JEE (MAIN) : ENTHUSIAST COURSE

TARGET : JEE (MAIN) 2015

SCORE – II | **DATE : 08 - 02 - 2015**

Full Syllabus | **Test Pattern : JEE (Main)**

ANSWER KEY

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

HINT – SHEET

1. Let point be (x_1, y_1) then according to the condition $\frac{3x_1+4y_1-11}{5} = -\left(\frac{12x_1+5y_1+2}{13}\right)$

Since the given lines are on opposite sides with respect to origin, hence the required locus is $99x+77y-133=0$

2. The given circle is $x^2+y^2-2x=0$. Let (x_1, y_1) be the middle point of any chord of this circle, than its equation is S_1 = T.

or $x_1^2+y_1^2-2x_1 = xx_1+yy_1-(x+x_1)$

If it passes through (0, 0), then

$x_1^2+y_1^2-2x_1 = -x_1 \Rightarrow x_1^2+y_1^2-x_1=0$

Hence the required locus of the given point (x_1, y_1) is $x^2+y^2-x=0$

3. Any point on $y^2=8x$ is $(2t^2, 4t)$ where the tangent is $yt = x+2t^2$.

Solving it with $xy=-1$, $y(yt-2t^2)=-1$

or $ty^2-2t^2y+1=0$.

For common tangent, it should have equal roots.

$\therefore$ $4t^4-4t=0 \Rightarrow t=0, 1$.

$\therefore$ The common tangent is $y=x+2$, (when $t=0$, it is $x=0$ which can touch $xy=-1$ at infinity only).

4. $\frac{x\cos\theta}{3\sqrt{3}} + y\sin\theta = 1.$

Sum of intercepts $=3\sqrt{3}\sec\theta + \mathrm{cosec}\theta = f(\theta)$ say

$f'(\theta) = \frac{3\sqrt{3}\sin^3\theta - \cos^3\theta}{\sin^2\theta \cos^2\theta}$

At $\theta = \frac{\pi}{6}$, $f(\theta)$ is minimum

6. $4x+x+x=180° \Rightarrow 6x=180° \Rightarrow x=30°$

$\frac{\sin 120^o}{a} = \frac{\sin 30^o}{b} = \frac{\sin 30^o}{c}$

$\therefore a:(a+b+c) = (\sin 120^o):(\sin 120^o + \sin 30^o + \sin 30^o)$

$= \frac{\sqrt{3}}{2} : \frac{\sqrt{3}+2}{2} = \sqrt{3} : \sqrt{3}+2.$

7.

Class	f_i	y_i	$d = y_i - A$, $A = 25$	$f_i d_i$	$f_i d_i^2$
0-10	1	5	– 20	– 20	400
10-20	3	15	– 10	– 30	300
20-30	4	25	0	0	0
30-40	2	35	10	20	200
Total	10			– 30	900

$$\sigma^2 = \frac{\sum f_i d_i^2}{\sum f_i} - \left(\frac{\sum f_i d_i}{\sum f_i}\right)^2 = \frac{900}{10} - \left(\frac{-30}{10}\right)^2$$

$\sigma^2 = 90 - 9 = 81 \Rightarrow \sigma = 9.$

8. $\sim (p \vee q) \vee (\sim p \wedge q))$

$\equiv (\sim p \ \wedge \sim q) \vee (\sim p \wedge q$

$\equiv \sim p \wedge (\sim q \vee q) \equiv \sim p$

9. Since function |x| is not differentiable at x = 0

$\therefore |x^2 - 3x + 2| = |(x-1)(x-2)|$

Hence is not differentiable at x = 1 and 2

Now $f(x) = (x^2 - 1)|x^2 - 3x + 2|\cos(|x|)$ is not differentiable at $x = 2$

For

$1 < x < 2$, $f(x) = -(x^2 - 1)(x^2 - 3x + 2) + \cos x$

For

$2 < x < 3$, $f(x) = +(x^2 - 1)(x^2 - 3x + 2) + \cos x$

$Lf'(x) = -(x^2 - 1)(2x - 3) - 2x(x^2 - 3x + 2) - \sin x$

$Lf'(2) = -3 - \sin 2$

$Rf'(x) = (x^2 - 1)(2x - 3) + 2x(x^2 - 3x + 2) - \sin x$

$Rf'(2) = (4 - 1)(4 - 3) + 0 - \sin 2 = 3 - \sin 2$

Hence $Lf'(2) \neq Rf'(2)$.

