Paper Code : 1001CJA102118076

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN) path to success

CLASSROOM CONTACT PROGRAMME

(Academic Session : 2018 - 2019)

JEE (Main + Advanced) : ENTHUSIAST COURSE : SCORE-II

ANSWER KEY : PAPER-1 **TEST DATE : 24-02-2019**

Test Type : FULL SYLLABUS

PART-1 : PHYSICS

Test Pattern : JEE-Advanced

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	B,C	A,C,D	A,B,D	A,C	A,C	A,B,C	D	A,C	A,B,C	A,C,D
SECTION-III	Q.	1	2	3	4	5	6	7	8	9	10
	A.	3	2	4	6	9	4	8	0	5	7

PART-2 : CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,C,D	A,B,C	A,B,D	A,B,C	A,B,C,D	A,B,D	A,B,C,D	A,B,C	A,B	A,C
SECTION-III	Q.	1	2	3	4	5	6	7	8	9	10
	A.	8	6	4	9	3	3	2	3	5	3

PART-3 : MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	C,D	A,B,C,D	A,B	A,D	B,C	A,C	B,C,D	A,B	A,B,C	A,B
SECTION-III	Q.	1	2	3	4	5	6	7	8	9	10
	A.	5	9	2	5	4	0	3	9	3	4

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JEE (Main + Advanced) : ENTHUSIAST COURSE : SCORE-II

ANSWER KEY : PAPER-2 **TEST DATE : 24-02-2019**

Test Type : FULL SYLLABUS

Test Pattern : JEE-Main

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	3	1	3	2	4	2	3	1	1	4	1	1	3	1	1	1	1	3	4
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	2	2	1	4	2	3	2	1	1	2	2	4	1	4	4	4	1	2	3	4
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	4	1	1	1	2	2	2	3	2	2	2	1	2	4	4	2	4	1	3	3
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	1	2	3	4	4	2	1	3	1	2	1	2	2	2	4	3	2	1	2	1
Que.	81	82	83	84	85	86	87	88	89	90										
Ans.	3	2	4	2	2	3	1	2	2	4										

JEE (Main + Advanced) : ENTHUSIAST COURSE

SCORE : II

Test Type : FULL SYLLABUS   Test Pattern : JEE-Advanced

TEST DATE : 24 - 02 - 2019

PAPER-1

PART-1 : PHYSICS   SOLUTION

SECTION-I

1. Ans. (B,C)

Sol. $mgL(\sin\alpha - \sin\beta) = \frac{1}{2}MV^2 + \frac{1}{2}I\omega^2$

2. Ans. (A,C,D)

Sol. Force due to surface tension is proportion at to length of surface.

Surface energy depends on area of surface.

3. Ans. (A,B,D)

Sol. ABD flux through inductor remains constant.

4. Ans. (A,C)

Sol. Using super position principle $i_{AB} = \frac{i}{2}$

$x = \mu_0 \frac{i}{2}$ ..... (i)

Let's find circulation due to only feeding wires.

---- ——A   B—— ----

If is equal to circulation due to infinite long wire minus the circulation due to the missing segment.

$$\mu_0 i - \left\{\frac{\mu_0 i}{4\pi\frac{a}{2}}(\sin 45° + \sin 45°)\right\} 2\pi\frac{a}{2}$$

$$= \mu_0 i\left(1 - \frac{1}{\sqrt{2}}\right) \quad ...... (ii)$$

y = | Quantity (i) – Quantity (ii) |

$$= \mu_0 i\left(\frac{1}{\sqrt{2}} - \frac{1}{2}\right)$$

Magnetic field on the entire Amperean loop is not the same (Symmetry is 2D but not 3D)

So, $z \neq \frac{x}{2\pi\frac{a}{2}}$

5. Ans. (A,C)

Sol. CA process is adiabatic

$3P_0V_1 = 2P_0V_0$

$V_1 = \frac{2V_0}{3}$

PV^r = constant

$3P_0V_1^r = P_0V_0^r$

Workdone = $nRT\ell n\left(\frac{V_2}{V_1}\right)$

6. Ans. (A,B,C)

Sol. (a) let V_0 be the speed of sound in liquid then time taken by signal to reach from left to right is $t_{LR} = \frac{D}{V_0 - V}$ and that from right to left is

$t_{LR} = \frac{D}{V_0 - V}; \lambda_L = \lambda_0 + VT$ and

$\lambda_R = \lambda_0 + VT$

$f_L = f_0\left(\frac{V_0 + V}{V_0 + V}\right)$

$f_R = f_0\left(\frac{V_0 - V}{V_0 - V}\right)$

7. Ans. (D)

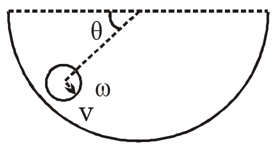
Sol. $J = \sigma E \Rightarrow \frac{I}{4\pi r^2} = S\left(\frac{Q_1 + Q_2 - Q}{4\pi\varepsilon_0 K r^2}\right)$

$$I=\frac{dQ}{dt}=\frac{\sigma(Q_1+Q_2-Q)}{\varepsilon_0 K}$$

$$\int_{Q_2}^{0}\frac{dQ}{Q_1+Q_2-Q}=\int_0^t\frac{\sigma}{\varepsilon_0 K}dt$$

8. Ans. (A,C)

Sol. Magnetic forces due to angular motion of sphere will not create any torque. Magnetic forces due to translational motion passes through centre of mass of sphere acts parallel to Normal reaction.



$v = r\omega$ ....(1)

$$\frac{1}{2}\left(\frac{2}{5}+1\right)mr^2\left(\frac{v}{r}\right)^2=mg(R-r)\sin\theta$$

$$v=\sqrt{\frac{10}{7}g(R-r)\sin\theta} \quad ....(2)$$

$$m\frac{v^2}{(R-r)}=N-mg\sin\theta-qvB$$

In limiting condition N = 0; θ = 90°

$$qvB=mg+\frac{10}{7}mg=\frac{17mg}{7}$$

$$B_{limiting}=\frac{17mg}{7qv}=2T$$

9. Ans. (A,B,C)

Sol. $$\frac{n_P}{n_P\left(\frac{d}{n_P}+\frac{t}{1}+\frac{x}{n_G}\right)}+\frac{1}{\infty}=\frac{(1-n_P)}{-R}$$

$$\Rightarrow\frac{d}{n_P}+t=\frac{R}{n_P-1}-\frac{x}{n_G}$$

10. Ans. (A,C,D)

SECTION-III

1. Ans. 3

Sol. For $A\le 50$; binding energy is given as

$$E=\frac{3A^2}{25}+2A$$

$$A_{45}+A_{30}\longrightarrow A_{75}+Q$$

If energy released is positive reaction will be spontaneous

$$Q=\frac{3}{25}(75^2-30^2-40^2)+2(75-30-40)$$

$Q > 0$

Similarly $A_{10}+A_{20}\longrightarrow A_{30}+\theta$, releases energy adn $A_{80}\longrightarrow 2A_{40}$; do not releases energy.

For A > 100

$E=12A-\frac{A^2}{25}$ is the binding E of a nuclear

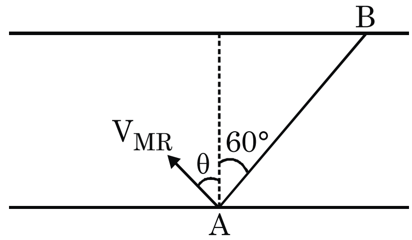
$$A_{150}\longrightarrow 2A_{75}+Q$$

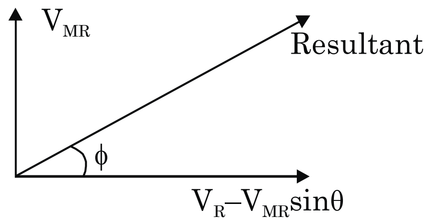
$$Q=\left[2(8)(75)\right]-\left[12(150)-\frac{(150)^2}{25}\right]$$

$Q > 0$

2. Ans. 2

Sol.





$$\tan\phi=\frac{V_{MR}\cos\theta}{V_R-V_{MR}\sin\theta};\ \phi=30^\circ$$

On solving $\frac{V_R}{\sqrt{3}\cos\theta+\sin\theta}=V_{MR}$

V_{MR} will be minimum when denominator is maximum. That is at θ = 30°.

and time $=\frac{100\sqrt{3}}{V_{MR}\cos\theta}=200\sqrt{2}$

3. Ans. 4

Sol. Since BC is shorted, potential difference across BC is zero.

Voltmeter reading = V_{AB} + V_{BC} = V_{AB} = 8 Volt (given)

Since length CD = 2 × length AB, V_{CD} = 2 × V_{AB} = 16 Volt

Therefore emf of cell = V_{AB} + V_{BC} + V_{CD} = 8 + 0 + 16 = 24 Volt

On removing the resistanceless wire connecting B and C.

