1. (a)

$$\frac{\Delta P}{P} \times 100\% = \left(2\frac{\Delta a}{a} + 3\frac{\Delta b}{b} + \frac{\Delta c}{c} + \frac{1}{2}\frac{\Delta d}{d}\right) \times 100\%$$

$$= 2(1\%) + 3(2\%) + 3\% + \frac{1}{2} \times 4\% = 13\%$$

2. (d) $M = \frac{W}{g} = \frac{200}{10} = 20 \text{ kg}$

Acc. due to gravity at a depth $g' = g\left(1 - \frac{d}{R}\right)$

$d \rightarrow$ depth from surface

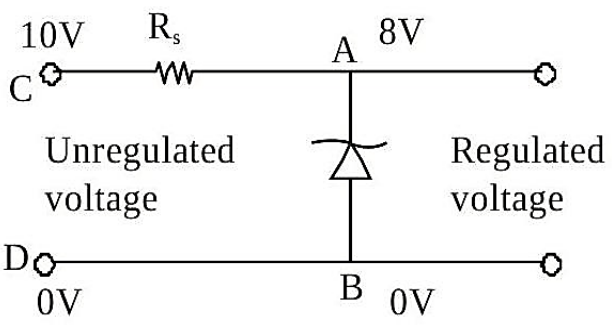
$$d = \frac{R}{2}$$

$$g' = g\left(1 - \frac{R/2}{R}\right) = \frac{g}{2} = 5 \text{ m/s}^2$$

weight $= m \times g$

at depth $R/2 = 20 \times 5 = 100$ N

3. (c)



$V_b = 8$ volt

$V_A - V_B = 8$ volt

Current through zener diode,

$$i = \frac{P}{V} = \frac{1.6 \text{ W}}{8 \text{ V}} = 0.2 \text{ A}$$

$V_C - V_A = 10 - 8$ volt

$$\therefore R = \frac{V_C - V_A}{i} = \frac{2 \text{ V}}{0.2 \text{ A}} = 10\Omega$$

4. (c) $R = \frac{v^2 \sin 2\theta}{g}$

$R \propto \sin(2\theta)$

$$\frac{R_1}{R_2} = \frac{\sin(2\theta_1)}{\sin(2\theta_2)} = \frac{\sin(2 \times 15)}{\sin(2 \times 45)} = \frac{\sin 30^\circ}{\sin 90^\circ}$$

$\frac{50}{R_2}=\frac{1}{2}$

$R_2=100 \text{ m}$

5. (b) Given, $A_c=15 \text{ V}$

$A_m=3 \text{ V}$

Maximum amplitude of modulated wave

$A_{max}=A_c+A_m=15+3=18 \text{ V}$

Minimum amplitude of modulated wave

$A_{min}=A_c-A_m=15-3=12 \text{ V}$

$\therefore \frac{A_c+A_m}{A_c-A_m}=\frac{18}{12}=\frac{3}{2}$

6. (c) $L=mvr,\ r \propto n^2,\ v \propto \frac{1}{n}$

$\therefore L \propto n$

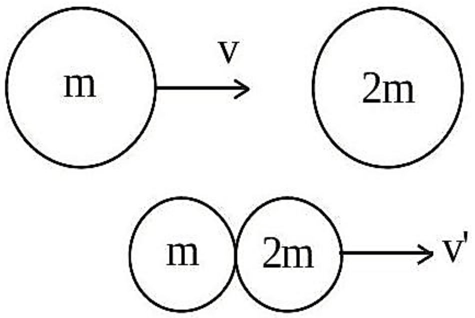
Also, $L=\frac{nh}{2\pi}$, Bohr orbit is, $L_1=L=\frac{1.h}{2\pi}$

$L_2=2[L]=2L$

$L_2=\frac{2h}{2\pi}$

So, change $=L_2-L_1=2L-L=L$

7. (c)



Applying conservation of linear momentum

$\Rightarrow \vec{P}_i=\vec{P}_f$

$mv+2m\times 0=(3m)v'$

$\therefore mv=3mv,$

$v'=\frac{v}{3}$

8. **(d)** For a moving coil galvanometer

$\mathrm{BiNA} = \mathrm{k}\theta$

$\theta = \left(\frac{\mathrm{BNA}}{\mathrm{k}}\right)\mathrm{i}$; Current sensitive $= \frac{\mathrm{BNA}}{\mathrm{k}}$

So, if N is doubled then current sensitivity is doubled.

Voltage sensitivity

$\mathrm{B}\frac{\mathrm{V}}{\mathrm{R}}\mathrm{NA} = \mathrm{k}\theta$

$\mathrm{V} = \frac{\mathrm{BNA}}{\mathrm{Rk}}\theta$, as N is doubled R is also doubled.

So, no change in voltage sensitivity.

9. **(c)** Factual

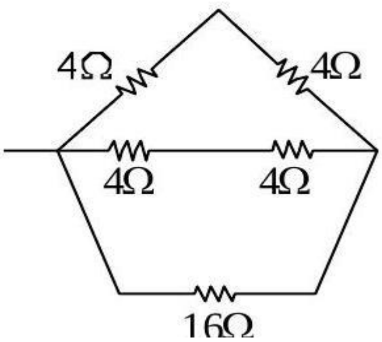
Type of gases	No. of degrees of freedom
Monoatomic gas	3 T
Diatomic + rigid	3 T + 2R
Diatomic + non-rigid	3 T + 2R + 1 V
Polyatomic	3 T + 3R + More than 1 V

T = Translational degree of freedom

R = Rotational degree of freedom

V = Vibrational degree of freedom

10. **(b)** The circuit can be reduced to



$\Rightarrow R_{eq} = \frac{16 \times 4}{16+4} = \frac{16}{5}\Omega$

$= R_{eq} = 3.2\Omega$

11. (d) Isothermal process, $T =$ constant

$PV = nRT =$ constant

$P_1 V_1 = P_2 V_2$

$PV = P_A(V/8)$

$P_A = 8P$

Adiabatic process, $PV^{\gamma} =$ constant

γ for monoatomic gas is $\frac{5}{3}$.