10. Since f is even function

$f\ (-x) = f(x)\ , \forall x \in (-5,\ 5).$

We are given that $f(x) = f\left(\frac{x+1}{x+2}\right)$

$$\Rightarrow f(-x) = f\left(\frac{-x+1}{-x+2}\right) \Rightarrow f(x) = f\left(\frac{-x+1}{-x+2}\right)$$

$[\because\ f(-x) = f(x)]$

To find the values of x, we set

$$x = \frac{-x+1}{-x+2} \Rightarrow x = \frac{3 \pm \sqrt{9-4}}{2} = \frac{3 \pm \sqrt{5}}{2}$$

Also $f(x) = f\left(\frac{x+1}{x+2}\right) = f(-x)$

To find the values of x, we set

$$-x = \frac{x+1}{x+2} \Rightarrow x = \frac{-3 \pm \sqrt{9-4}}{2} = \frac{-3 \pm \sqrt{5}}{2}$$

Thus the four required values of x are

$$\frac{-3-\sqrt{5}}{2}, \frac{-3+\sqrt{5}}{2}, \frac{3-\sqrt{5}}{2}, \frac{3+\sqrt{5}}{2}.$$

11. $$y = \lim_{x \to \pi/2} \frac{\int_{\pi/2}^{x} t\ .\ dt}{\sin\ (2x - \pi)} \Rightarrow y = \lim_{x \to \pi/2} \frac{\left[\frac{t^2}{2}\right]_{\pi/2}^{x}}{\sin\ (2x - \pi)}$$

$$y = \lim_{x \to \pi/2} \frac{\left(\frac{x^2}{2} - \frac{\pi^2}{8}\right)}{\sin\ (2x - \pi)} \Rightarrow y = \lim_{x \to \pi/2} \frac{1}{8} \frac{(4x^2 - \pi^2)}{\sin\ (2x - \pi)}$$

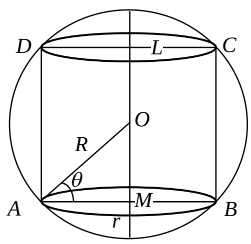
$$y = \lim_{x \to \pi/2} \frac{1}{8} \frac{(2x - \pi)\ \ (2x + \pi)}{\sin\ (2x - \pi)}$$

$$y = \frac{1}{8} \frac{\lim_{x \to \pi/2} (2x + \pi)}{\lim_{x \to \pi/2} \frac{\sin\ (2x - \pi)}{(2x - \pi)}} \left(\because \lim_{\theta \to 0} \frac{\theta}{\sin\theta} = 1\right)$$

$$y = \frac{1}{8} \times 2\pi = \frac{\pi}{4}$$

12. If r be the radius and h the height, then from the figure, $r^2 + \left(\frac{h}{2}\right)^2 = R^2 \Rightarrow h^2 = 4(R^2 - r^2)$

Now, $V = \pi r^2 h = 2\pi r^2 \sqrt{R^2 - r^2}$



$$\therefore \frac{dV}{dr} = 4\pi r \sqrt{R^2 - r^2} + 2\pi r^2 . \frac{1}{2} \frac{(-2r)}{\sqrt{R^2 - r^2}}$$

For max. or min., $\frac{dV}{dr} = 0$

$$\Rightarrow 4\pi r \sqrt{R^2 - r^2} = \frac{2\pi r^3}{\sqrt{R^2 - r^2}} \Rightarrow 2(R^2 - r^2) = r^2$$

$$\Rightarrow 2R^2 = 3r^2 \Rightarrow r = \sqrt{\frac{2}{3}} R \Rightarrow \frac{d^2V}{dr^2} = -ve.$$

Hence V is max., when $r = \sqrt{\frac{2}{3}} R$.

13. Curve $x+y=e^{xy}$

Differentiating with respect to x

$$1+\frac{dy}{dx}=e^{xy}\left(y+x\frac{dy}{dx}\right) \text{ or } \frac{dy}{dx}=\frac{ye^{xy}-1}{1-xe^{xy}}$$

$$\frac{dy}{dx}=\infty \Rightarrow 1-xe^{xy}=0 \Rightarrow 1-x(x+y)=0$$

This hold for $x=1,\ y=0$

14. Clearly, $b\perp c$, $\therefore$ $b.c=0$

Now,

$$d=c-b \Rightarrow |d|^2=|c-b|^2$$

$$= |c|^2+|b|^2-2b\ .\ c=16+16-0$$

$\Rightarrow$ $|d|=\sqrt{32}=4\sqrt{2}$

and direction of d is west.

15. Any point on $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}=\lambda$ is,

$(2\lambda+1,\ 3\lambda-1,\ 4\lambda+1);\ \lambda\in R$

Any point on $\frac{x-3}{1}=\frac{y-k}{2}=\frac{z}{1}=\mu$ is,

$(\mu+3,\ 2\mu+k,\ \mu);\ \mu\in R$

The given lines intersect if and only if the system of equations (in λ and μ)

$2\lambda+1=\mu+3$ ...(i)

$3\lambda-1=2\mu+k$ ...(ii)

$4\lambda+1=\mu$ ...(iii)

has a unique solution.

