MOTION IIT-JEE
(Where Faith Counts the Success)

TARGET IIT-JEE
HINT & SOLUTIONS

ANSWER KEY WITH SOLUTION

CLASS XIII (DATE 23-08-09)

MATHEMATICS

1.	B	2.	D	3.	B	4.	D	5.	A	6.	A	7.	C
8.	A	9.	C	10.	B	11.	D	12.	A	13.	A	14.	A
15.	A	16.	D	17.	D	18.	B	19.	C	20.	B		

PHYSICS

21.	B	22.	A	23.	A	24.	D	25.	A	26.	C	27.	B
28.	A	29.	C	30.	D	31.	B	32.	C	33.	A	34.	B
35.	C	36.	C	37.	B	38.	A	39.	A	40.	A		

CHEMISTRY

41.	D	42.	D	43.	D	44.	C	45.	C	46.	D	47.	D
48.	D	49.	C	50.	A	51.	C	52.	A	53.	B	54.	C
55.	A	56.	B	57.	A	58.	B	59.	C	60.	B		

MATHEMATICS

1. $x^2(a^2-1)+2ax+1=0$

$\Rightarrow \quad D = 4a^2 - 4(a^2-1) = 4$

Both roots $x \in (0, 1)$

$(a^2-1)\,f(0) > 0,\ (a^2-1)f(1) > 0,\ 0 < -\dfrac{B}{2A} < 1$

$\Rightarrow \quad a \in (-\infty, -2) \cup (1, \infty),$

$a \in \left(-\infty, \dfrac{-1-\sqrt{5}}{2}\right) \cup \left(0, \dfrac{-1+\sqrt{5}}{2}\right)$

Finally, $\quad a \in (-\infty, -2)$

2. $y = \dfrac{x^2-x}{1-ax}$

$\Rightarrow \quad x^2 - x = y - axy$

$\Rightarrow \quad x^2 + x(ay-1) - y = 0$

Since 'x' is real, therefore $(ay-1)^2 + 4y \geq 0$

$\Rightarrow \quad a^2y^2 + 2y(2-a) + 1 \geq 0 \ \forall\ y \in R$

$\Rightarrow \quad a^2 > 0,\ 4(2-a)^2 - 4a^2 \leq 0$

$\Rightarrow \quad 1 \leq a \qquad$ a cannot be 1.

Hence $a \in (1, \infty)$

3. Given, $f(x)\,.\,f(y) = f(x) + f(y)$

Replacing $\dfrac{1}{x}$ in place of y, we get,

$f(x)\,.\,f\left(\dfrac{1}{x}\right) = f(x) + f\left(\dfrac{1}{x}\right) \qquad ....(1)$

Let $f(x) = a_0 + a_1 x + ... + a_n x^n$

Putting in equation (1) and equating the coefficients of similar powers of x, we get

$a_0 = 1,\ a_n = 1$

$a_1 = a_2 = ... = a_{n-1} = 0$

$\therefore \quad f(x) = 1 \pm x^n$

But $\quad f(2) = 33 \qquad \Rightarrow f(x) \neq 1 - x^n$

$\therefore \quad f(x) = 1 + x^n$

$\Rightarrow \quad f(2) = 1 + 2^n = 33 \qquad \Rightarrow 2^n = 32 = 2^5$

$\therefore \quad n = 5 \qquad \therefore \quad f(x) = 1 + x^5$

Hence, product of roots of $f(x) = 0$ is -1

4. Since, $(a-2)(x-[x])^2 + 2(x-[x]) + a^2 = 0$

$\Rightarrow \quad (a-2)\{x\}^2 - 2\{x\} + a^2 = 0$

Let $y = \{x\} \qquad$ where, $0 \leq y < 1$

$\therefore \quad (a-2)y^2 - 2y + a^2 = 0 \qquad ...(1)$

since, the given equation has exactly one solution in (2, 3), so the equation (1) has exactly one root in (0, 1)