$P_1 V_1{}^{\gamma} = P_2 V_2^{\gamma}$

$$\frac{P_B}{P} = \left(\frac{V_1}{V_2}\right)^{\gamma} = \left(\frac{V}{V/8}\right)^{\frac{5}{3}}$$

$P_B = 32P$

$$\frac{P_B}{P_A} = \frac{32P}{8P} = 4$$

12. (c) Power will be maximum when impedance is minimum

$Z = [R^2 + (X_L - X_C)^2]^{\frac{1}{2}}$

At resonance, $X_L = X_C$

$Z_{min} = R$

13. (c) $v = \sqrt{\frac{GM}{r}}$

$$v \propto \frac{1}{\sqrt{r}} \Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{r_2}{r_1}} = \sqrt{\frac{3r}{r}}$$

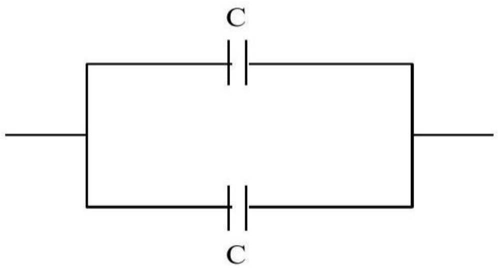
$= \sqrt{3}:1$

14. (b) Pressure in a static liquid will be same at each point on same horizontal level.

$\therefore P = P_{atm} + \rho gh$

As per Pascal law, same pressure applied to enclosed water is transmitted in all directions equally.

15. (c) The circuit can be reduced to



Parallel combination

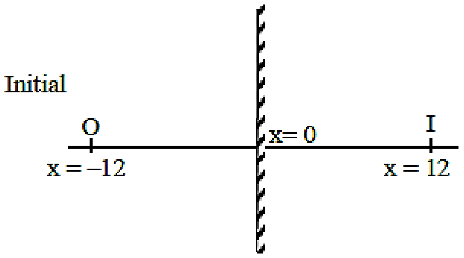
$C_{eq} = C + C = 2C$

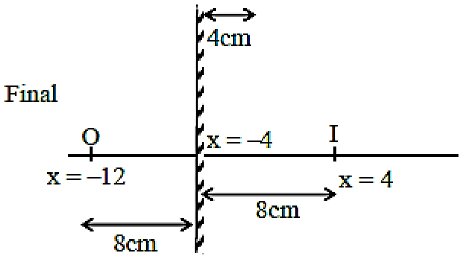
16. (c) $E = E_0 \sin(\omega t - kx)$

Energy density $\left(\frac{du}{dv}\right) = \varepsilon_0 E_0^2 \sin^2(\omega t - kx)$

$\frac{\varepsilon_0 E_0^2}{2}[1 - \cos(2\omega t - 2kx)]$

17. (b)





∴ Shifting of image will be 8 cm towards mirror.

18. (a) From K.T.G.

$v_{RMS} = \sqrt{\frac{3k_B T}{m}}$

$v_{RMS} \propto \sqrt{T}$

and $\frac{h}{mv_{RMS}} = \lambda$ i.e., $\lambda \propto \frac{1}{\sqrt{T}}$

$\frac{\lambda_2}{\lambda_1} = \sqrt{\frac{T_1}{T_2}} = \sqrt{\frac{300}{600}} = \frac{1}{\sqrt{2}}$

$\lambda_2 = \frac{\lambda_1}{\sqrt{2}}$

19. (a)

$X = A\sin(\omega t + \delta)$

$\frac{A}{2} = A\sin(\omega t + \delta)$

$V = A\omega\cos(\omega t + \delta)$

At $t = 0$ in 1^{st} quadrant or 4^{th}

$\sin\delta = \frac{1}{2} \Rightarrow \delta = \frac{\pi}{6}, \frac{5\pi}{6}$ quadrant

$\therefore$ Common solution is $\delta = \frac{\pi}{6}$

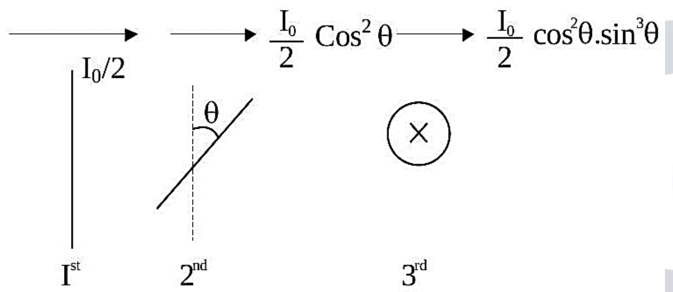
20. (a) As slope of B > Slope of A

$\therefore V_B > V_A$

Also, $t_B < t_A$

21. (30)

$I_0 = 32 w/m^2$



$I_{net} = 3 = \frac{32}{2}\cos^2\theta \cdot \sin^2\theta$

$\frac{3}{4} = 4\sin^2\theta \cdot \cos^2\theta = (\sin 2\theta)^2$

$\frac{\sqrt{3}}{2} = \sin(2\theta)$

Hence, $\theta = 30°$ and $60°$

22. (245)

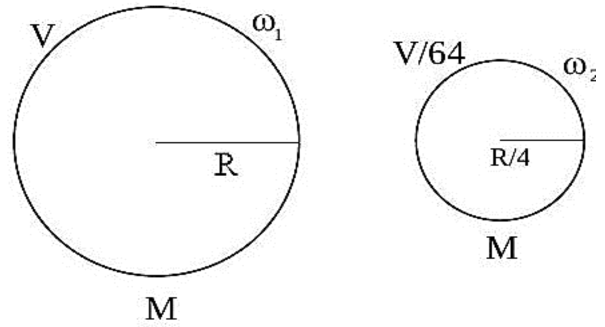
$r_{avg} = 15$ cm

$w_f + w_g = \Delta KE$

$w_f + 10 \times 0.3 = -\frac{1}{2} \times 484$

$W_f = -245 \text{ J}$

23. (16) From conservation of angular momentum



$\frac{2}{5}MR^2\omega_1 = \frac{2}{5}M\left(\frac{R}{4}\right)^2 \omega_2$

$\Rightarrow MR^2\omega_1 = \frac{MR^2}{16}\omega_2$

$\Rightarrow \frac{\omega_1}{\omega_2} = \frac{1}{16} \Rightarrow \frac{T_2}{T_2} = \frac{1}{16} \Rightarrow \frac{T_1}{T_2} = \frac{16}{1} = \frac{t_1}{x}$