Solving (i) and (iii), we get $\lambda=\frac{-3}{2},\ \mu=-5$

From (ii), we get $\frac{-9}{2}-1=-10+k\Rightarrow k=\frac{9}{2}$.

16. $I_1=\int_{1-k}^{k}xf\{x(1-x)\}dx$

$$=\int_{1-k}^{k}(1-k+k-x)f[(1-k+k-x)\{1-(1-k+k-x)\}]dx$$

$$(\because \int_a^b f(x)dx=\int_a^b f(a+b-x)dx)$$

$$=\int_{1-k}^{k}(1-x)f\{x(1-x)\}\ dx$$

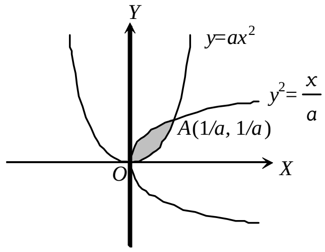
$$=\int_{1-k}^{k}f\{x(1-x)\}\ dx-\int_{1-k}^{k}xf\{x(1-x)\}\ dx=I_2-I_1$$

$$\therefore 2I_1=I_2\Rightarrow\frac{I_1}{I_2}=\frac{1}{2}$$

17. The x-coordinate of A is $\frac{1}{a}$

According to the given condition,

$$1=\int_0^{1/a}\left(\sqrt{\frac{x}{a}}-ax^2\right)dx$$



$$1=\frac{1}{\sqrt{a}}.\frac{2}{3}[x^{3/2}]_0^{1/a}-\frac{a}{3}[x^3]_0^{1/a}$$

18. We know $-1\le\sin x\le 1\Rightarrow -2\le 2\sin x\le 2$

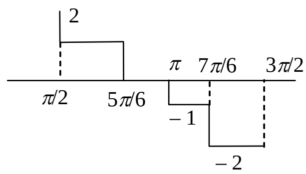
$$I=\int_{\frac{\pi}{2}}^{\frac{3\pi}{2}}[2\sin x]dx$$

$$=\int_{\frac{\pi}{2}}^{\frac{5\pi}{6}}[2\sin x]dx+\int_{\frac{5\pi}{6}}^{\pi}[2\sin x]dx$$

$$+\int_{\pi}^{\frac{7\pi}{6}}[2\sin x]dx+\int_{\frac{7\pi}{6}}^{\frac{3\pi}{2}}[2\sin x]dx$$

$$=\int_{\frac{\pi}{2}}^{\frac{5\pi}{6}}(1)dx+\int_{\frac{5\pi}{6}}^{\pi}(0)dx+\int_{\pi}^{\frac{7\pi}{6}}(-1)dx+\int_{\frac{7\pi}{6}}^{\frac{3\pi}{2}}(-2)dx$$

$$=\left(\frac{5\pi}{6}-\frac{\pi}{2}\right)+0-\left(\frac{7\pi}{6}-\pi\right)-2\left(\frac{3\pi}{2}-\frac{7\pi}{6}\right)$$



$$=\int_{\frac{\pi}{2}}^{\frac{5\pi}{6}}(1)dx+\int_{\frac{5\pi}{6}}^{\pi}(0)dx+\int_{\pi}^{\frac{7\pi}{6}}(-1)dx+\int_{\frac{7\pi}{6}}^{\frac{3\pi}{2}}(-2)dx$$

$$=\left(\frac{5\pi}{6}-\frac{\pi}{2}\right)+0-\left(\frac{7\pi}{6}-\pi\right)-2\left(\frac{3\pi}{2}-\frac{7\pi}{6}\right)$$

$$=\frac{2\pi}{6}-\frac{\pi}{6}-\frac{4\pi}{6}=-\frac{\pi}{2}$$

19. $xdy + ydx = \sqrt{1-x^2y^2}dx \Rightarrow \dfrac{xdy+ydx}{\sqrt{1-x^2y^2}} = dx$

$\dfrac{dxy}{\sqrt{1-(xy)^2}} = dx$ Integrating both side, we get

$\sin^{-1}xy = x + c \Rightarrow xy = \sin(x+c)$

20. For any $a \in R$, we have $a \geq a$, Therefore the relation R is reflexive but it is not symmetric as (2, 1) $\in R$ but (1, 2) $\notin R$. The relation R is transitive also, because $(a,b) \in R, (b,c) \in R$ imply that $a \geq b$ and $b \geq c$ which is turn imply that $a \geq c$.

