1. **(b)** True weight at equator, $W = mg$

Observed weight at equator,

$$W' = mg' = \frac{3}{5}mg$$

At equator, latitude $\lambda = 0$

Using the formula,

$$mg' = mg - mR\omega^2\cos^2\lambda$$

$$\frac{3}{5}mg = mg - mR\omega^2\cos^2 0 = mg - mR\omega^2$$

$$\Rightarrow mR\omega^2 = mg - \frac{3}{5}mg = \frac{2}{5}mg$$

$$\therefore \omega = \left(\frac{2}{5}\frac{g}{R}\right)^{1/2}$$

$$= \left(\frac{2\times 9.8}{5\times 6.4\times 10^6}\right)^{1/2} = 7.8\times 10^{-4}\text{rad/s}.$$

2. **(d)**

3. **(a)**

4. **(b)** Here $v_1 = 200$ m/s;

temperature $T_1 = 27^\circ C = 27 + 273 = 300k$

temperature $T_2 = 127^\circ C = 127 + 273 = 400k$, $V = ?$

R.M.S. Velocity, $V \propto \sqrt{T}$

$$\Rightarrow \frac{v}{200} = \sqrt{\frac{400}{300}}$$

$$\Rightarrow v = \frac{200\times 2}{\sqrt{3}}\ \text{m/s}$$

$$\Rightarrow v = \frac{400}{\sqrt{3}}\ \text{m/s}$$

5. **(c)** Growth in current in LR_2 branch when switch is closed is given by

$$i = \frac{E}{R_2}\left[1 - e^{-R_2t/L}\right]$$

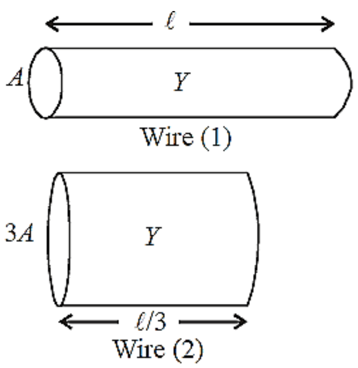
$$\Rightarrow \frac{di}{dt} = \frac{E}{R_2}\cdot\frac{R_2}{L}\cdot e^{-R_2t/L} = \frac{E}{L}e^{-\frac{R_2t}{L}}$$

Hence, potential drop across

$$L = \left(\frac{E}{L}e^{-R_2t/L}\right)L = Ee^{-R_2t/L}$$

$$= 12e^{-\frac{2t}{400\times 10^{-3}}} = 12e^{-5t}V$$

6. **(c)**



As shown in the figure, the wires will have the same Young's modulus (same material) and the length of the wire of area of crosssection 3A will be $\ell/3$ (same volume as wire 1).

For wire 1, $Y = \frac{F/A}{\Delta x/\ell}$

For wire 2, $Y = \frac{F'/3A}{\Delta x/(\ell/3)}$

From (i) and (ii), $\frac{F}{A} \times \frac{\ell}{\Delta x} = \frac{F'}{3A} \times \frac{\ell}{3\Delta x} \Rightarrow F' = 9F$

7. **(d)** Radius of small sphere $= r$

Thickness of small sphere $= t$

Radius of bigger sphere $= 2r$

Thickness of bigger sphere $= t/4$

Mass of ice melted $=$ (volume of sphere)

(density of ice)

Let K_1 and K_2 be the thermal conductivities of larger and smaller sphere.

For bigger sphere,

$$\frac{K_1 4\pi(2r)^2 \times 100}{t/4} = \frac{\frac{4}{3}\pi(2r)^3\rho L}{25 \times 60}$$

For smaller sphere,

$$\frac{K_2 \times 4\pi r^2 \times 100}{t} = \frac{\frac{4}{3}\pi r^3 \rho L}{16 \times 60}$$

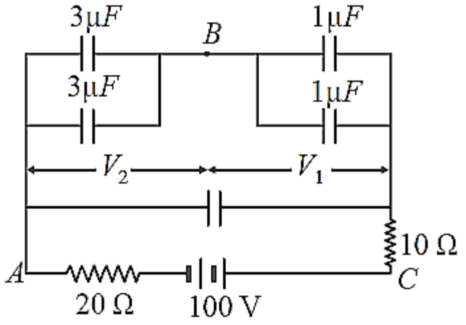
$$\therefore \frac{K_1}{K_2} = \frac{8}{25}$$

8. **(c)**

9. **(c)** The equivalent circuit is shown in figure

$V_1 + V_2 = 100$

and $2V_1 = 6V_2$



On solving above equations, we get $V_1 = 75\ V, V_2 = 25\ V$

10. (c) Let N_0 be the number of atoms of X at time $t = 0$.

Then at $t = 4$ hrs (two half lives)

$N_x = \frac{N_0}{4}$ and $N_y = \frac{3\,N_0}{4}$

$\therefore N_x/N_y = 1/3$

and at $t = 6$hrs (three half lives)

$N_x = \frac{N_0}{8}$ and $N_y = \frac{7\,N_0}{8}$

or $\frac{N_x}{N_y} = \frac{1}{7}$

The given ratio $\frac{1}{4}$ lies between $\frac{1}{3}$ and $\frac{1}{7}$.

Therefore, t lies between 4hrs and 6hrs.

11. (b) Compressibility of water,

$K = 45.4 \times 10^{-11}\ Pa^{-1}$

density of water $P = 10^3\ kg/m^3$

depth of ocean, $h = 2700$ m

We have to find $\frac{\Delta V}{V} = ?$

As we know, compressibility,

$$K = \frac{1}{B} = \frac{(\Delta V/V)}{P}(P = Pgh)$$

So, $(\Delta V/V) = KPgh$

$= 45.4 \times 10^{-11} \times 10^3 \times 10 \times 2700$

$= 1.2258 \times 10^{-2}$

12. (c)

Acceleration of body along AB is $g\cos\theta$

Distance travelled in time tsec =

$$AB = \frac{1}{2}(g\cos\theta)t^2$$

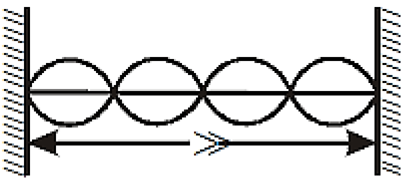
From $\triangle ABC, AB = 2R\cos\theta$

Thus, $2R\cos\theta = \frac{1}{2}g\cos\theta t^2$

$$\Rightarrow t^2 = \frac{4R}{g} \Rightarrow t = 2\sqrt{\frac{R}{g}}$$

13. (c) For a string vibrating in its n^{th} overtone $(n+1)^{th}$ harmonic)

$$y = 2A\sin\left(\frac{(n+1)\pi x}{L}\right)\cos\omega t$$



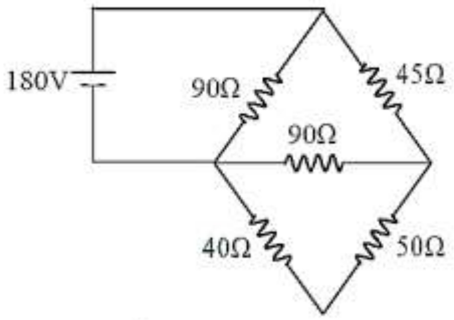
For $x = \frac{\ell}{3}\Big] 2\ A = a \& n = 3;$

