ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

DISTANCE LEARNING PROGRAMME
(Academic Session : 2020 - 2021)

JEE(Advanced)
MAJOR TEST # 02
21-02-2021

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								
	A.	B,C	A,C								
SECTION-II	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. $mg - T = ma$

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

$a = g/2$

2. Ans. (B)

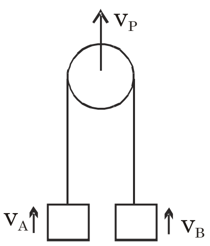
3. Ans. (B)

Sol. Relative acceleration of coin w.r.t. lift = 1 m/s^2 ↓

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

4. Ans. (D)

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



5. Ans. (B)

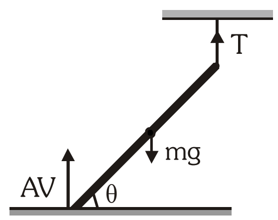
Sol. $v_0 = \frac{2}{g} r^2 \frac{(8.5-0.8)g}{\eta}$

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

$n = 17/77$

6. Ans. (A)

Sol.



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

Torque about com will be zero.

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

$N = T$

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

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

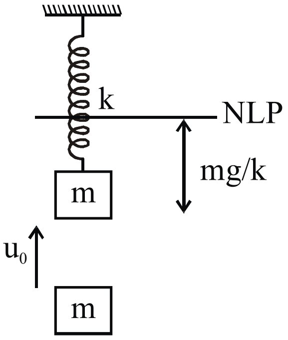
8. Ans. (A, C)

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

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)

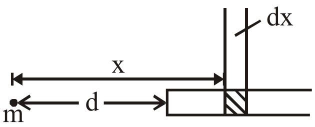
Sol. A - Ground frame - No psuedoforce.

B - Non inertial frame - centrifugal is balanced by friction.

SECTION-II

1. Ans. 2.00

Sol.



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

2. Ans. 2.16 to 2.19

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

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

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

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

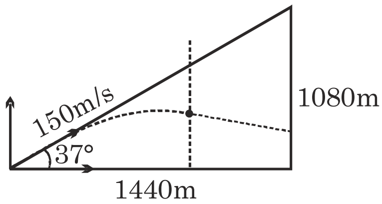
v at $t = \frac{1}{6}$ is $v = \frac{13}{6}$ m/s.

3. Ans. 3.80

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

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

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



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

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

Net s = 400 – 20 = 380 m

4. Ans. 1.98 to 2.00

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

$\therefore$ T = 2s

5. Ans. 100.00

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

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

$T = 10^3$ N

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

6. Ans. 1.33

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

PART-2 : CHEMISTRY

ANSWER KEY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	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)**

Sol. $2H_2 \quad + \quad O_2 \rightarrow 2H_2O$

mol 2 1

mass 2×2 1×32 g

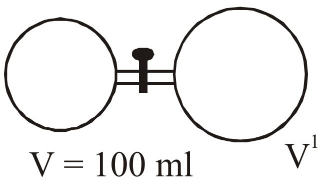
10 g 80 g

mol 5 2.5 mol $5 \times \frac{50}{100} \times 18$

$= 45$ gm

2 **Ans. (C)**

Sol.



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

$V_t = 250$ mL

So $V^1 = 150$ 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)

7^{th} 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

$\Delta U = Q + W$

$= 80 - 20 = 60$ 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

	Q.	1	2	3	4	5	6	7	8	9	10
SECTION-I	A.	A	C	D	D	C	C	A,C	A,C,D	A,C	A,B
	Q.	11	12								
	A.	A	A,B,C,D								
SECTION-II	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. $5.2n(2n-1)(2n-2) = 52.n.(n-1)(n-2)$

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

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

$\Rightarrow \quad n = 7$

2. Ans. (C)

Sol. Reverse alphabatic order

T R I A A

T ☐☐☐☐ $\frac{\lfloor 4}{\lfloor 2} = 12$ ways

R ☐☐☐☐ $\frac{\lfloor 4}{\lfloor 2} = 12$ ways

I ☐☐☐☐ $\frac{\lfloor 4}{\lfloor 2} = 12$ ways

A | T ☐☐☐ $\lfloor 3 = 6$ ways

A | R ☐☐☐ $\lfloor 3 = 6$ ways

A | I ☐☐☐ $\lfloor 3 = 6$ ways

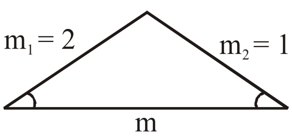
A | A | T ☐☐ $\lfloor 2 = 2$ ways

| A | A | R | T | I | $= 1$ way

Hence 57th Rank.

