Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60_NUCLEUS-BT JEE-MAIN Date: 26-07-2025

Time: 09.00Am to 12.00Pm RPTM-03 Max. Marks: 300

KEY SHEET

MATHEMATICS

1	**1**	2	**4**	3	**2**	4	**4**	5	**4**
6	**4**	7	**2**	8	**3**	9	**2**	10	**3**
11	**1**	12	**4**	13	**3**	14	**1**	15	**3**
16	**3**	17	**4**	18	**1**	19	**2**	20	**3**
21	**1600**	22	**2**	23	**3**	24	**5**	25	**4**

PHYSICS

26	**2**	27	**3**	28	**2**	29	**2**	30	**3**
31	**1**	32	**2**	33	**4**	34	**2**	35	**1**
36	**1**	37	**3**	38	**1**	39	**3**	40	**4**
41	**2**	42	**4**	43	**3**	44	**1**	45	**3**
46	**2**	47	**2**	48	**4**	49	**700**	50	**8**

CHEMISTRY

51	**3**	52	**3**	53	**1**	54	**2**	55	**3**
56	**1**	57	**4**	58	**3**	59	**3**	60	**3**
61	**2**	62	**4**	63	**1**	64	**3**	65	**1**
66	**4**	67	**4**	68	**1**	69	**2**	70	**4**
71	**8**	72	**2**	73	**4**	74	**3**	75	**3**

SOLUTION
MATHEMATICS

1. $f(x)=3\sqrt{x-2}+\sqrt{4-x}\quad x-2\ge 0$ and $4-x\ge 0\quad \therefore x\in[2,4]$

Let $x=2\sin^2\theta+4\cos^2\theta \therefore f(x)=3\sqrt{2}|\cos\theta|+\sqrt{2}|\sin\theta|$

$\therefore \sqrt{2}\le 3\sqrt{2}|\cos\theta|+\sqrt{2}|\sin\theta|\le\sqrt{9\times 2+2}$

$\sqrt{2}\le 3\sqrt{2}|\cos\theta|+\sqrt{2}|\sin\theta|\le\sqrt{20}\quad \therefore \alpha=\sqrt{2}\ \beta=\sqrt{20}$

$a^2+2\beta^2=2+40=42$

2. $f(x)=\sin x+3x-\frac{2}{\pi}\left(x^2+x\right)\ x\in\left[0,\frac{\pi}{2}\right]$

$f'(x)=\cos x+3-\frac{2}{\pi}(2x+1)>0 f(x)\uparrow$

$f'(x)=-\sin x+0-\frac{\pi}{2}(2)\qquad =-\sin x-\frac{4}{\pi}<0\ f'(x)\downarrow$

$0<x<\frac{\pi}{2}\quad -\underset{+3}{\frac{2}{\pi}}>\frac{-2}{\pi}(2x+1)>-\frac{2}{\pi}\underset{+3}{(\pi+1)}\quad \underset{+ve}{3}-\frac{2}{\pi}>3-\frac{2}{\pi}(2x+1)>3-\frac{2}{\pi}\underset{+ve}{(\pi+1)}$

3. $f(x)=(x-2)^{2/3}(2x+1)$

$f'(x)=\frac{2}{3}(x-2)^{-1/3}(2x+1)+(x-2)^{2/3}$

$f'(x)=2\times\frac{(2x+1)+(x-2)}{3(x-2)^{1/3}}\qquad \frac{3x-1}{(x-2)^{1/3}}=0$

Critical points $x=\frac{1}{3}$ and $x=2$

4. $f'(x)=6x^2-18ax+12a^2\qquad f'(x)=6\left(x^2-3ax+2a^2\right)$

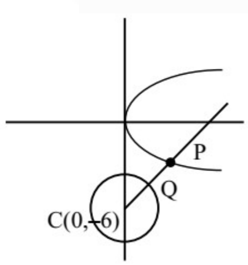
Roots are a, 2a $\qquad p^2=q\Rightarrow a^2=2a\quad a=2$

$f(x)=2x^3-18x^2+48x+1\qquad f(3)=37$

5. Thus, function is continuous at x = 0.

$f(0)>f\left(0^-\right), f(0)>f\left(0^+\right)$

6.