$V_{AC} = 2V_{CD}$

$V_{AC} = V_{CD} = 24$

$V_{AC} = 16$

4. Ans. 6

Sol. u = 5.0 cm

v = 10.0 cm

$$f = \frac{uv}{u+v} = \frac{10}{3} cm$$

$$\frac{df}{f} = f\left(\frac{du}{u^2} + \frac{dv}{v^2}\right)$$

$$\frac{df}{f} = f(du)\left(\frac{1}{u^2} + \frac{1}{v^2}\right)$$

% error in focal length

$$= = f(du)\left(\frac{1}{u^2} + \frac{1}{v^2}\right)100 = \frac{5}{3}$$

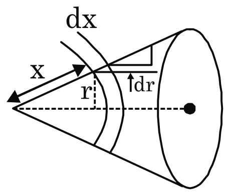
5. Ans. 9

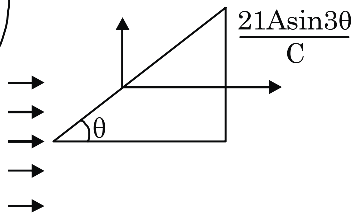
Sol. $$dF_R = \frac{2I_1 \cdot dA \cdot \sin^2\theta}{C}$$

$$\Rightarrow \frac{2 \cdot I_0 r^3}{R^3} \cdot \frac{2\pi r \cdot dx \cdot \sin^2\theta \cdot \sin\theta}{C}$$

$$\Rightarrow \frac{4\pi I_0 r^4 dr \sin^2\theta}{R^3 \cdot C}$$

$$F_R = \frac{4\pi I_0 \cdot R^2 \cdot \sin^2\theta}{5C}$$





6. Ans. 4

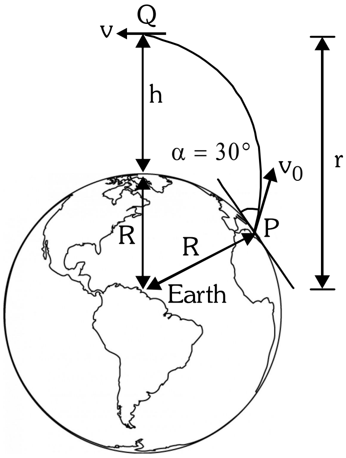
7. Ans. 8

Sol. Let velocity at highest point be v and R + h = r

Applying conservation of angular momentum between P and Q, we have

$mvr = mv_0 R \cos 30°$

or $v = \frac{\sqrt{3}v_0 R}{2r}$



Applying conservation of mechanical energy between P and Q, we have :

$$\frac{1}{2}mv_0^2 - \frac{GMm}{R} = \frac{1}{2}mv^2 - \frac{GMm}{r}$$

substituting the value of v from equation (1), we get

$$\frac{1}{2}mv_0^2 - \frac{GMm}{R} = \frac{1}{2}m\left\{\frac{3v_0^2R^2}{4r^2}\right\} - \frac{GMm}{r}$$

or $$v_0^2 - \frac{2GM}{R} = \frac{3v_0^2R^2}{4r^2} - \frac{2GM}{r}$$

or

$$\frac{1.5GM}{R} - \frac{2GM}{R} = \frac{3}{4}\left(\frac{1.5GM}{R}\right)\frac{R^2}{r^2} - \frac{2GM}{r}$$

$$\left(v_0 = \sqrt{\frac{1.5GM}{R}} \text{is given}\right)$$

or $$-\frac{1}{2R} = \frac{9}{8R} \cdot \frac{R^2}{r^2} - \frac{2}{r}$$

or $-4r^2 = 9R^2 - 16Rt$

or $4r^2 - 16Rr + 9R^2 = 0$

or $$r = \frac{16R \pm \sqrt{256R^2 - 144R^2}}{8}$$

$$\Rightarrow = \frac{16R \pm 10.58R}{8} = 3.323R \text{ and } 0.677R$$

but r < R

hence r = 3.323 R

or h = r – R = 2.323 R

8. Ans. 0

Sol. Path length travelled by rays on reaching S_1 and S_2 from S is same, so the control maximum will be formed on the central line.

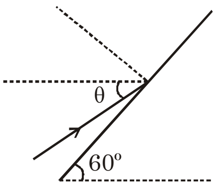
9. Ans. 5

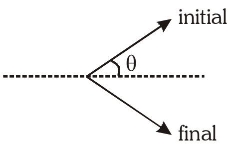
Sol. $r_1 = r_2 = 30^o$

$$1(\sin i_1) = \sqrt{2}\left(\frac{1}{2}\right) = \frac{1}{\sqrt{2}}$$

$i_1 = 45^o$

$\theta = 15^o$





Charge in momentum of each photon

$= 2P\sin(15^o)$

$$\text{Force} = \left(\frac{P_0}{P_c}\right) 2P\sin(15^o)$$

$$= \frac{2P_0}{c}\sin 15 = \frac{P_0}{c}\left(\frac{\sqrt{3}-1}{\sqrt{2}}\right)$$

$x = 3$

$y = 2$

10. Ans. 7

Sol. $mv + M(u) = (M + m)2$

$M + mv = (M + m)u$

PART–2 : CHEMISTRY SOLUTION

SECTION-I

1. Ans.(A,C,D)

Sol. The characteristics of a concentration cell is that each half cell is made of same metal and metal salt solution and only the concentration of metal salt solution in each half cell is different..

$$\text{e.g, } Zn(s)\left|\begin{matrix}Zn^{2+}\\ c_1M\end{matrix}\right|\left|\begin{matrix}Zn^{2+}\\ c_2M\end{matrix}\right|Zn(s)$$

Here $E^o_{Cell} = 0$

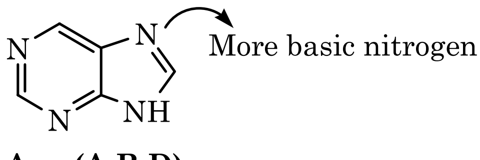
$$E_{Cell} = E^o_{Cell} - \frac{2.303RT}{nF}\log Q$$

$$\Rightarrow \text{as } E_{Cell} = -\frac{2.303RT}{nF}\log Q$$

Hence choices (A), (C), (D) are correct while (B) is incorrect.

2. Ans.(A,B,C)

Sol.



3. Ans.(A,B,D)

Sol. Theory based.

4. Ans.(A,B,C)

Sol. (A) Smoke is colloidal solution of carbon particles in air.

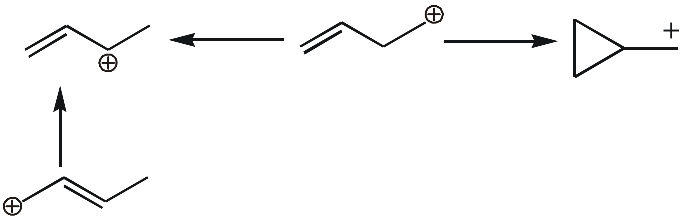
(B) Ruby glass is colloidal solution of coloured oxides in silicate

(C) Pumice stone is a colloidal solution

(D) Chlorophyll is a compound.

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

Sol.



6. Ans.(A,B,D)

Sol. The order of solubility of

$BeCO_3 > MgCO_3 > CaCO_3 > SrCO_3 > BaCO_3$.

can only be explained on the basis of lattice energy rest others can be explained by Fajan's rule.

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

Sol. Moles of A =10 moles

Moles of B = 40 moles

$\therefore$ Mole fraction $\Rightarrow x_A = \frac{10}{50}$

$x_B = \frac{40}{50}$

$\therefore P_T = P_A^0 x_A + P_B^0 x_B$

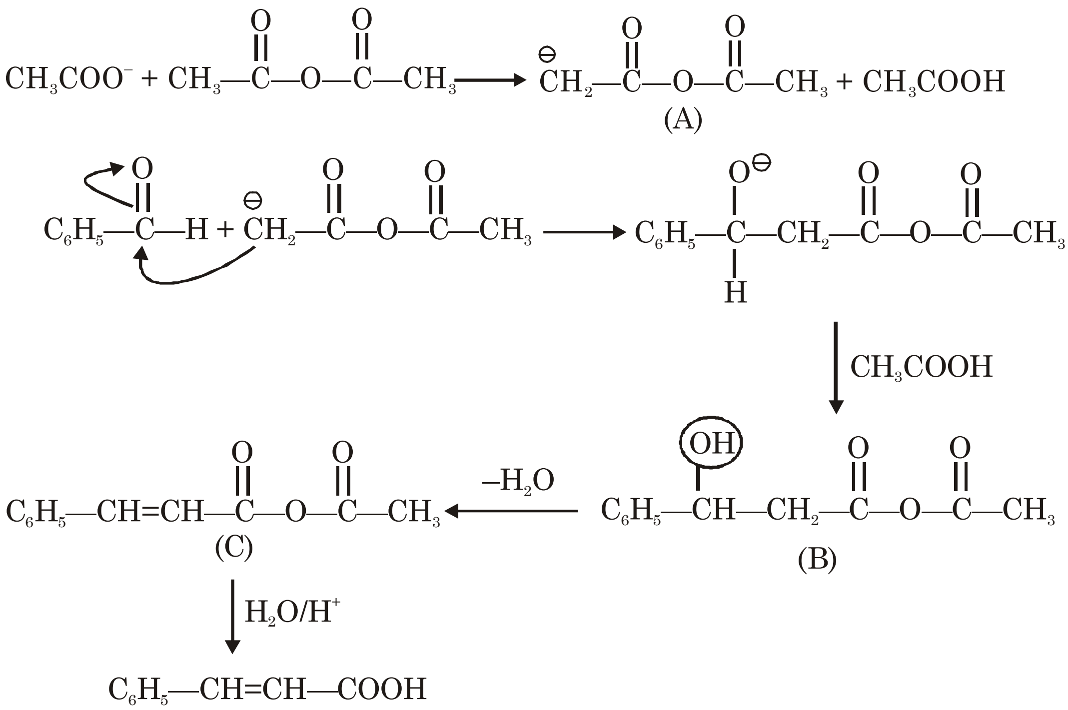
$\Rightarrow 100 \times \frac{10}{50} + 150 \times \frac{40}{50} = 140$ mm of Hg

Mole fraction of 'A' in vapour phase = $\frac{100 \times \frac{10}{50}}{140} = \frac{1}{7}$

$\therefore$ Mole fraction of 'B' in vapour phase = $\frac{6}{7}$

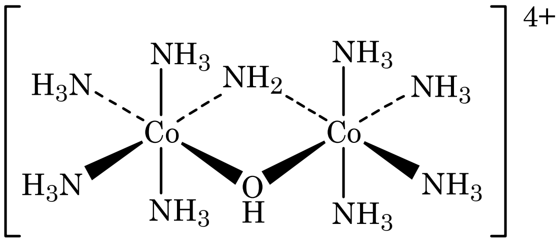
8. Ans.(A,B,C)

Sol. $CH_3COONa \longrightarrow CH_3COO^- + Na^+$



(D) is a final product and not intermediate.

