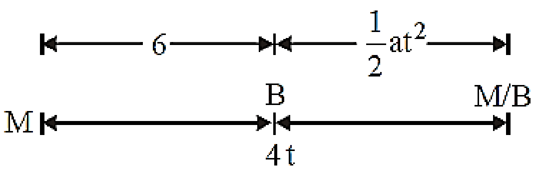
1. **(a)** It can be observed that component of acceleration perpendicular to velocity is $a = 4\ m/s^2$

$\therefore$ radius $= \frac{v^2}{a_c} = \frac{(2)^2}{4} = 1$ metre

2. **(a)** Let us draw the figure for given situation,



$$\Rightarrow\ 4t = 6 + \frac{1}{2} \times 1.2 \times t^2$$
$$\Rightarrow\ 4t = 6 + 0.6t^2$$

3. **(a)** Let $V = kT^a A^b \rho^c$, k = dimensional constant Writing dimension on both we side

$$[LT^{-1}] = [MLT^{-2}]^a [L^2]^b [ML^{-3}]^c$$
$$= \left[M^{a+c} L^{a+2b-3c} T^{-2a}\right]$$

Comparing power on both sides we have

$$a + c = 0, a + 2b - 3c = 1,\ -2a = -1$$

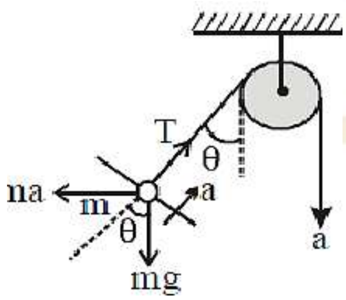
$$\therefore\quad a = \frac{1}{2}, c = -\frac{1}{2} \Rightarrow b = -\frac{1}{2}\ \ \therefore V = k\sqrt{\frac{T}{A\rho}}$$

4. **(d)** Here velocity is acting upwards when projectile is going upwards and acceleration is downwards. The angle θ between $\vec{v}$ and $\vec{a}$ is more than $0°$ and less than $180°$.

5. **(b)** The condition to avoid skidding,

$$v = \sqrt{\mu rg} = \sqrt{0.6 \times 150 \times 10} = 30\ m/s.$$

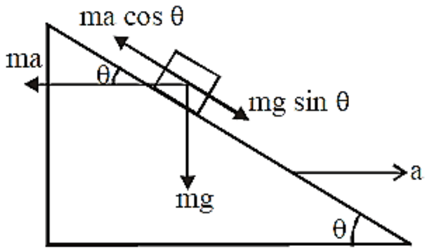
6. **(c)** Applying Newton's law along string



$$\Rightarrow T - m\sqrt{g^2 + a^2} = ma$$
$$\text{or } T = m\sqrt{g^2 + a^2} + ma$$

7. **(c)** Let the mass of block is m. It will remains stationary if forces acting on it are in equilibrium. i.e., $ma\cos\theta = mg\sin\theta$

$\Rightarrow a = g\tan\theta$



Here ma = Pseudo force on block, mg = weight.

8. **(c)**

9. **(c)** Given $m = 0.36$ kg, $M = 0.72$ kg.

The figure shows the forces on m and M. When the system is released, let the acceleration be a. Then

$T - mg = ma$

$Mg - T = Ma$

$\therefore\ a = \dfrac{(M-m)g}{M+m} = g/3$

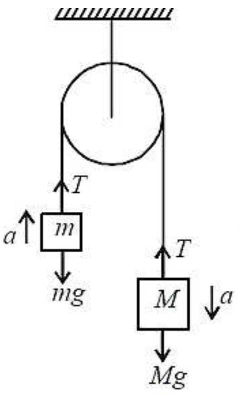
and $T = 4\text{mg}/3$

For block m :

$u = 0, a = g/3, t = 1, s = ?$

$\therefore$ Work done by the string on m is

$$\vec{T}.\vec{s} = Ts = 4\frac{mg}{3} \times \frac{g}{6} = \frac{4 \times 0.36 \times 10 \times 10}{3 \times 6} = 8\ \text{J}$$



10. **(a)**

Ratio of moment of inertia of the rings

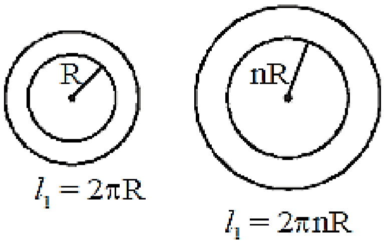
$$\frac{I_1}{I_2} = \left(\frac{M_1}{M_2}\right)\left(\frac{R_1}{R_2}\right)^2$$

$$= \left(\frac{\lambda l_1}{\lambda l_2}\right)\left(\frac{R_1}{R_2}\right)^2 = \left(\frac{2\pi \text{R}}{2\pi \text{nR}}\right)\left(\frac{\text{R}}{\text{nR}}\right)^2$$

($\lambda =$ linear density of wire $=$ constant)

$\Rightarrow \dfrac{\text{I}_1}{\text{I}_2} = \dfrac{1}{\text{n}^3} = \dfrac{1}{8}\quad (given)$

$\therefore\ \text{n}^3 = 8 \Rightarrow \text{n} = 2$



11. (d)

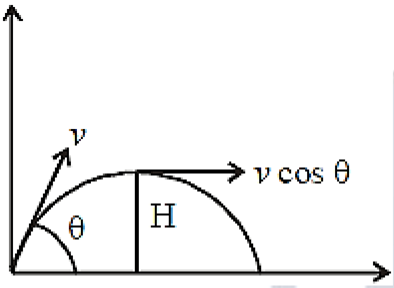
Angular momentum $L_0 = pr_\perp$

($\because$ linear momentum $p = mv\cos\theta$ and $r_\perp = H$)

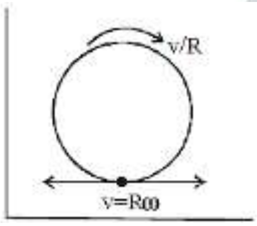
$\Rightarrow L_0 = mv\cos\theta H$

$$= mv\frac{\sqrt{3}}{2}\cdot\frac{v^2\sin^2 30^\circ}{2g}$$

$$= \frac{\sqrt{3}mv^3}{16g}$$



12. (d) As the disc is in combined rotation and translation, each point has a tangential velocity and a linear velocity in the forward direction. From figure v_{net} (for lowest point) $= v - R\omega = v - v = 0$ and acceleration $= \frac{v^2}{R} + 0 = \frac{v^2}{R}$ (since linear speed is constant)



13. (d) Gravitaional field inside the shell is zero, so nowork reauired

14. (d)

15. (b)

16. (c) Heat current in first rod (copper)

$$= \frac{390 \times A(0 - \theta)}{\ell}$$

Here θ is temperature of the junction and A &ℓ are area and length of copper rod.
Heat current in second rod (steel)

$$= \frac{46 \times A(\theta - 100)}{\ell}$$

In series combination, heat current remains same. So,

$$\frac{390 \times A(0-\theta)}{\ell} = \frac{46 \times A(\theta - 100)}{\ell}$$
$$-390\theta == 46\theta - 4600$$
$$436\theta = 4600 \Rightarrow \theta = 10.6°C$$

17. (d) Stefan's law for black body radiation

$$Q = \sigma e A T^4$$
$$T = \left[\frac{Q}{\sigma(4\pi R^2)}\right]^{1/4}$$

Here $e = 1$

$A = 4\pi R^2$

18. (d) For all process

$\Delta U = \Delta Q - \Delta W$

does not change as it depends on initial final states.

