**1. (b)** $mv\ell = I\omega$

$$\omega = \frac{mv\ell}{I}$$

$$\frac{1}{2}I\omega^2 = (m+M)g\ell_{com}(1-\cos\theta)$$

$$\frac{1}{2}\frac{(mv\ell)^2}{I} = (m+M)g\ell_{com}(1-\cos\theta)$$

$$I = \left(\frac{M\ell^2}{3} + m\ell^2\right)$$

$$I = \left(\frac{2}{3}+1\right) = \frac{5}{3}$$

$$\frac{36\times 3}{2\times 5} = \frac{3\times 10\times 2}{3}(1-\cos\theta)$$

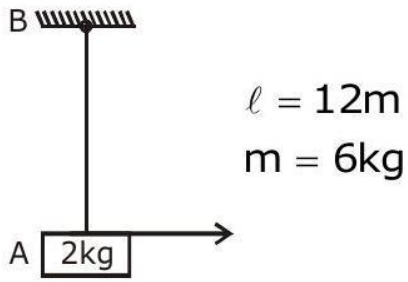
$$\frac{27}{50} = (1-\cos\theta)$$

$$\cos\theta = 1 - \frac{27}{50}$$

$$\cos\theta = \frac{23}{50}$$

$$\theta = 63^\circ$$

**2. (a)**




$\ell = 12m$

$m = 6kg$

$$\mu = \frac{6}{12} = \frac{1}{2}\ kg/m$$

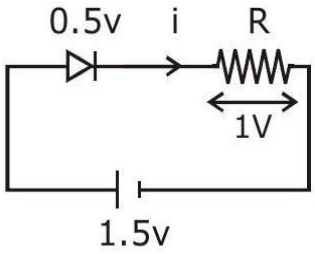
$$A \rightarrow V = \sqrt{\frac{T}{\mu}} = f\lambda$$