9. Ans.(A,B)

Sol. 

10. Ans.(A,C)

Sol. Polymerisation of caprolecutum is Nylon–6.

SECTION-III

1. Ans.(8)

Sol. $r_1 = 0.529 \times \frac{1^2}{2}\text{Å} = x$

$r_4 = 0.529 \times \frac{4^2}{4}\text{Å} = y$

$\frac{y}{x} = 4 \times 2 = 8$

2. Ans.(6)

Sol. $2^{3-1} + 2^{2-1} = 6.$

3. Ans.(4)

4. Ans.(9)

Sol. $\left(P + \frac{a}{V_m^2}\right)(V_m) = RT$

$PV_m + \frac{a}{V_m} = RT$

$PV_m^2 - RTV_m + a = 0$

$PV_m^2 - 24V_m + 2 = 0$

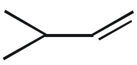
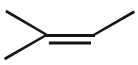
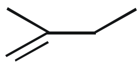
For real gas this equation must have only one root

$D = 0 \Rightarrow b^2 - 4ac = 0$

$(24)^2 - 4 \times P \times 2 = 0$

$P = 72$ atm

5. Ans.(3)

(1)  (2)  (3) 

6. Ans.(3)

Sol. $2NO_2 + H_2O \longrightarrow HNO_3 + HNO_2$

$N_2O_4 + H_2O \longrightarrow HNO_3 + HNO_2$

$N_2O_5 + H_2O \longrightarrow 2HNO_3$

7. Ans. (2)

Sol. $\rho_{ideal} = \dfrac{Z \times \dfrac{M_0}{N_A}}{a^3}$

$\dfrac{4 \times \dfrac{31.25}{N_A}}{(500 \times 10^{-10})^3} = \dfrac{4 \times 31.25 \times 1.67 \times 10^{-24}}{125 \times 10^{-24}} = 1.67\ g/ml$

$\rho_{actual} = 1.6075$ g/ml

Difference due to Schottky effect = 1.67 - 1.6075 = 0.0625 g/ml

= 0.0625 × 10^3 g/L = 62.5 g/L = $\dfrac{62.5}{31.25}$ Mole/L = 2 mole/L

8. Ans. (3)

Sol. Compound A = 2

Compound B = 1

So compound A and B = 3

9. Ans. (5)

Sol. $SO_2 + \frac{1}{2}O_2 \xrightarrow{V_2O_5} SO_3$

10. Ans. (3)

Sol. Ag, Au & Pt which are below the copper in the reactivity series.

PART-3 : MATHEMATICS SOLUTION

SECTION-I

1. Ans.(C,D)

Sol. $\vec{a}.\vec{b} = 0 \Rightarrow \vec{a} \times \vec{b}$ is a unit vector.

$\vec{c} = \lambda\vec{a} + \mu\vec{b} + \delta(\vec{a} \times \vec{b}) \Rightarrow \vec{c}.\vec{a} = \lambda,\ \vec{c}.\vec{b} = \mu$

& $\vec{c}.(\vec{a} \times \vec{b}) = \delta$

$(\vec{a} - \vec{c}).(\vec{b} + \vec{c}) = 0 \Rightarrow 0 + \lambda - \mu - 1 = 0 \Rightarrow \boxed{\lambda = \mu + 1}$

Also, $|\vec{c}|^2 = \lambda^2 |\vec{a}|^2 + \mu^2 |\vec{b}|^2 + w^2 |\vec{a} \times \vec{b}|^2$

($\vec{a}, \vec{b}, \vec{a} \times \vec{b}$ are orthogonal pairs of unit vectors)

$\boxed{1 = \lambda^2 + \mu^2 + w^2}$

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

Sol. $f'(x) = \dfrac{8x\left(x - \sqrt{2}\right)\left(x + \sqrt{2}\right)}{\left(x^2 + 3\right)^3}$

$-\ \ +\ \ -\ \ +$ (sign scheme at $-\sqrt{2}$, 0, $\sqrt{2}$)

$f(x)_{min}$ at $x = -\sqrt{2}, \sqrt{2}$

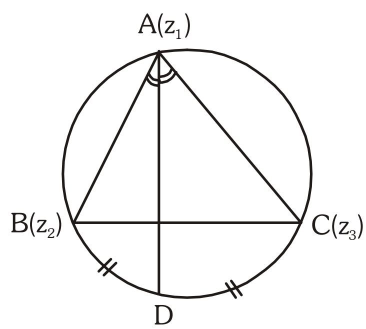
$f(x)_{min} = \dfrac{1}{3}$

3. Ans. (A,B)

Sol. $|z_1| = \sqrt{5}, z_2, z_3 = \pm 2 - i$ (on solving)

$|z_1| = |z_2| = |z_3| = \sqrt{5}$. So, z_0 (Circuncentre) = 0 + 0i (origin)

$\underset{\text{(orthocentre)}}{z_4} = \underset{\text{(centroid)}}{3z_4} = z_1 - 2i \Rightarrow |z_4 + 2i| = |z_1| = \sqrt{5}$



Clearly angle bisector of A passes through mid point of minor arc $\overline{BC} \Rightarrow D$.

4. Ans. (A,D)

Sol. Let's define some events : $E_1 \rightarrow$ first toss is heads.

$E_2 \rightarrow$ first two tosses are TH. & $E_3 \rightarrow$ first two tosses are TT.

$P(A_2) = P(E_3) = \left(\frac{1}{3}\right)^2 = \frac{1}{9}$. $\{P(A_n) = P_n\}$.

For $n > 2 \rightarrow P\left(\frac{A_n}{E_1}\right) = P(A_{n-1})$,

$P\left(\frac{A_n}{E_2}\right) = P(A_{n-2}), P\left(\frac{A_n}{E_3}\right) = 0$

Let $P(A_n) = P_n$

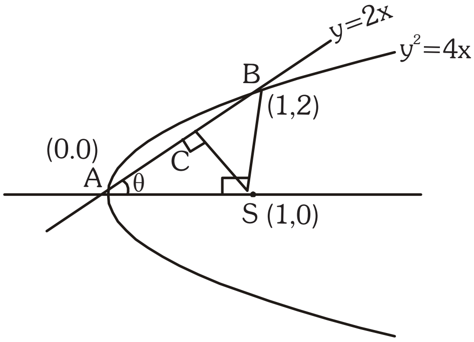
So, using total probability theorem :

$P_n = \frac{2}{3}.P_{n-1} + \frac{2}{9}.P_{n-2}; n > 2$

$P_1 = 0$ & $P_2 = \frac{1}{9} \Rightarrow P_3 = \frac{2}{27}, P_4 = \frac{2}{27}$

5. Ans. (B,C)

Sol.



$\frac{AC}{BC} = \frac{AS\cos\theta}{BS\sin\theta} = \frac{1}{2\tan\theta} = \frac{1}{4}$ or $\frac{AC}{BC} = \frac{4}{1}$

6. Ans. (A,C)

Sol. Let $\theta \rightarrow$ angle between line & plane

$\sin\theta = \left|\frac{4-1-4}{3.3}\right| = \frac{1}{9}$

$\frac{x}{2} = \frac{y-\lambda}{-1} = \frac{z}{2} = t \Rightarrow x = 2t, y = \lambda - t, z = 2t$

Solving with plane : $4t + \lambda - t - 4t = 6$

$\Rightarrow t = \lambda - 6$ (at point of intersection)

7. Ans. (B,C,D)

Sol. $I_n = 2\int_{-\pi/2}^{\pi/2} \frac{1}{1+2^{\sin t}}\left(\frac{\sin^2(nt)}{\sin^2 t}\right)dt$

$= 2\int_{-\pi/2}^{\pi/2} \frac{1}{1+2^{-\sin t}} \frac{\sin^2(nt)}{\sin^2 t}dt$

$2I_n = 2\int_{-\pi/2}^{\pi/2} \frac{\sin^2(nt)}{\sin^2 t}dt$

$\Rightarrow I_n = 2\int_0^{\pi/2} \frac{\sin^2(nt)}{\sin^2(t)}dt \rightarrow$ A.P.

$I_0 = 0, I_1 = \pi, I_2 = 2\pi$ and so on.

8. Ans. (A,B)

Sol. $\left(\frac{x^2+x+2}{x^2+x+1}\right)^2 - (a-3)\left(\frac{x^2+x+2}{x^2+x+1}\right) + (a-4) = 0$

$y = \frac{x^2+x+2}{x^2+x+1} = 1 + \frac{1}{x^2+x+1} \in \left(1, \frac{7}{3}\right]$

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

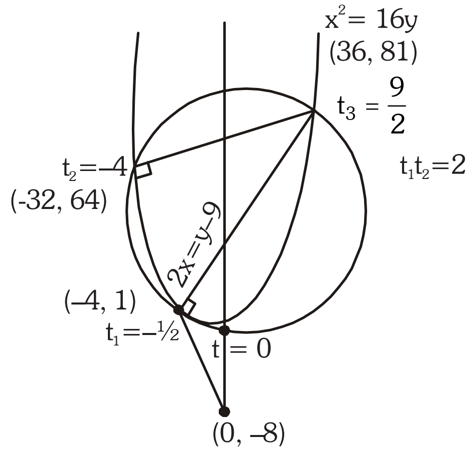
$\Rightarrow (y^2+3y-4) - a(y-1) = 0$

$\Rightarrow (y-1)(y+4-a) = 0 \Rightarrow 1 < a - 4 < \frac{7}{3}$

$a \in \left(5, \frac{19}{3}\right]$

9. Ans. (A,B,C)

Sol.