19. (a) The efficiency of the heat engine is

$$\eta = 1 - \frac{T_2}{T_1} = 1 - \left(\frac{273 + 27\text{ K}}{273 + 427\text{ K}}\right) = \frac{4}{7}$$
$$\text{But } \eta = \frac{W}{Q_1}$$
$$\therefore Q_1 = \frac{W}{\eta} = \frac{1.0\text{ kW}}{4/7} = 1.75\text{ kW} = 0.417\text{kcal/s}$$

Thus, the engine would require 417cal of heat per second, to deliver the requisite amount of work.

20. (c)

$$\text{Applying gas equation, } pV = nRT$$
$$\text{We can write, } p_1 V = n_1 RT_1 \text{ and } p_2 V = n_2 RT_2$$
$$\Rightarrow \frac{p_2}{p_1} = \frac{n_2}{n_1} \times \frac{T_2}{T_1} = \frac{1}{1} \times \frac{2\,T}{T} = 2$$
$$\Rightarrow p_2 = 2p$$

21. (d) We know, $V_{rms} = \sqrt{\frac{3RT}{M}}$

$\Rightarrow$ % increase in

$$V_{rms} = \frac{\sqrt{\frac{3RT_2}{M}} - \sqrt{\frac{3RT_1}{M}}}{\sqrt{\frac{3RTR_1}{M}}} \times 100$$

$$= \frac{\sqrt{T_2} - \sqrt{T_1}}{\sqrt{T_1}} \times 100$$

$$= \frac{\sqrt{400} - \sqrt{300}}{\sqrt{300}} \times 100$$

$$= \frac{20 - 17.32}{17.32} \times 100 = 15.5\%$$

22. (b) We know that

$$P_A V_A = n_A RT, P_B V_B = n_B RT$$
and $P_f(V_A + V_B) = (n_A + n_B)RT$
$$P_f(V_A + V_B) = P_A V_A + P_B V_B$$
$$\therefore \quad P_f = \left(\frac{P_A V_A + P_B V_B}{V_A + V_B}\right)$$
$$= \frac{1.4 \times 0.1 + 0.7 \times 0.15}{0.1 + 0.15} \text{MPa} = 0.98\text{MPa}$$

23. (a) Velocity, $v = \frac{dx}{dt} = -A\omega\sin(\omega t + \pi/4)$

Velocity will be maximum, when $\omega t + \pi/4 = \pi/2$ or $\omega t = \pi/2 - \pi/4 = \pi/4$ or $t = \pi/4\omega$

24. (c) Velocity of wave $v = n\lambda$

where n = frequency of wave $\Rightarrow n = \frac{v}{\lambda}$

$$n_2 = \frac{v_2}{\lambda_2} = \frac{396}{100 \times 10^{-2}} = 396 \text{ Hz}$$

no. of beats $= n_1 - n_2 = 4$

25. (d)

$$y = x_0 \cos 2\pi \left(nt - \frac{x}{\lambda}\right)$$
$$y = x_0 \cos \frac{2\pi}{\lambda}(vt - x) \ [\because v = n\lambda]$$
$$\left(\frac{dy}{dt}\right)_{max} = x_0 \times \frac{2\pi}{\lambda} v = 2v(\text{ given }) \therefore \lambda = \pi x_0$$

26. (b) $F_{net} = \sqrt{F^2 + F^2 + 2F^2\cos 60^\circ} = \sqrt{3}\,F$

27. (c) Initial energy of combined system

$$U_1 = \frac{1}{2}CV_1^2 + \frac{1}{2}CV_2^2$$

Final common potential, $V = \frac{V_1 + V_2}{2}$,

Final energy of system,

$$U_2 = 2 \times \frac{1}{2} C \left(\frac{V_1 + V_2}{2}\right)^2$$

Hence loss of energy $= U_1 - U_2$

$$= \frac{1}{4} C (V_1 - V_2)^2$$

28. (d) Fuse wire should be such that it melts immediatley when strong current flows through the circuit. The same is possible if its melting point is low and resistivity is high.

29. (b) $\therefore 4i_1 + 2(i_1 + i_2) - 3 + 4i_1 = 16\ \text{V}$

Using Kirchhoff's second law in the closed loop we have

$$9 - i_2 - 2(i_1 + i_2) = 0$$

Solving equations (i) and (ii), we get

$i_1 = 1.5\ \text{A}$ and $i_2 = 2\ \text{A}$

$\therefore$ current through 2 W resistor $= 2 + 1.5 = 3.5$ A.

30. (b) The magnetic field at C due to first conductor is $B_1 = \frac{\mu_0}{2\pi} \frac{I}{3\,d/2}$ (since, point C is separated by $d + \frac{d}{2} = \frac{3d}{2}$ from 1 st conductor). The direction of field is perpendicular to the plane of paper and directed outwards. The magnetic field at C due to second conductor is $B_2 = \frac{\mu_0}{2\pi} \frac{10}{d/2}$ (since, point C is separated by $\frac{d}{2}$ from 2nd conductor)

The direction of field is perpendicular to the plane of paper and directed inwards.

Since, direction of B_1 and B_2 at point C is in opposite direction and the magnetic field at C is zero, therefore,

$$B_1 = B_2$$

$$\frac{\mu_0}{2\pi} \frac{I}{3\,d/2} = \frac{\mu_0}{2\pi} \frac{10}{d/2}$$

On solving $I = 30.0$ A

31. (b) $\vec{v}$ and $\vec{B}$ are in same direction so that magnetic force on electron becomes zero, only electric force acts. But force on electron due to electric field is opposite to the direction of velocity.

32. (a)

33. (d)

$$M = \frac{\mu_0 N_1 N_2 A}{\ell}$$

$$= \frac{4\pi \times 10^{-7} \times 300 \times 400 \times 100 \times 10^{-4}}{0.2}$$

$$= 2.4\pi \times 10^{-4}\text{H}$$

34. (c) $\frac{I_S}{I_P} = \frac{N_P}{N_S} = \frac{1}{4} \Rightarrow I_S = \frac{1}{4} \times 4 = 1\ \text{A}$

35. (c)

36. (b) Frequency does not change on refraction.

37. (b) Cutting a lens in transverse direction doubles their focal length i.e. $2f$. Using the formula of equivalent focal length, $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3} + \frac{1}{f_4}$ We get equivalent focal length as $f/2$.

38. (b)

$$n_1\lambda_1 = n_2\lambda_2$$

$$10 \times 7000 = n_2 \times 5000 \Rightarrow n_2 = 14$$

39. (b) I $\rightarrow$ ON

II $\rightarrow$ OFF

In IInd state it is used as a amplifier it is active region.