$\therefore t_1 = 24 \Rightarrow \frac{16}{1} = \frac{24}{t_2} \Rightarrow x = 16$

24. (6) $I = H$

Given, $I = 2.4 \times 10^3 \text{ A/m}$

$2.4 \times 10^3 = H = ni$

$n = \frac{N}{\ell}$

$2.4 \times 10^3 = \frac{60}{15 \times 10^{-2}} i$

$i = \frac{2.4 \times 15 \times 10}{60} = \frac{36}{6} = 6 \text{ A}$

25. (18) $F = i\ell B$

$= \left(\frac{\varepsilon}{R}\right)\ell B = \left(\frac{vB\ell}{R}\right)\ell B = \frac{vB^2\ell^2}{R} = \frac{4}{5} \times \left(\frac{15}{100}\right)^2 \times 1^2$

$= \frac{4}{5} \times \frac{225}{10^4}$

$= \frac{180}{10^4} = 0.018 \text{ N}$

$= 18 \times 10^{-3} \text{ N}$

26. (20)

$y(x,t) = 5\sin(6t + 0.003x)$

$k = 0.003\ cm^{-1},\ \omega = 6 rad/s, v = \frac{\omega}{k}$

$\Rightarrow \frac{6}{0.003 \times 10^2} = 20\ ms^{-1}$

27. (15) $\lambda = 1.5 \times 10^{-5}\ s^{-1}$

No. of mole $= \frac{1\times10^{-6}}{60} = \frac{10^{-7}}{6}$

No. of atoms $=$ no. of moles $\times N_A$

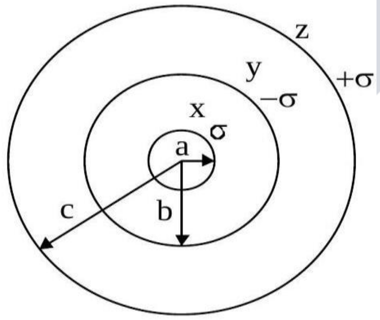
$= \frac{10^{-7}}{6} \times 6 \times 10^{23} = 10^{16}$

$A = N_0 \lambda e^{-\lambda t}$

For, $t = 0$, $A = A_0 = N_0\lambda$

$= 1.5 \times 10^{-5} \times 10^{16} = 15 \times 10^{10}$ Bq.

28. (5)



$q_x = \sigma 4\pi a^2$

$q_y = -\sigma 4\pi b^2$

$q_z = \sigma 4\pi c^2$

Potential x = potential z

$V_x = V_z$

$\frac{q_x}{4\pi\varepsilon_0 a} + \frac{q_y}{4\pi\varepsilon_0\ b} + \frac{q_z}{4\pi\varepsilon_0 c} = \frac{q_x}{4\pi\varepsilon_0 c} + \frac{q_y}{4\pi\varepsilon_0 c} + \frac{q_z}{4\pi\varepsilon_0 c}$

$\frac{\sigma 4\pi a^2}{a} - \frac{\sigma 4\pi b^2}{b} + \frac{\sigma 4\pi c^2}{c} = \frac{4\pi\sigma[a^2 - b^2 + c^2]}{c}$

$c(a - b + c) = a^2 - b^2 + c^2$

$c(a - b) = a^2 - b^2$

$c = a + b$

$c = 5$ cm

29. (100) Maximum resistance occurs

When all the resisters are connected in series combination

$\therefore R_{max} = 10R$

Here $R = 10$ ohm

Minimum resistance occurs

When all the resistance are connected in parallel combination

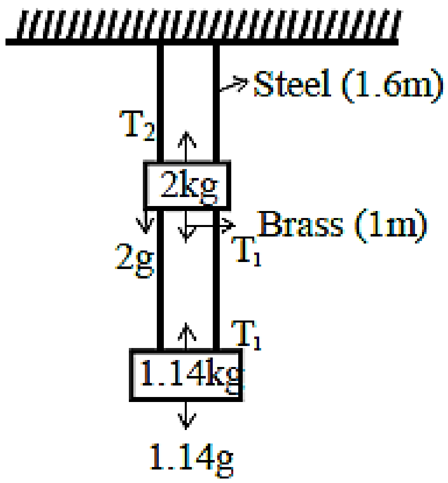
$R_{min} = \frac{R}{10}$

$\therefore \frac{R_{max}}{R_{min}} = 100$

30. (20) Tension in steel wire $T_2 = 2\,g + T_1$

$T_2 = 20 + 11.4$

$= 31.4$ N



Elongation in steel wire $\Delta L = \frac{T_2 L}{Ay}$

$$\Delta L = \frac{31.4 \times 1.6}{\pi(0.2 \times 10^{-2})^2 \times 2 \times 10^{11}}$$

$$\Delta L = \frac{16}{2 \times 4 \times 10^{-6} \times 10^{11}}$$

$= 2 \times 10^{-5}$ m

$= 20 \times 10^{-6}$ m

31. (d) If any component eluted second then it means that its R_f value is low and its adsorption is stronger

$R_f = \dfrac{\text{distance covered by substance from base line}}{\text{total distance covered by solvent from base line}}$

32. (a) Prolonged heating will cause oxidation of Fe^{+2} to Fe^{+3}

33. (b)

$CaO + H_2O \rightarrow Ca(OH)_2$

A (less soluble)