$\therefore \quad f(0)\,.\,f(1) < 0$

$\Rightarrow \quad a^2(a-2+2+a^2) < 0$

$\Rightarrow \quad a^2(a^2+a) < 0 \ \Rightarrow \quad a^3(a+1) < 0$

$\therefore \quad a \in (-1, 0)$

5. Let $a^{\cos x} = t$

$\Rightarrow \quad t + \dfrac{1}{t} = 6 \quad$ or $\quad t^2 - 6t + 1 = 0$

$\Rightarrow \quad t = \dfrac{6 \pm \sqrt{36-4}}{2} = \dfrac{6 \pm 4\sqrt{2}}{2} = 3 \pm 2\sqrt{2}$

$\Rightarrow \quad a^{\cos x} = 3 \pm 2\sqrt{2}$

$\Rightarrow \quad \cos x = \log_a(3 \pm 2\sqrt{2})$

Since, $a > 1$, for all the roots to be real, we must have

$\log_a(3+2\sqrt{2}) \leq 1$ and $\log_a(3-2\sqrt{2}) \geq -1$

Both are true for $a \geq 3 + 2\sqrt{2}$

$\therefore \quad a \in [3+2\sqrt{2}, \infty)$

6. $\sin^{-1}\left(\dfrac{1+t^2}{2t}\right)$ is defined if $\left|\dfrac{1+t^2}{2t}\right| \leq 1$ {by definition}

$\Rightarrow \quad \dfrac{1+|t|^2}{2|t|} \leq 1 \quad \Rightarrow \quad 1 + |t|^2 \leq 2|t|$

$\Rightarrow \quad (1-|t|)^2 \leq 0 \ \Rightarrow \quad (1-|t|)^2 = 0$

$\Rightarrow \quad |t| = 1 \quad$ or $\quad t = \pm 1$

$\therefore \quad k > \sin^{-1} 1 = \dfrac{\pi}{2} \qquad \{\because k > 0\}$

$\Rightarrow \quad [k] = \left[\dfrac{\pi}{2}\right] = 1$

Now, the given equation reduces to

$(x-1)(x+\alpha) - 1 = 0$

$\Rightarrow \quad (x-1)(x+\alpha) = 1 \qquad ...91)$

Now, the integral values of α for which the above equation has integeral roots.

$\Rightarrow \quad x$ and α must be integers

Now, from equation (1), we have

Case I : $x-1=1 \Rightarrow x=2$

and $x+\alpha=1 \Rightarrow \alpha=-1$

Case II : $x-1=-1 \Rightarrow x=0$

and $x+\alpha=-1 \Rightarrow \alpha=-1$

Thus, $\alpha=-1$

7. Let $E=\tan^{-1}\left[\underbrace{\cos\left\{2\tan^{-1}\left(\frac{3}{4}\right)\right\}}_{E_1}+\underbrace{\sin\left\{2\cot^{-1}\left(\frac{1}{2}\right)\right\}}_{E_2}\right]$

Now, $E_1=\cos\left\{\cos\left(\frac{1-\left(\frac{3}{4}\right)^2}{1+\left(\frac{3}{4}\right)^2}\right)\right\}$

$\Rightarrow \quad E_1=\cos\cos^{-1}\left(\frac{7}{25}\right)=\frac{7}{25}$

Also, $E_2=\sin\left\{2\cos^{-1}\left(\frac{1}{2}\right)\right\}=\sin(2\tan^{-1}2)$

$\Rightarrow \quad E_2=\sin\left\{\sin^{-1}\left(\frac{2.2}{1+(2)^2}\right)\right\}$

$\Rightarrow \quad E_2=\sin\sin^{-1}\left(\frac{4}{5}\right)=\frac{4}{5}$

$\therefore \quad E=\tan^{-1}\left(\frac{7}{25}+\frac{4}{5}\right)$

$\Rightarrow \quad E=\tan^{-1}\left(\frac{27}{25}\right)=\tan^{-1}\left(1+\frac{2}{25}\right)>\frac{\pi}{4}$

8. Since, $[\sin^{-1}\cos^{-1}\sin^{-1}\tan^{-1}x]=1$ {given}

$\Rightarrow \quad 1\le\sin^{-1}(\cos^{-1}\sin^{-1}\tan^{-1}x)\le\frac{\pi}{2}$

$\Rightarrow \quad \sin 1\le\cos^{-1}\sin^{-1}\tan^{-1}x\le 1$

$\Rightarrow \quad \cos\sin 1\ge\sin^{-1}\tan^{-1}x\ge\cos 1$

$\Rightarrow \quad \sin\cos\sin 1\ge\tan^{-1}x\ge\sin\cos 1$

$\Rightarrow \quad \tan\sin\cos\sin 1\ge x\ge\tan\sin\cos 1$

Hnce, $x\in[\tan\sin\cos 1, \tan\sin\cos\sin 1]$

9. Since, $f(x)=[x]$ and $g(x)=\{x\}$

Option (A) :