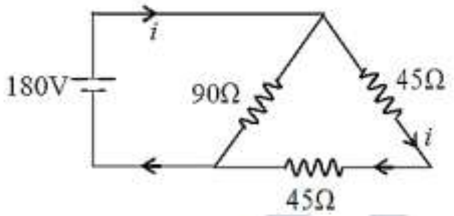
$$y = \left[a \sin\left(\frac{4\pi}{\ell} \cdot \frac{\ell}{3}\right)\right] \cos \omega t$$

$$= a \sin \frac{4\pi}{3} \cos \omega t = -a\left(\frac{\sqrt{3}}{2}\right) \cos \omega t$$

i.e. at $x = \frac{\ell}{3}$, the amplitude is $\frac{\sqrt{3}a}{2}$

14. (d)
15. (c)





$$i = \frac{180}{90} = 2\ A$$

16. (a) As we know, orbital speed, $V_{orb} = \sqrt{\frac{GM}{r}}$ Time period $T = \frac{2\pi r}{v_{orb}} = \frac{2\pi r}{\sqrt{GM}} \sqrt{r}$

Squarring both sides,

$$T^2 = \left(\frac{2\pi r\sqrt{r}}{\sqrt{GM}}\right)^2 = \frac{4\pi^2}{GM} \cdot r^3$$

$$\Rightarrow \frac{T^2}{r^3} = \frac{4\pi^2}{GM} = K \Rightarrow GMK = 4\pi^2.$$

17. (a)

$P_{in} = 25\ W, \lambda = 6600Å = 6600 \times 10^{-10}\ m$

$nh\nu = P$

$\Rightarrow$ Number of photons emitted / sec,

$$n = \frac{P}{\frac{hc}{\lambda}} = \frac{P\lambda}{hc} = \frac{25 \times 6600 \times 10^{-10}}{6.64 \times 10^{-34} \times 3 \times 10^{8}}$$

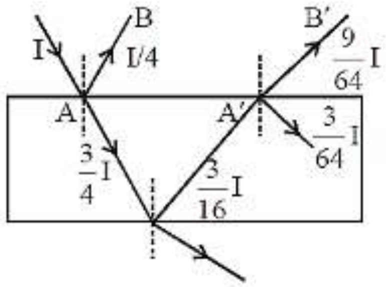
$$= 8.28 \times 10^{19} = \frac{25}{3} \times 10^{19}$$

3% of emitted photons are producing current

$$\therefore I = \frac{3}{100} \times ne$$

$$= \frac{3}{100} \times \frac{25}{3} \times 10^{19} \times 1.6 \times 10^{-19} = 0.4\ A$$

18. (a)



From figure $I_1 = \frac{I}{4}$ and $I_2 = \frac{9I}{64}$

$$\Rightarrow \frac{I_2}{I_1} = \frac{9}{16}$$

By using
$$\frac{I_{max}}{I_{min}} = \left(\frac{\sqrt{\frac{I_2}{I_1}}+1}{\sqrt{\frac{I_2}{I_1}}-1}\right)^2 = \left(\frac{\sqrt{\frac{9}{16}}+1}{\sqrt{\frac{9}{16}}-1}\right)^2 = \frac{49}{1}$$

19. (c) $h = \frac{2\,T\cos\theta}{r\rho g} \Rightarrow h \propto \frac{1}{r} \Rightarrow \frac{h_2}{h_1} = \frac{r_1}{r_2} = \frac{2}{3}$

$$\left(\because r_1 = r,\ r_2 = r + 50\%\text{ of } r = \frac{3}{2}r\right)$$

New mass $m_2 = \pi r_2^2\, h_2\rho = \pi\left(\frac{3}{2}r_1\right)^2\left(\frac{2}{3}\,h_1\right)\rho$

$$= \frac{3}{2}(\pi r_1^2\, h_1)\rho = \frac{3}{2}\ m$$

20. (d) Number of electrons per kg of silver

$$= \frac{6.023 \times 10^{26}}{108}$$

Number of electrons per unit volume of silver

$$n = \frac{6.023 \times 10^{26}}{108} \times 10.5 \times 10^3$$

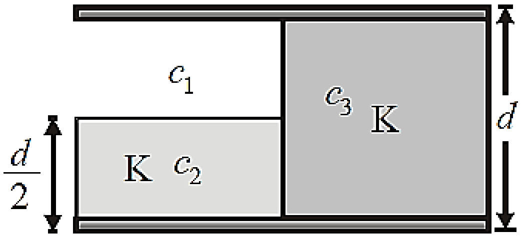
$$v_d = \frac{I}{neA}$$

$$= \frac{20}{6.023 \times 10^{26} \times 10.5 \times 10^3 \times 1.6 \times 10^{-19} \times 3.14 \times 10^{-6}} \times 108$$

$$= 6.798 \times 10^{-4}\ \text{m/sec.}$$

21. (d)

$$c_1 = \frac{(A/2)\varepsilon_0}{d/2} = \frac{A\varepsilon_0}{d}, c_2 = K\frac{A\varepsilon_0}{d}, c_3 = K\frac{A\varepsilon_0}{2d}$$



$$\therefore\ c_{eq.} = \frac{c_1 \times c_2}{c_1 + c_2} + c_3 = \frac{(3+K)KA\varepsilon_0}{2d(K+1)}$$

($\because$ C_1 and C_2 are in series and resultant of these two in parallel with C_3)

22. (c) For path difference λ, phase difference $= 2\pi$rad.

For path difference $\frac{\lambda}{4}$, phase difference $= \frac{\pi}{2}$rad.

As $K = 4I_0$ so intensity at given point where path difference is $\frac{\lambda}{4}$

$$K' = 4I_0 \cos^2\left(\frac{\pi}{4}\right)\left(\cos\frac{\pi}{4} = \cos 45^\circ\right)$$

$$= 2I_0 = \frac{K}{2}$$

23. (d) $M({}_8O^{16}) = M({}_7N^{15}) + 1\ m_P$ binding energy of last proton

$$= M(N^{15}) + m_P - M({}_1O^{16})$$
$$= 15.00011 + 1.00783 - 15.99492$$
$$= 0.01302\text{amu} = 12.13\text{MeV}$$

24. (b)

25. (a) $H_1 = \frac{u^2 \sin^2\theta}{2\,g}$

and $H_2 = \frac{u^2 \sin^2(90^\circ - \theta)}{2\,g} = \frac{u^2\cos^2\theta}{2\,g}$

$$H_1H_2 = \frac{u^2\sin^2\theta}{2g} \times \frac{u^2\cos^2\theta}{2g} = \frac{(u^2\sin 2\theta)^2}{16g^2} = \frac{R^2}{16}$$

$$\therefore R = 4\sqrt{H_1H_2}$$

26. (c) $\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

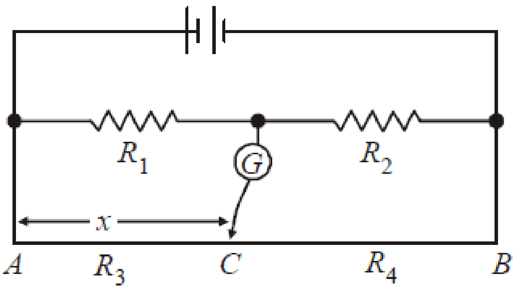
For limiting wavelength of Lyman series

$$n_1 = 1, n_2 = \infty\ \frac{1}{\lambda_L} = R$$

For limiting wavelength of Balmer series

$$n_1 = 2, n_2 = \infty$$
$$\frac{1}{\lambda_B} = R\left(\frac{1}{4}\right) \Rightarrow \lambda_B = \frac{4}{R}$$
$$\therefore \lambda_B = 4\lambda_L = 4 \times 912\text{Å}.$$

27. (a)



At null point $\frac{R_1}{R_2} = \frac{R_3}{R_4} = \frac{x}{100-x}$

If radius of the wire is doubled, then the resistance of AC will change and also the resistance of CB will change. But since

$\frac{R_1}{R_2}$ does not change so, $\frac{R_3}{R_4}$ should also

not change at null point. Therefore the point C does not change.