10. Ans. (A,B)

Sol. Let's demote the respective jumps by L_1, L_2, U_1, U_2 respectively.

(2, 2) can be reached as :

$$\left.\begin{array}{l} L_1L_1U_1U_1 \to \frac{4!}{2!2!} \\ L_1L_1U_2 \to \frac{3!}{2!} \\ L_2U_1U_2 \to \frac{3!}{2;} \\ L_2U_2 \to 2! \end{array}\right] = 6+3+3+2 = 14 \text{ ways}$$

(2, 3) can be reached as :

$$\left.\begin{array}{l} L_1L_1U_1U_1U_1 \to \frac{5!}{2!3!} \\ L_1L_1U_1U_2 \to \frac{4!}{2!} \\ L_2U_1U_1U_1 \to \frac{4!}{3!} \\ L_2U_1U_2 \to 3! \end{array}\right] = 10+12+4+6 = 32 \text{ ways}$$

SECTION - III

1. Ans. 5

Sol. $g(x) = f(x).\ t \to g'(x) = f'(x).t + f(x)\frac{dt}{dx}$

$$\frac{g'(x)}{f'(x)} = \frac{g(x) - \sqrt{f^2(x)+g^2(x)}}{f(x)} \to \frac{g(x)}{f(x)} = t$$

$$t + \frac{f(x)}{f'(x)}.\frac{dt}{dx} = t - \sqrt{1+t^2} \Rightarrow \int \frac{dt}{\sqrt{1+t^2}} = -\int \frac{f'(x)}{f(x)}dx$$

$$\Rightarrow \ell n\left(\sqrt{1+t^2+t}\right) + \ell n f(x) = \ell nc$$

$$\Rightarrow \sqrt{g^2(x)+f^2(x)} + g(x) = C$$

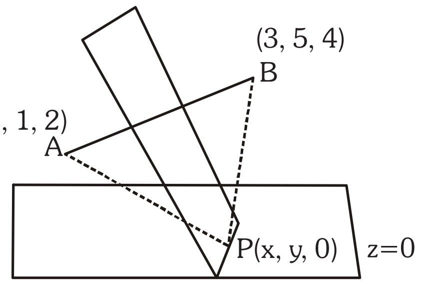
$f(0) = 10,\ g(0) = 0 \Rightarrow C = 10$

$$\lim_{x\to\infty}\sqrt{g^2(x)+f^2(x)} + \lim_{x\to\infty} g(x) = 10$$

$$\lim_{x\to\infty} g(x) = 5$$

2. Ans. 9

Sol.



$(x-1)^2 - (x-3)^2 + (y-1)^2 + (y-5)^2 + 2^2 - 4^2 = 0$

$(2x-4).2 + (2y-6).4 = 12$

$x - 2 + 2y - 6 = 3$

$x + 2y = 11$

3. Ans. 2

Sol. $I_n = \int_0^{\pi/2} \tan^n\left(\frac{x}{2}\right)dx = 2\int_0^{\pi/4} \tan^n t.dt$

$$I_n + I_{n+2} = \frac{2}{n+1} \quad \lim_{x\to\infty} n(I_n + I_{n+2})$$

$$= \lim_{x\to\infty}\frac{2n}{n+1} = 2$$

4. Ans. 5

Sol. $A = \begin{bmatrix} 1 & \frac{1}{2} & \frac{1}{3} \\ \frac{1}{2} & \frac{1}{3} & \frac{1}{4} \\ \frac{1}{3} & \frac{1}{4} & \frac{1}{5} \end{bmatrix}$

$$\Rightarrow B = \frac{1}{3}A^{-1} = \frac{1}{3}\begin{bmatrix} 9 & -36 & 30 \\ -36 & 192 & -180 \\ 30 & -120 & 180 \end{bmatrix}$$

$$\Rightarrow B = \begin{bmatrix} 3 & -12 & 10 \\ -12 & 64 & -60 \\ 10 & -60 & 60 \end{bmatrix}$$

5. Ans. 4

Sol. $P = 3!\ .\ 2 \quad Q = 3!\ .\ D_4 = 3!\ .\ 9$

6. Ans. 0

Sol. $(\sin x + \sqrt{3}\cos x)\sin x \cos y = 2$

Equality exists if $\sin x + \sqrt{3}\cos x = \pm 2$ and corresponding $\sin x \cos y = \pm 1$ which is impossible.

7. Ans. 3

Sol. $a = 2\beta - \alpha$ $\qquad c = \dfrac{\beta^2}{\alpha}$

$$\frac{1}{c} = \frac{2}{\beta} - \frac{1}{\alpha}$$

$b = 3\beta - 2\alpha$ $\qquad d = \dfrac{\beta^3}{\alpha^2}$

$$\frac{1}{f} = \frac{3}{\beta} - \frac{2}{\alpha}$$

$$d^2 = bf \Rightarrow \frac{\beta^6}{\alpha^4} = \left(\frac{3\beta - 2\alpha}{3\alpha - 2\beta}\right)\alpha\beta$$

$$\Rightarrow (3\alpha - 2\beta)\beta^5 = (3\beta - 2\alpha)\,\alpha^5 \;\Rightarrow 2(\alpha^6 - \beta^6)$$

$$= 3\alpha\beta\,(\alpha^4 - \beta^4)\;\; \frac{2(\alpha^6 - \beta^6)}{\alpha\beta(\alpha^4 - \beta^4)} = 3$$

8. Ans. 9

Sol. ${}^{7}C_{7}.{}^{12}C_{5} + {}^{7}C_{1}.{}^{12}C_{6}\_\_\_\_\_\_\_\_ + {}^{7}C_{0}.{}^{12}C_{12}$

$= {}^{19}C_{12}$

9. Ans. 3

Sol. L is line BC $\Rightarrow y - 0 = \dfrac{3-0}{\sqrt{3} - 2\sqrt{3}}(x - 2\sqrt{3})$

$y + \sqrt{3}x = 6 \Rightarrow$ min distance from origin

$$\frac{6}{\sqrt{1^2 + \left(\sqrt{3}\right)^2}} = 3$$

10. Ans. 4

Sol. $(2x+1)^2 a + (2x+1)(x-1)b + (x-1)^2 c = 0$

$$a\left(\frac{2x+1}{x-1}\right)^2 + b\left(\frac{2x+1}{x-1}\right) + c = 0$$

$$\frac{2x+1}{x-1} = m, n \;\Rightarrow\; 2 + \frac{3}{x-1} = m, n$$

$$\frac{3}{x-1} = m-2, n-2 \;\Rightarrow\; x - 1 = \frac{3}{m-2}, \frac{3}{n-2}$$

$$\Rightarrow\; x = \frac{m+1}{m-2}, \frac{n+1}{n-2}$$

JEE (Main + Advanced) : ENTHUSIAST COURSE
SCORE : II

Test Type : FULL SYLLABUS　　Test Pattern : JEE-Main

TEST DATE : 24 - 02 - 2019

PAPER-2

SOLUTION

1. Ans. (2)

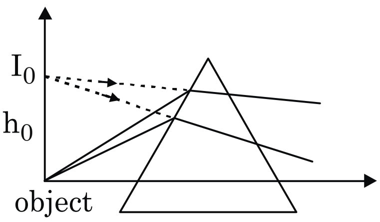
Sol. Across PN junction

Resistance ↓ on increasing

Voltage across it hence current increases more than that of across R.

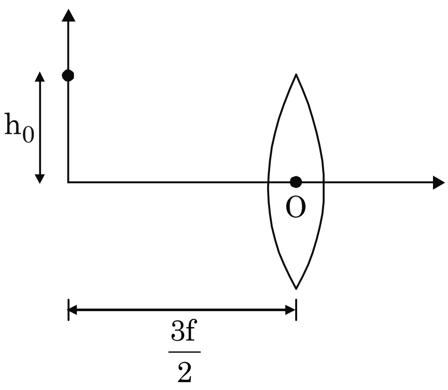
2. Ans. (3)

Sol.



$\delta = (n-1) \times \alpha$

$h_0 = f(n-1)\alpha$



$$\frac{1}{v} - \frac{2}{(-3f)} = \frac{1}{f}$$

$$\frac{1}{v} = \frac{1}{f} - \frac{2}{3f}$$

$$\frac{1}{v} = \frac{3-2}{3f} \Rightarrow v = 3f$$

$$\frac{h_2}{h_1} = \frac{v}{u} \Rightarrow h_2 = h_0\frac{3f}{-\frac{3f}{2}}$$

$h_2 = -2f(n-1)\alpha$

3. Ans. (1)

Sol. $U_i = \frac{KQ^2}{2R}$　$U_f = \frac{KQ^2}{2(2R)}$

(whole charge will get transformed to outer sphere)

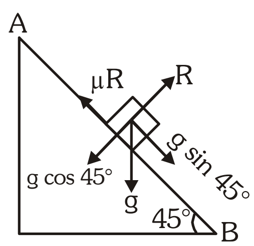
$$\text{so heat} = \frac{KQ^2}{2(2R)} = \frac{KQ^2}{4R}$$

4. Ans. (3)

Sol. The acceleration produced in the block the smooth 45° inclined plane, $a_1 = g\sin 45° = g/\sqrt{2}$ and for the rough 45° inclined plane

$$a_2 = g\sin 45° - \mu_k g\cos 45° = \frac{g}{\sqrt{2}}(1-\mu_k)$$

where μ_k is the coefficient of kinetic friction.