Equation of normal to parabola

$y^2=8x$ is $y=mx-4m-2m^3$

Passes through (0, -6) we get

$-6 = -4m - 2m^3 \quad \Rightarrow m^3 + 2m - 3 = 0 \Rightarrow (m-1)(m^2+m+3) = 0 \Rightarrow m = -1$

$P = (am^2 - 2am) = (2, -4) \qquad \therefore$ shortest distance $= PC - r \quad = (2\sqrt{2} - 1)$

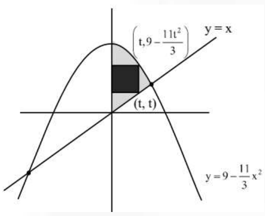
7. $f'(x) = 18x^2 - 90ax + 108a^2 = 0$

$x = 2a$ and $x = 3a \quad x_1 = 2a \quad x_2 = 3a$

$x_1 x_2 = 54 \qquad 6a^2 = 54 \qquad a = 3$

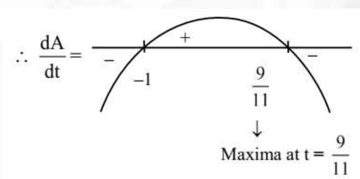
$a + x_1 + x_2 \quad 3 + 2\times 3 + 3\times 3 = 18$

8. $t.\left(9 - \dfrac{11t^2}{3} - t\right)$



$A = 9t - t^2 - \dfrac{11}{3}t^3 \quad \dfrac{dA}{dt} = 9 - 2t - 11t^2 \quad \Rightarrow 11t^2 + 2t - 9 = 0$

$11t^2 + 11t - 9t - 9 = 0 \qquad t = -1 \ \& \ t = \dfrac{9}{11}$



$\therefore \text{largest area} = \dfrac{9}{11}\left(9 - \dfrac{11}{3}, \dfrac{81}{121} - \dfrac{9}{11}\right) \quad = \dfrac{9}{11}.\dfrac{63}{11} = \dfrac{567}{121}$

9. $f'(x) = \dfrac{2}{x-2} - 2x + a \geq 0 \qquad f''(x) = \dfrac{-2}{(x-2)^2} - 2 < 0$

$f'(x)\downarrow \qquad f'(3) \geq 0 \qquad a_{min} = 4$

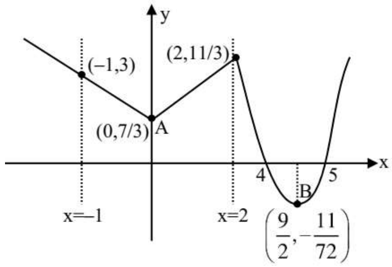
$g(x) = (x-1)^3 (x+2-a)^2 \qquad g(x) = (x-1)^3 (x-2)^2$

$g'(x) = (x-1)^3 2(x-2) + (x-2)^2 3(x-1)^2$

$= (x-1)^2 (x-2)(2x - 2 + 3x - 6) \qquad = (x-1)^2 (x-2)(5x-8) < 0 \qquad x \in \left(\dfrac{8}{5}, 2\right)$

$100(a+b-c) = 100\left(4 + \dfrac{8}{5} - 2\right) = 360$

10.
$$f(x) = \begin{cases} 1-2x, & x < -1 \\ \frac{1}{3}(7-2x), & -1 \leq x \leq 2 \\ \frac{1}{3}(7+2x) & 0 \leq x < 2 \\ \frac{11}{18}(x-4)(x-5), & x > 2 \end{cases}$$



$\therefore$ Local minimum values of A and B

$\frac{7}{3}-\frac{11}{72} \quad \Rightarrow \frac{168-11}{72} \Rightarrow \frac{157}{72}$

11. $\begin{vmatrix} 1+\sin^2 x & \cos^2 x & 4\sin 4x \\ \sin^2 x & 1+\cos^2 x & 4\sin 4x \\ \sin^2 x & \cos^2 x & 1+4\sin 4x \end{vmatrix}, x \in R$

$R_2 \to R_2 - R_1$ & $R_3 \to R_1$

$f(x)\begin{vmatrix} 1+\sin^2 x & \cos^2 x & 4\sin 4x \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{vmatrix}$

Expand about R_1, use get f(x) = 2 + 4 sin4x $\therefore$ M = max. value of f(x) = 6