28. (a)

29. (c)

$$v = \frac{p}{2\ell}\left[\frac{F}{m}\right]^{1/2}$$

$$v^2 = \frac{p}{4\ell^2}\frac{F}{m} \Rightarrow m = \frac{p^2 F}{4\ell^2 v^2}$$

Now, dimensional formula of R.H.S.

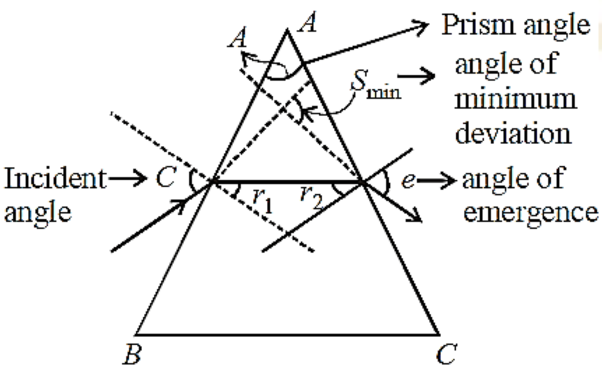
$$= \frac{MLT^{-2}}{L^2\left(\frac{1}{T}\right)^2}$$

[p will have no dimension as it is an integer]

$= ML^{-1}\,T^0.$

So, dimensions of m will be $ML^{-1}\,T^0$.

30. (b)



The angle of minimum deviation is given as

$\delta_{\text{min}} = i + e - A$

for minimum deviation

$\delta_{\min} = A$ then
$2A = i + e$

in case of $\delta_{\min} i = e$

$$2A \quad = 2i\, r_1 = r_2 = \frac{A}{2}$$
$$i \quad = A = 90^\circ$$

from smell's law
$1 \sin i = n \sin r_1$
$\sin A = n \sin \frac{A}{2}$
$2 \sin \frac{A}{2} \cos \frac{A}{2} = n \sin \frac{A}{2}$

$2 \cos \frac{A}{2} = n$

when $A = 90^\circ = i_{\min}$
then $n_{\min} = \sqrt{2}$
$i = A = 0\; n_{\max} = 2$

31. (b)

32. (d) Induced emf in the loop is given by $e = -B \cdot \frac{dA}{dt}$ where A is the area of the loop. $e = -B \cdot \frac{d}{dt}(\pi r^2) = -B\pi 2r \frac{dr}{dt}$ $r = 2 \text{ cm} = 2 \times 10^{-2} \text{ m}$ $dr = 2 \text{ mm} = 2 \times 10^{-3} \text{ m}$ $dt = 1 \text{ s}$

$$\begin{aligned} e &= -0.04 \times 3.14 \times 2 \times 2 \times 10^{-2} \times \frac{2 \times 10^{-3}}{1} \text{ V} \\ &= 0.32\pi \times 10^{-5} \text{ V} \\ &= 3.2\pi \times 10^{-6} \text{ V} \\ &= 3.2\pi\mu\text{V} \end{aligned}$$

33. (b) In cyclic process ABCA

$$\begin{aligned} Q_{\text{cycle}} &= W_{\text{cycle}} \\ Q_{AB} + Q_{BC} + Q_{CA} &= \text{ar. of } \Delta ABC \\ +400 + 100 + Q_{C\to A} &= \frac{1}{2}(2 \times 10^{-3})(4 \times 10^4) \\ \Rightarrow Q_{C\to A} &= -460 \text{ J} \\ \Rightarrow Q_{A\to C} &= +460 \text{ J} \end{aligned}$$

34. (d)

$$\begin{aligned} R_1 &= R_0(1 + \alpha_1 t) + R_0(1 + \alpha_2 t) \\ &= 2R_0\left(1 + \frac{\alpha_1 + \alpha_2}{2} t\right) \end{aligned}$$

Comparing with $R = R_0(1 + \alpha t)$

$$\alpha = \frac{\alpha_1 + \alpha_2}{2}$$

35. (c) From figure $\tan \theta = \frac{F_e}{mg} \simeq \theta$

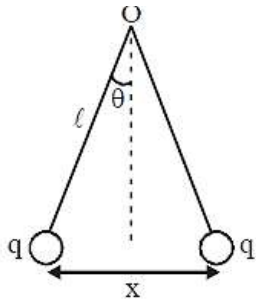
$$\frac{kq^2}{x^2mg} = \frac{x}{2\ell}$$

or $x^3 \propto q^2$ ... (1)

or $x^{3/2} \propto q$ ... (2)

Differentiating eq. (1) w.r.t. time

$3x^2\frac{dx}{dt} \propto 2q\frac{dq}{dt}$ but $\frac{dq}{dt}$ is constant



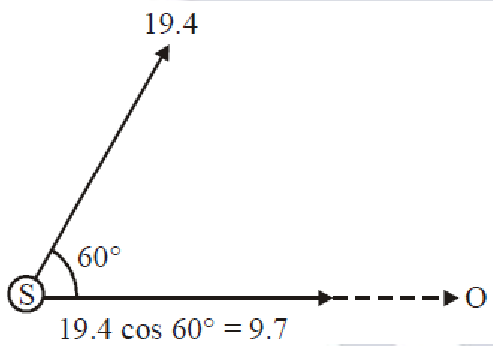
so $x^2(v) \propto q$ Replace q from eq. (2)

$x^2(v) \propto x^{3/2}$ or $v \propto x^{-1/2}$

36. **(a)**

37. **(a)** Here, original frequency of sound, $f_0 = 100$ Hz

Speed of source $V_s = 19.4\cos 60° = 9.7$



From Doppler's formula

$$f^1 = f_0\left(\frac{V - V_0}{V - V_s}\right)$$

$$f^1 = 100\left(\frac{V - 0}{V - (+9.7)}\right)$$

$$f^1 = 100\frac{V}{V\left(1 - \frac{9.7}{V}\right)}$$

$$f^1 = 100\left(1 + \frac{9.7}{330}\right) = 103 \text{ Hz}$$

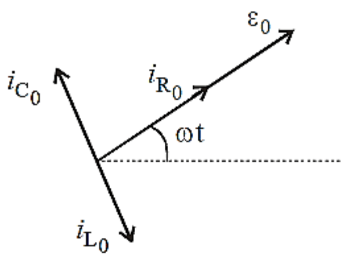
Apparent frequency $f^1 = 103$ Hz

38. **(a)**

$$\frac{i_{R_0}}{\sqrt{\left(i_{R_0}\right)^2+\left(i_{c_0}-i_{L_0}\right)^2}}=\frac{1}{2}$$

$$\Rightarrow \quad \frac{\varepsilon_0/R}{\sqrt{(\varepsilon_0/R)^2+\left(\varepsilon_0\omega C-\frac{\varepsilon_0}{\omega L}\right)^2}}=\frac{1}{2}$$

$$\Rightarrow \quad R=\frac{\sqrt{3}}{\left(\omega C-\frac{1}{\omega L}\right)}$$

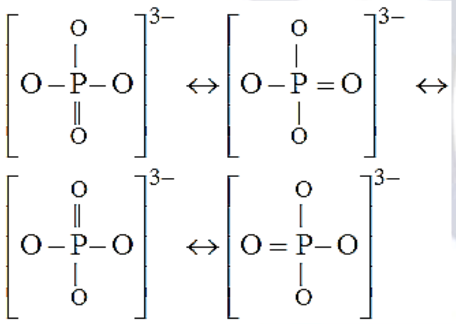


39. (c) By covering aperture, focal length does not change. But intensity is reduced by $\frac{1}{4}$ times, as aperture diameter $\frac{d}{2}$ is covered.

$$\therefore\ I'=I-\frac{I}{4}=\frac{3I}{4}$$

$\therefore$ New focal length = f and intensity = $\frac{3I}{4}$.