$f(x+y)=f(x)+f(y)$

$\Rightarrow \quad [x+y]=[x]+[y]$

which is true if x and y are both integers or fractional part of x and y do not exceed unity i.e. $\{x\}+\{y\}<1$

But Since $x, y\in R$

so the equality may not hold true $\forall\ x, y\in R$

Option (B) :

$g(x+y)=g(x)+g(y)$

$\Rightarrow \quad \{x+y\}=\{x\}+\{y\}$

Which is true if $x, y\in I$ but not true for $x, y\in R$

Option (C) :

$f(x+y)=f(x)+f(y+(g(x))$

$\Rightarrow \quad [x+y]=[x]+[y+\{x\}]$

$\Rightarrow \quad [x+y]=[x]+[y+x-[x]]$

$\Rightarrow \quad [x+y]=[x]+([y+x]-[x])$

$\therefore \quad [x+y]=[x+y]$ which is true $\forall$ $x, y\in R$

10. $a+b=m$; $ab=2$

$(a+b)+\frac{1}{a}+\frac{1}{b}=p$

$(a+b)+\frac{a+b}{ab}=p$

$\therefore \quad p=m+\frac{m}{2}=\frac{3m}{2}$ ....(1)

also $\left(a+\frac{1}{b}\right)\left(b+\frac{1}{a}\right)=q$

$\Rightarrow \quad ab+\frac{1}{ab}+2=q$

$\Rightarrow \quad 2+\frac{1}{2}+2=q \Rightarrow q=\frac{9}{2}$ ....(2)

now from (1) and (2)

$p=2q$

$\frac{3m}{2}=9 \Rightarrow m=6$ Ans.]

11. $y=\frac{x+2}{2x^2+3x+6}$

$\Rightarrow 2x^2y+3xy+6y=x+2$

$\Rightarrow 2x^2y+x(3y-1)+2(3y-1)=0, x\in R$

$\therefore D\ge 0$

$\Rightarrow (3y-1)^2-16y(3y-1)\ge 0$

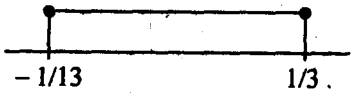
$\Rightarrow 9y^2-6y-48y^2+16y+1\ge 0$

$\Rightarrow -39y^2+10y+1\ge 0$

$\Rightarrow 39y^2-10y-1\le 0$

$\Rightarrow 39y^2-13y+3y-1\le 0$

$\Rightarrow (3y-1)(13y+1) \le 0$



$\therefore$ maximum value (M) = $\frac{1}{3}$ and

minimum value (m) = $-\frac{1}{13}$

$\Rightarrow \frac{1}{M} - \frac{1}{m} = 3 + 13 = 16$ Ans.

12. $\frac{x^2+10x-36}{x(x-3)^2} = \frac{a(x-3)^2+b(x-3)x+cx}{x(x-3)^2}$

hence $x^2 + 10x - 36 = a(x-3)^2 + b(x-3)x + cx$

put $x = 0$; $-36 = 9a \Rightarrow a = -4$

$x^2 + 10x - 36 = x^2(-4 + b) + x(24 - 3b + c) + (-36)$

comparing coefficients

also, $-4 + b = 1 \Rightarrow b = 5$

$24 - 15 + c = 10 \Rightarrow 9 + c = 10 \Rightarrow c = 1$

$a = -4$; $b = 5$; $c = 1$ i.e. $a + b + c = 2$ Ans.

13. $a_0 + a_1 + a_2 + a_3 + a_4 = ?$

Given $x^{19} + 2x^{14} + 3x^9 + 4x^4 + 5$

$= Q(x^5 - x^4 + x^3 - x^2 + x - 1) + a_4x^4 + a_3x^3 + a_2x^2 + a_1x + a_0$

put $x = 1$ to get

$a_0 + a_1 + a_2 + a_4 + a_4 = 15$ Ans.