$$B \rightarrow \sqrt{\frac{T'}{\mu}} = f\lambda'$$

$$\sqrt{\frac{T}{T'}} = \frac{\lambda}{\lambda'}$$

$$\sqrt{\frac{20}{80}} = \frac{6}{\lambda'} = \lambda' = 12$$

**3. (d)**




$V = iR$

$$R = \frac{V}{i} = \frac{1}{10\ mA}$$

$$= \frac{1000}{10} = 100\Omega$$

**4. (b)** Least count $= \frac{0.1}{50} = \frac{1}{500} = 0.2 \times 10^{-2} = 0.002$

when we multiply by division no.'s

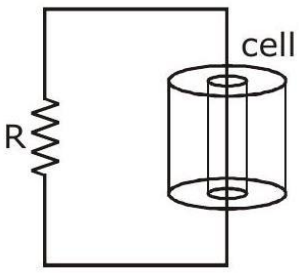
it must be even because L.C. is 0.002

**5. (d)** $dR = \rho \frac{dr}{2\pi r \ell}$

$$\int dR = \frac{\rho}{2\pi\ell} \int_a^b \frac{1}{r} dr$$

$$R = \frac{\rho}{2\pi\ell} [\ln(r)]_a^b$$

$$R = \frac{\rho}{2\pi\ell} \ln\left(\frac{b}{a}\right)$$




$r = R$

For Max heat transfer

**6. (b)** $U = \frac{f}{2} nRT$

$U = \frac{6}{2}nRT$

$U = 3nRT \; n = 1$

$U = 3RT$

**7. (b)**

$\phi = BA\cos\omega t$

$\epsilon = \frac{d\phi}{dt} = BA\omega\sin\omega t$

$\epsilon = B\pi ab\omega\sin\omega t$

$\epsilon_0 = B\pi ab\omega$

$P = \frac{\epsilon^2}{R} = \frac{B^2\pi^2a^2\,b^2\omega^2}{R}(\sin^2\omega t)$

$P_{av} = \frac{B^2\pi^2a^2\,b^2\omega^2}{2R}$

**8. (d)** irreversible adiabatic → Because Energy can not be restored.

**9. (b)** $KE_{max} = \frac{hc}{\lambda_1} - \phi$

$3KE_{max} = \frac{hc}{\lambda_2} - \phi$

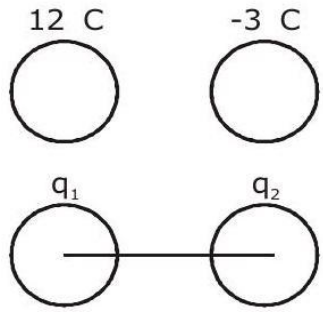
$3\left(\frac{hc}{\lambda_1} - \phi\right) = \frac{hc}{\lambda_2} - \phi$

$\frac{3hc}{\lambda_1} - \frac{hc}{\lambda_2} = 2\phi$

$\frac{3 \times 1240}{500} - \frac{1240}{200} = 2\phi$

$\phi = 0.6$

**10. (a)**




$q_1 + q_2 = 9\mu C$

$\frac{Kq_1}{\frac{2}{3}R} = \frac{Kq_2}{\frac{1}{3}R}$

$q_1 = 2q_2$

$3q_2 = 9\mu c$

$q_2 = 3\mu c$

$q_1 = 6\mu c$

**11. (a)** $N = N_0 e^{-\lambda t}$

$\left(\frac{N}{N_0}\right) = e^{-\lambda t}$

$\frac{9}{16} = e^{-\lambda t}$

$\frac{N}{N_0} = e^{-\lambda t/2}$

$\frac{N}{N_0} = \left(\frac{9}{16}\right)^{\frac{1}{2}} = \frac{3}{4}$

**12. (d)** $M = d.V$

$M = d\pi R^2 L$

$I = M\left(\frac{R^2}{4} + \frac{L^2}{12}\right)$

$I = M\left(\frac{M}{4d\pi L} + \frac{L^2}{12}\right)$

$I = \left(\frac{M^2}{4\,d\pi L} + \frac{ML^2}{12}\right)$

$\frac{dI}{dL} = \frac{M^2}{4\,d\pi}\left(\frac{-1}{L^2}\right) + \frac{2LM}{12} = 0$

$\frac{M^2}{4\,d\pi L^2} = \frac{2\,LM}{12}$

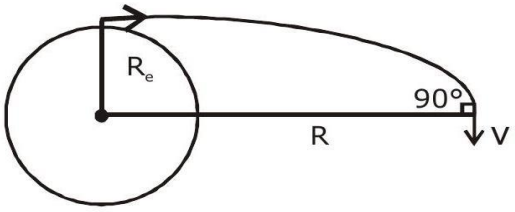
$\frac{d\pi R^2\,L}{4\,d\pi L^2} = \frac{L}{6}$

$\frac{R^2}{L^2} = \frac{2}{3}$

$\frac{R}{L} = \sqrt{\frac{2}{3}} \Rightarrow \frac{L}{R} = \sqrt{\frac{3}{2}}$

**13. (b)**

$V_0 = \sqrt{\frac{GM}{R_e}} \times \sqrt{\frac{3}{2}}$




$mV_0R_e = mVR$

$\sqrt{\frac{3}{2}}\sqrt{\frac{GM}{R_e}}R_e = VR$

$-\frac{GMm}{R_e}+\frac{1}{2}mv_0^2 = -\frac{GMm}{R}+\frac{1}{2}mv^2$

$-\frac{GMm}{R_e}+\frac{1}{2}m\frac{3}{2}\frac{GM}{R_e} = -\frac{GMm}{R}+\frac{1}{2}m\frac{3}{2}\frac{GM}{R_e}\frac{R_e^2}{R^2}$