21. $a_1 = 1,\ a_2 = r,\ a_3 = r^2, ...$

$\therefore 4a_2 + 5a_3 = 4r + 5r^2$

To be its minimum $\dfrac{d}{dr}(4r+5r^2) = 0 \Rightarrow r = \dfrac{-2}{5}$

22. Let the equation (in correctly written form) be $x^2 + 17x + q = 0$. Roots are – 2, – 15. So 30=q, so correct equation is $x^2 + 13x + 30 = 0$. Hence roots are – 3, – 10.

23. Required number of ways $= {}^{12}C_3 - {}^{7}C_3$ $= 220 - 35 = 185$.

24. $(9-r)\left(-\dfrac{1}{6}\right) + r\left(\dfrac{1}{3}\right) = 0 \Rightarrow r = 3$

So the term independent of y

$= {}^9C_3(y^{-1/6})^6(-y^{1/3})^3 = -84$

25. For the equation to be inconsistent D = 0

$$\therefore\ D = \begin{vmatrix} 1 & 2 & -3 \\ 0 & 0 & k+3 \\ 2k+1 & 0 & 1 \end{vmatrix} = 0$$

$\Rightarrow\ k = -3$

and $$D_1 = \begin{vmatrix} 1 & 2 & -3 \\ 3 & 0 & 0 \\ 0 & 0 & 1 \end{vmatrix} \neq 0$$

So that system is inconsistent for k = –3

26. Let A = $\begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$

The matrix of cofactors of the elements of A,

$= \begin{bmatrix} \cos\alpha & -(-\sin\alpha) \\ -\sin\alpha & \cos\alpha \end{bmatrix}$

$\therefore$ adjA = the transpose of matrix of cofactors of A

$= \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$

$\therefore$ A adj A = $\begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$

$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} k & 0 \\ 0 & k \end{bmatrix}$ (as given) $\Rightarrow$ k = 1

27. Since $|z_1| = |z_2| = 1$, we have

$z_1 = \cos\theta_1 + i\sin\theta_1, z_2 = \cos\theta_2 + i\sin\theta_2$

where $\theta_1 = \arg(z_1)$ and $\theta_2 = \arg(z_2)$

Also, $z_1 = a + ib$ and $z_2 = c + id$.

Therefore $a = \cos\theta_1$, $b = \sin\theta_1, c = \cos\theta_2$

and $d = \sin\theta_2$

Also, $R(z_1\bar{z}_2) = 0$

$\Rightarrow\ R[(\cos\theta_1 + i\sin\theta_1)(\cos\theta_2 - i\sin\theta_2)] = 0$

$\Rightarrow\ R[(\cos(\theta_1 - \theta_2) + i\sin(\theta_1 - \theta_2)] = 0$

$\Rightarrow\ \cos(\theta_1 - \theta_2) = 0 \quad \Rightarrow \quad \theta_1 - \theta_2 = \dfrac{\pi}{2}$

$\Rightarrow\ \theta_1 = \theta_2 + \dfrac{\pi}{2}$

Now, $\omega_1 = a + ic = \cos\theta_1 + i\cos\theta_2 = \cos\theta_1 + i\sin\theta_1$

$\Rightarrow |\omega_1| = 1$. Similarly, $|\omega_2| = 1$

Next $\omega_1\bar{\omega}_2 = (\cos\theta_1 + i\sin\theta_1)(\cos\theta_2 - i\sin\theta_2)$

$= \cos(\theta_1 - \theta_2) + i\sin(\theta_1 - \theta_2)$

$= \cos\pi/2 + i\sin\pi/2 = 0 + i$

$\therefore\ R(\omega_1\bar{\omega}_2) = 0.$

28. Let γ be the angle made by n with z-axis. Then direction cosines of n are

$\ell = \cos 45^o = \dfrac{1}{\sqrt{2}},\quad m = \cos 60^o = \dfrac{1}{2}$

and $n = \cos\gamma$.

$\therefore\ l^2 + m^2 + n^2 = 1 \Rightarrow \left(\dfrac{1}{\sqrt{2}}\right)^2 + \left(\dfrac{1}{2}\right)^2 + n^2 = 1$

$\Rightarrow n^2 = \dfrac{1}{4} \Rightarrow n = \dfrac{1}{2}$

[$\because\ \gamma$ is acute, $\therefore\ n = \cos\gamma > 0$]

We have $|n| = 8$, $\therefore\ n = |n|(li + mj + nk)$

$\Rightarrow n = 8\left(\dfrac{1}{\sqrt{2}}i + \dfrac{1}{2}j + \dfrac{1}{2}k\right) = 4\sqrt{2}i + 4j + 4k$

The required plane passes through the point $(\sqrt{2}, -1,\ 1)$ having position vector $a = \sqrt{2}i - j + k$.