3. Ans. (D)

Sol.



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

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

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

4. Ans. (D)

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

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

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

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

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

sum $= i + 95 + 97 = i + 192$

5. Ans. (C)

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

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

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

$= 100 + 22 = 122$

6. Ans. (C)

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

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

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

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

7. Ans. (A,C)

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

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

$\left. .... + {}^{2n+1}C_{2n} 5.(2\sqrt{6})^{2n}\right)$

$\Rightarrow I + f + f' = 10 \times$ an integer ...(1),

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

also $0 < f < 1$

so $0 < f + f' < 2$

but $f + f'$ must be an integer

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

$\therefore$ (1) $\Rightarrow$ I = a multiple of 10 – 1 = odd integer and I + 1 = multiple of 10.

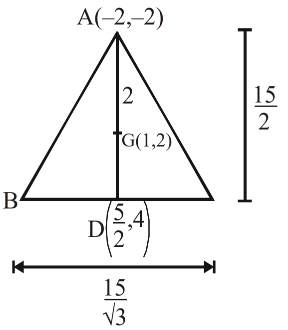
Also, the integer next above $\left(5+2\sqrt{6}\right)^{2n+1}$ is $I + f + f'$, divisible by 10

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



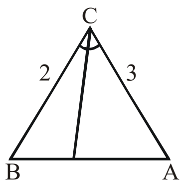
$$r=\frac{\Delta}{s}=\frac{\frac{\sqrt{3}}{4}a^2}{\frac{3a}{2}}=\frac{1}{2\sqrt{3}}a=\frac{\sqrt{5}}{2.3}=\frac{5}{2}$$

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

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

9. Ans. (A,C)

Sol.



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

$= 13 - 6 = 7$

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

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

10. Ans. (A,B)

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

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

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

11. Ans. (A)

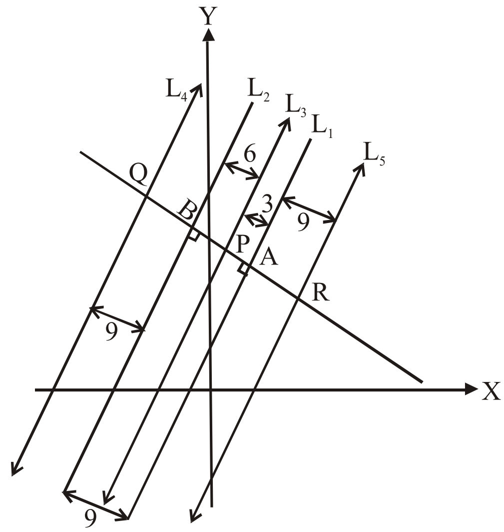
Sol. $a^2 = b^2(1 - e_1^2)$ and $b^2 = a^2(e_2^2 - 1)$

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

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

or $xy - Sx - Sy + S^2 = S^2$ (where $S = 2^3.3^4.5^6$)

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

So, number of positive integral solution

$= (6 + 1).(8 + 1)(12 + 1)$

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

2. Ans. 4.00

Sol. AM $\geq$ GM

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

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

3. Ans. 16.00

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

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

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

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

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

$-8.21 \le 2n \le 6.21$

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

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

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

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

5. Ans. 0.22 or 0.23

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

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

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

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

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

6. Ans. 14.00

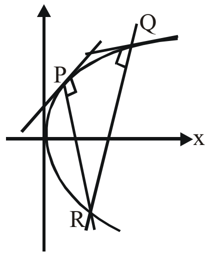
Sol. Let $P(t_1^2, 2t_1)$

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

where $t_1t_2 = 2$ and $t_1 + t_2 + t_3 = 0$

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

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

$\Rightarrow \quad (t_1 + t_2 + t_3)^2 - 2\{t_1t_2 + t_2t_3 + t_3t_1\} = 24$

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

$\Rightarrow \quad t_3^2 = 14$

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN) path to success

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JEE(Advanced)
MAJOR TEST # 02
21-02-2021

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

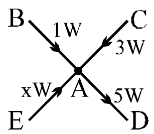
1. Ans. (B,D)

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)

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

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

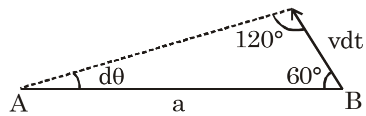
$\omega = \frac{v}{r} = 2,$

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

SECTION-II

1. Ans. 2.00

Sol.