Now time taken to reach the block from A to B down the smooth inclined plane is t_1 and that for the rough inclined plane is t_2.

$$AB = 0 + \frac{1}{2}a_1t_1^2 = \frac{1}{2}a_2t_2^2$$

$$\therefore \quad a_1t_1^2 = a_2t_2^2$$

or $\dfrac{t_1}{t_2}=\sqrt{\dfrac{a_2}{a_1}}=\sqrt{\dfrac{g/\sqrt{2}(1-\mu_k)}{g/\sqrt{2}}}=\sqrt{1-\mu_k}$

Given, $t_2=2t_1$ or $\dfrac{t_1}{t_2}=\dfrac{1}{2}$ $\quad\therefore\ 1-\mu_k=\dfrac{1}{4}$

or $\mu_k=1-\dfrac{1}{4}=0.75$

5. Ans. (2)

Sol. Potential gradient in first case is

$K_1=\dfrac{\varepsilon_0}{\ell}$

$\therefore\quad \varepsilon=K_1\times\dfrac{\ell}{3}\Rightarrow\varepsilon=\dfrac{\varepsilon_0}{\ell}\times\dfrac{\ell}{3}=\dfrac{\varepsilon_0}{3}$

In the second case

Potential gradient $K_2=\dfrac{\varepsilon_0}{\frac{3\ell}{2}}=\dfrac{2\varepsilon_0}{3\ell}$

$\varepsilon=K_2\ell'\Rightarrow\dfrac{\varepsilon_0}{3}=\dfrac{2\varepsilon_0}{3\ell}\ell'\Rightarrow\ell'=\dfrac{\ell}{2}$

6. Ans. (4)

Sol. $m\propto v^a\rho^b g^c$

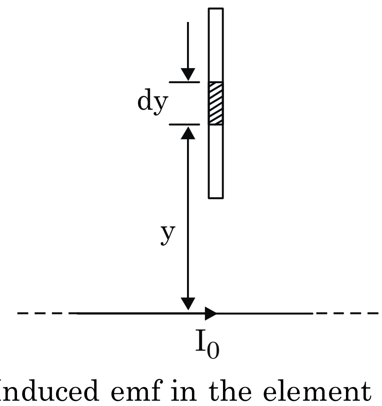
$[M^1L^oT^o]\propto[L^1T^{-1}]^a\,[M^1L^{-3}]^b\,[L^1T^{-2}]^c$

$b=1,\ c=-3,\ a=6$

$m\propto v^6$

7. Ans. (2)

Sol. Magnetic field at any distance from the wire is $B=\dfrac{\mu_0I_0}{2\pi y}$



$\therefore$ Induced emf in the element dy is

$$E_{ind}=\frac{\mu_0I_0vdy}{2\pi y}$$

$$E_{ind}=\frac{\mu_0I_0v}{2\pi}\int_a^{2a}\frac{1}{y}dy=\frac{\mu_0I_0v}{2\pi}\ln 2$$

Current in the loop (applying Kirchoff's law)

$$I_{ind}=\frac{E_{ind}}{R}\Rightarrow I_{ind}=\frac{\mu_0I_0v}{2\pi R}\ln 2$$

The force on the element dy is given by

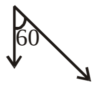
$$dF=Bidy\Rightarrow dF=\frac{\mu_0I_0}{2\pi y}\frac{\mu_0I_0v}{2\pi R}\ln 2\,dy$$

$$F=\int dF\Rightarrow F=\frac{\mu_0^2I_0^2v}{4\pi^2R}\ln 2\int_a^{2a}\frac{1}{y}dy$$

$$=\frac{\mu_0^2I_0^2v}{4\pi^2R}(\ell n\,2)^2$$

8. Ans. (3)

Sol.

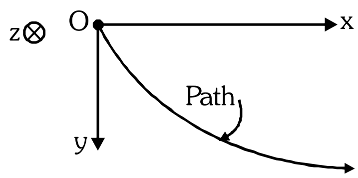


mu cos 60

net I = 2mu cos 60 = mu

9. Ans. (1)

Sol. Let ball be dropped from origin at t = 0.



$\vec{B}=B\hat{k};\ \vec{g}=g\hat{j}$

At = 0, $\vec{v}=0$, force due to $\vec{B}$ is in xy plane always, force due to gravity is along Y.

$\therefore$ Ball always moves in XY plane

$\therefore\quad \vec{v}=v_x\hat{i}+v_y\hat{j}$ (at any time)

$\vec{F}=mg\,\hat{j}+q(v_x\hat{i}+v_y\hat{j})\times(B\hat{k})$

$\vec{F}=qBv_y\hat{i}+(mg-qBv_x)\hat{j}$

$\therefore$ Components of acceleration :

$a_x=\dfrac{qBV_y}{m}$ ....(1)

$a_y=g-\dfrac{qBV_x}{m}$ ....(2)

$\dfrac{d}{dt}$ of (2) :

$\ddot{v}_y=-qBv_x$

$\ddot{v}_y=\dfrac{-qB}{m}\left(\dfrac{qBv_y}{m}\right)$ from (1)

$\ddot{v}_y=-\left(\dfrac{qB}{m}\right)^2v_y$

$v_y=A\sin\left(\dfrac{qBt}{m}+\phi\right)$ ....(3)

$a_y=\dfrac{AqB}{m}\cos\left(\dfrac{qBt}{m}+\phi\right)$ ....(4)

At t = 0, $v_y = 0$ and $a_y = g$

$\therefore$ From (3); $\sin\phi = 0$, & $g = \frac{AqB}{m}\cos\phi$

$\therefore$ $\phi = 0$ and $A = \frac{mg}{Bq}$

$\therefore$ $v_y = \frac{mg}{Bq}\sin\left(\frac{qBt}{m}\right)$ ....(5)

$v_y = \frac{mg}{Bq}\sin\left(\frac{qBt}{m}\right)$

$\int_0^y dy = \frac{mg}{Bq}\int_0^t \sin\left(\frac{qBt}{m}\right)dt$

$y = \left(\frac{m}{Bq}\right)^2 g\left(1-\cos\frac{qBt}{m}\right)$ ....(6)

y is max. when $v_y = 0$ i.e. $\sin\left(\frac{qBt}{m}\right) = 0$

$\therefore$ $y_{max} = \left(\frac{m}{Bq}\right)^2 g(1-(-1))$

$\therefore$ $y_{max} = 2\left(\frac{m}{Bq}\right)^2 g$

$\therefore$ 3k – 1 = 2

$\therefore$ k = 1

10. Ans. (1)

Sol. $E = e\sigma AT^4$

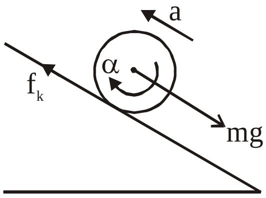
$\Rightarrow$ $100 = 0.3 \times 5.62 \times 10^{-8} \times A \times (2780)^4$

$\therefore$ Surface area or bulb

$= \frac{100}{101.46\times10^4} = 0.98\times10^{-4}m^2$

11. Ans. (4)

Sol.



$f_k - mg\sin\theta = ma$

$f_k R = I\alpha = \frac{mR^2}{2}\alpha$

$f_k = \frac{mR\alpha}{2}$

$R\alpha = \frac{2f_k}{m} = \frac{2(\mu N)}{m}$

$= \frac{2(\mu)mg\cos\theta}{m}$ ($\because$ $\mu = \tan\theta$)

$= 2(\tan\theta)g\cos\theta = 2g\sin\theta$

There is rolling & slipping so, $a \neq R\alpha$

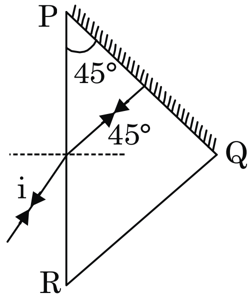
& a = 0

12. Ans. (1)

Sol. $1 \times \sin i = n \sin r$

$\sin i = n \sin 45°$

$\sin i = \frac{n}{\sqrt{2}}$



For i = 45° : $\frac{1}{\sqrt{2}} = \frac{n}{\sqrt{2}}$

n = 1

For i = 90° :

$1 = \frac{n}{\sqrt{2}} \Rightarrow n = \sqrt{2}$

$\therefore$ Range is $\sqrt{2} > n > 1$

13. Ans. (1)

Sol. $q_1 = CE$

$q_2 = CE \times \frac{3}{5}$

14. Ans. (3)

Sol. The Bragg angle is half the angle through which the beam is deviated. Thus, in this case, the bragg angle .....

$\theta = 1/2 \times 60° = 30°$

by bragg equation, $2d\sin\theta = n\lambda$

Here, $d = 3 \times 10^{-10}$m, θ = 30°; n = 1, λ = ?