So, its vector equation is $(r - a).n = 0$ or $r.\ n = a.\ n$

$\Rightarrow\ r.(4\sqrt{2}i + 4j + 4k)$

$= (\sqrt{2}i - j + k).(4\sqrt{2}i + 4j + 4k)$

$\Rightarrow\ r.(\sqrt{2}i + j + k) = 2$

29. Let n be the least number of bombs required and X the number of bombs that hit the bridge. Then X follows a binomial distribution with parameters n and p = 1/2. Now

$P(X \geq 2) > 0.9 \Rightarrow 1 - P(X < 2) > 0.9$

$\Rightarrow P(X = 0) + P(X = 1) < 0.1$

$$\Rightarrow {}^nC_0\left(\frac{1}{2}\right)^n + {}^nC_1\left(\frac{1}{2}\right)^{n-1}\left(\frac{1}{2}\right) < \frac{1}{10}$$

$$\Rightarrow \frac{n+1}{2^n} < \frac{1}{10} \Rightarrow 10(n+1) < 2^n$$

By trial and error least value of n is 8.

30. $$\frac{dy}{dx} + \frac{3x^2}{1+x^3}y = \frac{\sin^2 x}{1+x^3}$$

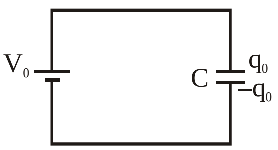
Here, $P = \frac{3x^2}{1+x^3}$

$\Rightarrow$ I.F. = $= e^{\int P\,dx} = e^{\log(1+x^3)} = 1 + x^3$

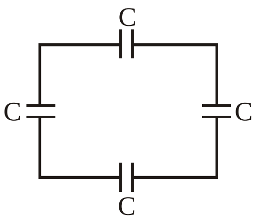
Thus the solution is

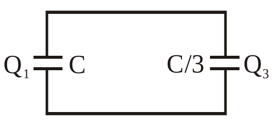
$$y.(1+x^3) = \int \frac{\sin^2 x}{1+x^3}(1+x^3)dx = \int \frac{1-\cos 2x}{2}dx$$

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

31. 

$q_0 = CV_0$

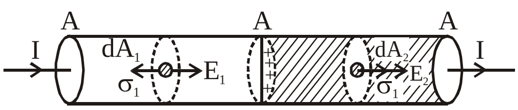




$Q_1 = CV$

$Q_3 = C/3\ V$

$Q_2 = 3Q_1$

32. 

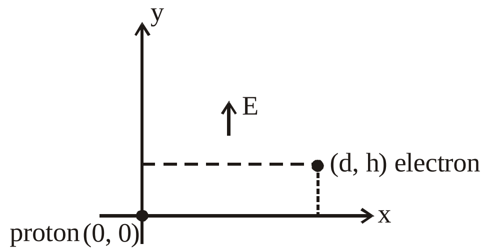
$$\oint \vec{E}.\vec{dA} = \frac{q_{in}}{\varepsilon_0}$$

$$E_2A - E_1A = \frac{q_{in}}{\varepsilon_0}$$

$$JA\left(\frac{1}{\sigma_2} - \frac{1}{\sigma_1}\right) = \frac{q_{in}}{\varepsilon_0}$$

$$\varepsilon_0 I\left(\frac{1}{\sigma_2} - \frac{1}{\sigma_1}\right) = q_{in}$$

33. Equipotential surfaces are perpendicular to electric field lines

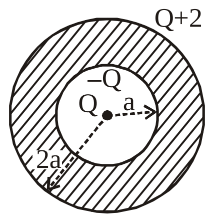
34. 

$$y_p = \frac{1}{2}a_pt^2 = \frac{1}{2}\frac{qE}{m_p}t^2$$

$$y_e = d - \frac{1}{2}a_et^2 = \frac{1}{2}\frac{qE}{m_e}t^2$$

$y_p = y_e$

35. $$\frac{Q+q}{4\pi(2a)^2} = \frac{-Q}{4\pi a^2}$$



$$\frac{Q+q}{4} = -Q$$

$Q + q = -4Q$

$q = -5Q$

33. Flux first increases becomes max and then decreases

37. $E = B\ell v$

$$F = I\ell B = \frac{B^2\ell^2 v}{R_{total}} = \frac{B^2d^2v}{R + \left(\frac{d}{\sin\theta}\right)^r}$$

38. In region 2 and region 4 magnetic fields due to currents are in opposite direction. Due to one current it is into the plane of paper and due to other it is out of the plane of paper