M = min value of f(x) = -2 $\therefore M^4 - M^4 = 1280$

12. $f'(x) = ax(x-1) \Rightarrow f'(2) = 6 \Rightarrow a = 3$

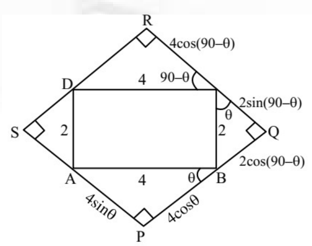
$f'(x) = 3(x^2 - x) \Rightarrow f(x) = x^3 - \frac{3x^2}{2} + C \qquad \therefore f(x) = x^2\left(x - \frac{3}{2}\right)$

$f(2) = 2 \Rightarrow C = 0$

13. $\therefore f(x) = ax^4 + bx^3 + 2x^2 \;\; \therefore f'(1) = 4a + 3b + 4$

and, $f'(2) = 32a + 12b + 8 \qquad \therefore f(x) = \frac{x^4}{2} - 2x^3 + 2x^2$

14.



$\text{area} = (4\cos\theta + 2\sin\theta)(2\cos\theta + 4\sin\theta)$

$= 8\cos^2\theta + 16\sin\theta\cos\theta + 4\sin\theta\cos\theta + 8\sin^2\theta$

$= 8 + 20\sin\theta\cos\theta \;\; = 8 + 10\sin 2\theta$

$\text{max. area} = 8 + 10 = 18(\sin 2\theta = 1)\theta = 45^0$

$(a+b)^2 = (4\cos\theta + 2\sin\theta + 2\cos\theta + 4\sin\theta)^2$

$= (6\cos\theta + 6\sin\theta)^2 \qquad = 36(\sin\theta + \cos\theta)^2 \qquad = 36\left(\sqrt{2}\right)^2 = 72$

15. $2x+2r+\pi r=l$

$A=2rx+\frac{1}{2}\pi r^2$

A is max or min $\frac{dA}{dr}=0\Rightarrow r=\frac{1}{4+\pi}$ $\quad\therefore At\ r=\frac{l}{\pi+4}\ \frac{d^2A}{dr^2}<0$

16. We know that

$(\cos\theta)\left(\cos\left(60^0-\theta\right)\left(\cos\left(60^0+\theta\right)\right)\right)=\frac{1}{4}\cos 3\theta$

So equation reduces to $\left|\frac{1}{4}\cos 3\theta\right|\le\frac{1}{8}$

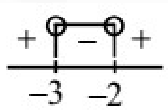
$\Rightarrow|\cos 3\theta|\le\frac{1}{2}$ $\quad\Rightarrow -\frac{1}{2}\le\cos 3\theta\le\frac{1}{2}$

As $\theta\in[0, 2\pi]$ possible values are

$\theta=\left\{\frac{\pi}{9},\frac{5\pi}{9},\frac{7\pi}{9},\frac{11\pi}{9},\frac{13\pi}{9},\frac{17\pi}{9}\right\}$

Whose sum is $\frac{\pi}{9}+\frac{5\pi}{9}+\frac{7\pi}{9}+\frac{11\pi}{9}+\frac{13\pi}{9}+\frac{17\pi}{9}=\frac{54\pi}{9}=6\pi$

17. $\frac{x^2+x+2}{x^2+5x+6}<0$ $\quad\Rightarrow\frac{1}{(x+2)(x+3)}<0$



$x\in(-3,-2)......(1)$ $\quad f(x)=1+x\left(\lambda^2-x^2\right)$

Finding local minima $\quad f'(x)=\left(\lambda^2-x^2\right)+(-2x).x$

put $f'(x)=0$ $\quad\Rightarrow\lambda^2=3x^2\ \Rightarrow x=\pm\frac{\lambda}{\sqrt{3}}$ $\quad -3<\frac{-\lambda}{\sqrt{3}}<-2$

$3\sqrt{3}>\lambda>2\sqrt{3}$ $\quad\alpha=2\sqrt{3},\ \beta=3\sqrt{3}\ \ \alpha^2+\beta^2=12+27=39$

18. If f(x) is increasing then $f'(x)>0$

If f(x) is decreasing then $f'(x)<0$

19. Let 'x' be thickness $\quad$ V = total volume $=\frac{4}{3}\pi(10+x)^3$

$\frac{dv}{dt}=4\pi(10+x)^2\frac{dx}{dt}$ $\quad 50=4\pi(10+5)^2\frac{dx}{dt}\ \frac{dx}{dt}=\frac{1}{18\pi}$