$-\frac{1}{R_e}+\frac{3}{4R_e} = -\frac{1}{R}+\frac{3}{4}\frac{R_e}{R^2}$

$-\frac{1}{4R_e} = -\frac{1}{R}+\frac{3}{4}\frac{R_e}{R^2}$

By further calculating

$R = 3R_e$

**14. (d)** $P_{in} = P_0 + \frac{4T}{R_1}$

$1.01 = 1 + \frac{4T}{R_1}$

$0.01 = \frac{4T}{R_1}$

$0.02 = \frac{4T}{R_2}$

$\frac{1}{2} = \frac{R_2}{R_1}$

$\frac{V_1}{V_2} = \frac{8}{1}$

**15. (c)** $B = \frac{\lambda D}{d}$

$\theta = \frac{\beta}{D} = \left(\frac{\lambda}{d}\right)$

$\theta = \frac{500\times10^{-9}}{(0.05\times10^{-3})}$

$\theta = \frac{5\times10^{-2}}{5} = \frac{5}{100\times5}$

$\theta^\circ = \frac{5}{100} \times \frac{180}{5 \times \pi}$

$\theta^\circ = 0.57^\circ$

**16. (d)**

$f = 750Hz, V_{rms} = 20V, R = 100\Omega, L = 0.1803H$

$C = 10\mu f$

$S = 2\ J/^\circ C$

$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{R^2 + \left(2\pi fL - \frac{1}{2\pi fC}\right)^2}$

$|z| = \sqrt{(100)^2 + \left(2 \times 3.14 \times 750 \times 0.1803 - \frac{1}{2 \times 3.14 \times 750 \times 10^{-5}}\right)^2}$

$|Z| = 834\Omega$

In AC

$P = V_{rms}\, i_{rms} \cos\phi$

$P = \left(V_{rms} \cdot \frac{V_{rms}}{|Z|} \cdot \frac{R}{|Z|}\right)$

$P = \left(\frac{V_{rms}}{|Z|}\right)^2 R$

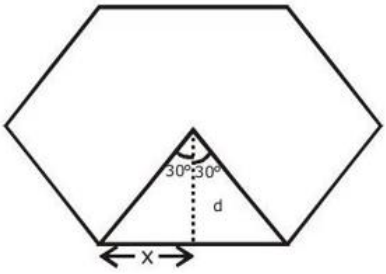
$P = \left(\frac{20}{834}\right)^2 \times 100 = 0.0575\ J/S$

$P \times t = S\Delta\theta$

$t = \frac{2(10)}{0.0575}$

$t = 348sec$

**17. (c)**



$$\tan 30 = \frac{x}{d}$$

$$d = \frac{x}{\tan 30}$$

$$d = \frac{5 \times 10^{-2}}{\frac{1}{\sqrt{3}}}$$

$$d = 5\sqrt{3} \times 10^{-2}$$

$$B = \frac{6 \times \mu_0 \text{IN}}{4\pi \text{d}} (\sin\theta_1 + \sin\theta_2)$$

$$B = \frac{\mu_0 I}{4\pi} \times \frac{50 \times 6}{5\sqrt{3} \times 10^{-2}} (\sin 30 + \sin 30)$$

$$B = \frac{10 \times 6 \times 100}{\sqrt{3} \times 4} \left(\frac{\mu_0 I}{\pi}\right)$$

$$B = 500\sqrt{3}$$

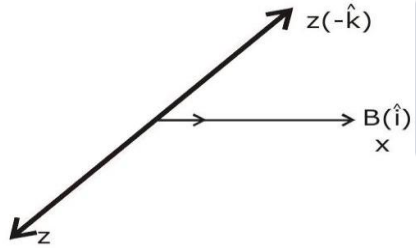
**18. (a)**

$$\text{E} = \text{BC}$$

$$E = 3 \times 10^{-8} \times 3 \times 10^{8}$$

$$\text{E} = 9$$

$$\vec{\text{S}} = \frac{\vec{\text{E}} \times \vec{\text{B}}}{\text{r}}$$



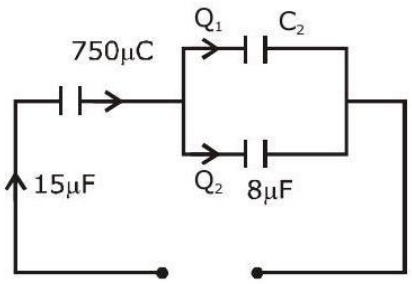

$$E = 9\sin[200\pi(y + ct)(-\hat{k})]$$

**19. (c)** $\vec{\text{F}} = \text{q}(\vec{\text{V}} \times \vec{\text{B}})$

$$\vec{F} = 10^{-6}(2\hat{\imath} + 3\hat{\jmath} + 4\hat{k}) \times (5\hat{\imath} + 3\hat{\jmath} - 6\hat{k}) \times 10^{-3}$$