39. $E_i = E_f$

$$\frac{1}{2}mu^2 - U_i = \frac{1}{2}mv^2 - U_f$$

$$U = -\int_{\infty}^{r}\frac{GMm}{r^{2.1}}dr$$

40. $\vec{\tau} = \vec{\mu} \times \vec{B}$

$\tau = \mu B \sin\theta$

$\tau = \mu B = IAB$

$\tau = I(\pi r^2)B$

41. $F = mg$

$$(1+\rho)\frac{P}{C} = mg$$

$$(1.5)\frac{10}{0.13\times10^{-3}\times3\times10^{8}} = m\times10$$

$m = 39 \times 10^{-6}$kg

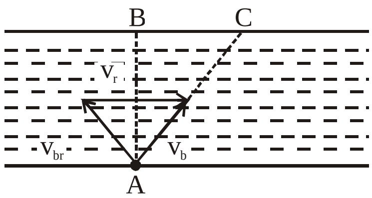
$m = 39$ mg

42. $$\frac{1}{4\pi\varepsilon_0}\frac{(3q)(q)}{r^2} = \frac{mv^2}{r} \quad \ldots(1)$$

$$mvr = \frac{nh}{2\pi} \quad \ldots(2)$$

$n = 1 \quad \ldots(3)$

43. $BC_{min} = b\sqrt{\left(\frac{v_r}{v_{br}}\right)^2 - 1} = 400$ m



$AC = \sqrt{(AB)^2 + (BC_{min})^2}$

$AC = 500$ m

44. $n = \frac{360}{\theta}$

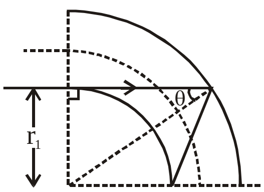
when $\theta = 90°$

Number of images = n – 1

when $\theta < 90°$

Number of images > 3

45.

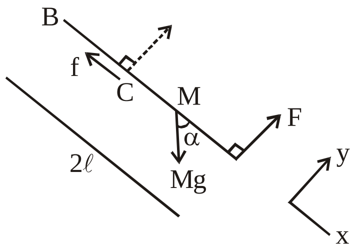


$\theta > \theta_c$

$\sin\theta > \sin\theta_c$

$$\frac{r_1}{r_1 + d} > \frac{1.5}{1.6}$$

46. net torque = 0
about c



$$Mg\left(\frac{\ell}{2}\right)\sin\alpha - F\left(\frac{3\ell}{2}\right) = 0 \quad \ldots(i)$$

$(F_{net})_y = 0$

$F + N - Mg\sin\alpha = 0 \quad \ldots(ii)$

$(F_{net})_x = 0$

$f_{max} = Mg\cos\alpha = 0 \quad \ldots(iii)$

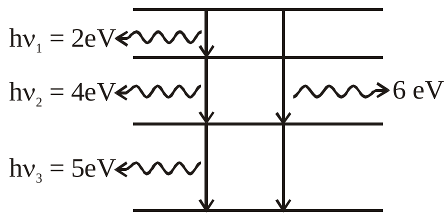
$f_{max} = \mu N \quad \ldots(iv)$

47. $\lambda^i = \frac{\lambda}{n}$

$\lambda_2 > \lambda_1 > \lambda_3$

$n_2 < n_1 < n_3$

48.



4 eV photon is emitted when three photons are emitted.

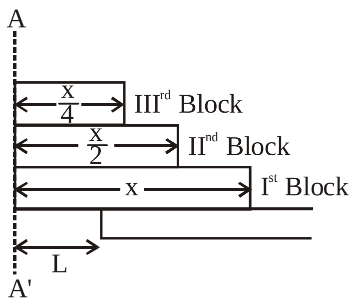
49. When Binding energy of nucleus is less than that of its products then nucleus decays.

50. At equlibrium temp. of both objects are same

Heat loss + heat gain = 00

$M_BC_B\,(T - 100) + M_AC_A\,(T - 0) = 0$

51. Distance of centre of mass = x/ 2
of I[st] block from axis AA'



Distance of centre of mass = x/4
of II[nd] block from axis AA'

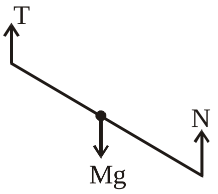
Dtance of centre of mass of system

$$\Rightarrow d = \left[\frac{m\left(\frac{x}{2}\right) + \frac{m}{4}\left(\frac{x}{4}\right) + \ldots\frac{m}{2^{2(n-1)}}\left(\frac{x}{2^n}\right)}{m + \frac{m}{4} + \ldots\frac{m}{2^{2(n-1)}}}\right]$$