$\underset{Ba(OH)}{2} + CO_2 \rightarrow CaCO_3 + H_2O$

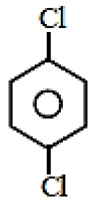
B (insoluble)

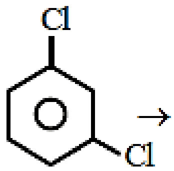
$CaCO_3 + H_2O + CO_2 \rightarrow \underset{\text{Soluble}}{Ca(HCO_3)_2}$

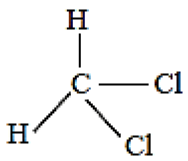
34. (c)

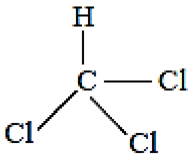
(1) Benzene → non polar

Anisidine → polar

(2)  → Non polar

 → polar

(3) CH_2Cl_2, $\mu_{net} \neq 0$ polar 

$CHCl_3$, $\mu_{net} \neq 0$ polar 

(4)  ⇒ polar

 ⇒ non polar

35. (a) Steel plant produces slag from blast furnace. Thermal power plant produces fly ash, Fertilizer industries produces gypsum. Paper mills produces bio degradable waste

36. (a)

(P) Gabriel phthalimide synthesis is used for the preparation of aliphatic primary amines. Aromatic primary amines cannot be prepared by this method.

(Q) 2°-amines reacts with Hinsberg's reagent to give solid insoluble in NaOH

(R) Aromatic primary amine react with nitrous acid at low temperature $(273 - 298\ K)$ to form diazonium salts, which form Red dye with β Naphthol

37. (c) (a) $K_2Cr_2O_7$ is used as primary standard. The concentration $Na_2Cr_2O_7$ changes in aq. solution.

(b) It is less soluble than $Na_2Cr_2O_7$.

38. (c) 2° and 3° structure of proteins are stabilized by hydrogen bonding, disulphide linkages, Van der Waals force of attraction and electrostatic force of attraction

39. (a)

$T_1 = 1270\ \mathrm{K}\ \ T_2 = 673\ \mathrm{K}$

$T_1 > T_2$ on the basis of data

40. (a)

(A) The M^{3+}/M^{2+} reduction potential for manganese is greater than iron

(B) $E^0_{Fe^{+3}/Fe^{+2}} = +0.77$

$E^0_{Mn^{+3}/Mn^{+2}} = +1.57$

(C) $E^0_{Cr^{+3}/Cr^{+2}} = -0.26$

$\therefore\ Cr^{2\oplus} + H^{\oplus} \longrightarrow Cr^{3\oplus} + \frac{1}{2}H_2$

(D) $V^{2\oplus}$ = 3 unpaired electron Magnetic Moment = 3.87 B.M

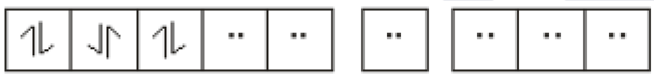
41. (d) Cresol is used as stabilizer.

42. (d)

(a) Paramagnetic, High Spin & Tetrahedral
(b) Paramagnetic, High Spin & Octahedral
(c) Paramagnetic, High Spin & Octahedral
(d) Diamagnetic, Low Spin & Octahedral
$[Co(NH_3)_6]^{3+}$, CN = 6 (Octahedral)

$NH_3 = SFL$

$Co^{+3} = [Ar]3\,d^6$



Diamagnetic & Low spin complex

43. (a) Target equation

$$C\ (\text{graphite}) + \frac{1}{2}O_{2(g)} \rightarrow CO_{(g)} \ldots\ldots(i)\ \Delta H$$
$$C\ (\text{graphite}) + O_{2(g)} \rightarrow CO_{2(g)}.(ii)\ \Delta H_1 = -y\,\mathrm{kJ/mole}$$
$$CO_{2(g)} \rightarrow CO_{(g)} + \frac{1}{2}O_{2(g)} \ldots\ (iii)\ \Delta H_2 = \frac{x}{2}\ \mathrm{kJ/mole}$$
$$\text{eq. (i)} = \text{eq.(ii)} + \text{eq (iii)}$$
$$\therefore \Delta H = \frac{x}{2} - y = \frac{x-2y}{2}$$

44. (a) Sodium superoxide is not stable

45. (d)

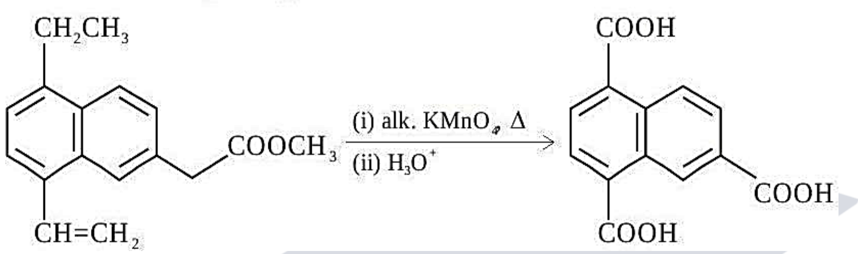
(A) Nylon-2-nylon-6
Biodegradable polymer and polyamides (II)
(B) Buna- N → Butadiene acrylonitrile rubber → synthetic rubber (III)
(C) Urea-formaldehyde resin → Thermosetting polymer (I)
(D) Dacron → Polyester polymer of ethylene glycol and terephthalic acid (IV)

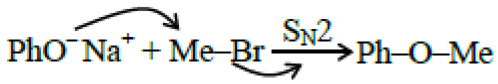
46. (d) Number of moles of $O_2 = \frac{2.8375}{22.7} = 0.125$

$\Rightarrow$ Number of molecules $= 0.125\ N_A$

$= 7.525 \times 10^{22}$

47. (a) Adsorption is exothermic process due to decrease in surface energy Micelle formation is endothermic
48. (d) $KMnO_4$ oxidises benzylic carbon containing atleast one α-hydrogen atom to $-COOH$.





49. (c)
50. (b) All are correct

(A) S_N2 reaction decreases with increase in steric crowding.