40. (b)

$$Y = A + (\bar{A} \cdot B) = (A + \bar{A}) \cdot (A + B)$$
$$= A + B$$
$\Rightarrow$ OR gate

41. (d)

$$\text{Molarity (M)} = \frac{\text{wt} \times 1000}{\text{mol wt.} \times \text{vol(mL)}}$$
$$2 = \frac{\text{wt.}}{63} \times \frac{1000}{250}$$
$$\text{wt.} = \frac{63}{2}\ \text{g}$$
$$\text{wt. of 70\% acid} = \frac{100}{70} \times 31.5 = 45\ \text{g}$$

42. (d) Radius of hydrogen atom $= 0.530$Å, Number of excited state $(n) = 2$ and atomic number of hydrogen atom $(Z) = 1$. We know that the Bohr radius.

$$(r) = \frac{n^2}{Z} \times \text{ Radius of atom } = \frac{(2)^2}{1} \times 0.530$$
$$= 4 \times 0.530 = 2.12\text{Å}$$

43. (d) The screening effect of inner electron of the nucleus causes the decrease in ionization potential, therefore the order of the screening effect is

$f < d < p < s$

Hence, the screening effect of d-electron is less than p-electron.

44. (b) Rare gases; as the e^- is to be removed from stable configuration.

45. (c) Amongst isoelectronic species, ionic radii of anion is more than that of cations. Further size of anion increase with increase in -ve charge and size of cation decrease with increase in + ve charge. Hence ionic radii decreases from O^- to Al^{3+}.

46. (b) B_2 and O_2 are paramagnetic due to presence of unpaired electron. MO electronic configuration of B_2 is:

$\sigma ls^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^1 = \pi 2p_y^1$

MO electorn i.e. configuration of O_2 is:

$$\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 \pi 2p_x^2$$
$$= \pi 2p_y^2 \pi^* 2p_x^1 = \pi^* 2p_y^1$$

47. (b) RMS velocity of molecules depends on mass. If mol. wt. increases, rms velocity of melocules decreases.

$$\text{rms} \propto \frac{1}{\sqrt{\text{m} \cdot \text{wt}}}$$

The order of increasing m. wt. is

$H_2 < N_2 < O_2 < HBr$

Order of V_{rms} of molecules.

$HBr < O_2 < N_2 < H_2$.

48. (a)

$$\Delta H = \Delta H_{(product)} - \Delta H_{(reactant)}$$
$$162 = 2 \times \Delta H_H - \Delta H_{H_2}$$
$$\Delta H_H = \frac{162}{2} \left(\because \Delta H_{H_2} = 0\right)$$
$$\Delta H_H = 81 \text{Kcal}$$

49. (c) Bybomb calorimeter we get ΔE.

$$2C_6H_6(l) + 15O_2(g) \longrightarrow 12CO_2(g) + 6H_2O(l)$$
$$\Delta H - \Delta E = \Delta nRT$$
$$= (12 - 15) \times 8.314 \times 300 = -7.483 \text{ kJ}$$

50. (b)

$$\underset{1-x}{I_2} \rightleftharpoons \underset{2x}{2I^-}$$

$$K_c = \frac{(2x)^2}{(1-x)} = 10^{-6}$$

It shows that $(1 - x) < 2x$

51. (c)

$$K_p = K_c(RT)^{\Delta n}_{\Delta n} = 1 - \left(1 + \frac{1}{2}\right) = 1 - \frac{3}{2} = -\frac{1}{2}$$
$$\therefore \frac{K_p}{K_c} = (RT)^{-1/2}$$

52. (c)

$$Na_2S_4O_6$$
$$2 + 4x - 12 = 0$$
$$4x - 10 = 0$$
$$x = \frac{10}{4} = \frac{+5}{2}$$

Oxidation state of S is $= \frac{+5}{2}$

53. (a)

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$$
$$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$$

$\therefore$ Ratio of volumes of H_2 evolved is 1: 1

54. (d) The stability of alkali metal hydrides decreases from Li to Cs. It is due to the fact that $M - H$ bonds becomes weaker with increase in size of alkali metals as we move down the group from Li to Cs. Thus the order of stability of hydrides is

LiH > NaH > KH > RbH > CsH

55. (d) $-NO_2$ group, being strong electron withdrawing, disperses the -ve charge, hence stabilizes the concerned carbanion.

56. (a) A chiral object or structure has four different groups attached to the carbon.

57. (d) The structure $CH_3\overset{*}{C}HBr\overset{*}{C}HBrCOOH$

has two different chiral carbon atoms, hence number of enantiomers (optically active forms) is $2^n = 2^2 = 4$

58. (a) Electrolysis of a concentrated aqueous solution of either sodium or potassium salts of saturated carboxylic acids yields higher alkane at anode.

$$2RCOOK \xrightarrow[\text{Oxidation}]{\text{Electrolytic}} \underset{\text{Anode}}{2RCOO^-} + \underset{\text{Cathode}}{2K^+}$$

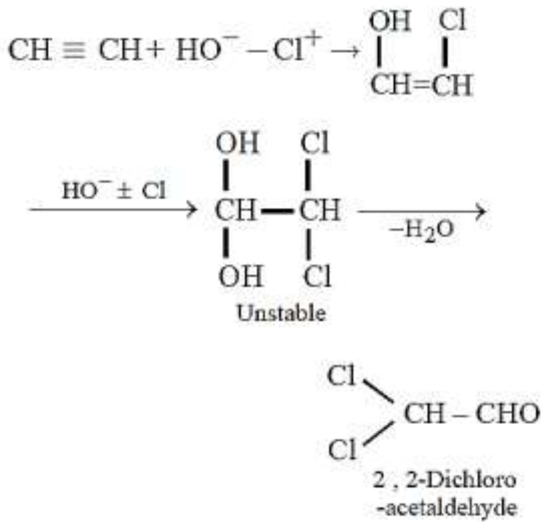
At anode $2RCOO^- \rightarrow 2RCOO + 2e^- \longrightarrow R—R + 2CO_2$

At Cathode $2K^+ + 2e^- \rightarrow 2K$

$$2K + H_2O \rightarrow 2KOH + H_2\uparrow$$

(Kolbe's Method)

59. (c)



60. (a) Green- house gases such as CO_2, ozone, methane, the chlorofluoro carbon compounds and water vapour form a thick cover around the earth which prevents the IR rays emitted by the earth to escape. It gradually leads to increase in temperature of atmosphere.

61. (c) No change in density.

62. (c) When equal weights of different solutes are present in equal volumes of solution the molarity is inversely related to molecular mass of the solute. Mol. mass of NaCl is less than KCl. Hence, molarity of NaCl solution will be more.

63. (c)

$$m=\frac{\text{E. wt}\times Q}{96500};$$

$$\therefore\ \text{E. wt}=\frac{m\times 96500}{Q}$$

$$=\frac{22.2\times 96500}{2\times 5\times 60\times 60}=60.3$$

$$\text{Oxidation state}=\frac{\text{At wt.}}{\text{Eq. wt.}}=\frac{177}{60.3}=3$$

64. **(d)** At cathodes: $Fe^{+}+2e^{-}\longrightarrow Fe$;

$$Fe^{3+}+3e^{-}\longrightarrow Fe$$

$$(E_{Fe})_1=\frac{\text{At. wt.}}{2};\ (E_{Fe})_2=\frac{\text{At. wt.}}{3}$$

Hence, $\frac{(E_{Fe})_1}{(E_{Fe})_2}=\frac{3}{2}$

65. **(c)** The velocity constant doubles for every $10^{\circ}C$ rise in temperature.