For system to topple d < L

52. $\overrightarrow{F_{net}} = 0$

$\overrightarrow{\tau_{net}} = 0$

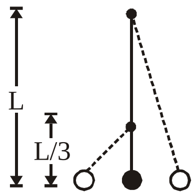


53. y-component of velocity is parallel to wall so it will not change velocity of sphere = $-v\hat{i} + \hat{j}$

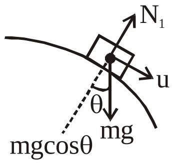
$e = \dfrac{V_{seperation}}{V_{approach}} \Rightarrow \dfrac{1}{3}$

$\dfrac{V}{3} = \dfrac{1}{3}$

54. Time period $\propto \sqrt{L}$

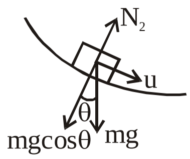


55. Normal in case 2 > Normal in case 1
Friction ∝ Normal



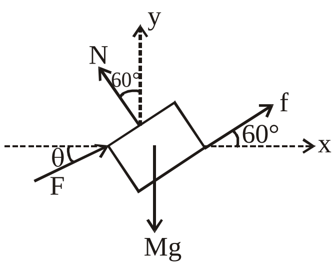
$mg\cos\theta - N_1 = \dfrac{mu^2}{r}$

$N_1 = mg\cos\theta - \dfrac{mv^2}{r}$



$N_2 - mg\cos\theta = \dfrac{mu^2}{r}$

56. $\Sigma F_y = 0$



$N\cos 60° + f_{max}\sin 60° + F\sin\theta - Mg = 0$ …(i)

$\Sigma F_x = 0$

$f_{max}\cos 60° + F\cos\theta - N\sin 60° = 0$ …(ii)

$f_{max} = \mu N$ …(iii)

$\dfrac{dF}{d\theta} = 0$ …(iv)

57. Elongation in spring $\Rightarrow x_e = \dfrac{M_1 g}{K}$

at equilibrium position

Max. compression = $x - x_e$

$K(x - x_e) = M_2 g$

58. Let 'θ' is angle of inclination of plane

Time of flight = $\dfrac{2u\sin 30°}{g\sin\theta}$

59. $\eta = 1 - \dfrac{T_2}{T_1}$

$\dfrac{T_2}{T_1} = 0.7$

$T_1 = 1000$ K

$T_2 = 0.7 \times 1000$

$T_2 = 700$ K

$T_2 = 427$°C

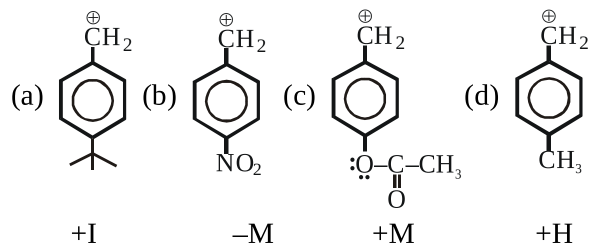
60. $R = \dfrac{\rho \ell}{A}$

$\rho = \dfrac{RA}{\ell} = \dfrac{R\pi r^2}{\ell} = \dfrac{\pi d^2 R}{4\ell}$

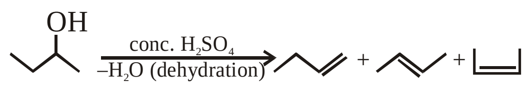
$\dfrac{\Delta\rho}{\rho} = \dfrac{\Delta R}{R} + \dfrac{\Delta d}{d} + \dfrac{\Delta \ell}{\ell}$

61. A has R configuration
B has S configuration
C has R configuration

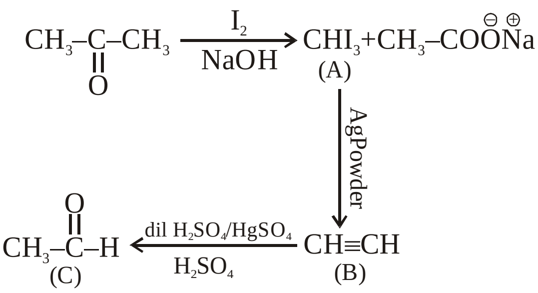
62.



63.



64.

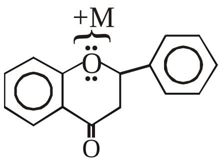


65. $R—CH_2–CH_2–OH \xrightarrow{PBr_3} R–CH_2–CH_2–Br$

$\xrightarrow{KCN} R–CH_2–CH_2–CN$

$\xrightarrow{H_3O^+} R–CH_2–CH_2–COOH$

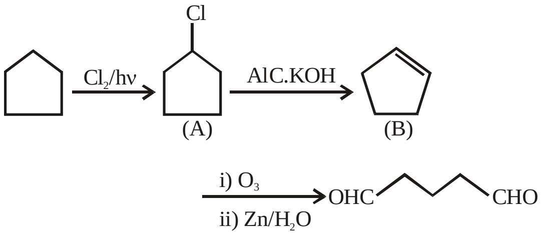
66.