$$\vec{F} = (-30\hat{\imath} + 32\hat{\jmath} - 9\hat{k}) \times 10^{-9}$$

**20. (c)**

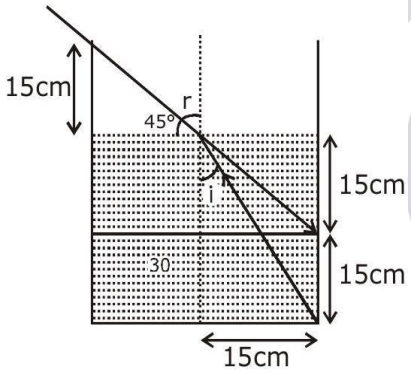



$Q_2 = CV = 8\mu f 20 = 160\mu C$
$Q_1 = 750 - 160 = 590\mu C$

**21. (9)** $I_1\omega_1 = \omega_2 I_2$

$$\left(\frac{MR^2}{2} + mR^2\right)\omega_1 = \omega_2 \frac{MR^2}{2}$$
$$\left(1 + \frac{2mR^2}{MR^2}\right)\omega_1 = \omega_2$$
$$\left(1 + \frac{2 \times 80}{200}\right)\omega_1 = \omega_2$$
$\omega_2 = \omega_1 1.8$
$2\pi f_2 = 2\pi f_1 \times 1.8$
$f_2 = 5 \times 1.8 = 9$

**22. ( 1. 58)**




$\mu \sin i = 1 \sin 45$

$$\mu \frac{15}{\sqrt{1125}} = \frac{1}{\sqrt{2}}$$

$$\mu = \frac{\sqrt{1125}}{15\sqrt{2}}$$

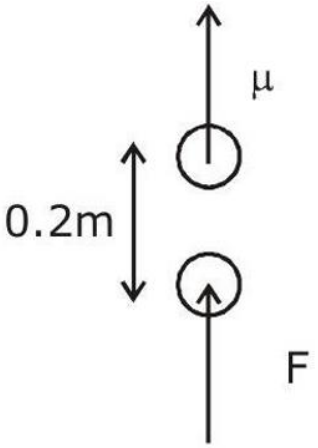
$$\mu = \sqrt{\frac{1125}{450}}$$

$\mu = 1.58$

$$\mu = \frac{N}{100} = 1.58$$

**23. (150)**

$m = 0.15$ kg




$\mu = \sqrt{2gh}$

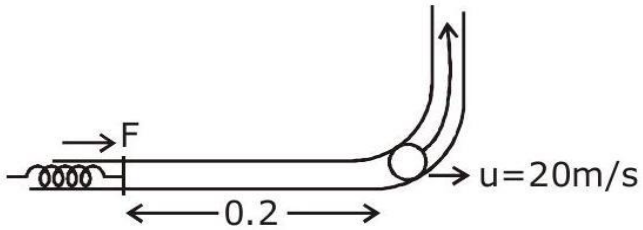
$\mu = \sqrt{2 \times 10 \times 20}$

$\mu = 20$ m/sec

$Fd = \frac{1}{2}mv^2$

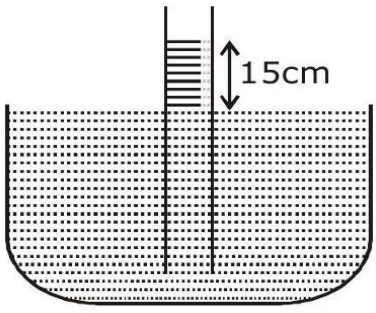
$F \times 0.2 = \frac{1}{2} \times \frac{0.15}{100} \times 400$