66. **(d)** At high pressure the extent of adsorption follows zero order kinetics.

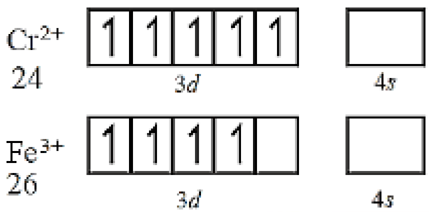
67. **(d)** F_2 is expected to have highest bond energy but the correct decreasing order is $Cl_2>Br_2>F_2$ because of fluorine atom has very small size due to which there is a high inter electronic repulsion between two fluorine atoms so the bond between two fluorine gets weaker and need less energy.

68. **(a)** The acids which contain $P-H$ bond have strong reducing properties. Thus H_3PO_2 acid is good reducing agent as it contains two $P-H$ bonds. For example, it reduces $AgNO_3$ to metallic silver.

$$4AgNO_3+2H_2O+H_3PO_2\longrightarrow 4Ag+4HNO_3+H_3PO_4$$

69. **(b)**

$[Cr(H_2O)_6]^{2+}$Cr is in Cr^{2+} form



In $[Fe(H_2O)]^{2+}Fe^{2+}$ form. Both will have 4 unpaired electrons.

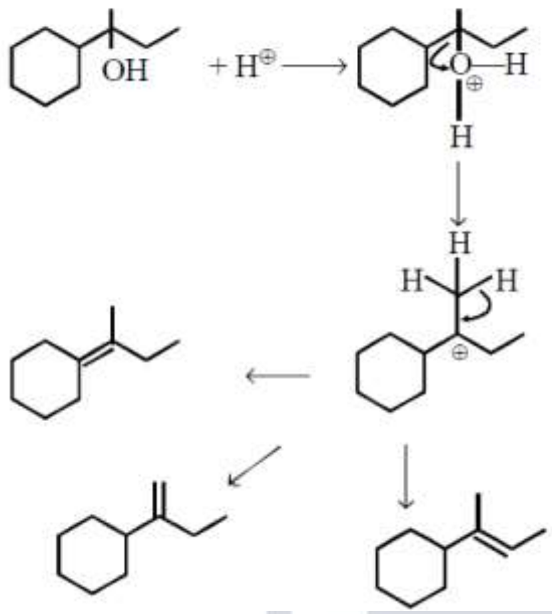
70. **(a)** Due to stronger-I-effect of F than that of Cl, CHF_3 should be more acidic than $CHCl_3$. But actually reverse is true.
This is due to : CCl_3^-left after the removal of a proton from $CHCl_3$ is stabilised due to presence of d-orbitals in Cl than: CF_3^-left after the removal of a proton from CHF_3 which is not stabilised due to the absence of d-orbitals on F.

71. **(d)** S_N2 mechanism is followed in case of primary and secondary halides i.e., S_N2 reaction is favoured by small groups on the carbon atom attached to halogens so

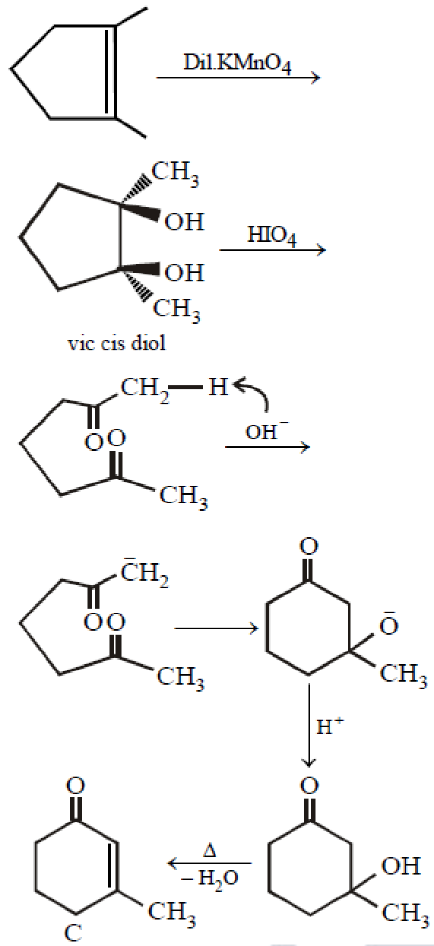
$CH_3CH_2Br > CH_3CH_2CH_2Br >$

$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2Br > CH_3-\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}-Br$

72. (b)



73. (a)



74. **(c)** Aldehydes are more reactive than ketones due to +I effect of $-CH_3$ group. There are two $-CH_3$ group in acetone which reduces +ve charge density on carbon atom of carbonyl group. More hindered carbonyl group becomes less reactive. So in the given case CH_3CHO is the right choice.

75. **(d)**

76. **(b)** When Potassium is treated with ammonia, then potassium amide is obtained.

$$K + NH_3 \longrightarrow \underset{\text{Pot.amide}}{KNH_2} + \frac{1}{2}H_2$$

77. **(b)** Insulin is a biochemically active peptide harmone secreted by pancreas.

78. **(a)** Due to resonance,

$$-\overset{\overset{O}{\|}}{C}-\ddot{N}H- \longleftrightarrow -\overset{\overset{O^-}{|}}{C}=\overset{+}{N}H-,\quad C-N$$

bond acquires some double bond character, hence shorter in length.

79. **(b)** CuS and CdS are precipitated by H_2 S. Hydroxide of Al will pass into the solution in the form of $NaAlO_2$ being amphoteric in nature. Hence filtrate will give test for sodium and aluminium.

80. **(a)** Normality of $3\% Na_2CO_3$.

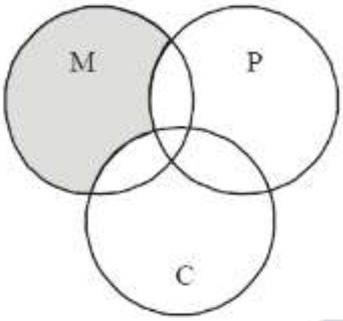
$$N = \frac{3 \times 1000}{53 \times 100} = 0.566\ N$$

For H_2SO_4 sol. $N_1 = 0.1,\ V_1 = 100$ mL
For Na_2CO_3 sol. $N_2 = 0.566$.
Now apply $N_1 V_1 = N_2 V_2$

$$V_2 = \frac{N_1 V_1}{N_2} = \frac{0.1 \times 1000 \text{ mL}}{0.566} = 176.66 \text{ mL}$$

81. (c)

$$\begin{aligned} & \text{n(M alone)} \\ = \; & n(M) - n(M \cap C) - n(M \cap P) + n(M \cap C \cap P) \\ = \; & 100 - 28 - 30 + 18 = 60 \end{aligned}$$



82. (a) $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$
and $x\sin\theta = y\cos\theta$
Equation (i) may be written as

$$\begin{aligned} & x\sin\theta \cdot \sin^2\theta + y\cos^3\theta = \sin\theta\cos\theta \\ & \Rightarrow y\cos\theta\sin^2\theta + y\cos^3\theta = \sin\theta\cos\theta \\ & \Rightarrow y\cos\theta(\sin^2\theta + \cos^2\theta) = \sin\theta\cos\theta \\ & \Rightarrow y\cos\theta = \sin\theta\cos\theta \therefore y = \sin\theta \end{aligned}$$