14. Let $\sin^{-1}(x+2) = \alpha \Rightarrow x + 2 = \sin\alpha$

$\therefore 2\alpha = \cos^{-1}(x+3)$

$\cos 2\alpha = x + 3 = (x+2) + 1 = 1 + \sin\alpha$

$1 - 2\sin^2\alpha = 1 + \sin\alpha$

$\sin\alpha(1 + 2\sin\alpha) = 0$

$\Rightarrow \sin\alpha = 0$ or $\sin\alpha = -1/2$

$\therefore x = -2$ or $x = -2.5$ (rejected)

$\therefore x^2 = 4$

15. for f to be one-one $f'(x) > 0$

and $f'(x) < 0$ for all x

clearly f is continuous at $x = 0$ and $f(0) = -1$

$x \le 0$, $f'(x) = 2(x + m)$ for $x < 0$

$f'(x)$ can not be > 0 for $\forall\ x < 0$ if $m > 0$

$\therefore f'(x) < 0$ for $\forall\ m \le 0$

but $m \ne 0$ as for $x > 0$, f is constant

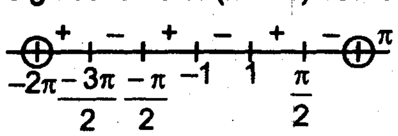
and $\forall\ m < 0$, $f'(x) < 0$, $\forall\ x > 0$

16. $|x^2 - 1 + \cos x| = |x^2 - 1| + |\cos x|$.

It implies that $(x^2 - 1) + |\cos x|$

$|x + y| = |x| + |y|$ if $xy \ge 0$

Sign scheme of $(x^2 - 1)\cos x$ is



Thus solution is $\left[-\frac{\pi}{2}, -1\right] \cup \left[1, \frac{\pi}{2}\right] \cup \left(-2\pi, \frac{3\pi}{2}\right]$

17. $\left[\log_2\left(\frac{x}{[x]}\right)\right] \ge 0$

$\Rightarrow \log_2\left(\frac{x}{[x]}\right) \ge 0 \Rightarrow \frac{x}{[x]} \ge 1$

$\Rightarrow \frac{x - [x]}{[x]} \ge 0 \Rightarrow \frac{\{x\}}{[x]} \ge 0$

It implies that 'x' is any positive real number greater than or equal to one or 'x' is any non zero integer.

18. $[x]^2 = x + 2\{x\}$

$\Rightarrow [x]^2 = [x] + 3\{x\} \Rightarrow \{x\} = \frac{[x]^2 - [x]}{3}$

$\Rightarrow 0 \le \frac{[x]^2 - [x]}{3} \Rightarrow 0 \le [x]^2 - [x] < 3$

$\Rightarrow [x] \in \left(\frac{1-\sqrt{13}}{2}, 0\right] \cup \left[1, \frac{1+\sqrt{13}}{2}\right)$

$\Rightarrow [x] = -1, 0, 1, 2$

$\Rightarrow \{x\} = \frac{2}{3}, 0, 0, \frac{2}{3}$

$\Rightarrow x = -\frac{1}{3}, 0, 1, \frac{8}{3}$

19. $\sin\frac{\pi}{18} = \sin 10°$, $\sin 30° = \frac{1}{2}$

also $\sin 30° = 3\sin 10° - 4\sin^3 10°$

$\frac{1}{2} = 3\sin 10° - 4\sin^3 10°$

$8\sin^3 10° + 0\sin^2 10° - 6\sin 10° + 1 = 0$ ....(1)

given, $f(\sin 10°) = 0$

$a\sin^3 10° + b\sin^2 10° + c\sin 10° + d = 0$ ....(2)

comparing (1) and (2)

$a = 8$, $b = 0$, $c = -6$, $d = 1$

hence $f(1) = a + b + c + d$

$f(1) = 3$ Ans.