$\lambda = \frac{2d\sin\theta}{n} = \frac{2\times(3\times10^{-10})\sin30°}{1}m$

$= 3\times10^{-10}m = 3Å$

15. Ans. (1)

Sol. $f = \frac{1}{2\pi\sqrt{LC}} \Rightarrow f \propto \frac{1}{\sqrt{C}}$

$f' \propto \frac{1}{\sqrt{16C}} \Rightarrow f' = \frac{f}{4}$

16. Ans. (1)

Sol. Forward thrust does positive work on the spacecraft causing it to rise higher and its potential energy will increase. With increase in r, the kinetic energy decreases.

17. Ans. (1)

Sol. $\theta = \omega_1 t$

$\theta + \pi = \omega_2 t$

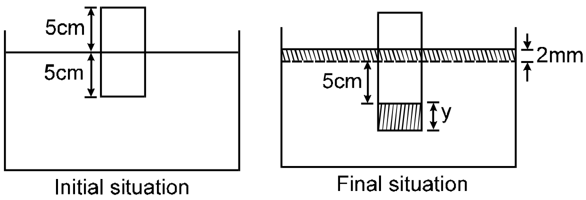
$\pi = (\omega_2 - \omega_1)t$

$t = \frac{\pi}{\omega_2 - \omega_1}$

& $\omega = \sqrt{\frac{GM}{r^3}}$

18. Ans. (1)

Sol. Let the cube dips further by y cm and water level rises by 2 mm.



Volume of water raised

= volume of extra depth of wood

$\Rightarrow \quad 100\,y = (1500 - 100)\,\dfrac{2}{10}$

$= 1400 \times \dfrac{2}{10} = 280$

$\therefore \quad y = 2.8$ cm

$\therefore$ Extra upthrust

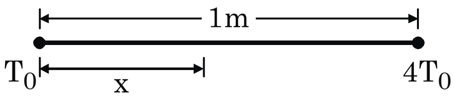
$\rho_{water} \times (2.8 + 0.2) \times 100\, g = mg$

$\Rightarrow \quad m = 300$ gm.

m = 300 gm. Ans.

19. Ans. (3)

Sol.



$$T = T_0 + \frac{4T_0 - T_0}{1} \times x \Rightarrow T = T_0 + 3T_0 x$$

$$V = k\sqrt{T} \Rightarrow \frac{dx}{dt} = kT_0^{1/2}(1+3x)^{1/2}$$

$$\int_{\ell=0}^{\ell=1m} \frac{dx}{(1+3x)^{1/2}} = k\sqrt{T_0}\int_0^t dT$$

$$\frac{2}{3}\left[\sqrt{1+3x}\right]_0^1 = k\sqrt{T_0}\,t$$

$$\frac{2}{3}[2-1] = k\sqrt{T_0}\,t \Rightarrow t = \frac{2}{3k\sqrt{T_0}}$$

20. Ans. (4)

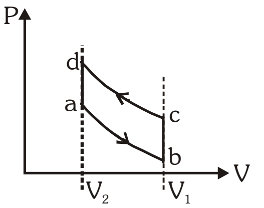
Sol. $\rho = \dfrac{\rho}{M_0}RT \;\Rightarrow \rho = \dfrac{P}{\rho} = \dfrac{R}{M_0}T$

Slope of the curve α Temperature

Hence cd and ab are isothermal processes.

$\rho \propto \dfrac{1}{V}$

i.e. bc and da are constant volume process



Equivalent PV diagram

(1) and (2) are true.

Temp. in cd process is greater than ab.

Net work done by the gas in the cycle is negative, as is clear by the PV-diagram.

21. Ans. (2)

Sol. Nuclear mass = atomic mass – mass of the atom's electron

$\therefore \quad N_{nucleus} = M_{atom} - Z_{me}$

$= 6.015125 - 3 \times 0.0005499$

$= 6.013478$ U

22. Ans. (2)

Sol. $t = \dfrac{n\lambda}{(\mu - 1)}$

$\Rightarrow \; t = \dfrac{5 \times 6 \times 10^{-5}}{(1.5-1)} = 6 \times 10^{-4}$ cm

23. Ans. (1)

Sol. $n \times \dfrac{4\pi}{3}r^3 = \dfrac{4\pi}{3}R^3 \Rightarrow R = (n)^{1/3} r$

$$V = K\frac{nq}{R} \Rightarrow V = K\frac{nq}{(n)^{1/3}r} \Rightarrow V = n^{2/3}\frac{Kq}{r}$$

$$V = (8)^{2/3} = \frac{9 \times 10^9 \times 66 \times 10^{-15}}{1 \times 10^{-3}} = 2.4V$$

24. Ans. (4)

Sol. Here f = 0.5 HZ; N = 100, A = 0.1 m^2 and B = 0.01 T. Employing eq.

e_0 = NBA (2π v)

= 100 × 0.01 × 0.1 × 2 × 3.14 × 0.5

= 0.314 V

The maximum voltage is 0.314 V

We urge you to explore such alternative possibiliities for power generation.

25. Ans. (2)

Sol. $I = \dfrac{34-10}{12} = 2$ amp.

$\Rightarrow \quad V_D = 0$

$\therefore \quad V_E = -4 \times 2 = -8$ volt

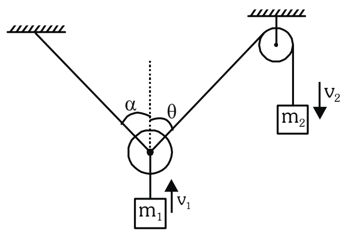
26. Ans. (3)

Sol. By constraint :

$-v_1 \cos\alpha - v_1 \cos\theta + v_2 = 0$

$v_2 = v_1 \cos\theta + v_1 \cos\alpha$

$v_2 > v_1 \cos\theta$



27. Ans. (2)

Sol. $kx = mg$

$\Rightarrow \frac{2mg}{a}x = mg$

$\Rightarrow x = \frac{a}{2}$ so work done by earth

$= mgx = mg\frac{a}{2}$

28. Ans. (1)

Sol. $\frac{hc}{\lambda} = 5\ eV_0 + \phi$

$\frac{hc}{3\lambda} = eV_0 + \phi \Rightarrow \frac{2hc}{3\lambda} = 4eV_0 \Rightarrow \phi = \frac{hc}{6\lambda}$

29. Ans. (1)

30. Ans. (2)

Sol. Work done $= \int_{V_1}^{V_2} PdV$

But $PV = RT$

$P = \frac{RT}{V}$

$w = RT\int_{v_1}^{v_2}\frac{dV}{V} = RT\log_e\frac{V_2}{V_1}$

Here $\frac{V_2}{V_1} = 4$

$\Delta w = RT \times 2.3026\ \log_{10}(4)$

Here, Δw and R are in the units of work.

gain in entropy $= \frac{\Delta H}{T}$

$\frac{\Delta W}{JT} = \frac{RT \times 2.3026\log_{10}4}{JT}$

$= 1.387\frac{R}{J}\text{cal / K}$

31. Ans. (2)

Sol. Decomposition is an endothermic process and $\Delta ng > 0$.

32. Ans. (4)

Sol. C (diamond) + $O_2 \longrightarrow CO_2(g)$; $\Delta H = -97.6$ kcal

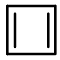
C (graphite) + $O_2 \longrightarrow CO_2(g)$; $\Delta H = -94.3$ kcal

C (diamond) $\longrightarrow$ C (Graphite); $\Delta H = -3.3$ kcal

Heat required to convert 12 gram diamond to graphite = 3.3

$\therefore$Heat required to convert 1 gm diamond to graphite $= \frac{3.3}{12} = 0.275$

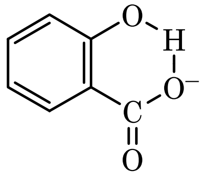
33. Ans. (1)

Sol.  has clyclic conjugation of $4\pi e^{\ominus}$.

34. Ans. (4)

35. Ans. (4)

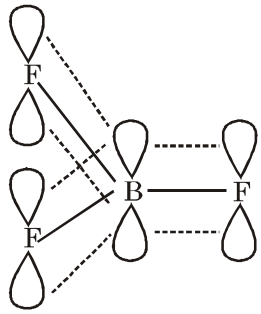
Sol. Option (4) is correct because o – hydroxybenzoate ion is stabilized by intramolecular hydrogen bonding.



Intramolecular hydrogen bonding

36. Ans. (4)

Sol. $p\pi$–$d\pi$ back bonding possible when an empty orbital present in the outermost orbit of centre atom. In BF_3 there is maximum possibility of $p\pi$–$p\pi$ back bonding.



3 $p\pi$ – $p\pi$ bonds

37. Ans. (1)

Sol. Amount of A left in n_1 halves life $= \left[\frac{1}{2}\right]^{n_1}[A]_0$

Amount of B left in n_2 halves life $= \left[\frac{1}{2}\right]^{n_2}[B]_0$

At the end

$\frac{[A]_0}{2^{n_1}} = \frac{[B]_0}{2^{n_2}} = \frac{4}{2^{n_2}} = \frac{4}{2^{n_1}} = \frac{1}{2^{n_2}}$

$\frac{2^{n_1}}{2^{n_2}} = 4 \Rightarrow 2^{n_1-n_2} = (2)^2 \therefore n_1 - n_2 = 2$

$n_2 = (n_1 - 2)$

$\frac{n_1(t_{1/2})_1}{n_2(t_{1/2})_2} = 1 \Rightarrow \frac{n_1 \times 5}{n_2 \times 15} = 1 \Rightarrow \frac{n_1}{n_2} = 3$

$n_1 = 3n_2$

$n_2 = 3n_2 - 2$

$2n_2 = 2$

$n_2 = 1$

$n_1 = 3$

$t = 3 \times 5 = 15$ mintues

38. Ans. (2)

Sol. Redox titration

Eq. of $K_2C_2O_4.3H_2C_2O_4.4H_2O$ = Eq. of $KMnO_4$

$$\frac{0.1 \times V}{1000} = \frac{20 \times 0.05 \times 5}{1000} \Rightarrow V = 50ml$$

n factor of $K_2C_2O_4.3H_2C_2O_4.4H_2O$

for redox titration = 8

for acid base titration = 6

$\therefore$ for acid base titration normality of

$$K_2C_2O_4.3H_2C_2O.4H_2O = \frac{0.1}{8} \times 6N$$

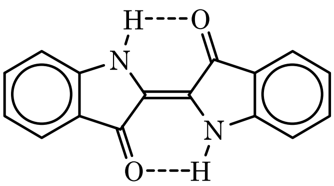
Eq. of acid = Eq. of base

$$\frac{0.1 \times 50}{8 \times 1000} = \frac{1}{8} \times \frac{Vml}{1000}$$

Vml = 30 ml

39. Ans. (3)

Sol.