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

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

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

2. Ans. 5.00

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

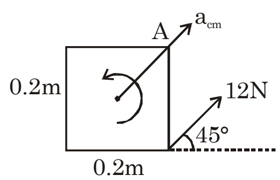
3. Ans. 6.00

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

$\theta_m = 30^\circ$

4. Ans. 6.00

Sol.



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

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

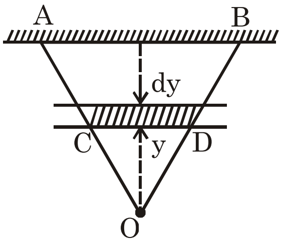
$$\vec{a}_A = \vec{a}_{A/cm} + \vec{a}_{cm/g}$$

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

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

5. Ans. 5.00

Sol.



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

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

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

Total elastic energy

$$= \frac{1}{2}\frac{1}{Y}\int_0^{\ell}\left[\frac{mg}{\pi R^2}\left(\frac{y}{\ell}\right)\right]^2 \cdot \pi\left(\frac{y}{\ell}R\right)^2 dy$$

$$= \frac{m^2g^2\ell}{10\pi R^2 Y}$$

6. Ans. 0.50

Sol. $\left|\hat{a}+\hat{b}\right| = 2\times1\times\cos\frac{\theta}{2}$

$\left|\hat{a}-\hat{b}\right| = 2\times1\times\sin\frac{\theta}{2}$

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

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

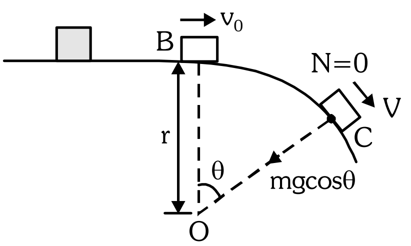
$\theta = 60°$

$\hat{a}\,.\,\hat{b} = 1\times1\times\cos 60 = 0.50$

SECTION-III

1. Ans. 6

Sol.



$-\Delta U = \Delta K$

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

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

2. Ans. 5

Sol. Assume a = 4z

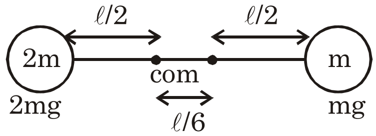
$$y = \frac{16M\times2z - M\left(\frac{3z}{2}+\frac{5z}{2}+\frac{7z}{2}\right)}{13M}$$

3. Ans. 4

Sol. Apply COM

4. Ans. 8

Sol.



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

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

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

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

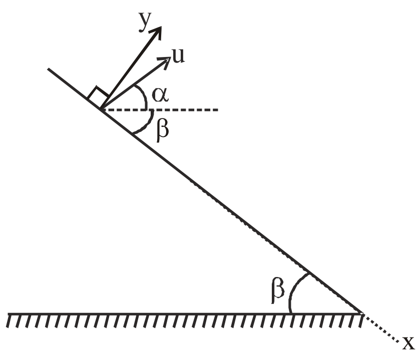
$= \frac{8mg}{3} = F = F = 8\times\left(\frac{50}{1000}\right)\times\frac{10}{3} = \frac{4}{3}$

$= 6F = 8$

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. $n(FeSO_4.6H_2O) = \dfrac{2.6\times10^3}{260} = 10$

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)

Sol. $C(s) + O_2(g) \rightarrow CO_2(g)$; $\Delta H_1 = -393$ kJ/mol ....(1)

$C(s) + \frac{1}{2} O_2(g) \rightarrow CO_2(g)$; $\Delta H_2 = -110$ kJ/mol ....(2)

$H_2 + \frac{1}{2} O_2(g) \rightarrow H_2O(l)$; $\Delta H_3 = -240$ kJ/mol ....(3)

$\Delta_r H = 393 - 110 - 240 = 393 - 350 = 43$ 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)