Putting the value of y from (iii) in (ii), we get

$x\sin\theta = \sin\theta \cdot \cos\theta \Rightarrow x = \cos\theta$ ... (iv)

Squaring (iii) and (iv) and adding, we get

$x^2 + y^2 = \cos^2\theta + \sin^2\theta = 1$

83. (d)

$$\begin{aligned} & \cos 7\theta = \cos\theta - \sin 4\theta \\ & \Rightarrow \sin 4\theta = \cos\theta - \cos 7\theta \\ & \Rightarrow \sin 4\theta = 2\sin 4\theta \sin 3\theta \\ & \Rightarrow \sin 4\theta(1 - 2\sin 3\theta) = 0 \\ & \therefore \sin 4\theta = 0 \text{ or } \sin 3\theta = \frac{1}{2} \\ & \Rightarrow 4\theta = n\pi \text{ or } 3\theta = n\pi + (-1)^n \frac{\pi}{6} \\ & \Rightarrow \theta = \frac{n\pi}{4} \text{ or } \frac{n\pi}{3} + (-1)^n \frac{\pi}{18} \end{aligned}$$

84. (d) Real part of $\frac{\bar{z}+2}{\bar{z}-1}$ is given by

$$\frac{1}{2}\left[\frac{\bar{z}+2}{\bar{z}-1}+\left(\frac{\bar{z}+2}{\bar{z}-1}\right)\right]=4$$
$$\Rightarrow \frac{\bar{z}+2}{\bar{z}-1}+\frac{z+2}{z-1}=8$$
$$\Rightarrow z\bar{z}-\bar{z}+2z-2+z\bar{z}+2\bar{z}-z-2$$
$$=8(z\bar{z}-\bar{z}-z+1)$$
$$\Rightarrow z\bar{z}-\frac{3}{2}z-\frac{3}{2}\bar{z}+2=0$$

Comparing with the equation
$z\bar{z}+\bar{a}z+a\bar{z}+b=0$, we get $a=-\frac{3}{2}$ and b $=2$. Thus, the locus of z given by the equation (i) is a circle with centre $\frac{3}{2}$ and radius $=\frac{1}{2}$

85. **(d)** We have $x^3+1\equiv(x+1)(x^2-x+1)$. Therefore, α and β are the complex cube roots of -1 so that we may take $\alpha=-\omega$ and
$\beta=-\omega^2$, where $\omega\neq 1$ is a cube root of unity. Thus $\alpha^{100}=(-\omega)^{100}=\omega$ and $\beta^{100}=(-\omega^2)^{100}=\omega^2$, so that the required equation is $x^2+x+1=0$.

86. **(a)**

Given, $\dfrac{3-|x|}{4-|x|}\geq 0$
$\Rightarrow 3-|x|\leq 0$ and $4-|x|<0$
or $3-|x|\geq 0$ and $4-|x|<0$
$\Rightarrow |x|\geq 3$ and $|x|>4$
or $|x|\leq 3$ and $|x|<4$
$\Rightarrow |x|>4$ or $|x|\leq 3$
$\Rightarrow x\in(-\infty,-4)\cup[-3,3]\cup(4,\infty)$

87. **(c)** Dividing R at $\frac{2}{3},\frac{4}{3}$ and 2 , analyse 4 cases.
When $x\leq\frac{2}{3}$, the inequality becomes
$2-3x+4-3x+6-3x\geq 12.$
implying $-9x\geq 0\Rightarrow x\leq 0.$
when $x\geq 2$ the ineqality becomes
$3x-2+3x-4+3x-6\geq 12,$
Implying $9x\geq 24\Rightarrow x\geq 8/3$
The inequality in invalid in the other two sections.
$\therefore$ either $x\leq 0$ or $x\geq 8/3$

88. **(d)** Leaving one seat vacant between two boys, 5 boys may be seated in 4 ! ways. Then at remaining 5 seats, 5 girls any sit in 5 ! ways. Hence the required number $=4!\times 5$!

89. **(a)** Atleast one black ball can be drawn in the following ways
(i) one black and two other colour balls

$={}^3C_1\times{}^6C_2=3\times 15=45$

(ii) two black and one other colour balls

$={}^3C_2\times{}^6C_1=3\times 6=18$

(iii) All the three are black $={}^3C_3\times{}^6C_0=1$
$\therefore$ Req. no. of ways $=45+18+1=64$

90. (d) When exponent is n then total number of terms are $n+1$. So, total number of terms in

$(2+3x)^4 = 5$

Middle term is 3rd. $\Rightarrow T_3 = {}^4C_2(2)^2 \cdot (3x)^2$

$$= \frac{4\times3\times2\times1}{2\times1\times2} \times 4 \times 9x^2 = 216x^2$$

91. (a)

$$C_0 + (C_0 + C_1) + (C_0 + C_1 + C_2) + \cdots \ldots \ldots \ldots .$$
$$+(C_0 + C_1 + \cdots \ldots \ldots \ldots C_{n-1})$$
$$= nC_0 + (n-1)C_1 + (n-2)C_2 + \cdots \ldots . C_{n-1}$$
$$= C_1 + 2C_2 + 3C_3 + 4C_4 \ldots \ldots . nC_n = n \cdot 2^{n-1}$$

92. (b) Let $S = 1 + 2\cdot 2 + 3\cdot 2^2 + 4.2^2 + \cdots . +100.2^{29}$ .... (i)

It is an arithmetico - geometric series. On multiplying Eq. (i) by 2 and then subtracting it from Eq. (i), we get

$$S = 1 + 2.2 + 3.2^2 + 4.2^3 + \cdots + 100.2^{99}$$

$$\_\ S = 1.2 + 2.2^2 + 3.2^3 + \cdots + 99.2^{99} + 100.2^{100}$$

$$-S = 1 + 2 + 2^2 + 2^3 \ldots + 2^{99} - 100.2^{100}$$

$$\Rightarrow -S = \frac{1(2^{100}-1)}{2-1} - 100.2^{100}$$

$$\Rightarrow -S = 2^{100} - 1 - 100.2^{100}$$

$$\Rightarrow -S = -1 - 99.2^{100}$$

$$\Rightarrow S = 99.2^{100} + 1$$

93. (b) Equation of the line making intercepts a and b on the axes is $\frac{x}{a} + \frac{y}{b} = 1$.

Since, it passes through (1,1)

$$\Rightarrow \frac{1}{a} + \frac{1}{b} = 1$$

Also, the area of the triangle formed by the line and the axes is A.

$$\therefore \frac{1}{2}ab = A \Rightarrow ab = 2\,A$$

From eqs. (i) and (ii), we get, $a + b = 2\,A$ Hence, a and b are the roots of the eq.

$$x^2 - (a+b)x + ab = 0 \Rightarrow x^2 - 2Ax + 2A = 0$$

94. (a)

$4a^2+b^2+2c^2+4ab-6ac-3bc$
$\equiv (2a+b)^2-3(2a+b)c+2c^2=0$
$\Rightarrow (2a+b-2c)(2a+b-c)=0 \Rightarrow c=2a+b$
or $c=a+\frac{1}{2}b$

The equation of the family of lines is

$a(x+2)+b(y+1)=0$ or $a(x+1)+b\left(y+\frac{1}{2}\right)=0$

giving the point of concurrence $(-2,-1)$ or

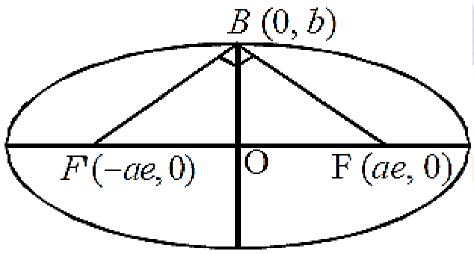
$\left(-1,-\frac{1}{2}\right)$.