$\Rightarrow$ Can show GI

$\Rightarrow$ Trans is more stable than cis due to H–bond.

$\Rightarrow$ It is planer.

40. Ans. (4)

Sol. An organometallic compound contains a covalent bond between metal and carbon atom

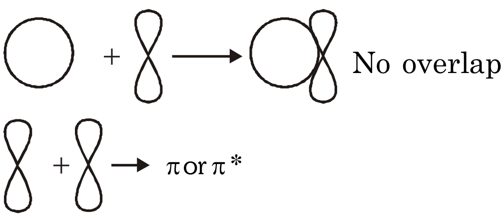
CH_3—Mg—Br	Grignard's reagent
$(H_3C)_2$CuLi	Gillman's reagent
CH_3—Li	Methyl lithium

41. Ans. (4)

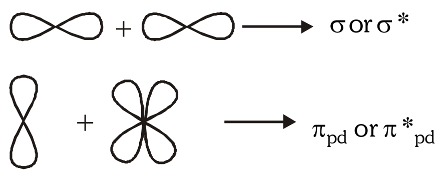
Sol. $[Ni(NH_3)_6]^{2+}$ is outer orbital complex $\because$ 4s, 4p and 4d orbitals (sp^3d^2) hybridisation are involved whereas (1), (2) and (3) are liner complexes ie. d^2sp^3 hybridisation.

42. Ans. (1)

Sol. $1s + 2p_x \longrightarrow$ zero overlap



$2p_x$ $2p_x$



43. Ans. (1)

Sol. Density of ice < Density of water.

44. Ans. (1)

Sol. $\lambda = K \times \frac{1000}{N}$

$$1.50 \times 10^{-4} \times 10^4 = 9 \times 10^{-5} \times 10^{-2} \times \frac{1000}{N}$$

$N = 6 \times 10^{-5}$

$$S = M = \frac{N}{n_f} = \frac{6 \times 10^{-5}}{3} = 2 \times 10^{-5} \text{ mol / L}$$

$Ag_3PO_4 = 3\ Ag^+ + PO_4$

3S S

$K_{sp} = (3S)^3.S = 27.\ S^4 = 27 \times (2 \times 10^{-5})^4$

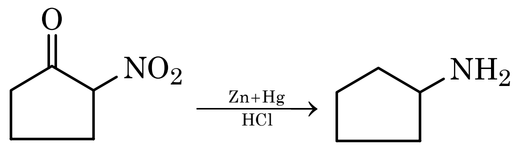
$= 4.32 \times 10^{-18}$

45. Ans. (2)

Sol. 3° halide under solvolysis conditions and at high temperature gives elimination product as major product.

46. Ans. (2)

Sol.



47. Ans. (2)

Sol. Ag is correct because impurity of Pb is present in silver can be removed as volatile oxide (PbO) in the process called cupellation. Impure Ag is heated in a cupel (boat shaped) shallow crucible made of bone ash. (1), (3), (4) are not possible.

48. Ans. (3)

Sol. $2Cu^{2+} + 4I^- \longrightarrow Cu_2I_2\downarrow + I_2$

$Cu^{2+} + 3CN^- \longrightarrow CuCN\downarrow + (CN)_2$

49. Ans. (2)

Sol. Lyophilic colloids are reversible sols.

50. Ans. (2)

Sol. $\Psi(r) = K\ .e^{-K'r}[r^2(r^2 + K_1r + K_2)]$

$\Psi(r) = K\ .e^{-K'r}\ r^2(r^2 + K_1r + K_2)$

Radial nodes = 2

$n - \ell - 1 = 2$

For $\ell = 2$

51. Ans. (2)

Sol. At low temperature (–70°C); $LiAlH_4$ only reduces carbonyl group.

52. Ans. (1)

Sol. Reaction through cyclic halonium ion.

53. Ans. (2)

Sol. $NaCl + AgNO_3 \longrightarrow AgCl \downarrow$ (White) + $NaNO_3$; $AgS \downarrow$ (black) ; Ag_2CO_3 and Ag_2SO_3 dissolves in dil. HNO_3 liberating CO_2 and SO_2 respecitvely.

54. Ans. (4)

55. Ans. (4)

Sol. $NH_4OH \rightleftharpoons NH_4^+ + OH^-$

1	0	0
$1-\alpha$	α	α
$c(1-\alpha)$	$c\alpha$	$c\alpha$

$[OH^-] = c\alpha$

$\Rightarrow \quad \frac{50}{100} \times 0.1 = 0.05\,M$

K_{sp} of $Zn(OH)_2 = [Zn^{2+}]\ [OH^-]^2$

$[OH^-]$ being common ion, solubility of $Zn(OH)_2$ will decrease.

$\Rightarrow \quad 1 \times 10^{-14} = [Zn^{2+}]\ [0.05]^2$

$[Zn^{2+}] = 4 \times 10^{-12}$ M.

Solubility of $Zn(OH)_2 = [Zn^{2+}] = 4 \times 10^{-12}$ M

56. Ans. (2)

Sol. $\because$ 8 g sulphur present in 100 g of compound

$\therefore$ 1 g sulphur present in $\frac{100}{8}$ g of compound

$\therefore$ 32 g sulphur present in $\frac{100 \times 32}{8}$ = 400 g

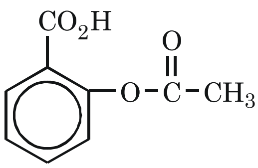
Least molecular mass means at least one atom of sulphur must be present.

57. Ans. (4)

Sol. disaccharides having hemiacetal group are reducing.

58. Ans. (1)

Sol. Aspirin



Acetyl salicylic acid

59. Ans. (3)

Sol. $BF_3 + 3H_2O \longrightarrow B(OH)_3 + 3HF$ (Partial hydrolysis)

$BF_3 + HF \longrightarrow HBF_4$.

60. Ans. (3)

Sol. $Fe_2(SO_4)_3 \longrightarrow Fe_2O_3 + 3SO_3$.

61. Ans. (1)

Sol. $\frac{AB}{AC} = \frac{BD}{CD} = \frac{25}{39} \Rightarrow D \equiv \left(\frac{175}{8}, 0\right)$

Equation of $AD \equiv y = -8\left(x - \frac{175}{8}\right)$

$8x + y = 175$

62. Ans. (2)

Sol $\cos\frac{99\pi}{7} - \cos\frac{54\pi}{7} - \cos\frac{60\pi}{7} =$

$\cos\frac{\pi}{7} + \cos\frac{5\pi}{7} + \cos\frac{3\pi}{7}$

$\frac{\sin\frac{3\pi}{7}\cos\frac{3\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{2}$

63. Ans. (3)

Sol. Let $y = \frac{3}{2-x^2} = f(x)$ ....(1)

The function y is not defined for $x = \pm\sqrt{2}$

From (1), $x2 = \frac{2y-3}{y}$

since for real x, $x^2 \geq 0$,

We have $\frac{2y-3}{y} \geq 0$

$y \geq 3/2$ or $y < 0$

Hence the range of the function is $(-\infty, 0) \cup \left[\frac{3}{2}, \infty\right)$

64. Ans. (4)

Sol $f'(x) = \frac{\cos x - \sin x}{1 + (\sin x + \cos x)^2}$

f (x) is monotonic increasing when $f'(x) > 0$

$\Rightarrow \frac{\cos x - \sin x}{1 + (\sin x + \cos x)^2} > 0 \Rightarrow \cos x - \sin x > 0$

$\Rightarrow \sqrt{2}\cos\left(x + \frac{\pi}{4}\right) > 0$

$\Rightarrow -\pi/2 < x + \pi/4 < \pi/2$

($\because$ cos x is positive when $-\pi/2 < x < \pi/2$)

$\therefore -3\pi/4 < x < \pi/4$

65. Ans. (4)

Sol. $\left[\vec{a}\,\vec{b}\,\vec{c}\right]$

$$=\begin{vmatrix}1 & -1 & 0\\ x & 1 & 1-x\\ y & x & 1+x-y\end{vmatrix}$$

$=1+x-y-x+x^2+x+x^2-xy-y+xy$

$=1+x-2y+2x^2$

66. Ans. (2)

Sol. Normal vector for the plane containing points (1 + 2λ, 2 + 3λ, 3 + 4λ) and (2 + 3μ, 3 + 4 μ, 4 + 5μ) is $\left(2\hat{i}+3\hat{j}+4\hat{k}\right)\times\left(3\hat{i}+4\hat{j}+5\hat{k}\right)=-\hat{i}+2\hat{j}-\hat{k}$