20. if $x \in 1^{st}$ quadrant then $y = 1 + 1 + 1 + 1 = 4$

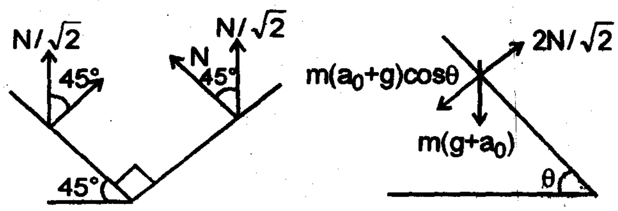
if $x \in 2^{nd}$ quadrant then $y = 1 - 1 - 1 - 1 = -2$

if $x \in 3^{rd}$ quadrant then $y = -1 - 1 + 1 + 1 = 0$

if $x \in 4^{th}$ quadrant then $y = -1 + 1 - 1 - 1 = -2$

$\Rightarrow y_{min} = -2$

21. B



$$\frac{2N}{\sqrt{2}} = m(g + a_0)\cos\theta \qquad ...(1)$$

$$f_r = 2\mu N = m\,(g + a_0)\sin\theta \qquad ...(2)$$

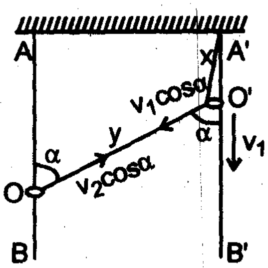
(1) ÷ (2)

$$\frac{1}{\mu\sqrt{2}} = \frac{1}{\tan\theta}$$

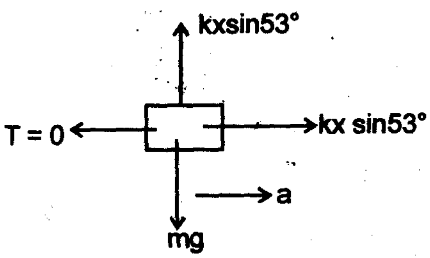
22. A

Rate of decrease of length y
= Rate of increase of length x

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



23. A



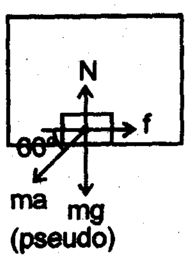
initially $kx\cos 53° = mg$

Now $kx\sin 53° = ma$

$\Rightarrow$ $mg\tan 53° = ma$

$$\Rightarrow \quad a = \frac{4}{3}g$$

24. D



Let *m* be mass of the block and let the reference frame be rigidly fixed with the elevator.

Hence $N = mg + ma\sin 60°$

$\mu N \ge ma\cos 60°$

$$\Rightarrow \quad \mu \ge \frac{ma\cos 60°}{mg + ma\sin 60°}$$

$$\Rightarrow \quad \mu \ge \frac{5(1/2)}{10 + 5(\sqrt{3}/2)}$$

$$\Rightarrow \quad \mu \ge \frac{1}{4+\sqrt{3}}$$

Since the blocks cannot accelerate in horizontal direction therefore the normal interaction force between the blocks as well as between 5 kg block and the wall is F = 1000 N. Again both the blocks accelerate downward with acceleration $\vec{g}\ m/s^2$ and therefore the relative acceleration between the blocks is zero. Hence the friction force between the blocks is zero.

25. A

We know $T_{max} - T_{min} = 6mg$

And $T_{max} = 2T_{min}$ (given)

Since tension is max at lowest parts

$$T = mg + \frac{mv^2}{L}$$

$$12mg = mg + \frac{mv^2}{L}$$

$$\Rightarrow \quad v = \sqrt{11gL}$$

26. C

$$(i) = Mg\frac{L}{2} = 0.5MgL$$

$$(ii) = Mg\frac{L}{2} = 0.5MgL$$

$$(iii) = Mg\frac{2R}{\pi} = \frac{2Mg}{\pi}\frac{L}{\pi} = \frac{2}{\pi^2}MgL \approx 0.2MgL$$

$$(iv) = \frac{4}{\pi^2}MgL \approx 0.4MgL$$

$$(v) = Mg\left(R - \frac{2R}{\pi}\right) = \left(\frac{\pi-2}{\pi}\right)MgR = \frac{\pi-2}{\pi^2}MgL$$