40. (c)
41. (c)



Bond order

$$=\frac{\text{Number of bonds}}{\text{Number of Resonating structures}}$$
$$=\frac{5}{4}=1.25$$

Three- unit negative charge is being shared by four O atoms. Formal charge $=-3/4$

42. (b) Closed shell (Ne), half filled (P) and completely filled configuration (Mg) are the cause of higher value of I.E.
43. (b) Most of the Ln^{3+} compounds except La^{3+} and Lu^{3+} are coloured due to the presence of f-electrons.
44. (a)
45. (d) Fe^{2+} electronic configuration is $[Ar]3\,d^6$. Since CN is strong field ligand d electrons are paired. In$Ni(CO)_4$O. S. of Ni is zero electronic configuration is $[Ar\}3\,d^8 4\,s^2$. In presence of CO it is $[Ar]3\,d^{10} 4\,s^0$, electrons are

paired. Electronic configuration of Ni^{2+} $[Ar]3\ d^8 4\ s^0$, due to CN^-ligand all electrons are paired. Co^{3+} is $[Ar]3\ d^6$ since F is weak ligand hence paramagnetic.

46. **(a)** The complex chlorodiaquatriammine cobalt (III) chloride can have the structure $[CoCl(NH_3)_3(H_2O)_2]Cl_2$

47. **(c)** Wt. of $NH_3 = 26\text{ g} = \frac{26}{17}\text{ geq} = 1.53\text{ geq}$

Vol. of soln. $= 100\text{mc} = 0.1\text{ L}$

$\therefore$ Normality $= \frac{1.53}{0.1} = 15.3\text{ N}$

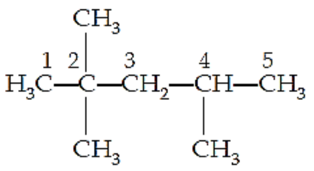
48. **(a)** Let the amount of Na_2CO_3 present in the mixture be xg. Na_2SO_4 will not react with H_2SO_4. Then

$$\frac{x}{53} = \frac{20 \times 0.1 \times 10}{1000} \therefore x = 1.06g$$

$\therefore$ Percentage of $Na_2CO_3 =$

$$\frac{1.06 \times 100}{1.25} = 84.8\%$$

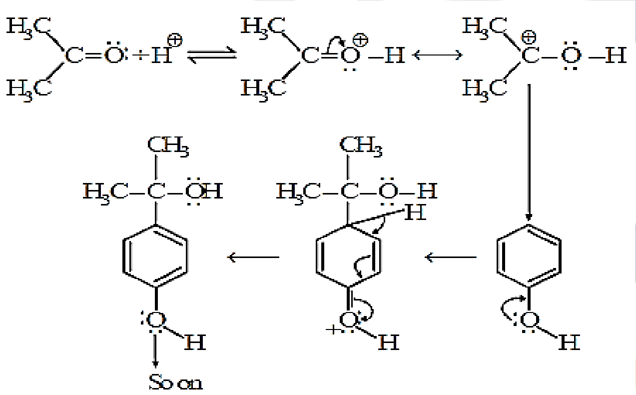
49. **(c)**



C_1 and C_5 are $1°$, C_3 is $2°$, C_4 is $3°$, and C_2 is $4°$.

50. **(b)** A rapid umbrella type inversion rapidly converts the structure III to its enantiomer; hence the two enantiomers are not separable.

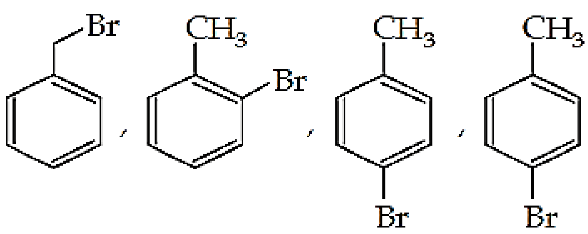
51. **(d)**



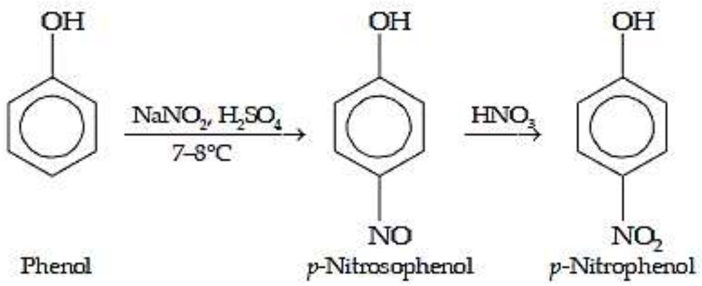
52. **(c)** Catalytic hydrogenation of alkynes gives cis-alkene which in turn adds deuterium atoms in presence of H_2 again in cis-manner forming meso-2, 3-dideuterobutane.

53. **(d)** D_2SO_4 transfers D^+, an electrophile, to form hexadeuterobenzene.

54. **(c)**



55. **(b)**



Thus here, oxidation of phenol is minimised by forming p-nitrosophenol.

56. (d)
57. (d)
58. (d) Although blue coloured ferric ferrocyanide is formed but due to the presence of yellow coloured Fe^{3+} salts, the blue colour gives the shade of green.
59. (c) Ketoses on reduction produce a new chiral carbon leading to the formation of two isomeric alcohols which are diastereomeric as well as $C-2$ epimers.
60. (d) Reaction of D-(+)-glucose with methanolic $-$HCl leads to formation of methyl glucoside (C_1-OH group is methylated) which, being acetal, is not hydrolysable by base, so it will not respond Tollens' reagent.
61. (c) Magnesium hydrosilicate forms base of Talcum powder.
62. (a) BHT is the important antioxidant used in food.
63. (d) For Balmer $n_1=2$ and $n_2=3$;

$$v=R\left(\frac{1}{2^2}-\frac{1}{3^2}\right)=\frac{5R}{36}\ \mathrm{cm}^{-1}$$

64. (d) When $m=-3, l=3, \therefore n=4$.
65. (c) $r \propto U$ and $U=\sqrt{\frac{3RT}{M}}$

$$\frac{r_1}{r_2}=\sqrt{\frac{T_1M_2}{T_2M_1}} \text{ or } \frac{r_{N_2}}{r_{SO_2}}=\sqrt{\frac{T_1\times 64}{323\times 28}}=1.625$$

or $T_2=373$ K

66. (b)

$$\overline{KE}=\frac{3}{2}kT=\frac{3}{2}\times\frac{8.313}{6.023\times10^{23}}\times 298=6.17\times10^{-21}\ \mathrm{J}.$$