$F = \frac{15 \times 200 \times 10}{100 \times 0.2} = 150$




**24. (101)**

0.015




$h = \frac{2\ T}{\rho gr}$

$$T = \frac{h\rho gr}{2}$$

$$T = \frac{15 \times 10^{-2} \times 900 \times 10 \times 0.015 \times 10^{-2}}{2 \times 10^{3}}$$

$$T = 101 \text{milliN/m}$$

**25. (20)**

$$\Delta V = v\gamma\Delta T$$

$$v_1\gamma_1 = v_2\gamma_2$$

$$500cc \times 6 \times 10^{-6} = V_m \times 1.5 \times 10^{-4}$$

$$V_m = \frac{500 \times 6 \times 10^{-6}}{1.5 \times 10^{-4}} = \frac{30}{1.5}$$

$$V_m = 20cc$$

**26. (c)**

**27. (a)**

$2HCl + CH_3COO^- \longrightarrow CH_3COOH + OH^-$

10 20

X 10 10

Acidic buffer

**28. (c)**

(A) $NO_2$ → (Sn/HCl) → $NH_2$

(B) $CN$ → ($LiAlH_4$) → $CH_2NH_2$

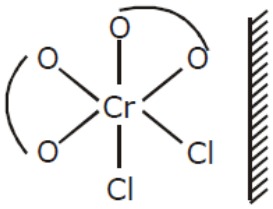
(C) $CH_2CN$ → (i) $SnCl_2$ + HCl, (ii) $H_2O$ → $CH_2CHO$ + $NH_4Cl$

(D) $NH_2$ → ($NaNO_2$, HCl) → $\overset{\oplus}{N_2}Cl^{\ominus}$

Diazo compound and inorganic nitrogen can't be estimeted by kjeldal method.

**29. (d)** Less than 300 K (factual)

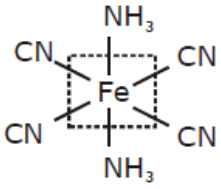
**30. (a)**




Nonsuper imposable
M.I.

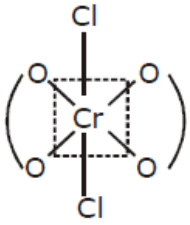
optically active

$cis - \left[CrCl_2(ox)_2\right]^{3-}$ (ox = oxalate)



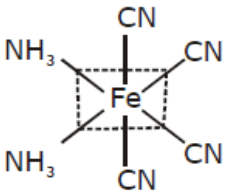

POS optically inactive

$trans - \left[Fe(NH_3)_2(CN)_4\right]^-$




→ POS optically inactive

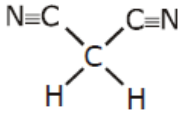
$trans - \left[Cr(Cl_2)(ox)_2\right]^{3-}$




→ POS opticaly inactive

$cis - \left[Fe(NH_3)_2(CN)_4\right]^-$

**31. (c)**



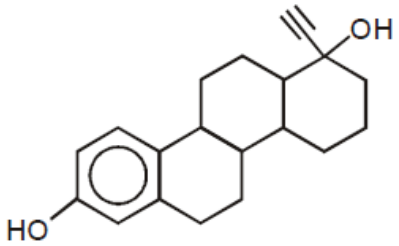

has most acidic hydrogen among given compound, this is due to strong - *M* effect of $-CN$ group which stabilize -ve charge significantly.

**32. (d)**

$Au + HNO_3 + HCl \rightarrow HAuCl_4 + NO + H_2O$

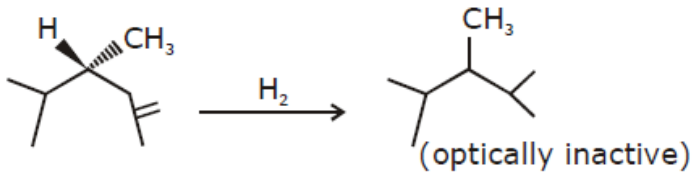
$$Pt + \underbrace{HNO_3 + HCl}_{\text{aquaregia}} \rightarrow H_2PtCl_6 + NO + H_2O$$

**33. (a)** Novestrol




It can reacts with $Br_2$/ water due to presence of unsaturation, with $ZnCl_2/HCl$ due to $-OH$ group and with $FeCl_3$ due to phenol.