$$= \frac{1.14}{\pi^2}MgL = 0.114MgL$$

i = ii > iv > iii > v

27. B

$$\frac{mdv}{dt}v = P \Rightarrow \frac{mv^2}{2} = Pt$$

$$v = \sqrt{\frac{2P}{m}}t^{1/2} \Rightarrow \frac{dx}{dt} = kt^{1/2}$$

$s \propto t^{3/2}$

28. A

$\vec{v}(t) = u\cos 30\hat{i} + (4\sin 30° - gt)\hat{j}$

$= 10\sqrt{3}\,\hat{i} + (10 - 10t)\hat{j}$

Now $v(0).\, v(t) = 0$

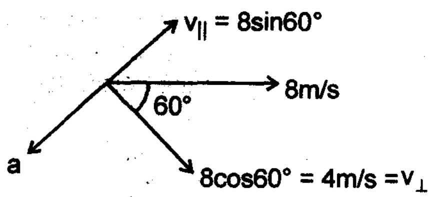
$\Rightarrow$ $[10\sqrt{3}\,\hat{i} + 10\hat{j}] . [10\sqrt{3}\,\hat{i} + 10(1-t)\hat{j}]$

$=$ $3 + (1 - t) = 0$

$\Rightarrow$ $t = 4$ sec.

so $x = 10\sqrt{3}\,t = 40\sqrt{3}$ m

29. C



At certain Instant velocity parallel to acceleration will be zero.

$r_{min} = \dfrac{(v_{\perp})^2}{a} = \dfrac{4^2}{2} = 8m$

30. D

$v_y = u - g\cos\theta\, t$

$v_x = g\sin\theta\, t$

$\tan 45° = \dfrac{v_y}{v_x} = \dfrac{(u - g\cos\theta t)}{g\sin\theta t}$

$1 = \dfrac{\sqrt{2}u - gt}{gt}$

$2gt = \sqrt{2}u \quad \Rightarrow \quad t = \dfrac{u}{\sqrt{2}g}$

31. B

$\vec{a}.\vec{b} = ab\cos\theta$

$(\vec{a}+\vec{b}).\vec{a} = |a+b|a\cos\alpha = a^2 + ab\cos\theta$ ...(1)

$(\vec{a}-\vec{b}).\vec{a} = |a-b|a\cos\beta = a^2 - ab\cos\theta$ ...(2)

$|\vec{a}\times\vec{b}| = ab\sin\theta$

$|(\vec{a}+\vec{b})\times\vec{a}| = |a+b|\, a\sin\alpha = ab\sin\theta$ ...(3)

$|(\vec{a}-\vec{b})\times\vec{a}| = |a-b|\, a\sin\beta = ab\sin\theta$ ...(4)

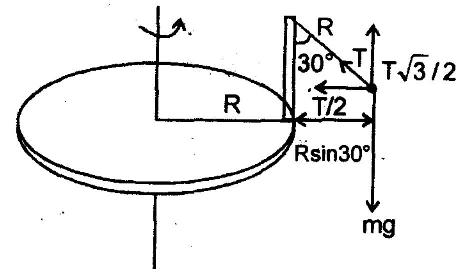
[(3) ÷ (1)] + [(4) ÷ (2)]

$\tan\alpha + \tan\beta = ab\sin\theta\left[\dfrac{1}{a^2 + ab\cos\theta} + \dfrac{1}{a^2 - ab\cos\theta}\right]$

$= \dfrac{ab\sin\theta(2a)}{a^2 - b^2\cos^2\theta} = \dfrac{2ab\sin\theta}{a^2 - b^2\cos^2\theta}$

32. C

33. A



$\dfrac{T}{2} = m\omega^2(R + R\sin 30°)$ ...(1)

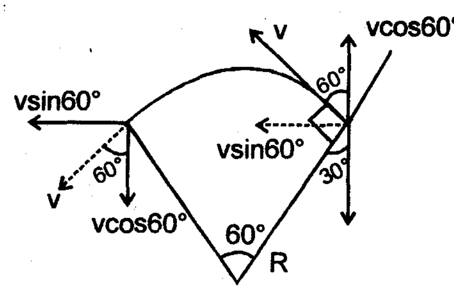
$\dfrac{T\sqrt{3}}{2} = mg$ ...(2)

from (1) & (2)