20. $x^2-11x+30\le 0$ $\quad(x-6)(x-5)\le 0\Rightarrow 5\le x\le 6$

$f'(x)=3\left(3x^2\right)-18(2x)+27=9x^2-36x+27=9\left(x^2-4x+3\right)$

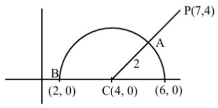
For maximum and minimum $f'(x)=0$ at $\quad x=1, x=3$

But [5, 6] $f'(x)>0$ so $f(x)\uparrow$ function : maximum at x = 6

$3(6)^3 - 18(6)^2 + 27(6) - 40 = 122$

21. $(x-7)^2 + (y-4)^2 \quad y = \sqrt{8x - x^2 - 12}$

$y^2 = -(x-4)^2 + 16 - 12 \quad (x-4)^2 + y^2 = 4$



$m = 9 \qquad M = 41 \qquad M^2 - m^2 = 41^2 - 9^2 = 1600$

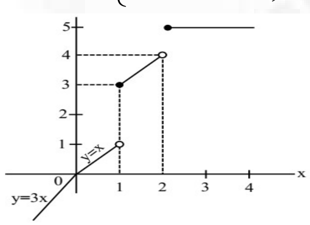
22. $f\left(\dfrac{\alpha+\beta}{2}\right) < \dfrac{f(\alpha)+f(\beta)}{2}$ for all α and β

$\Rightarrow f(x)$ must be concave upward for all $x \in R \qquad \Rightarrow f''(x) \ge 0 \ \forall x \in R$

23. Area of $\Delta ABC = \dfrac{1}{2}\begin{vmatrix} 4 & -2 & 1 \\ 1 & 1 & 1 \\ 9 & -3 & 1 \end{vmatrix} = 6$ sq. units.

Maximum area of AFDE = $\dfrac{1}{2} \times 6 = 3$sq. units

24. $f(x) = \begin{cases} 3x; & 0 < 0 \\ \min(1+x, x); & 0 \le x < 1 \\ \min(2x+x, x+2); & 1 \le x < 2 \\ 5; & x > 2 \end{cases} \qquad f(x) = \begin{cases} 3x; & x < 0 \\ x; & 0 \le x < 1 \\ x+2; & 1 \le x < 2 \\ 5; & x > 2 \end{cases}$



not continuous at $x \in \{1, 2\} \Rightarrow \alpha = 2$

not diff. at $x \in \{0, 1, 2\} \Rightarrow \beta = 3 \ \alpha + \beta = 5$

25. $D = (\sin 2\theta)^2 - 4\left(1 - \dfrac{\sin^2 2\theta}{2}\right)\left(1 - \dfrac{3}{4}\sin^2 2\theta\right) = (\sin 2\theta)^2 - 4\left(1 - \dfrac{5}{4}\sin^2 2\theta + \dfrac{3}{8}\sin^4 2\theta\right)$

$D = \dfrac{3}{2}\sin^4 2\theta + 6\sin^2 2\theta - 4 > 0 \ \ 3\sin^4 2\theta - 12\sin^2 2\theta + 8 < 0$

$\sin^2 2\theta = \dfrac{12 \pm \sqrt{12^2 - 12.8}}{6} = \dfrac{12 \pm 4\sqrt{3}}{6} = \dfrac{6 \pm 2\sqrt{3}}{3}$

$\sin^2 2\theta = 2 \pm \dfrac{2}{\sqrt{3}}$, but $\sin^2 2\theta \in [0, 1]$

$\therefore \alpha = 2 - \dfrac{2}{\sqrt{3}}, \beta = 1 \to (\alpha-2)^2 = \dfrac{4}{3}, (\beta-1)^2 = 0$

$3(\alpha-2)^2 + (\beta-1)^2 = 4$

PHYSICS

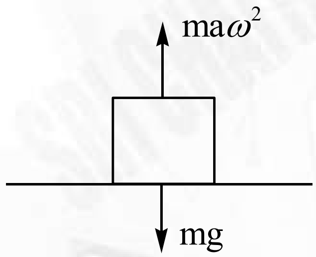
26. When 3 kg mass is released the amplitude of its oscillations is 2m and at a distance 1 m from the equilibrium position we can find the speed of it using the relation $v=\left[(k/m)\left(A^2-x^2\right)\right]^{1/2}$ then by conservation of momentum we can find the resulting speed of the combined mass and the new amplitude using the above relation