95. (d) Equation of pair of tangents is given by

$SS_1=T^2$,
or $S=x^2+y^2+20(x+y)+20,\ S_1=20,$
$T=10(x+y)+20=0$
$\therefore SS_1=T^2$
$\Rightarrow\ 20(x^2+y^2+20(x+y)+20)=10^2$
$(x+y+2)^2$
$\Rightarrow\ 4x^2+4y^2+10xy=0 \Rightarrow 2x^2+2y^2+5xy=0$

96. (a)

$\because \angle FBF'=90^\circ \Rightarrow FB^2+F'B^2=FF'^2$
$\therefore \left(\sqrt{a^2e^2+b^2}\right)^2+\left(\sqrt{a^2e^2+b^2}\right)^2=(2ae)^2$
$\Rightarrow 2(a^2e^2+b^2)=4a^2e^2 \Rightarrow e^2=\frac{b^2}{a^2}$

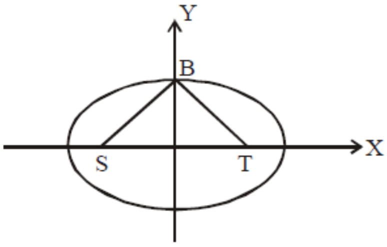


Also, $e^2=1-b^2/a^2=1-e^2$
(By using equation (i))

$\Rightarrow 2e^2=1 \Rightarrow e=\frac{1}{\sqrt{2}}$.

97. (b)

98. (c) Let eq. of ellipse be $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, S is $(-ae,0)$, T is $(ae,0)$ and B is $(0,b)$.



$\Rightarrow SB=\sqrt{(0+ae)^2+b^2}$

Also $SB^2=ST^2 \Rightarrow 4a^2e^2=a^2e^2+b^2$

$\Rightarrow 3a^2e^2=a^2(1-e^2)=a^2-a^2e^2$

$\Rightarrow 4a^2e^2=a^2 \Rightarrow e^2=\frac{1}{4} \Rightarrow e=\frac{1}{2}$

99. (d)

Given $f(x)=g(x)h(x)$

$\Rightarrow h(x)=\frac{f(x)}{g(x)}$

$\Rightarrow \lim_{x\to1} h(x)=\lim_{x\to1}\frac{f(x)}{g(x)}$

$\Rightarrow \lim_{x\to1}\frac{(x^5-1)(x^3+1)}{(x^2-1)(x^2-x+1)}$

$=\lim_{x\to1}\frac{x^5-1^5}{x-1}=5\times1^4=5$

100. **(d)**

101. **(b)** Mode = 3 Median - 2 Mean

$\therefore$ Median $=\frac{1}{3}(\text{ mode }+2\text{ mean })=\frac{1}{3}(60+2\times66)=64$

102. **(c)**

103. **(a)** Since, $|a-a|=0\leq1$, so $aRa, \forall a\in R$

$\therefore R$ is reflexive.

Now, $aRb\Rightarrow|a-b|\leq1\Rightarrow|b-a|\leq1\Rightarrow bRa$

$\therefore R$ is symmetric.

But R is not transitive as

$1R2, 2R3$ but $1\not R3$

$[\because |1-3|=2>1]$

104. **(c)** We have, $(\sin^{-1}x)^2+(\cos^{-1}x)^2$

$$= (\sin^{-1}x + \cos^{-1}x)^2 - 2\sin^{-1}x \cdot \cos^{-1}x$$
$$= \frac{\pi^2}{4} - 2\sin^{-1}x\left(\frac{\pi}{2} - \sin^{-1}x\right)$$
$$= \frac{\pi^2}{4} - \pi\sin^{-1}x + 2(\sin^{-1}x)^2$$
$$= 2\left[(\sin^{-1}x)^2 - \frac{\pi}{2}\sin^{-1}x + \frac{\pi^2}{8}\right]$$
$$= 2\left[\left(\sin^{-1}x - \frac{\pi}{4}\right)^2 + \frac{\pi^2}{16}\right]$$

Thus, the least value is $2\left(\frac{\pi^2}{16}\right)$ i.e. $\frac{\pi^2}{8}$

and the greatest value is

$$2\left[\left(\frac{-\pi}{2} - \frac{\pi}{4}\right)^2 + \frac{\pi^2}{16}\right] \text{ i.e. } \frac{5\pi^2}{4}.$$

105. **(c)** The given trigonometric ratio

$$= \cos\left[\frac{1}{2}\left(\cos\left(\cos^{-1}\frac{1}{8}\right)\right)\right]$$
$$= \cos\left(\frac{1}{2}\cos^{-1}\frac{1}{8}\right)$$
$$= \sqrt{\frac{1 + \cos\left(\cos^{-1}\frac{1}{8}\right)}{2}} = \frac{3}{4}$$

106. **(d)** The given determinant vanishes, i.e.,

$$\begin{vmatrix} 1 & x-3 & (x-3)^2 \\ 1 & x-4 & (x-4)^2 \\ 1 & x-5 & (x-5)^2 \end{vmatrix} = 0$$

Expanding along C_1, we get

$$(x-4)(x-5)^2 - (x-5)(x-4)^2 - \{(x-3)(x-5)^2$$
$$-(x-5)(x-3)^2\} + (x-3)(x-4)^2$$
$$-(x-4)(x-3)^2 = 0$$
$$\Rightarrow (x-4)(x-5)(x-5-x+4)$$
$$-(x-3)(x-5)(x-5-x+3)$$
$$+(x-3)(x-4)(x-4-x+3) = 0$$

$$\Rightarrow -(x-4)(x-5) + 2(x-3)(x-5) - (x-3)$$
$$(x-4) = 0$$
$$\Rightarrow -x^2 + 9x - 20 + 2x^2 - 16x + 30 - x^2 + 7x - 12 = 0$$
$$\Rightarrow -32 + 30 = 0 \Rightarrow -2 = 0$$

Which is not possible, hence no value of x satisfies the given condition.