$\dfrac{1}{\sqrt{3}} = \dfrac{\omega^2 R(1+1/2)}{g}$

$\Rightarrow \quad \omega = \left(\dfrac{2g}{3\sqrt{3}R}\right)^{1/2}$

34. B



$\Delta v = v\cos 60° - (-v\cos 60°) = v$

$\Delta t = \dfrac{\pi/3R}{v} = \dfrac{\pi R}{3v}$

$a_{avg} = \dfrac{\Delta v}{\Delta t} = \dfrac{3v^2\sqrt{\dfrac{3}{4}+\dfrac{1}{4}}}{\pi R} = \dfrac{3}{\pi}\dfrac{v^2}{R}$

$a_{ins} = \dfrac{v^2}{R}$

$\dfrac{a_{ins}}{a_{avg}} = \dfrac{\pi}{3}$

35. C

E.C. $\quad mg(25) = \dfrac{1}{2}mv_B^2 - mg(15)$

$\Rightarrow \quad 2g(10) = v_B^2$

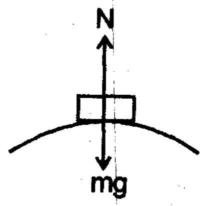
$\Rightarrow \quad v_B^2 = 200$

at B $\quad mg - N = \frac{mv_B^2}{R}$

$N = mg - \frac{mv_B^2}{R} > 0$

$\Rightarrow \quad gR > 200$

$\Rightarrow \quad R > 20$



36. **D**

acceleration = deacceleration = a

$\Rightarrow \quad v^2 = u^2 + 2as$

$\Rightarrow \quad 25 = 0 + 2 \times a \times 50$

$\Rightarrow \quad a = 1/4 \text{ m/sec}^2$

37. **D**

$P_{max} = FV_{max} = ma \times v_{max}$

$= 1000 \times \frac{1}{4} \times 5$

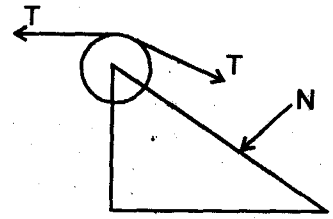
$= 1250$ J/s

38. **A**

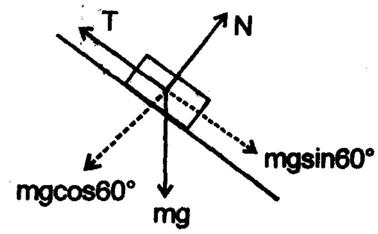
39. **A**

- at $r = 0$, $\frac{dU}{dr} = 0$ thus, $F = 0$
- In the region $0 \le r \le R$, the slope of the curve is **increasing,** therefore F is **linearly** increasing in this region.
- In the region $r \ge R$, U is **decreasing** as inverse square function therefore, F will **decrease** as an **inversely** proportional function.

40. **A**



$T + N \sin 60° - T \cos 60° = ma \quad ...(1)$



$b = \sqrt{a^2 + a^2 + 2a^2 \cos 120°} \quad ...(2)$

$mg \sin 60° - T = ma\,(1 - \cos 60°) \quad ...(3)$

$mg \cos 60° - N = ma \sin 60° \quad ...(4)$

from (1) (2) (3) & (4)

$\frac{T}{N} = 3\sqrt{3}$

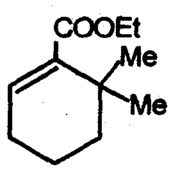
CHEMISTRY

41. **D**

42. **D**

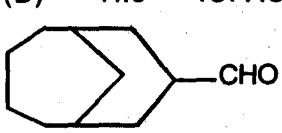
43. **D**

44. **C**

(A) The I.U.P.A.C name of  is ethyl–6, 6–dimethyl cyclohex – 1 – en – 1 – carboxylate

(B) If β - H of iso butyramide is replaced by $-CH_2COOH$. The IUPAC name of the compound formed is 4-carbampyl pentanoic acid

(C) The IUPAC name of the secondary iso pentyl group is 1,2-dimetyl propyl

(D) The IUPAC name of the  is bicylo [4,3,1] decane-8-carbaldehyde

45. **C**

46. **D**

47. **C**

48. **D**

Mass of the system remains conserved.

49. **C**

50. **A**

51. **C**

52. **A**

53. **B**

Complexes, (A) and (B) have weak-field ligand and so Co^{3+} has three unpaired electron but in (C) DMG is a strong field ligand, so it has only one unpaired electron.