27. Comparing the graph with the relation in velocity and displacement $v=\left[(k/m)\left(A^2-x^2\right)\right]^{1/2}$ maximum acceleration of the particle is given by $a_{max}=kA/m$

28. Due to the Pseudo force on block (considered external) its mean position will shift to a distance mg/K above natural length of spring as net force now is mg in upward direction so total distance of block from new mean position is 2mg/K which will be the amplitude of oscillations. During oscillation spring will pass through the natural length. As block is oscillating under spring force and the constant force which do not affect the SHM frequency.

29. By finding restoring force on particle using F = -dU/dx we can see that force is a linear function of 'x' which verifies that particle is executing SHM. From the given expression we have at x = 4 potential energy is minimum so this is the mean position of the oscillating particle. If in this expression we put U = 36 J which will happen at x = 8 m or x = 0m which are the extreme positions of the oscillations so amplitude of oscillations is 4m. At x = 2m we can use the velocity expression $v=\left[(k/m)\left(A^2-x^2\right)\right]^{1/2}$ and find the kinetic energy and verify

30. Block loses contact at the highest point. Then



$mg=ma\omega^2$

$\Rightarrow \omega=\sqrt{\frac{g}{a}}=\sqrt{\frac{10}{0.4}}=5\ \text{rad}\,s^{-1} \qquad \Rightarrow T=\frac{2\pi}{5}s$

At lowest point

$N=mg+ma\omega^2$

N = 2mg (from (1))

Halfway down from mean position,

$N=mg+k\left(\frac{a}{2}\right) \qquad =mg+\frac{m\omega^2 a}{2}=1.5\ mg$

Block has maximum velocity when displacement (and thus acceleration) is zero, and thus have N = mg

31. When the spring has maximum extension by conservation of momentum we use 5(3) + 2(10) = 7(v) which gives v = 5 m/s and by energy conservation we can obtain the maximum extension of spring. Both particles are executing SHM about their center of mass and in the frame of center of mass by any one particle's phase analysis we can find the time of maximum compression which is an extreme position of the blocks. Velocity of center of mass here is 5 m/s and with respect to center of mass 5 kg block is moving at 2 m/s away from it and the force constant of spring for 5 kg mass can taken as 1120(5 + 2) 2 = 3920 N/m.

32. Net force on ball will be zero at a depth where buoyant force balances its weight where $\rho_0 = \alpha h$ hence mean position of SHM will be at a depth ρ_0 / α so this will be the amplitude of SHM and other extreme position of the ball will be at a distance twice the amplitude from the free surface.

33. Due to constant pseudo force on block it will execute SHM with same time period $2\pi\sqrt{\frac{m}{k}}$ as constant external force never changes the frequency of SHM. Mean position of SHM is the position where pseudo force balances the spring force. Total energy of oscillation is given by $(1/2)mw^2A^2$ with which you can verify.

34. $x = 3\sin 100t + 8\cos^2 50t$

$= 3\sin 100t + \frac{8[1+\cos 100t]}{2}$

$x = 4 + 3\sin 100t + 4\cos 100t$

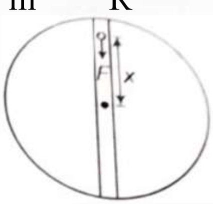
$\left\{\tan\phi = \frac{4}{3}\right\}$

Amplitude = 5 units

Maximum displacement = 9 units.

35. Key : 2

$\frac{F}{m} = -\frac{GM}{R^3}x \quad a = -\frac{GM}{R^3}x$



The bolt executes SHM

$\omega = \sqrt{\frac{GM}{R^3}} \qquad T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{R^3}{GM}} = 86.4 \text{ min} \qquad t = \frac{T}{2} = 43.2 \text{ min}$

36. (1) Given that acceleration of car is

$f = a - bx$

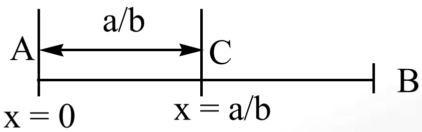
for maximum velocity, acceleration should be zero. $\Rightarrow a - bx = 0 \quad \Rightarrow x = \frac{a}{b}$

At $x = \frac{a}{b}$, the particle has its maximum velocity

We use $f = \frac{vdv}{dx} = a - bx$ $\Rightarrow$ distance between the station is $\frac{2a}{b}$

Alternate : $f = a - bx$ means particle will execute SHM

At mean position; $f = 0$



$\Rightarrow x = \frac{a}{b}$

In the fig. shown. 'C' is the mean position and A and B are extreme positions.