(Average Kinetic energy $\overline{KE}=\frac{3}{2}kT=\frac{3}{2}\frac{R}{N}T$)

67. (b)
68. (d)

$$K_p=p_{B_1}^2\times p_{C_1}^3$$

Again, $K_p=p_{B_2}^2\times(2p_{C_1})^3$

$\therefore p_{B_1}^2\times p_{C_1}^3=P_{B_2}^2\times 8p_{C_1}^3$

$\therefore \frac{p_{B_1}^2}{8}=p_{B_2}^2$ or, $\frac{p_{B_1}}{2\sqrt{2}}=p_{B_2}$

69. (b) At equilibrium $\Delta G = 0$

Hence, $\Delta G = \Delta H - T_e \Delta S = 0$

$\therefore \Delta H = T_{e\Delta}\Delta$ or $T_e = \frac{\Delta H}{\Delta S}$

For a spontaneous reaction ΔG must be negative which is possible only if $\Delta H - T\Delta S < 0$

$\therefore \Delta H < T\Delta S$

or $T > \frac{\Delta H}{\Delta S}; T_e < T$

70. (c) Applying Hess's Law

$$\Delta_f H^\circ = \Delta_{sub} H + \frac{1}{2}\Delta_{diss} H + \text{I.E.} + \text{E.A} + \Delta_{lattice} H$$

$$-617 = 161 + 520 + 77 + \text{E.A.} + (-1047)$$

$$\text{E.A.} = -617 + 289 = -328 \text{ kJ mol}^{-1}$$

$\therefore$ electron affinity of fluorine $= -328 \text{ kJ mol}^{-1}$

71. (a)

$$\alpha = \sqrt{\frac{K_w}{K_a \times K_b}} = \sqrt{\frac{1 \times 10^{-14}}{1.8 \times 10^{-5} \times 1.8 \times 10^{-5}}} = 0.55$$

72. (b)

$$ApBq \rightleftharpoons \underset{Sp}{pA^+} + \underset{Sq}{q\overline{B}}$$

Let the solubility be Smol/ liter Thus,

$$K_{sp} = [A^+]^p[B^-]^q$$
$$= [Sp]^p[Sq]^q = p^p \cdot q^q (S)^{p+q}.$$

73. (d)

74. (d) For P, if $_{50\%} = x$

then $t_{75\%} = 2x$

This is true only for first order reaction.

So, order with respect to P is 1 .

Further the graph shows that concentration of Q decreases with time. So rate, with respect to Q, remains constant.

Hence, it is zero order wrt Q.

So, overall order is $1 + 0 = 1$

75. (b) The oxidation potential

$\propto \frac{1}{\text{Concentration of ions}}$ and reduction

potential $\propto$ concentration of ions. The cell voltage can be increased by decreasing the concentration of ions around anode or by increasing the concentration of ions around cathode

76. (c)

77. (c) The reaction

$$2Cu^+(aq) \longrightarrow Cu(s) + Cu^{2+}(aq)$$

$$E_{cell} = E^\circ_{cell} - \frac{0.0592}{1}\log\frac{[Cu^{2+}]}{[Cu^+]^2}$$

At equilibrium $E_{cell} = 0$

$\therefore\ E^\circ_{cell} = 0.0592\log K_c$

or, $\log K_c = \dfrac{0.52 - 0.16}{0.0592}$

$\therefore K_c = 1.2 \times 10^6$

78. **(a)** The number of Fe^{3+} ions replacing $\times$ Fe^{2+} ions $= \frac{2x}{3}$ vacancies of cations $= x - \frac{2x}{3} = x/3$

But $x/3 = 1 - 0.94 = 0.06, x = 0.06 \times 3 = 0.18 = 18\%$

79. **(d)**

$$\rho = \frac{Z \times M}{N_o \times a^3}$$

$$2.7 = \frac{Z \times 27}{6.02 \times 10^{23} \times (4.05)^3 \times 10^{-24}}$$

$\therefore Z = 4$

Hence it is face centred cubic unit lattice.

Again $4r = a\sqrt{2} = 5.727\text{Å}$

$\therefore r = 1.432\text{Å}$

80. **(d)** $Xe = 53.5\% \therefore F = 46.5\%$

Relative number of atoms $Xe = \frac{53.5}{131.2} = 0.4$ and $F = \frac{46.5}{19} = 2.4$

Simple ratio $Xe = 1$ and $F = 6$; Molecular formula is XeF_6

O.N. of Xe is +6

81. **(d)**
82. **(a)**
83. **(a)**
84. **(a)**
85. **(a)**
86. **(c)**
87. **(d)**
88. **(b)**
89. **(d)**
90. **(d)**
91. **(a)**
92. **(b)**
93. **(a)**
94. **(c)**
95. **(a)**
96. **(a)** In each row, the third figure comprises of a black circle and only those line segments which are not common to the first and the second figures.
97. **(d)** In each row (as well as each column), the third figure is a combination of all the, elements of the first and the second figures.
98. **(c)** In each row, the third figure is a collection of the common elements (line segments) of the first and the second figures.

99. (b) The given sequence is a combination of two series:

I. 3,7,13,21,31, ? and II. 4,7,13,22,34

The pattern in I is $+4, +6, +8, +10, \ldots.$

The pattern in II is $+3, +6, +9, +12, \ldots.$

So, missing term $= 31 + 12 = 43$.

100. **(a)** The father of the boy's uncle is the grandfather of the boy and daughter of the grandfather is sister of father.

101. **(a)** In this series, the third letter is repeated as the first letter of the next segment. The middle letter, A, remains static. The third letters are in alphabetical order, beginning with R.

102. **(d)** In this series, the letters remain the same:

DEF.

The subscript numbers follow this series:

$111,112,122,222,223,233,333, \ldots$

103. **(b)** Since both the premises are universal and one premise is negative, the conclusion must be universal negative and should not contain the middle term. So, only II follows.

104. **(a)** Since one premise is particular and the other premise is negative, the conclusion must be particular negative and should not contain the middle term. So, it follows that 'Some desks are not red'. However, I is the converse of the first premise and thus it holds.

105. **(c)**

106. **(a)**

$$f(x) = \frac{ax+b}{cx+d}$$

$$fof(x) = \frac{a\left\{\frac{ax+b}{cx+d}\right\}+b}{c\left\{\frac{ax+b}{cx+d}\right\}+d} \Rightarrow \frac{a^2x+ab+bcx+bd}{acx+bc+cdx+d^2} = x$$

$$\Rightarrow (ac+dc)x^2 + (bc+d^2-bc-a^2)x$$
$$-ab-bd = 0, \forall x \in R$$
$$\Rightarrow (a+d)c = 0, d^2 - a^2 = 0 \text{ and } (a+d)b = 0$$
$$\Rightarrow a+d = 0$$

107. **(b)**

$$2^m - 2^n = 112 \Rightarrow 2^n(2^{m-n}-1) = 16.7$$
$$\therefore\ 2^n(2^{m-n}-1) = 2^4(2^3-1)$$