Sol. $Cl_2(g) \rightleftharpoons 2Cl_2(g)$

t = 0 $\quad P_0 \quad$ —

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

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

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

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

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

$\Delta G^o = -RT \ln K^{\circ}_{eq}$

$= -\dfrac{2}{1000}\times1000 \ln 20P_0(20)$

$= -2\ell n\ 20 = 6$

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

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

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

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

3. Ans. (B,C,D)

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

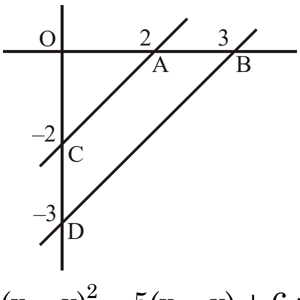
$\Rightarrow \frac{a}{2\Delta} + \frac{b}{2\Delta} + \frac{c}{2\Delta} = 1 \Rightarrow \frac{3b}{2\Delta} = 1$

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

$p_2 = 3$

4. Ans. (B,C)

Sol.



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

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

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

& OA.OB = OC.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 $(x^2 + y^2 - 2x - 4y - 4) + \lambda(3x + 4y - 8) = 0$

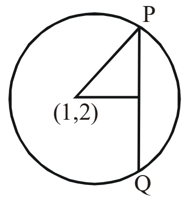
$\because$ AB is diameter $\Rightarrow \lambda = \frac{6}{25}$

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) $\boxed{E}\ \underline{N}\,\underline{G}\,\underline{I}\,\underline{N}\,\underline{E}\,\underline{E}\,\underline{R} - \boxed{E}\_\_\_\_\_\_\_\boxed{N}$

$\frac{\lfloor 7}{\lfloor 2 \lfloor 2} - \frac{\lfloor 6}{\lfloor 2} = 900$

(C) Get A ≡ words starting with. E

Set B ≡ words ending with N

Total – n(A ∪ B)

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

SECTION-II

1. Ans. –3.14

Sol. $\lim_{x\to 0} \frac{\sin\left(\pi - \pi e^{x^2}\right)}{\left(\pi - \pi e^{x^2}\right)} \frac{\left(\pi - \pi e^{x^2}\right)}{x^2} \frac{x^2}{\sin x^2}$

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

2. Ans. 0.06 or 0.07

Sol. $\sin 10^\circ \sin 30^\circ \sin 50^\circ \sin 70^\circ$

$= \sin 30^\circ [\sin 10^\circ \sin 50^\circ \sin 70^\circ]$

$= \frac{1}{2}.\frac{1}{4}.\sin 30° = \frac{1}{2}.\frac{1}{4}.\frac{1}{2} = \frac{1}{16}$

$[\because \sin\theta.\sin(60° - \theta)\sin(60° + \theta) = \frac{1}{4}\sin 3\theta]$

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

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

$k = \pm 15$

4. Ans. 24.00

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

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

Putting the values of H_1& H_2 in (1)

$a = -24$

$\Rightarrow |a| = 24$

5. Ans. 7.71

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

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

cofficient of $x^2 = {}^9C_2.9 - 8.{}^9C_1.3 + b$

cofficient of $x^3 = -{}^9C_3.27 + 8.{}^9C_2.9 - b.{}^9C_1.3$

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

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

$= \frac{1}{4}.\frac{2}{3}.\frac{1}{3}.\frac{1}{2}.\frac{1}{2} = \frac{1}{8.9}$

$= \frac{1}{2^3.3^2}$ $\quad$ a + b = 5

2. Ans. 0

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

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

for k = 0 IIIrd equation becomes $x^2 + 4x = 0$

No common roots

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

for k = –3 IIIrd equation becomes

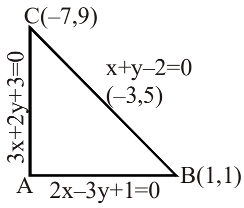
$x^2 + 4x - 12 = 0$

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

$\therefore$ No common roots to all equation.

3. Ans. 4

Sol.



Thus circumcenter = (–3,5), 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. $S = {}^{12}C_2 = 66$

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

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

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

$T - D - S = 160$

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

5. Ans. 0

Sol. Sum of series =

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

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

$\Rightarrow$ sum = 0

6. Ans. 8

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

$\therefore$ semilatus rectum = 2a = 8.