(B) S_N1 reaction increases with stability of carbocation.

(C) EAS reaction decreases with decrease in electron density.

(D) Presence of electron withdrawing group at ortho and para-position to a halogen in haloarene increase nucleophilic aryl substitution.

51. (3)
52. (3) N_3^- linear

NO_2^- bent

I_3^- linear

O_3 bent

SO_2 bent

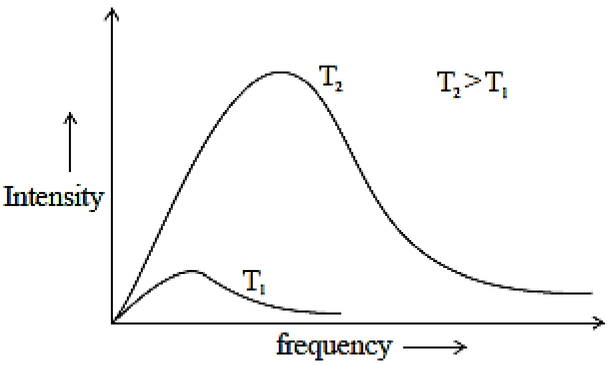
53. (2)

$$\frac{1}{t_{1/2}} = \frac{1}{3} + \frac{1}{12} = \frac{4+1}{12} = \frac{5}{12}$$

$$t_{1/2} = \frac{12}{5}\min = 2.4$$

Ans. is 2

54. (0) A blackbody can emit and absorb all the wavelengths in electromagnetic spectrum ⇒ (A) is correct



⇒ (B), (C), (D) correct Ans (0)

55. (5)

$$Na_2O + H_2O \rightarrow 2NaOH$$
$$Cl_2O_7 + H_2O \rightarrow 2HClO_4$$
$$1 + 4 = 5$$

56. (1825)

$$FeO_4^{2-} \xrightarrow[n=3]{2.2V} Fe^{3+} \xrightarrow[n=1]{0.7V} Fe^{2+} \xrightarrow{-0.45V} Fe$$

$$\underbrace{FeO_4^{2-} \rightarrow Fe^{2+}}_{E\,=\,?}$$

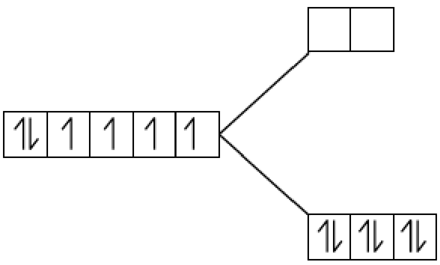
$$n = 4$$

$$4 \times E = 3 \times 2.2 + 1 \times 0.7$$
$$E = \frac{7.3}{4} = 1.825V = 1825 \times 10^{-3}V$$

57. (30)

$$i = 1 + \alpha \text{ (for HA)}$$
$$= 1.3$$
$$\%\text{ increase } = \frac{(\Delta T_f)_{obs} - (\Delta T_f)_{cal}}{(\Delta T_f)_{cal}} \times 100$$
$$= \frac{K_f \times i \times m - K_f \times m}{K_f \times m} \times 100$$
$$= \frac{i-1}{1} \times 100 = 30\%$$

58. (3) $K_4[Fe(CN)_6]$



$t_{2g}^6 e_g^0$

$Fe^{+2} = [Ar]3\,d^6$
$CN^- = SFL$

t_{2g} contain 6 electron so it become 3 pairs: -

59. (1567)

$P_1\,V_1 = P_2\,V_2$

$940.3 \times 100 = P_2 \times 60$

$P_2 = 1567$ mm of Hg

60. (1) $IF_5 = 1$ lone pair

$IF_7 = 0$ lone pair

$1 + 0 = 1$

61. (a) $AB = OB - OA$

$= (2\hat{i} + 4\hat{j} - 2\hat{k}) - (-2\hat{i} + \hat{j} - 3\hat{k})$

$= 4\hat{i} + 3\hat{j} + \hat{k}$

$\overrightarrow{AC} = \overrightarrow{OC} - \overrightarrow{OA} = -2\hat{i} + \hat{j} + 2\hat{k}$

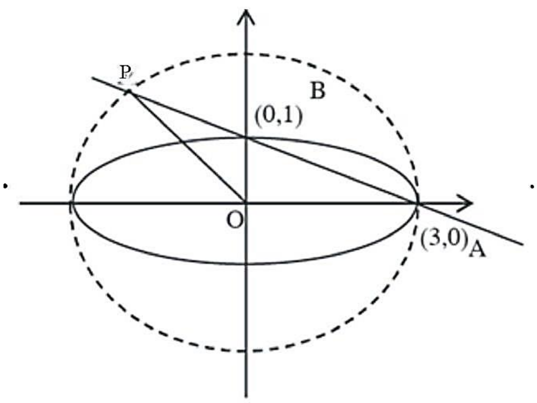
$\overrightarrow{AB} \times \overrightarrow{AC} = 5\hat{i} - 10\hat{j} + 10\hat{k}$

$\overrightarrow{OP} = -\hat{i} - 2\hat{j} + 3\hat{k}$

Projection

$$= \frac{(\overrightarrow{OP}) \cdot (\overrightarrow{AB} \times \overrightarrow{AC})}{|\overrightarrow{AB} \times \overrightarrow{AC}|} = 3$$

62. (c)



