = 840$$

SECTION-II

1. Ans. -3.14

$$\text{Sol. } \lim_{x \rightarrow 0} \frac{\sin(\pi - \pi e^{x^2})}{(\pi - \pi e^{x^2})} \cdot \frac{(\pi - \pi e^{x^2})}{x^2} \cdot \frac{x^2}{\sin x^2}$$

$$\lim_{x \rightarrow 0} \frac{-\pi(e^{x^2} - 1)}{x^2} = -\pi$$

2. Ans. 0.06 or 0.07

$$\text{Sol. } \sin 10^\circ \sin 30^\circ \sin 50^\circ \sin 70^\circ = \sin 30^\circ [\sin 10^\circ \sin 50^\circ \sin 70^\circ]$$

$$= \frac{1}{2} \cdot \frac{1}{4} \cdot \sin 30^\circ = \frac{1}{2} \cdot \frac{1}{4} \cdot \frac{1}{2} = \frac{1}{16}$$

$$[\therefore \sin \theta \cdot \sin(60^\circ - \theta) \sin(60^\circ + \theta) = \frac{1}{4} \sin 3\theta]$$

3. **Ans. 15.00**

Sol. $9x^2 - 24xy + 16y^2 = (3x - 4y)^2$

$\Rightarrow$ The given equation is

$$(3x - 4y)^2 + k(3x - 4y) = 0$$

$$(3x - 4y)(3x - 4y + k) = 0$$

$\Rightarrow$ These are parallel lines

$$\Rightarrow \text{distance between them } \left| \frac{k}{5} \right| = 3$$

$$k = \pm 15$$

4. **Ans. 24.00**

Sol. $H_1 = \frac{4a}{a+2}$ & $H_2 = \frac{8a}{a+4}$

$$\& H_3 = \frac{2H_1H_2}{H_1 + H_2} \quad \dots(1)$$

Putting the values of H_1 & H_2 in (1)

$$a = -24$$

$$\Rightarrow |a| = 24$$

5. **Ans. 7.71**

Sol. $(1 + 8x + bx^2)(1 - 3x)^9$

$$(1 + 8x + bx^2) \sum_{r=0}^9 {}^9C_r (-3x)^r$$

$$\text{coefficient of } x^2 = {}^9C_2 \cdot 9 - 8 \cdot {}^9C_1 \cdot 3 + b$$

$$\text{coefficient of } x^3 = -{}^9C_3 \cdot 27 + 8 \cdot {}^9C_2 \cdot 9 - b \cdot {}^9C_1 \cdot 3$$

$$\text{both are equal} \Rightarrow b = \frac{54}{7}$$

6. **Ans. -0.33 or -0.34**

Sol. $\frac{x^2}{16} - \frac{y^2}{9} = 1 \Rightarrow e = \sqrt{1 + \frac{9}{16}} = \frac{5}{4}$

$$3 \tan \frac{\alpha}{2} \tan \frac{\beta}{2} = 3 \times \frac{1-e}{1+e} = 3 \times \frac{1-\frac{5}{4}}{1+\frac{5}{4}} = -\frac{1}{3}$$

SECTION-III

1. **Ans. 5**

Sol. P F P F P

$$\left(\frac{1}{0+4} \right) \left(1 - \frac{1}{0+3} \right) \left(\frac{1}{1+2} \right) \left(1 - \frac{1}{1+1} \right) \left(\frac{1}{2+0} \right)$$

$$= \frac{1}{4} \cdot \frac{2}{3} \cdot \frac{1}{3} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8 \cdot 9}$$

$$= \frac{1}{2^3 \cdot 3^2} \quad a + b = 5$$

2. **Ans. 0**

Sol. $(x-2)(x-3) = 0$

$$\text{Put } x = 2 \text{ in } x^2 - 2x + k = 0 \Rightarrow k = 0$$

$$\text{for } k = 0 \text{ III}^{\text{rd}} \text{ equation becomes } x^2 + 4x = 0$$

No common roots

$$\text{but } x = 3 \text{ in } x^2 - 2x + k = 0 \Rightarrow k = -3$$

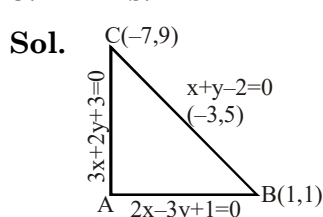
$$\text{for } k = -3 \text{ III}^{\text{rd}} \text{ equation becomes}$$

$$x^2 + 4x - 12 = 0$$

$$(x+6)(x-2) = 0$$

$\therefore$ No common roots to all equation.

3. **Ans. 4**



$$\text{Thus circumcenter} = (-3, 5), \text{ radius} = 4\sqrt{2}$$

equation of circles are

$$x^2 + y^2 + 6x - 10y + 2 = 0$$

$$x^2 + y^2 - kx - 2y - k = 0$$

$$\Rightarrow 2 \left(3 \left(-\frac{k}{2} \right) + (-5)(-1) \right) = 2 - k$$

$$-3k + 10 = 2 - k$$

$$2k = 8$$

$$k = 4$$

4. **Ans. 2**

Sol. $S = {}^{12}C_2 = 66$

$$T = {}^{13}C_3 - 6 = 286 - 6 = 280$$

$$D = {}^{12}C_2 - 12 = 54$$

$$\therefore T + D + S = 400$$

$$T - D - S = 160$$

$$\therefore \left[\frac{T+D+S}{T-D-S} \right] = 2$$

5. **Ans. 0**

Sol. Sum of series =

$$\text{coefficient of } x^{15} \text{ in } (1+x)^{20}(1-x)^{20} \text{ or } (1-x^2)^{20}$$

$$\text{but } (1-x^2)^{20} \text{ contains only even powers of } x$$

$$\Rightarrow \text{sum} = 0$$

6. **Ans. 8**

Sol. Distance between vertex & focus of parabola will be equal to radius of circle = 4 = a.

$$\therefore \text{semilatus rectum} = 2a = 8.$$