Comparing we get $n = 4$ and $m - n = 3 \Rightarrow\ n = 4$ and $m = 7$

108. **(b)**

Given, $3\cos^2 A + 2\cos^2 B = 4$
$\Rightarrow 2\cos^2 B - 1 = 4 - 3\cos^2 A - 1$
$\Rightarrow \cos 2B = 3(1 - \cos^2 A) = 3\sin^2 A \ldots (1)$
and $2\cos B\sin B = 3\sin A\cos A$
$\sin 2B = 3\sin A\cos A \ \ldots (2)$
Now, $\cos(A + 2B) = \cos A\cos 2B - \sin A$
$\sin 2B$
$= \cos A(3\sin^2 A) - \sin A(3\sin A\cos A) = 0$
$\Rightarrow A + 2B = \frac{\pi}{2}$ [using eqs. (1) and (2)]

109. (a)

Since, $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$
$\therefore \sin\theta_1 = \sin\theta_2 = \sin\theta_3 = 1 \Rightarrow \theta_1 = \theta_2 = \theta_3 =$
$\frac{\pi}{2}$
$\therefore \cos\theta_1 + \cos\theta_2 + \cos\theta_3 = 0$

110. (b) Given,

$\tan(\cot x) = \cot(\tan x) = \tan\left(\frac{\pi}{2} - \tan x\right)$
$\Rightarrow \cot x = n\pi + \frac{\pi}{2} - \tan x$
$\Rightarrow \cot x + \tan x = n\pi + \frac{\pi}{2}$
$\Rightarrow \frac{1}{\sin x\cos x} = n\pi + \frac{\pi}{2} \Rightarrow \frac{1}{\sin 2x} = \frac{n\pi}{2} + \frac{\pi}{4}$
$\Rightarrow \sin 2x = \frac{1}{\frac{n\pi}{2} + \frac{\pi}{4}} = \frac{4}{(2n+1)\pi}$

111. (d)

Given, $\sin 2x + 2\sin x + 2\cos x + 1 = 0$
$\Rightarrow 1 + \sin 2x + 2(\sin x + \cos x) = 0$
$\Rightarrow (\sin x + \cos x)^2 + 2(\sin x + \cos x) = 0$
$\Rightarrow (\sin x + \cos x)(\sin x + \cos x + 2) = 0$
$\therefore \sin x + \cos x = 0$ or $\sin x + \cos x = -2$

But, $\sin x + \cos x = -2$ is inadmissible
Since, $|\sin x| \leq 1, |\cos x| \leq 1$

$\therefore \sin x + \cos x = 0 \Rightarrow \sin\left(x + \frac{\pi}{4}\right) = 0$
$\Rightarrow x + \frac{\pi}{4} = n\pi \Rightarrow x = n\pi - \frac{\pi}{4}$

112. (d)

$$\frac{\cos A}{a}=\frac{\cos B}{b}=\frac{\cos C}{c}$$
$$\Rightarrow \frac{\cos A}{2R\sin A}=\frac{\cos B}{2R\sin B}=\frac{\cos C}{2R\sin C}$$
$$\Rightarrow \cot A=\cot B=\cot C$$
$$\Rightarrow A=B=C=60^\circ \Rightarrow \Delta ABC \text{ is equilateral}$$

Hence, area of $\Delta=\frac{\sqrt{3}}{4}a^2=\sqrt{3}$.

113. **(d)** Given,

$$\sin^{-1}\left(\frac{2a}{1+a^2}\right)-\cos^{-1}\left(\frac{1-b^2}{1+b^2}\right)=\tan^{-1}\left(\frac{2x}{1-x^2}\right)$$
$$\therefore\ 2\tan^{-1}a-2\tan^{-1}b=2\tan^{-1}x$$
$$\Rightarrow \tan^{-1}a-\tan^{-1}b=\tan^{-1}x$$
$$\Rightarrow \tan^{-1}\left(\frac{a-b}{1+ab}\right)=\tan^{-1}x$$
$$\Rightarrow x=\frac{a-b}{1+ab}$$

114. **(c)**

Given $M=\frac{a+b+c+d+e}{5}$

$$\Rightarrow a+b+c+d+e=5M$$
$$\Rightarrow a+b+c+d+e-5M=0$$

$$\Rightarrow (a-M)+(b-M)+(c-M)+(d-M)$$
$$+(e-M)=0$$

Hence, required value $=0$

115. **(a)** Let the progression be $a, a+d, a+2d$,

Then $x_4=3x_1 \Rightarrow a+3d=3a \Rightarrow 3d=2a$
Again $x_7=2x_3+1$

$\Rightarrow a+6d=2(a+2d)+1 \Rightarrow 2d=a+1$

Solving (i) and (ii), we get

$a=3, d=2$

116. **(c)**

$$\frac{1}{2}+\frac{3}{4}+\frac{7}{8}+\frac{15}{16}+\cdots$$
$$=\left(1-\frac{1}{2}\right)+\left(1-\frac{1}{4}\right)+\left(1-\frac{1}{8}\right)+\left(1-\frac{1}{16}\right)+\cdots$$
$$=n-\frac{\frac{1}{2}\left\{1-\frac{1}{2^n}\right\}}{1-\frac{1}{2}}=n-1+2^{-n}$$

117. **(c)**
118. **(a)** The series is

$$(x^2+x^4+x^6+\cdots)+\left(\frac{1}{x^2}+\frac{1}{x^4}+\frac{1}{x^6}+\cdots\right.$$
$$+(2+2+\cdots.)$$
$$=\frac{x^2(x^{2n}-1)}{x^2-1}+\frac{\frac{1}{x^2}\left(1-\frac{1}{x^{2n}}\right)}{1-\frac{1}{x^2}}+2n$$
$$=\frac{x^2(x^{2n}-1)}{x^2-1}+\frac{x^{2n}-1}{(x^2-1)x^{2n}}+2n$$
$$=\frac{x^{2n}-1}{x^2-1}\times\frac{x^{2n+2}+1}{x^{2n}}+2n$$

119. (a)

$$\left(\frac{z_1}{z_2}\right)^{50}=\left(\frac{\sqrt{3}+i\sqrt{3}}{\sqrt{3}+i}\right)^{50}$$
$$=\left[\left(\frac{\sqrt{3}(1+i)}{\sqrt{3}+i}\right)^2\right]^{25}=\left[\frac{3(2i)}{3-1+2\sqrt{3}i}\right]^{25}$$
$$=\left(\frac{3i}{1+\sqrt{3}i}\right)^{25}=\frac{3^{25}i^{25}}{(-2\omega^2)^{25}}$$

$$=-i.\omega\left(\frac{3}{2}\right)^{25}=-i\left(\frac{-1+\sqrt{3}i}{2}\right)\left(\frac{3}{2}\right)^{25}$$
$$=\left(\frac{3}{2}\right)^{25}\left(\frac{\sqrt{3}}{2}+\frac{1}{2}i\right)$$

Hence, $\left(\frac{z_1}{z_2}\right)^{50}$ lies in the first quadrant as both real and imaginary parts of this number are positive.

120. (b) $|A|=0$ as the matrix A is singular

$$\therefore |A|=\begin{vmatrix}1 & 3 & \lambda+2\\ 2 & 4 & 8\\ 3 & 5 & 10\end{vmatrix}=0$$

Apply $R_2\to R_2-2R_1$ and $R_3\to R_3-3R_1$ and expand.

$$-2(4-3\lambda)+4(4-2\lambda)=0$$
$$\Rightarrow 8-2\lambda=0\Rightarrow\lambda=4$$

For $\lambda=4$, the second and the third column are proportional.