107. **(a)** Since the lines are concurrent, so

$$\begin{vmatrix} \ell & m & n \\ m & n & \ell \\ n & \ell & m \end{vmatrix} = 0 \Rightarrow 3\ell mn - \ell^3 - m^3 - n^3 = 0$$

$\Rightarrow \quad (\ell + m + n)(\ell^2 + m^2 + n^2 - \ell m - mn - n\ell) = 0$

$\Rightarrow \quad \ell + m + n = 0[\because \ell^2 + m^2 + n^2 > \ell m + mn + n]$

108. **(c)** $y = e^x \Rightarrow \frac{dy}{dx} = e^x = y$

109. **(b)** $\lim_{x\to -5} f(x) = \frac{(x-2)(x+5)}{(x+5)(x-3)} = \frac{-7}{-8} = \frac{7}{8}$

110. **(d)** The equation of the given curve is

$$y = \frac{1}{x-3}, x \neq 3.$$

The slope of the tangent to the given curve at any point (x, y) is given by $\frac{dy}{dx} = \frac{-1}{(x-3)^2}$ For tangent having slope 2, we must have

$$2 = \frac{-1}{(x-3)^2}$$

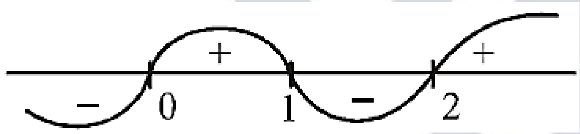
$$\Rightarrow 2(x-3)^2 = -1 \Rightarrow (x-3)^2 = -\frac{1}{2}$$

which is not possible as square of a real number cannot be negative.
Hence, there is no tangent to the given curve having slope 2 .

111. **(c)** Here, $f(x) = (x(x-2))^2$

$\Rightarrow f'(x) = 4x(x-2)(x-1)$

For $f(x)$ as increasing, $f'(x) > 0$
So, $4x(x-1)(x-2) > 0 \Rightarrow x(x-1)(x-2) > 0$



From the above figure required interval is, $(0,1) \cup (2, \infty)$

112. **(d)** If the sum of two positive quantities is a constant, then their product is maximum, when they are equal.
$\therefore a^2x^4 \cdot b^2y^2$ is maximum when

$$a^2x^4 = b^2y^4 = \frac{1}{2}\Big(a^2x^4 = \frac{1}{2}(a^2x^4 + b^2y^4) = \frac{c^4}{2}$$

$\therefore$ maximum value of

$$a^2x^4 \cdot b^2y^4 = \frac{c^4}{2} \cdot \frac{c^4}{2} = \frac{c^8}{4}$$

$$\text{Maximum value of } xy = \left(\frac{c^8}{4a^2b^2}\right)^{1/4} = \frac{c^2}{\sqrt{2ab}}$$

113. **(b)**

$$I=\int \frac{x^2\left(1-\frac{1}{x^2}\right)dx}{x^2\left(x+\frac{1}{x}\right)\left(x^2+\frac{1}{x^2}\right)^{1/2}}$$

$$\text{Let } x+\frac{1}{x}=p \Rightarrow \left(1-\frac{1}{x^2}\right)dx=dp$$

$$I=\int \frac{dp}{p\sqrt{p^2-2}}=\frac{1}{\sqrt{2}}\sec^{-1}\frac{p}{\sqrt{2}}$$

$$=\frac{1}{\sqrt{2}}\sec^{-1}\left(\frac{x^2+1}{\sqrt{2}x}\right)+c$$

114. **(b)** Let $I=\int_0^{\pi/2}\frac{\sin x}{1+\cos^2 x}dx$

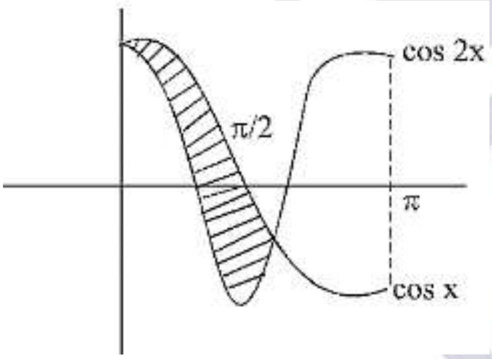
Let $\cos x=t$ and $-\sin x dx=dt$.
Now, $x=0 \Rightarrow t=\cos 0=1$ and

$$x=\frac{\pi}{2}\Rightarrow t=\cos\frac{\pi}{2}=0$$

$$\therefore\ I=\int_1^0 \frac{\sin x}{1+t^2}\left(\frac{-dt}{\sin x}\right)=-\int_1^0\frac{dt}{1+t^2}$$

$$=[\tan^{-1}t]_1^0=-\left[0-\frac{\pi}{4}\right]=\frac{\pi}{4}$$

115. **(d)**



Area $=\int_0^{2\pi/3}(\cos x-\cos 2x)dx=\frac{3\sqrt{3}}{4}$

116. **(b)** The equation is,

$$\frac{dy}{dx}=\sin(x-y)-\sin(x+y)=2\cos x\sin(-y)$$

$$\Rightarrow \frac{dy}{\sin y}+2\cos x dx=0$$

$$\Rightarrow \int \operatorname{cosec} y dy+2\int \cos x dx=C$$

$$\Rightarrow \log\tan\frac{y}{2}+2\sin x=C$$

117. **(a)** We have $\frac{dy}{dx}=\frac{f'(x)}{f(x)}y-\frac{y^2}{f(x)}$

$$\Rightarrow \frac{dy}{dx}-\frac{f'(x)}{f(x)}y=-\frac{y^2}{f(x)}$$

Divide by y^2: $y^{-2}\frac{dy}{dx} - y^{-1}\frac{f'(x)}{f(x)} = -\frac{1}{f(x)}$
Put $y^{-1} = z \Rightarrow -y^{-2}\frac{dy}{dx} = \frac{dz}{dx}$

$$-\frac{dz}{dx} - \frac{f'(x)}{f(x)}(z) = -\frac{1}{f(x)}$$
$$\Rightarrow \frac{dz}{dx} + \frac{f'(x)}{f(x)}z = \frac{1}{f(x)}$$
$$\text{I.F.} = e^{\int \frac{f'(x)}{f(x)}dx} = e^{\log f(x)} = f(x)$$

$\therefore$ The solution is

$$z(f(x)) = \int \frac{1}{f(x)}(f(x))dx + c$$
$$\Rightarrow y^{-1}(f(x)) = x + c \Rightarrow f(x) = y(x + c)$$

118. **(c)**

We have $\vec{a} + \vec{b} + \vec{c} = \vec{0}$
$\therefore |\vec{a} + \vec{b} + \vec{c}| = 0 \Rightarrow |\vec{a} + \vec{b} + \vec{c}|^2 = 0$
$\Rightarrow |\vec{a}|^2 + |\vec{b}|^2 + |\vec{c}|^2$
$+2(\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}) = 0$
$\Rightarrow 1 + 1 + 1 + 2(\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}) = 0$
$\Rightarrow \vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a} = -\frac{3}{2}$

119. **(d)** If given vectors are coplanar, then there exists two scalar quantities x and y such that

$2\hat{\imath} - \hat{\jmath} + \hat{k} = x(\hat{\imath} + 2\hat{\jmath} - 3\hat{k}) + y(3\hat{\imath} + a\hat{\jmath} + 5\hat{k})$

Comparing coefficient of $\hat{\imath}, \hat{\jmath}$ and $\hat{k}$ on both sides of (1)

we get $x + 3y = 2, 2x + ay = -1, -3x + 5y = 1$

Solving first and third equations, we get

$x = 1/2, y = 1/2$

Since the vectors are coplanar, therefore these values of x and y will satisfy the equation