$\Rightarrow x_{max} = \frac{2a}{b}$ and $x_{max} = \omega A = \sqrt{b}.\frac{a}{b} = \frac{a}{\sqrt{b}}$

37. (3) The maximum static frictional force is

$f = \mu mg\cos\theta = 2\tan\theta mg\cos\theta = 2mg\sin\theta$

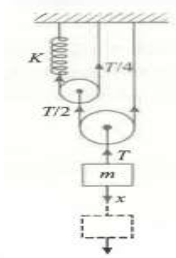
Applying Newton's second law to block at lower extreme position, we have

$f - mg\sin\theta = m\omega^2 A$ $\Rightarrow \omega^2 A = g\sin\theta$ As $\omega = \sqrt{\frac{k}{3m}}$ $\Rightarrow A = \frac{3mg\sin\theta}{k}$

38. Key : 1

Conceptual

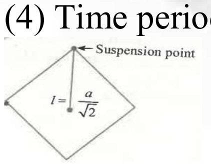
39. (3) Let mass 'm' falls down by 'x' so spring extends by 4x; which cause an extra tension T in lowest string. $\Rightarrow \frac{T}{4} = k(4x)$



$T = (16k)x$ Thus equation of motion of mass 'm' is $T = ma$ $\Rightarrow a = -\frac{16k}{m}x$

we get $\omega = \sqrt{\frac{16k}{m}}$ $\Rightarrow f = \frac{\omega}{2\pi} = \frac{1}{2\pi}\sqrt{\frac{16k}{m}}$ $= \frac{2}{\pi}\sqrt{\frac{k}{m}}$

40. (4) Time period of a compound pendulum is given as +



$$T = 2\pi\sqrt{\frac{I}{mgl}} = 2\pi\sqrt{\frac{\frac{m(a^2+a^2)}{12} + m\left(\frac{a}{\sqrt{2}}\right)^2}{mg.\frac{a}{\sqrt{2}}}} = 2\pi\sqrt{\frac{\left(\frac{a}{6}+\frac{a}{2}\right).\sqrt{2}}{g}} = 2\pi\sqrt{\frac{2\sqrt{2}a}{3g}}$$

41. For one oscillation distance travelled is 4A.

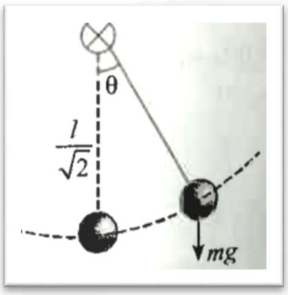
$\frac{3}{8}^{th}$ oscillation $= \frac{3}{8} \times 4A = \frac{3}{2}A = A + \frac{A}{2}$

From extreme position : $\frac{T}{4}+\frac{T}{12}=\frac{T}{3}$

From mean position $\frac{T}{2}-\frac{T}{12}=\frac{5T}{12}$

$\frac{5}{8}^{th}$ oscillation $=\frac{5}{8}\times 44=\frac{5A}{2}$

42. (4) In given situation if we look at pendulum from side its effective oscillating length is $\frac{l}{\sqrt{2}}$



Side view of pendulum Thus angular frequency of oscillations is

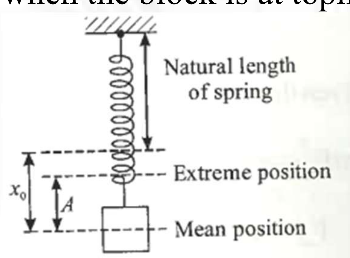
$$\omega=\sqrt{\frac{g}{l_{eff}}}=\sqrt{\frac{\sqrt{2}g}{l}}\Rightarrow T=2\pi\sqrt{\frac{l}{\sqrt{2}g}}$$