For line AB$x + 3y = 3$ and circle is $x^2 + y^2 = 9$

$(3 - 3y)^2 + y^2 = 9$

$\Rightarrow 10y^2 - 18y = 0$

$\Rightarrow y = 0, \frac{9}{5}$

$\therefore$ Area $= \frac{1}{2} \times 3 \times \frac{9}{5} = \frac{27}{10}$

$m - n = 17$

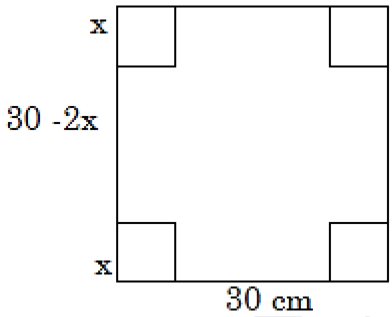
63. (b) Let $f(x) = \frac{Ax+B}{Cx-A}$

$$f(f(x)) = \frac{A\left(\frac{Ax+B}{Cx-A}\right) + B}{C\left(\frac{Ax+B}{Cx-A}\right) - A} = x$$

$$f\left(f\left(\frac{4}{x}\right)\right) = \frac{4}{x}$$

$$f(f(x)) + f\left(f\left(\frac{4}{x}\right)\right) = x + \frac{4}{x} \geq 4(\text{ by A.M. } \geq \text{ G.M. })$$

64. (c)



Volume $(V) = x(30 - 2x)^2$

$\frac{dV}{dx} = (30 - 2x)(30 - 6x) = 0$

$x = 5$ cm

Surface area $= 4 \times 5 \times 20 + (20)^2 = 800 \text{ cm}^2$

65. (a) Differentiate the given equation

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

$\Rightarrow x^2 \frac{dy}{dx} - 2xy = 1$

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

$\text{I. F.} = e^{\int \frac{2}{x} \ln x} = \frac{1}{x^2}$

$\therefore y\left(\frac{1}{x^2}\right) = \int \frac{1}{x^4} dx$

$$\Rightarrow \frac{y}{x^2} = \frac{-1}{3x^3} + c$$

$$\Rightarrow y = -\frac{1}{3x^3} + c$$

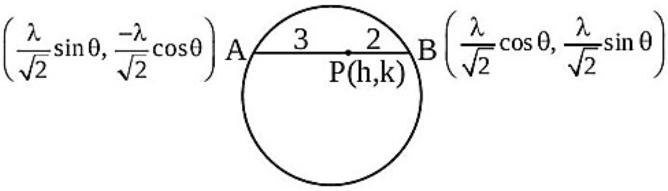
$$\Rightarrow y = -\frac{1}{3x} + cx^2$$

$$\because f(a) = \frac{2}{3} = -\frac{1}{3} + c \Rightarrow c = 1$$

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

$$18f(c) = 160$$

66. (d)



$$h = \frac{\frac{2\lambda}{\sqrt{2}\sin\theta} + 3 \times \frac{\lambda}{\sqrt{2}}\cos\theta}{5}$$

$$k = \frac{\frac{-2\lambda}{\sqrt{2}} 2\cos\theta + \frac{3\lambda}{\sqrt{2}}\sin\theta}{5}$$

$$h^2 + k^2 = \frac{19\lambda^2}{5}$$

$$r = \frac{\sqrt{19}\lambda}{5}$$

67. (d) $\frac{2z-3i}{2z+i}$ is purely imaginary

$$\therefore \frac{2z-3i}{2z+i} + \frac{2\bar{z}+3i}{2\bar{z}-i} = 0$$

$$z = x + iy$$

$$\Rightarrow 4x^2 + 4y^2 - 4y - 3 = 0$$

Given that $x + y^2 = 0$

$$y^4 + y^2 - y = 3/4$$

68. (a)

$$P = 96\cos\frac{\pi}{33}\cos\frac{2\pi}{33}\cos\frac{4\pi}{33}\cos\frac{8\pi}{33}\cos\frac{16\pi}{33}$$

$$2P \times \sin\frac{\pi}{33} = 96 \times 2\sin\frac{\pi}{33}\cos\frac{\pi}{33}\cos\frac{2\pi}{33}\cos\frac{4\pi}{33}\cos\frac{8\pi}{33}\cos\frac{16\pi}{33}$$

$$2P \times \sin\frac{\pi}{33} = 6 \times \sin\frac{32\pi}{33} = 6\sin\frac{\pi}{33}$$

$P = 3$

69. (a)

$$|3\text{adj}\,|3A|A^2| = 3^3|\text{adj}(54A^2)| = 3^3 \cdot |54A^2|^2$$

$$= 3^3 \times 54^6 \times |A|^4 = 3^{11} \times 6^{10}$$

70. (b) $\frac{dy}{dx} = \frac{1+\left(\frac{y}{x}\right)^2}{2\left(\frac{y}{x}\right)}$

Let $y = tx$

$$\Rightarrow t + x\frac{dt}{dx} = \frac{1+t^2}{2t}$$

$$\Rightarrow x\frac{dt}{dx} = \frac{1-t^2}{2t}$$

$$\Rightarrow \int \frac{2t}{1-t^2}dt = \int \frac{dx}{x}$$

$$\Rightarrow \ln|1-t^2| = \ln x + \ln c$$

$$\Rightarrow (1-t^2)(cx) = 1$$

$$\Rightarrow \left(1-\frac{y^2}{x^2}\right)cx = 1$$

$$y(b) = 0 \Rightarrow c = \frac{1}{2}$$

$$\left(1-\frac{y^2}{x^2}\right)\cdot\frac{1}{2}x = 1$$

at $x = 8$

$$\left(1-\frac{y^2}{64}\right)\times\frac{8}{2} = 1$$

$y = \pm 4\sqrt{3}$

71. (c)

$$\Delta = \begin{vmatrix} 2 & -1 & 3 \\ 3 & 2 & -1 \\ 4 & 5 & \alpha \end{vmatrix} = 7(\alpha + 5)$$

$\Delta_1 = \begin{vmatrix} 5 & -1 & 3 \\ 7 & 2 & -1 \\ \beta & 5 & \alpha \end{vmatrix} = 17\alpha - 5\beta + 130$ $\Delta_2 = \begin{vmatrix} 2 & 5 & 3 \\ 3 & 7 & -1 \\ 4 & \beta & \alpha \end{vmatrix} = -11\beta + \alpha + 104$

$\Delta_3 = \begin{vmatrix} 2 & -1 & 5 \\ 3 & 2 & 7 \\ 4 & 5 & \beta \end{vmatrix} = 7(\beta - 9)$