121. (a) Since α_1,α_2 and β_1,β_2 are the roots of $ax^2+bx+c=0$ and $px^2+qx+r=0$ respectively, therefore

$$\alpha_1+\alpha_2=\frac{-b}{a},\alpha_1\alpha_2=\frac{c}{a}$$

and $\beta_1+\beta_2=\frac{-q}{p},\beta_1\beta_2=\frac{r}{p}$

Since the given system of equation has a non-trivial solution

$\therefore \begin{vmatrix} \alpha_1 & \alpha_2 \\ \beta_1 & \beta_2 \end{vmatrix} = 0$ i.e. $\alpha_1\beta_2 - \alpha_2\beta_1 = 0$

or $\frac{\alpha_1}{\beta_1} = \frac{\alpha_2}{\beta_2} = \frac{\alpha_1+\alpha_2}{\beta_1+\beta_2} = \sqrt{\frac{\alpha_1\alpha_2}{\beta_1\beta_2}}$

$\Rightarrow \frac{pb}{qa} = \sqrt{\frac{pc}{ra}} \Rightarrow \frac{b^2}{q^2} = \frac{ac}{pr}$

122. **(a)** Since, $-1 \le x < 0$

$\therefore [x] = -1$
$0 \le y < 1 \ \therefore [y] = 0$
$1 \le z < 2 \ \therefore [z] = 1$

$\therefore$ Given determinant $= \begin{vmatrix} 0 & 0 & 1 \\ -1 & 1 & 1 \\ -1 & 0 & 2 \end{vmatrix} = 1 = [z]$

123. **(d)**
124. **(a)** Given equation is $(x-a)(x-b)+(x-b)$

$(x-c)+(x-c)(x-a)=0$
$\Rightarrow 3x^2 - 2(b+a+c)x + ab + bc + ca = 0$

Now, here $A = 3, B = -2(a+b+c)$

$C = ab + bc + ca$
$\therefore D = \sqrt{B^2 - 4AC}$
$= \sqrt{(-2(a+b+c))^2 - 4(3)(ab+bc+ca)}$
$= \sqrt{4(a+b+c)^2 - 12(ab+bc+ca)}$
$= 2\sqrt{a^2+b^2+c^2-ab-bc-ca}$
$= 2\sqrt{\frac{1}{2}\{(a-b)^2-(b-c)^2+(c-a)^2\}} \ge 0$

125. **(b)** limit $= \lim_{n\to\infty} \frac{1+\left(\frac{b}{a}\right)^n}{1-\left(\frac{b}{a}\right)^n} = 1$, because $0 < \frac{b}{a} < 1$ implies $\left(\frac{b}{a}\right)^n \to 0$ as $n \to \infty$

126. **(c)** The function $\log|x|$ is not defined at $x = 0$, so, $x = 0$ is a point of discontinuity. Also for $f(x)$ to be defined, $\log|x| \neq 0 \Rightarrow x \neq \pm 1$. Hence, $0, 1, -1$ are three points of discontinuity.
127. **(a)** We have,

$$Lf'(0) = \lim_{h\to 0}\frac{f(0-h)-f(0)}{-h} = \lim_{h\to 0}\frac{-h\log\cosh}{-h\log(1+h^2)}$$
$$= \lim_{h\to 0}\frac{\log\cosh}{\log(1+h^2)}\left(\frac{0}{0}\text{ form}\right)$$
$$= \lim_{h\to 0}\frac{-\tan h}{2h/(1+h^2)} = -1/2$$
$$Rf'(0) = \lim_{h\to 0}\frac{f(0+h)-f(0)}{h} = \lim_{h\to 0}\frac{h\log\cosh}{h\log(1+h^2)}$$
$$= \lim_{h\to 0}\frac{\log\cos h}{\log(1+h^2)}\left(\frac{0}{0}\text{ form}\right)$$
$$= \lim_{h\to 0}\frac{-\tan h}{2h/(1+h^2)} = \frac{-1}{2}$$

Since $Lf'(0) = Rf'(0)$, therefore $f(x)$ is differentiable at $x = 0$

Since differentiability $\Rightarrow$ continuity, therefore $f(x)$ is continuous at $x = 0$.

128. (a)

$$\frac{dy}{dx} = \left(\frac{dx}{dy}\right)^{-1}$$
$$\Rightarrow \frac{d^2y}{dx^2} = -1\left(\frac{dx}{dy}\right)^{-2}\left\{\frac{d}{dx}\left(\frac{dx}{dy}\right)\right\}$$
$$\Rightarrow \frac{d^2y}{dx^2} = (-1)\left(\frac{dx}{dy}\right)^{-2}\left\{\frac{d}{dy}\left(\frac{dx}{dy}\right)\frac{dy}{dx}\right\}$$
$$= (-1)\left(\frac{dy}{dx}\right)^{2}\left\{\frac{d^2x}{dy^2}\cdot\frac{dy}{dx}\right\} = -\left(\frac{dy}{dx}\right)^{3}\left\{\frac{d^2x}{dy^2}\right\}$$
$$\Rightarrow \frac{d^2x}{dy^2}\left(\frac{dy}{dx}\right)^{3} + \frac{d^2y}{dx^2} = 0$$

129. (c)
130. (c)

(A) Graph of $f(x) = \cos x$ cuts x-axis at infinite number of points. (5 of list II)
(B) Graph of $f(x) = \ln x$ cuts x-axis in only one point. (4 of list II)
(C) Graph of $f(x) = x^2 - 5x + 4$ cuts x axis in two points (2 of list II)
(D) Graph of $f(x) = e^x$ cuts y-axis in only one point. (3 of list II)

131. (b)

$$f(x) = \sqrt{x}(7x-6) = 7x^{3/2} - 6x^{1/2}$$
$$f'(x) = 7\times\frac{3}{2}x^{1/2} - 6\times\frac{1}{2}x^{-1/2}$$

When tangent is parallel to x axis $f'(x) = 0$

or,
$$\frac{21}{2}x^{1/2} - 3x^{-1/2} = 0$$
$$\frac{21}{2}\sqrt{x} = \frac{3}{\sqrt{x}}$$

or, $7x = 2 \Rightarrow x = \frac{2}{7}$

132. **(d)** Let one side of quadrilateral be x and another side be y

so, $2(x + y) = 34$

or, $(x + y) = 17$

We know from the basic principle that for a given perimeter square has the maximum area, so, $x = y$ and putting this value in equation (i)

$$x = y = \frac{17}{2}$$

$$\text{Area} = x \cdot y = \frac{17}{2} \times \frac{17}{2} = \frac{289}{4} = 72.25$$

133. **(a)** Since f(x) is an increasing function in $[-1,1]$ and it has a root in $(-1,1)$.

$\therefore$ Only statement I is correct.

134. **(a)** At an extreme point of a function f(x), slope is always zero.

Thus, At an extreme point of a function f(x), the tangent to the curve is parallel to the x-axis.

135. **(a)** Let $y = xe^x$.

Differentiate both side w.r.t. ' x '.

$$\Rightarrow \frac{dy}{dx} = e^x + xe^x = e^x(1 + x)$$

Put $\frac{dy}{dx} = 0$

$\Rightarrow e^x(1 + x) = 0$

$\Rightarrow x = -1$

Now, $\frac{d^2y}{dx^2} = e^x + e^x(1 + x) = e^x(x + 2)$

$$\left(\frac{d^2y}{dx^2}\right)_{(x=-1)} = \frac{1}{e} + 0 > 0$$

Hence, $y = xe^x$ is minimum function and

$$y_{\min} = -\frac{1}{e}.$$

136. **(a)**

137. **(b)** We have $a = 1, h = -\sqrt{3}, b = 3, g = -\frac{3}{2}$,

$$f = \frac{3\sqrt{3}}{2}, c = -4.$$

Thus $abc + 2fgh - af^2 - bg^2 - ch^2 = 0$

Hence the equation represents a pair of straight lines.