43. Ans: 3

$y(t)=\frac{y_0}{2}(1-\cos 2\omega t)$ $\frac{mg}{K}=\frac{y_0}{2}[Amplitude]$

$2\omega=\sqrt{\frac{K}{m}}$ $\omega=\frac{1}{2}\sqrt{\frac{K}{m}}=\frac{1}{2}\sqrt{\frac{2g}{y_0}}=\sqrt{\frac{g}{2y_0}}$

44. (1) The spring is never compressed. Hence spring shall exert least force on the block when the block is at topmost position.



$$F_{least}=kx_0-kA=mg-m\omega^2A=mg-4\frac{\pi^2}{T^2}mA.$$

45. $\frac{1}{2}m\,A^r\,\omega^2=15\times10^{-3}$

$A=l\theta;\ \omega=\sqrt{\frac{g}{l}}$

46. (3)
Due to impulse, the total energy of the particle becomes

$$\frac{1}{2}m\omega^2A^2+\frac{1}{2}m\omega^2A^2=m\omega^2A^2$$

Let A' be the new amplitude. $\Rightarrow \frac{1}{2}m\omega^2(A')^2=m\omega^2A^2$ $\Rightarrow A'=\sqrt{2}A$

47. (2) We use $f_0=\frac{1}{2\pi}\sqrt{\frac{mgl}{I}}$

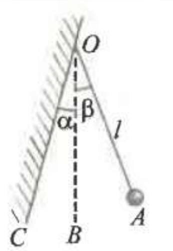
Where, l is distance between point of suspension and centre of mass of the body.
Thus, for the stick of length L and mass 'm' frequency is

$$f_0=\frac{1}{2\pi}\sqrt{\frac{m.g\frac{L}{2}}{(mL^2/12)}}=\frac{1}{2\pi}\sqrt{\frac{6g}{L}}$$

When bottom half of the stick is cut off we use

$$f_0=\frac{1}{2\pi}\sqrt{\frac{\frac{m}{2}.g.\frac{L}{2}}{\frac{m}{2}\frac{(L/2)^2}{12}}}=\frac{1}{2\pi}\times\sqrt{\frac{12g}{L}}=\sqrt{2}f_0$$

48. (2) The time period of free oscillation of pendulum $T=2\pi\sqrt{\frac{l}{g}}=2s$



Time taken by bob to go from extreme position A to mean position B is = T/4.
Time taken by bob to move from mean position B to position C (where its angular displacement α is half the angular amplitude (β) is found from equation

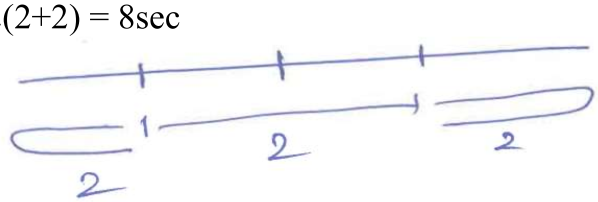
$\alpha=\beta\sin\left(\frac{2\pi}{T}t\right)$ Solving we get t = T/12

$\Rightarrow$ total time period of oscillation is $=2\left[\frac{T}{4}+\frac{T}{12}\right]=\frac{2}{3}T=\frac{4}{3}s$

49. $v=\omega\sqrt{A^2-y^2}$ $\Rightarrow 3\omega\sqrt{10^2-5^2}=\omega\sqrt{(A')^2-5^2}$

$\Rightarrow 9\times75=(A')^2-25$ $\Rightarrow A'=\sqrt{28\times25}cm$ $\Rightarrow x=700$

50. 2(2+2) = 8sec



CHEMISTRY

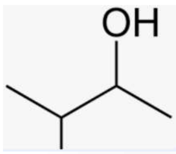
51. A) Rate will depend on nucleophilicity of alkene, which is in the order III > II > I

B) Stability $\propto$ no. of alpha-hydrogen.

C) In general, heat of hydrogenation $\propto \dfrac{1}{\text{stability}}$, when no. of π bonds are equal.

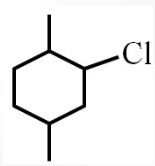
D) In general, heat of combustion $\propto$ no. of carbons.

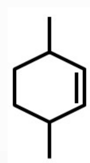
52.

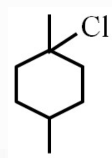
X = 

Y= 

53.