54. **C**

$A \rightarrow 2B + C$

$A_0 - x \quad 2x \quad x$

Let P & Q are the rotation of B & C /mole respectively

at $t = 10$ min

$60 = 2xp + qx$ ...(i)

at the end of the reaction

$2A_0 \times P + A_0 q = 180$

$A_0 (2p + q) = 180$ ...(ii)

from (i) & (ii)

$(A_0 - x)(2P + q) = 120$

$$\frac{A_0}{A_0 - x} = \frac{180}{120} = \frac{3}{2}$$

$$\frac{A_0 - x}{A_0} = \frac{2}{3}$$

% Amount of A left at t = 10 min

$$\frac{A_0 - x}{A_0} \times 100 = \frac{2}{3} \times 100 = 66.67\%$$

55. **A**

When phenolphthalein is used as indicator then 1/2 meq of Na_2CO_3 = meq of Acid.

$$\frac{a}{2} = 2.5 \times 0.1 \times 2 = 0.5 \Rightarrow a = 1$$

when methyl orange is added then

meq of H_2SO_4 = meq of $NaHCO_3$ produced + meq of $NaHCO_3$ original

$$2.5 \times 0.2 \times 2 = \frac{a}{2} + b$$

$1 = 0.5 + b \Rightarrow b = 0.5$

$$\text{weight of } Na_2CO_3\text{/litre} = a \times 10^{-3} \times \frac{106}{2} \times 1000$$

$$= 1 \times 10^{-3} \times 53 \times 100 = 5.3 \text{ gm}$$

$$\text{weight of } NaHCO_3 \text{ / lt.} = \frac{b \times 10^{-3} \times 84}{10} \times 1000$$

$$= 0.5 \times 8.4 = 4.2 \text{ gm}$$

56. **B**

Let the mmoles are K_2CO_3 & $KHCO_3$ = n

K_2CO_3 & $KHCO_3$ are equimolar when methyl orange is used as indicator

meq. of H_2SO_4 = meq. of K_2CO_3 + meq. of $KHCO_3$

$60 \times N = n \times 2 + n \times 1$

$3n = 60$ N

$n = 20$ N $= 20 \times 0.6 \times 2$

When 2w gm mixture is treated with H_2SO_4 in th presence Phenolphthalein as indicator then

$$\frac{1}{2}\text{meq of } K_2CO_3 = \text{meq. of } H_2SO_4$$

$$\frac{1}{2} \times 2n \times [illegible] = 0.6x \times x \times 2 \times 1000$$

$n = 0.6x \times x \times 1000$

$20 \times 0.6 \times 2 = 0.6\, x^2 \times 1000$

$$\frac{40}{1000} = x^2 \Rightarrow x = \frac{2}{10} = 0.2 \text{ Ans.}$$

57. **A**

$C_{2a}H_{3a}N_a + O_2 \rightarrow CO_2 + H_2O + NO_2$

40 ml 250 ml

$3O_2 \xrightarrow{u.v} 2O_3$

Let remaining O_2 = V ml

$3O_2 \rightarrow 2O_3$

$V - 3x \quad 2x$

Now $V - 3x = 2x$

$v = 5x$

moles of $NO_2 = 2x = 2v/5$

reacted $O_2 = (250 - v)$

Applying POAC on N

$$40\,a = \frac{2v}{5} \Rightarrow 100a = V$$

Apply POAC on H

$120\,a = 2$ 0+ moles of H_2O

$60\,a$ = moles of H_2O

Apply POAC on C

$40 \times 2a$ = moles of CO_2

$80\,a$ = moles of CO_2

Applying POAC on O

$$(250 - v) \times 2 = 2 \times 80\,a + 60\,a + 2 \times \frac{2v}{5}$$

$$500 - 2v = 160\,a + 60a + \frac{4v}{5}$$

$$500 = 220\,a + 14\frac{v}{5}$$

$$500 = 220\,a + 14 \times \frac{100}{5}a$$

$= 220\,a + 280\,a$

$500 = 500\,a$

$a = 1$

Hence $C_2H_3N = CH_3CN$

58. **B**

59. **C**

60. **B**