Again $\frac{a}{h} = \frac{h}{b} = \frac{g}{f} = -\frac{1}{\sqrt{3}}$

$\therefore$ the lines are parallel. The distance between them

$$= 2\sqrt{\frac{g^2 - ac}{a(a + b)}} = 2\sqrt{\frac{\frac{9}{4} + 4}{1(1 + 3)}} = \frac{5}{2}.$$

138. **(b)** Let $P(x, y)$ be the point dividing the join of A and B in the ratio $2:3$ internally, then

$$x = \frac{20\cos\theta + 15}{5} = 4\cos\theta + 3 \Rightarrow \cos\theta = \frac{x-3}{4}$$
$$y = \frac{20\sin\theta + 0}{5} = 4\sin\theta \Rightarrow \sin\theta = \frac{y}{4}$$

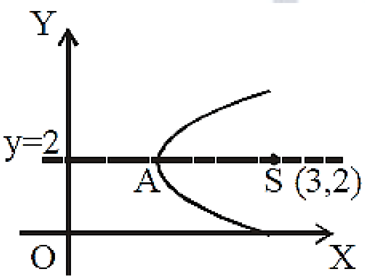
Squaring and adding (i) and (ii), we get the required locus $(x-3)^2 + y^2 = 16$, which is a circle.

139. (c)

Radius ≤ 5

$$\sqrt{\frac{\lambda^2}{4} + \frac{(1-\lambda)^2}{4} - 5} \leq 5 \Rightarrow \lambda^2 + (1-\lambda)^2 - 20 \leq 100$$
$$\Rightarrow 2\lambda^2 - 2\lambda - 119 \leq 0$$
$$\therefore \frac{1-\sqrt{239}}{2} \leq \lambda \leq \frac{1+\sqrt{239}}{2} \Rightarrow -7.2 \leq \lambda \leq 8.2$$
$$\therefore \lambda = -7, -6, -5, \dots\dots, 7, 8, \text{in all } 16$$
(approx.)
values

140. (a)
141. (c)
142. (c)
143. (b) Vertex of the parabola is a point which lies on the axis of the parabola, which is a line ⊥ to the directrix through the focus, i.e., $y = 2$ and equidistant from the focus and directrix $x = 0$, so that the vertex is $\left(\frac{3}{2}, 2\right)$.



144. (b)
145. (d) $\sum_{r=0}^{n} \frac{r+2}{r+1} {}^nC_r = \frac{2^8-1}{6}$

$$\Rightarrow \sum_{r=0}^{n} \left[1 + \frac{1}{r+1}\right] {}^nC_r = \frac{2^8-1}{6}$$
$$\Rightarrow 2^n + \sum_{r=0}^{n} \frac{1}{n+1} \cdot {}^{n+1}C_{r+1} = \frac{2^8-1}{6}$$
$$\Rightarrow 2^n + \frac{2^{n+1}-1}{n+1} = \frac{2^8-1}{6} \Rightarrow \frac{2^n(n+3)-1}{n+1} = \frac{2^8-1}{6}$$
$$\Rightarrow \frac{2^n(n+1+2)-1}{n+1} = \frac{2^5(6+2)-1}{6}$$

Comparing we get $n + 1 = 6 \Rightarrow n = 5$

146. (d) No. of words starting with A are $4! = 24$
No. of words starting with H are $4! = 24$
No. of words starting with L are $4! = 24$
These account for 72 words
Next word is RAHLU and the 74^{th} word RAHUL

147. **(a)**

$$(x+a)^n = {}^nC_0x^n + {}^nC_1x^{n-1}a + {}^nC_2x^{n-2}a^2$$
$$+{}^nC_3x^{n-3}a^3 + {}^nC_4x^{n-4}a^4 + \cdots.$$
$$= ({}^nC_0x^n + {}^nC_2x^{n-2}a^2 + {}^nC_4x^{n-4}a^4 + \cdots.) +$$
$$+({}^nC_1x^{n-1}a + {}^nC_3x^{n-3}a^3 + {}^nC_5x^{n-5}a^5) + \cdots$$
$$= A + B$$

Similarly, $(x-a)^n = A - B$
Multiplying eqns. (1) and (2), we get

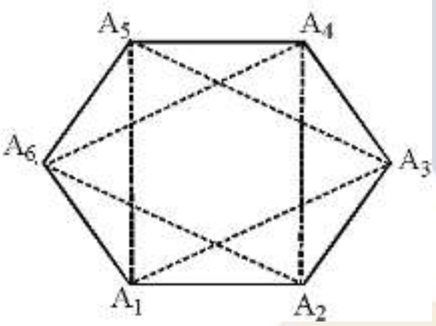
$(x^2-a^2)^n = A^2 - B^2$

148. **(c)**

Put $\log_{10} x = y$, the given expression becomes $(x+xy)^5$.

$$T_3 = {}^5C_2 \cdot x^3(x^y)^2 = 10x^{3+2y} = 10^6 \text{ (given)}$$
$$\Rightarrow (3+2y)\log_{10} x = 5\log_{10} 10 = 5$$
$$\Rightarrow (3+2y)y = 5$$
$$\Rightarrow y = 1, -\frac{5}{2}$$
$$\Rightarrow \log_{10} x = 1 \text{ or } \log_{10} x = -\frac{5}{2}$$
$$\therefore x = 10 \text{ or } x = (10)^{-5/2}$$

149. **(c)** Three vertices can be selected in ${}^6C_3$ ways.



The only equilateral triangles possible are $A_1A_3A_5$ and $A_2A_4A_6$

$$p = \frac{2}{{}^6C_3} = \frac{2}{20} = \frac{1}{10}$$

150. **(b)** As $0.4 + 0.6 = 1$, the man either takes a step forward or a step backward. Let a step forward be a success and a step backward be a failure.
Then, the probability of success in one step

$$= p = 0.4 = \frac{2}{5}$$

The probability of failure in one step

$= q = 0.6 = \frac{3}{5}.$

In 11 steps he will be one step away from the starting point if the numbers of successes and failures differ by 1 .
So, the number of successes $= 6$
The number of failures $= 5$
or the number of successes $= 5$.
The number of failures $= 6$
$\therefore$ the required probability

$$
\begin{aligned}
&= {}^{11}C_6 p^6 q^5 + {}^{11}C_5 p^5 q^6 \\
&= {}^{11}C_6 \left(\frac{2}{5}\right)^6 \cdot \left(\frac{3}{5}\right)^5 + {}^{11}C_5 \left(\frac{2}{5}\right)^5 \cdot \left(\frac{3}{5}\right)^6 \\
&= \frac{11!}{6!\,5!} \cdot \left(\frac{2}{5}\right)^5 \cdot \left(\frac{3}{5}\right)^5 \cdot \left\{\frac{2}{5} + \frac{3}{5}\right\} \\
&= \frac{11.10.9 \cdot 8 \cdot 7}{120} \cdot \frac{2^5 \cdot 3^5}{5^{10}} = 462 \times \left(\frac{6}{25}\right)^5
\end{aligned}
$$