For infinitely many solutions

$\Delta = \Delta_1 = \Delta_2 = \Delta_3 = 0$

For $\alpha = -5$ and $\beta = 9$

72. (a) $N =$ Sum of the numbers when two dice are rolled such that $2^N < N!$

$\Rightarrow 4 \leq N \leq 12$

Probability that $2^N \geq N!$

Now $P(N = 2) + P(N = 3) = \frac{1}{36} + \frac{2}{36} = \frac{3}{36} = \frac{1}{12}$

Required probability $= 1 - \frac{1}{12} = \frac{11}{12} = \frac{m}{n}$

$4m - 3n = 8$

73. (c) $P = (3\lambda - 3, \lambda - 2, 1 - 2\lambda)$

P lies on the plane, $x + y + z = 2$

$\Rightarrow \lambda = 3$

$P = (6, 1, -5)$

$q = \left|\frac{18 - 4 - 60 - 32}{\sqrt{9 + 16 + 144}}\right| = \frac{78}{13} = 6$

$q = 6, 2q = 12$

Equation, $x^2 - 18x + 72 = 0$

74. (a) $\sim [(p \vee q) \wedge (q \vee (\sim p)]$

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

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

Apply distribution law

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

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

75. (b)

$$T_{r+1} = {}^{13}C_r(ax)^{13-r}\left(-\frac{1}{bx^2}\right)^r$$

$$= {}^{13}C_r(a)^{13-r}\left(-\frac{1}{b}\right)^r x^{13-3r}$$

$13 - 3\mathbf{r} = 7 \Rightarrow r = 2$

Coefficient of $x^7 = {}^{13}C_2(a)^{11} \cdot \frac{1}{b^2}$

In the other expansion $T_{r+1} = {}^{13}C_r(ax)^{13-r}\left(\frac{1}{bx^2}\right)^r$

$13 - 3r = -5 \Rightarrow r = 6$

Coefficient of $x^{-5} = {}^{13}C_6(a)^7 \cdot \frac{1}{b^6}$

$${}^{13}C_2\frac{a^{11}}{b^2} = {}^{13}C_6\frac{a^7}{b^6}$$

$$a^4b^4 = \frac{{}^{13}C_6}{{}^{13}C_2} = 22$$

76. (b) Given, $A(2,4,6), B(0,-2,-5)$

$G(2,1,-1)$

Let vertex $C(x,y,z)$

$$\frac{2+0+x}{3} = 2 \Rightarrow x = 4$$

$$\frac{4-2+y}{3} = 1 \Rightarrow y = 1$$

$$\frac{6-5+z}{3} = -1 \Rightarrow z = -4$$

Third vertex, C(4, 1, -4)

Then image of vertex in the plane let image (α, β, γ)

i.e,. $\frac{\alpha-4}{1} = \frac{\beta-1}{2} = \frac{\gamma+4}{4} = \frac{-2(4+2-16-11)}{21}$

$\alpha = 6, \beta = 5, \gamma = 4$

$\alpha\beta + \beta\gamma + \gamma\alpha = 30 + 20 + 24 = 74$

77. (b)

$$\frac{x+2}{1} = \frac{y}{-2} = \frac{z-5}{2} \;\&\; \frac{x-4}{1} = \frac{y-1}{2} = \frac{z+3}{0}$$

Formula for shortest distance

$$\text{S.D.} = \frac{\begin{vmatrix} x_2 - x_1 & y_2 - y_1 & z_2 - z_1 \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix}}{\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix}}$$

$$= \frac{\begin{vmatrix} 6 & 1 & -8 \\ 1 & -2 & 2 \\ 1 & 2 & 0 \end{vmatrix}}{\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -2 & 2 \\ 1 & 2 & 0 \end{vmatrix}} = \frac{54}{6} = 9$$

78. (c)

$$\mathrm{I(x)} = \int \frac{e^{\sin x} \cdot \sin 2x}{\mathrm{II}} \cdot \frac{\cos x}{\mathrm{I}} dx - \int e^{\sin^2 x} \cdot \sin x dx$$

$$\Rightarrow \mathrm{I(x)} = e^{\sin^2 x} - \int (-\sin x) \cdot e^{\sin^2 x} dx - \int e^{\sin^2 x} \cdot \sin x dx$$

$$\Rightarrow \mathrm{I(x)} = e^{\sin^2 x} \cdot \cos x + c$$

Put $x = 0, c = 0$

$$\therefore \mathrm{I}\left(\frac{\pi}{3}\right) = e^{\frac{3}{4}} \cdot \cos\frac{\pi}{3} = \frac{1}{2} e^{\frac{3}{4}}$$

79. (a)

$$\Rightarrow a^2 + a^2 r^2 + a^2 r^4 = 33033$$

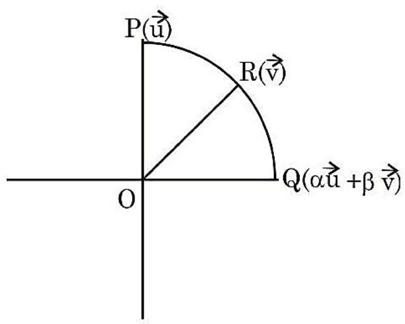
$$\Rightarrow a^2(r^4 + r^2 + 1) = 3 \times 7 \times 11^2 \times 13 \Rightarrow a = 11$$

$$\Rightarrow r^4 + r^2 + 1 = 273 \;\Rightarrow r^4 + r^2 - 272 = 0$$

$$\Rightarrow (r^2 + 17)(r^2 - 16) = 0 \Rightarrow r^2 = 16 \Rightarrow r = \pm 4$$

$$t_1 + t_2 + t_3 = a + ar + ar^2 = 11 + 44 + 176 = 231$$

80. (a)



$$|\vec{u}| = |\vec{v}| = |\alpha\vec{u} + \beta\vec{v}|$$

$$(\vec{u}) \cdot (\alpha\vec{u} + \beta\vec{v}) = 0$$

$\vec{u}.\vec{v} = |u||v|\cos 45°$

$\alpha = -\frac{\beta}{\sqrt{2}}$

$= |\alpha\vec{u} + \beta\vec{v}| = r$

$\alpha^2 + \beta^2 + \sqrt{2}\alpha\beta = 1$

$\alpha = -1, \beta^2 = 2$

81. (960)