67. Glyptal is polymer of ethylene glycol & Pthalic acid

68. Sucrose with anomeric-OH groups in glycosidic linkage & thus non-Reducing

69.



70. $CH_3 - NH_2 + CHCl_3 + 3KOH \rightarrow CH_3NC + 3KCl + 3H_2O$

71. No. of radial nodes = $n - \ell - 1 = 1$.

$3 - \ell - 1 = 1 \qquad \therefore \ell = 1$

Orbital angular momentum $= \sqrt{\ell(\ell+1)}\dfrac{h}{2\pi}$

$= \sqrt{2}\ \dfrac{h}{2\pi}$

72.

$A \rightleftharpoons B + C$

1   0   0

$1-\alpha \quad \alpha \quad \alpha \qquad = (1+\alpha)$

$Kp_1 = \dfrac{\alpha^2}{1-\alpha^2} \cdot p_1$

$D \rightleftharpoons 2E$

1   0

$1-\alpha \quad 2\alpha \ = (1+\alpha)$

$K_{p_2} = \dfrac{4\alpha^2}{1-\alpha^2} \cdot p_2$

$\dfrac{K_{p_1}}{K_{p_2}} = \dfrac{p_1}{4p_2}$

so $\dfrac{p_1}{p_2} = 4 \cdot \dfrac{Kp_1}{Kp_2} = 4 \times 9 = 36 : 1$

73. We have, $\dfrac{[B]_t}{[C]_t} = \dfrac{4}{3}\dfrac{k_1}{k_2} = \dfrac{16}{9}$ so, $\dfrac{k_1}{k_2} = \dfrac{4}{3}$

Now, $k = k_1 + k_2 = [2 \times 10^{-3} + \dfrac{3}{4} \times 2 \times 10^{-3}]\ sec^{-1} = \dfrac{7}{2} \times 10^{-3}\ sec^{-1} = \dfrac{7 \times 10^{-3} \times 60}{2}\ min^{-1}$

so, $T_{1/2} = \dfrac{\ell n\ 2}{7 \times 30 \times 10^{-3}}\ min = \dfrac{693}{7 \times 30}$

74. All velocities α T. as $T_2 > T_1$

$\therefore U_{MP}$ at $T_2 > U_{MP}$ at T_1

75. $pH = pKa + \log \dfrac{V}{300 - V}$

$4.5 = 4.2 + \log \dfrac{V}{300 - V}$

$0.3 = \log \dfrac{V}{300 - V}$

$\log 2 = \log \dfrac{V}{300 - V}$

$\therefore 2 = \dfrac{V}{300 - V}$

$\therefore V = 200 \therefore$ Volume of the acid = 300 – 200 = 100

76. meq of $FeSO_4$ = meq of $KMnO_4$

eq. of $FeSO_4 = \dfrac{100 \times 2 \times 5}{1000} = 1$

moles of $FeSO_4 = 1$

$\therefore$ Mole fraction of $FeSO_4 = \dfrac{1}{3}$

77. $\sqrt{2}a = 660\sqrt{2}$ pm ; so a = 660 pm

Now if tetrahedral void is occupied by cations than $\dfrac{\sqrt{3}}{4}\ a = (r_+ + r_-)$

$r_- = \left(\dfrac{\sqrt{3} \times 600}{4} - 110\right) = 110\left[\dfrac{3}{2}\sqrt{3} - 1\right]$

$= 1.598 \times 110$

so $\dfrac{r_+}{r_-} = \dfrac{1}{1.\ 598} \simeq \dfrac{1}{1.6} = \dfrac{10}{16} = 0.625$

but $\dfrac{r_+}{r_-} > 0.414$ so it must not be occupying tetrahedral void then $a = 2(r_+ + r_-) \Rightarrow 330 = r_+ + r_-$

hence $r_- = 220$ pm $\{\dfrac{r_+}{r_-} = 0.5$ it can occupy octahedral void$\}$

78. (1) as in case of negative deviation.

(2) ΔG_{mix} is generally positive.

(3) Ideal mixture follows Raoult's law at all compositions, so can not form a constant boiling mixture.

(D) It is theoretically impossible to obtain an ideal solution.

79. According Hardy-Schulze rule.

88. EA of $A_{(g)}$ = IE of $A^-_{(g)}$