So, equation of plane will be x – 2y + z = p

Since, it passes through (1, 2, 3), p = 0

Hence distance between the two planes will be $\sqrt{6}$

67. Ans. (1)

Sol. $b^2-4ac=p^2-4aq$

$\Rightarrow (b-p)(b+p)=4a(c-q)$

$\alpha=\dfrac{q-c}{b-p}$

Sum of roots of

$f(x)=-\dfrac{b}{a}$ and that of $g(x)=-\dfrac{p}{a}$

AM of all roots $=-\dfrac{(b+p)}{4a}=\dfrac{q-c}{b-p}=\alpha$

68. Ans. (3)

Sol. Total number of ways in which 8 persons can be selected = $^{12}C_8$. Out of these 495 cases, there are 3 cases when all 8 are chosen from only two countries. So, 492 ways

69. Ans. (1)

Sol. Only point where we need to check differentiability is 0

$$f(x)=\begin{cases}4x^2(1-2x)^2, & x<0\\ 0, & x\ge 0\end{cases}$$

$$f'(0)=\begin{cases}0, & x<0\\ 0, & x\ge 0\end{cases}$$

So, differentiable at x = 0

70. Ans. (2)

Sol. x + y + z = 6 … (1)

x + 2y + 3z = 14 ….(2)

3*(2) – (1) will result in 2x + 5y + 8z = 36

So, when $\alpha=8$ and $\beta\neq 36$ we will have no solution

71. Ans. (1)

Sol. Maximum value of $(\sin x+\cos x)^2$ is 2 and minimum value of $3-2\tan x+\tan^2 x$ is 2

Hence, $\sin x+\cos x=\pm\sqrt{2}$ and tanx = 1

So, $x=2n\pi+\dfrac{\pi}{4}\Rightarrow x=\dfrac{\pi}{4}$

72. Ans. (2)

Sol. A is the event that at least one die does not show 5

B is the event that sum of two numbers showing on the two dices is 8

$P(A)=\dfrac{35}{36}$ (only one case (5, 5) is not allowed)

$P(A\cap B)=\dfrac{5}{36}$

$P(B|A)=\dfrac{P(A\cap B)}{P(A)}=\dfrac{1}{7}$

73. Ans. (2)

Sol. z = x + iy

y = 8 and $x+\sqrt{x^2+y^2}=2$

$x+\sqrt{x^2+64}=2$

$x^2+64=x^2-4x+4$

$x=-15$

$z=-15+8i$, $|z|=17$

74. Ans. (2)

Sol. $(\sim(\sim r\wedge\sim p))$ is equivalent to $r\vee p$

And $(p\Rightarrow q)$ is equivalent to $\sim p\vee q$

$(p'\cup q)\cup(r\cup p)$ is universal set

75. Ans. (4)

Sol. Number of terms in the expansion of $(2-3x+4x^2)^n$ is 2n + 1

So, n = 6

To find sum of all coefficients, put x = 1 to get 729

76. Ans. (3)

Sol. If width of river is 'd' and 'h' is height of the tree, then

d $\tan 60^0=h$

and (d + 20)$\tan 30^0=h$

So, d = 10

77. Ans. (2)

Sol. Point of intersection of transverse tangents divides the line(internally) joining the centers in ratio of the radius of the circles So, it divides (12, –1) and (–10, 3) in 5 : 15 or 1 : 3 ratio

78. Ans. (1)

Sol. $A = \begin{bmatrix} 3 & 2 \\ 1 & -4 \end{bmatrix}, \text{adj}A = \begin{bmatrix} -4 & -2 \\ -1 & 3 \end{bmatrix}$

$A(\text{adj}A) = \begin{bmatrix} -14 & 0 \\ 0 & -14 \end{bmatrix} = -14I$

79. Ans. (2)

Sol. Limiting case will be when the line touches the parabola

So, discriminant of $(x + 2)^2 = ax$ should be 0

$x^2 + (4 - a)x + 4 = 0$

$a^2 - 8a = 0 \Rightarrow a = 8$

$\Rightarrow$ Length of latus rectum = 8

80. Ans. (1)

Sol. Total burning time = 30 + 40 + 50 = 120

If t is time for which exactly two candles are burning, then

10*3 + 20 + 2t = 120

So, t = 35

81. Ans. (3)

Sol. $(\vec{a} + \mu\vec{b}).\vec{n} = 0 \Rightarrow \mu = -\frac{\vec{a}.\vec{n}}{\vec{b}.\vec{n}}$

$\vec{r} = \vec{a} - \left(\frac{\vec{a}.\vec{n}}{\vec{b}.\vec{n}}\right)\vec{b}$

82. Ans. (2)

Sol. All three sides of the triangle are equal

So, $\sqrt{a^2 \sec^2\theta + b^2 \tan^2\theta} = 2a\sec\theta$

$b^2 \tan^2\theta = 3a^2 \sec^2\theta$

$\frac{b^2}{a^2} = 3\text{cosec}^2\theta > 3$

$e^2 = 1 + \frac{b^2}{a^2} > 4$

$e > 2$

83. Ans. (4)

Sol. If number arranged in ascending order are x, 1, 4, 10, 12, then

$\frac{27 + x}{5} = 4 \Rightarrow x = -7$

If number arranged in ascending order are 1, x, 4, 10, 12, then also x = –7 which is not possible

If number arranged in ascending order are 1, 4, x, 10, 12, then $\frac{27 + x}{5} = x \Rightarrow x = 6.75$

If number arranged in ascending order are 1, 4, 10, x, 12, then $\frac{27 + x}{5} = 10 \Rightarrow x = 23$ which is not possible

If number arranged in ascending order are 1, 4, 10, 12, x then $\frac{27 + x}{5} = 10 \Rightarrow x = 23$

So, three possibilities

84. Ans. (2)

Sol. $2\cos x = 3\tan x$

$\Rightarrow 2\cos^2 x = 3\sin x$

$\Rightarrow 2\sin^2 x + 3\sin x - 2 = 0$

$\Rightarrow x = \frac{\pi}{6}$

Area bounded by the curves and y axis will be $\int_0^{\frac{\pi}{6}} (2\cos x - 3\tan x)dx$

$= 2\sin x - 3\ln|\sec x|\Big|_0^{\frac{\pi}{6}} = 1 - 3\ln\left(\frac{2}{\sqrt{3}}\right)$

$= 1 - 3\ln 2 + \frac{3}{2}\ln 3$

85. Ans. (2)

Sol. p'''(x) = 0 means p(x) is a two – degree polynomial

Since $\lim_{x \to 2} f(x)$ exists, p(x) will be divisible by x – 2

$\Rightarrow p(x) = a(x-2)(x-b)$

So, $a(2-b) = 7$

Since, $p(3) = 9, a(3-b) = 9$

Dividing them we will get $b = -\frac{3}{2}$ and $a = 2$

So, $p(x) = 2x^2 - x - 6$

86. Ans. (3)

Sol. If y – 2x = k, then k will take its extreme values when this straight line is tangent to the given ellipse

Equation of tangent to the ellipse and having slope 2 is

$y = 2x \pm \sqrt{3.4 + 4} \Rightarrow y = 2x \pm 4$

So, $k \in [-4, 4]$

87. Ans. (1)

Sol. $\frac{1}{y}\frac{dy}{dx} - \log y = e^x$

Put $\log y = t$, $\frac{1}{y}\frac{dy}{dx} = \frac{dt}{dx}$

$\frac{dt}{dx} - t = e^x$

Integrating factor $= e^{-x}$

So, $te^{-x} = x + c$

$t = xe^x + ce^x$

$y = e^{xe^x + ce^x}$

Since, $f(0) = 1$, $c = 0$

$f(x) = e^{xe^x} \Rightarrow f(1) = e^e$

88. Ans. (2)

Sol. $\int_{-\pi}^{\pi} \frac{2x(1+\sin x)}{1+\cos^2 x}dx$

$= \int_{-\pi}^{\pi} \frac{2x}{1+\cos^2 x}dx + \int_{-\pi}^{\pi} \frac{2x\sin x}{1+\cos^2 x}dx$

$\frac{2x}{1+\cos^2 x}$ is an odd function and $\frac{2x\sin x}{1+\cos^2 x}$ is an even function

$I = \int_{-\pi}^{\pi} \frac{2x(1+\sin x)}{1+\cos^2 x}dx = 0 + 2\int_0^{\pi} \frac{2x\sin x}{1+\cos^2 x}dx$

$I = 2\int_0^{\pi} \frac{2(\pi - x)\sin x}{1+\cos^2 x}$

Add them to get $I = \pi\int_0^{\pi} \frac{2\sin x}{1+\cos^2 x}dx$

Put $\cos x = t$, $-\sin x\,dx = dt$

$I = \pi\int_{-1}^{1} \frac{2}{1+t^2}dt = \pi^2$

89. Ans. (2)

Sol. $A = \frac{a+b}{2}$, $G = \sqrt{ab}$ and $H = \frac{2ab}{a+b}$

So, A, G and H are in GP

xA = yG = zH = k

$x = \frac{k}{A}$, $y = \frac{k}{G}$, $z = \frac{k}{H}$

Hence x, y, z are in GP

90. Ans. (4)

$$f(x) = \begin{cases} \int_0^x (1+|1-t|)dt, & x > 2 \\ 5x-7, & x \le 2 \end{cases}$$

Sol. $$= \begin{cases} \int_0^1 (2-t)dt + \int_1^x t\,dt, & x > 2 \\ 5x-7, & x \le 2 \end{cases}$$

$$= \begin{cases} 1 + \frac{x^2}{2}, & x > 2 \\ 5x-7, & x \le 2 \end{cases}$$

So, clearly f(x) is continuous at x = 2 but not differentiable