General term $= \frac{10!}{r_1! \cdot r_2! \cdot r_3!}(-1)^{r_2} \cdot (2)^{r_3} x^{r_2+3r_3}$

where $r_1 + r_2 + r_3 = 10$ and $r_2 + 3r_3 = 7$

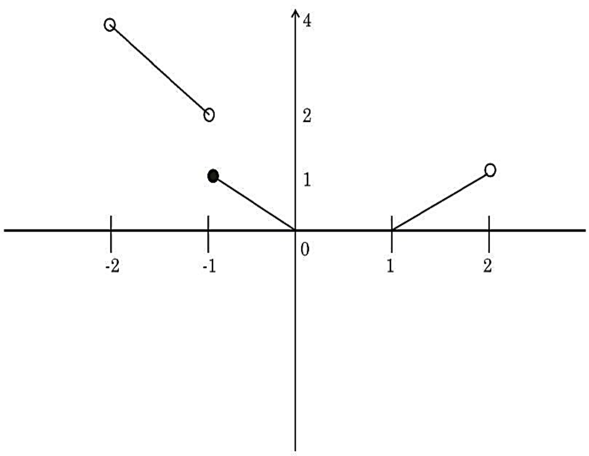
r_1	r_2	r_3
3	7	0
5	4	1
7	1	2

Required coefficient

$$= \frac{10!}{3!\cdot 7!}(-1)^7 + \frac{10!}{5!\cdot 4!}(-1)^4(2) + \frac{10!}{7!\cdot 2!}(-1)^1(2)^2$$
$$= -120 + 2520 - 1440 = 960$$

82. (4)

$$f(x) = \begin{cases} x[x] & , -2 < x < 0 \\ (x-1)[x] & , 0 \le x < 2 \end{cases}$$



$|f(x)| =$ Remain same

$m = 1, n = 3$

$m + n = 4$

83. (9525) Required sum $= (3+8+13+18++373)$

$-(3+18+33+\cdots\ldots+363)$

$= \frac{75}{2}(3+373) - \frac{25}{2}(3-363)$

$= 75 \times 188 - 25 \times 183$

$= 9525$

84. (32) General tangent of slope m to the circle $(x-4)^2 + y^2 = 16$ is given by $y = m(x-4) \pm 4\sqrt{1+m^2}$

General tangent of slope m to the parabola $y^2 = 4x$ is given by $y = mx + \frac{1}{m}$

For common tangent $\frac{1}{m} = -4m \pm 4\sqrt{1+m^2}$

$m = \pm\frac{1}{2\sqrt{2}}$

Point of contact on parabola is $(8, 4\sqrt{2})$

Length of tangent PQ from $(8, 4\sqrt{2})$ on the circle $(x-4)^2 + y^2 = 16$ is equal to $\sqrt{(8-4)^2 + (4\sqrt{2})^2 - 16}$ is equal to $\sqrt{32}$

PQ^2 is equal to 32

85. (4898)

Digits → 1,2,3,4,5,6,7
Total permutations = 7 !
Let A = number of numbers containing string 153
Let B = number of numbers containing string 2467

$n(A) = 5! \times 1$	153	2467
$n(B) = 4! \times 1$	2467	135
$n(A \cap B) = 2!$	153	2467

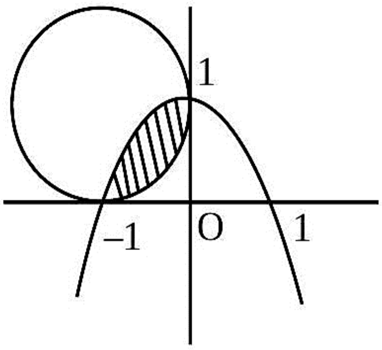
$n(A \cup B) = 5! + 4! - 2! = 142$

n(neither string 153 nor string 2467)

$=$ Total $- n(A \cup B)$

$= 7! - 142 = 4898$

86. (8)
87. (16) There can be infinitely many parabolas through given points.



$A=\int_{-1}^{0}(1-x^2)-\left(x-\sqrt{1-(x+1)^2}\right)dx$

$=\int_{-1}^{0}-x^2+\sqrt{1-(x+1)^2}dx$

$=\left(-\frac{x^3}{3}+\frac{x+1}{2}=\sqrt{1-(x+1)^2}+\frac{1}{2}\cdot\sin^{-1}\left(\frac{x+1}{1}\right)\right)_{-1}^{0}$

$A=\frac{\pi}{4}-\left(\frac{1}{3}\right)$

$\therefore\ 12(\pi-4\text{ A})=12\left(\pi-4\left(\frac{\pi}{4}-\frac{1}{3}\right)\right)=16$

88. (151)

Given mean is $=28$

$$\frac{2\times5+3\times15+x\times25+5\times35+4\times45}{14+x}=28$$

$x=6$

$$\text{Variance }=\left(\frac{\sum x_i^2 f_i}{\sum f_i}\right)-(\text{ mean })^2$$

$$\text{Variance }==\frac{2\times5^2+3\times15^2+6\times25^2+5\times35^2+4\times45^2}{20}-(28)^2$$

$=151$

89. (16)

${}^{n}C_2\times{}^{n-2}C_2\times2=840$

$\Rightarrow n=8$

Therefore, total persons $=16$

90. (6) $-6<n^2-10n+19<6$

$\Rightarrow n^2-10n+25>0$ and $n^2-10n+13<$

$(n-5)^2>0 n\in[5-2\sqrt{3},5+2\sqrt{3}]$

$n\in R-[5]$

$\therefore n\in[1.3,8.3]$

$\Rightarrow n = 2,3,4,6,7,8$