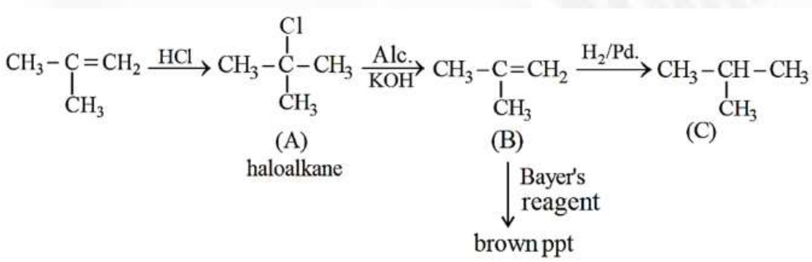
A= 

B= 

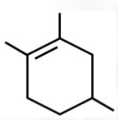
C= 

54. Rate of electrophilic addition ∝ Stability of carbocation

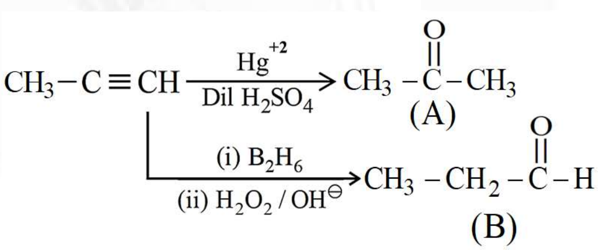
55.



56.



57.

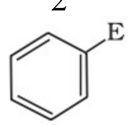


A and B are functional group isomers.

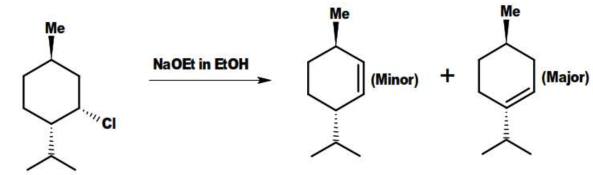
58. a) $CH_4 \xrightarrow{Br_2\,/\,hv} CH_3-Br$ (F.R.S.R)

b) $CH_3\text{-}CH{=}CH_2 \xrightarrow{HBr/R_2O_2} CH_3\text{-}CH_2\text{-}CH_2\text{-}Br$ (F.R.A.R)

c) $CH \equiv CH \xrightarrow{HBr} CH_2{=}CH\text{-}Br$ (E.A.R)

d) $C_6H_6 \xrightarrow{\overset{\oplus}{E}}$  (E.S.R)

59.



60. Option 3 will give meso compound

61.

$$CaO + 3C \longrightarrow \underset{\text{calcium carbide}}{CaC_2} + CO$$

$$CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$$

62. NCERT Page no 315 & 316

63. Conceptual

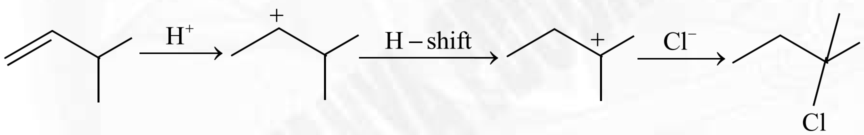
64. C will give 

65. Conceptual

66. Terminal alkynes do not give birch reduction

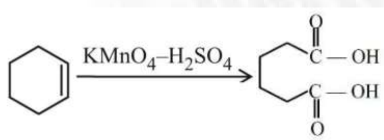
67. Conceptual

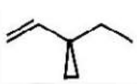
68.

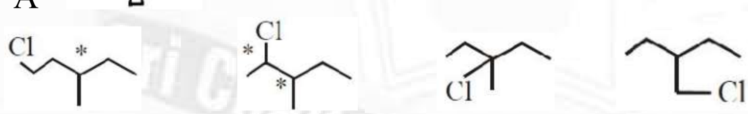


69. Trans compound + Trans addition will give meso product

70.



71. A= 



72. Conceptual

73. Conceptual

74. $CH_3 - C \equiv CH + 2Br_2 \rightarrow 2Br \rightarrow CH_3 - CBr_2 - CHBr_2$

(molar mass = 360)

$2 \times 160g\ Br_2$ produces $= 360 \times 0.27g$ ccompound

$1g\ Br_2$ produces $= \dfrac{360 \times 0.27}{2 \times 160} g \qquad = 0.30375 = 3.0375 \times 10^{-1}$

75.