$2x + ay = -1$
$\therefore 2(1/2) + a(1/2) = -1 \Rightarrow a = -4$

120. **(a)** Equation of the line through the given points is $\frac{x-3}{5-3} = \frac{y-4}{1-4} = \frac{z-1}{6-1} \Rightarrow \frac{x-3}{2} = \frac{y-4}{-3} = \frac{z-1}{5}$
Any point on this line can be taken as $(3 + 2\lambda, 4 - 3\lambda, 1 + 5\lambda)$
If this point lies on XY-plane then the z-coordinate is zero

$$\Rightarrow 1 + 5\lambda = 0 \Rightarrow \lambda = -\frac{1}{5}$$

Thus the required coordinates of the point are

$\left(3-\frac{2}{5}, 4-3\left(-\frac{1}{5}\right), 0\right) \equiv \left(\frac{13}{5}, \frac{23}{5}, 0\right)$

121. **(a)** The angle between two planes is the angle between their normals. From the equation of the planes, the normal vectors are $\vec{N}_1 = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{N}_2 = 3\hat{i} - 6\hat{j} - 2\hat{k}$

Therefore, $\cos\theta = \left|\frac{\vec{N}_1 \cdot \vec{N}_2}{|\vec{N}_1||\vec{N}_2|}\right|$

$$= \left|\frac{(2\hat{i}+\hat{j}-2\hat{k})\cdot(3\hat{i}-6\hat{j}-2\hat{k})}{\sqrt{4+1+4}\sqrt{9+36+4}}\right| = \left(\frac{4}{21}\right)$$

Hence, $\theta = \cos^{-1}\left(\frac{4}{21}\right)$

122. **(b)** In a box, $B_1 = 1R, 2\,W; B_2 = 2R, 3\,W$ and B3 =3R,4W

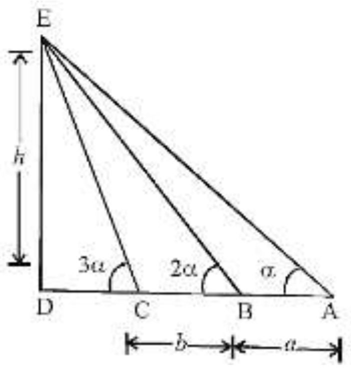
$$\text{Also, given that, } P(B_1) = \frac{1}{2}, P(B_2) = \frac{1}{3}$$
$$\text{and } P(B_3) = \frac{1}{6}$$

$$\therefore\ P\left(\frac{B_2}{R}\right) = \frac{P(B_2)P\left(\frac{R}{B_2}\right)}{P(B_1)P\left(\frac{R}{B_1}\right) + P(B_2)P\left(\frac{R}{B_2}\right) + P(B_3)P\left(\frac{R}{B_3}\right)}$$
$$= \frac{\frac{1}{3}\times\frac{2}{5}}{\frac{1}{2}\times\frac{1}{3}+\frac{1}{3}\times\frac{2}{5}+\frac{1}{6}\times\frac{3}{7}} = \frac{\frac{2}{15}}{\frac{1}{6}+\frac{2}{15}+\frac{1}{14}} = \frac{14}{39}.$$

123. **(c)** The sample space is [LWW, WLW]

$\therefore$ P(LWW) + P(WLW)
= Probability that in 5 match series, it is India's second win
= P(L)P(W)P(W) + P(W)P(L)P(W)
$= \frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$

124. **(c)**



Let $ED = h, \angle EAB = \alpha$

$\therefore\ \angle EBD = 2\alpha, \angle ECD = 3\alpha$

Now, $\angle DBE = \angle EAB + \angle BEA$

$\Rightarrow\ 2\alpha = \alpha + \angle BEA$
$\Rightarrow\ \angle BEA = \alpha = \angle EAB$

$\Rightarrow AB = EB = a$

Similarly, $\angle EBC = \alpha$

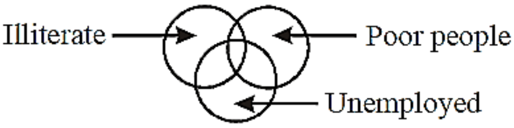
$$\text{In } \triangle EBC, \frac{BC}{\sin\alpha} = \frac{EB}{\sin(180^\circ - 3\alpha)}$$
$$\Rightarrow \frac{b}{\sin\alpha} = \frac{a}{\sin 3\alpha} \Rightarrow \frac{a}{b} = \frac{\sin 3\alpha}{\sin 3\alpha}$$
$$\Rightarrow \frac{a}{b} = \frac{3\sin\alpha - 4\sin^3\alpha}{\sin\alpha} = 3 - 4\sin^2\alpha$$
$$\Rightarrow 4\sin^2\alpha = 3 - \frac{a}{b} = \frac{3b-a}{b}$$
$$\Rightarrow \sin\alpha = \sqrt{\frac{3b-a}{4b}}$$

In $\triangle$ EBD, $\sin 2\alpha = \frac{ED}{EB}$

$$\Rightarrow\ ED = a\cdot 2\sin\alpha\cdot\cos\alpha$$
$$\Rightarrow\ h = 2a\sqrt{\frac{3b-a}{4b}}\cdot\sqrt{1-\frac{3b-a}{4b}}$$
$$= 2a\sqrt{\frac{3b-a}{4b}}\sqrt{\frac{b-a}{4b}}$$
$$= \frac{a}{2b}\sqrt{(a+b)(3b-a)}$$

125. **(a)** $x, y \geq 0$ and $4x + 3y \leq 24$.
126. **(b)** Sagacious means 'judicious', so 'wise' is correct answer.
127. **(a)** Remedial means 'reformative', so 'corrective' is correct answer.
128. **(d)** Reticent means 'quiet' so 'secretive' is correct answer:
129. **(d)** Fidelity means 'faithfulness in relations', so 'treachery' is correct antonym.
130. **(b)** Infrangible means 'strong', so 'breakable' is correct antonym.
131. **(b)** Progeny means 'child', so 'parent' is correct antonvm
132. **(c)** Use of 'draw' is more suitable for using before word 'conclusion', so option (c) is correct.
133. **(a)** Use of 'looking for' is proper because look for means 'to search for something' which suits here.
134. **(d)** 'Mind your language' is proper to use here because it gives proper sense of sentence.
135. **(b)** 'Use to' is used when any habit is to be shown, so use of option (b) is proper.
136. **(c)** 'Angry' agrees with preposition 'with', so use of option (c) is correct here.
137. **(b)** Laugh agrees with preposition 'at', so use of option (b) is correct here.
138. **(c)**
139. **(b)**
140. **(a)**
141. **(d)**
142. **(d)** From fig. 1, $93 - (27 + 63) = 93 - 90 = 3$
From fig. 2, $79 - (38 + 37) = 79 - 75 = 4$
From fig. 3, $67 - (16 + 42) = 67 - 58 = 9$

143. **(b)**



144. **(b)**

145. **(a)** From the information given in the question the arrangement of students is

1st $\longrightarrow$ D
2nd $\longrightarrow$ E
3rd $\longrightarrow$ C
4th $\longrightarrow$ A
5th $\longrightarrow$ B

146. **(b)** The given series follows the pattern

$1^3 + 1 = 2$
$2^3 + 1 = 8 + 1 = 9$
$3^3 + 1 = 27 + 1 = 28$
$4^3 + 1 = 64 + 1 = 65$
$5^3 + 1 = 125 + 1 = 126$

147. **(d)**

148. **(b)** Both Assertion and Reason are correct but India is a democratic country because the government is elected by its citizens and not because India has its own constitution.

149. **(b)**

150. **(c)**