**34. (c)**




**35. (a)** B.O. $NO^- = 2$

$BONO + 3$

$BONO^{2+} = 2.5$

$BONO = 2.5$

B. $O \propto \frac{1}{\text{B.L}}$

**36. (b)** conceptual Glycerol is separated in soap industries by distillation under reduced pressure

**37. (d)** Refer enviornmental chemistry

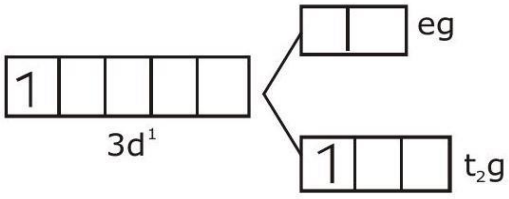
It emits $CO_2$ that combine with mositure of atmosphere and forms $H_2CO_3$ (carbonic acid)

**38. (a)** $p = K_H X$ mol fraction of gas in liquid.

On increasing tamp, ' $K'_{H\ H}$ increases

Hence solubility ↓

**39. (d)** $[Ti(H_2O)_6]^{3+} Ti^{3+} 3\ d^1$ in octahedral field of ligend



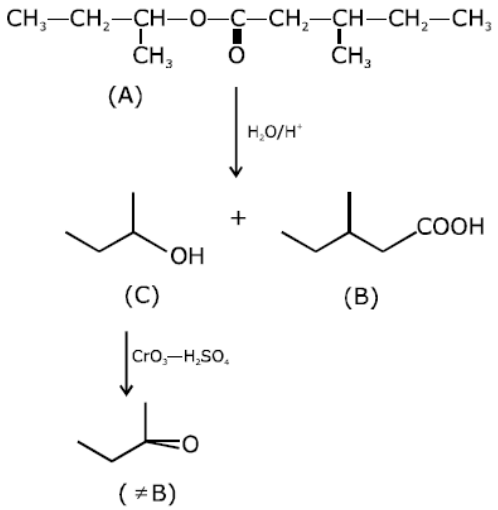

$CFSE = -0.4\Delta_0$

CFSE $= \frac{-0.4\times20300}{83.7}$

$= 97$ kJ mol

**40. (a)**

**41. (b)**




**42. (b)**

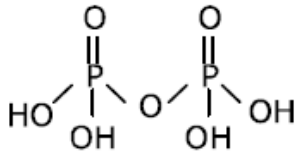
**43. (d)** Diameter of dispersed particles should not be much smaller than wavelength of light used. Refer topic surface chemistry

**44. (d)**

Ionic

$C_{NaCl} >> C_{BaSO_4}$ at temp 'T'

**45. (b)**




P – OH bonds = 4

P = O bonds = 2

P – O – P linkage = 1

**46. (47%)**

$x_{Glucose} = 0.1$

$$\text{mass \% of glucose} = \frac{0.1 \times 180}{0.1 \times 180 + 0.9 \times 18} \times 100$$
$$= \frac{1800}{18 + 16.2}$$
$$= \frac{1800}{34.2}\%$$
$$= 52.63\%$$
$$= 53\%$$

$\therefore$ mass % of $H_2O$ =47%

**47. (100)**

Vol. strength $= \frac{8.9}{2} \times \frac{0.821 \times 273}{1}$

$= 99.73$

$= 100$

**48. (143)** Density $= \frac{Z \times GMM}{N_A \times a^3}$

$$2.7 \times 10^3 = \frac{Z \times 2.7 \times 10^{-2}}{6.023 \times 10^{23} \times (405 \times 10^{-12})^3}$$

$$Z = 6.023 \times 405 \times 405 \times 405 \times 10^{23-36+3+2}$$

$$Z = 6.023 \times 405 \times 405 \times 405 \times 10^{-8}$$

$Z = 4$

FCC

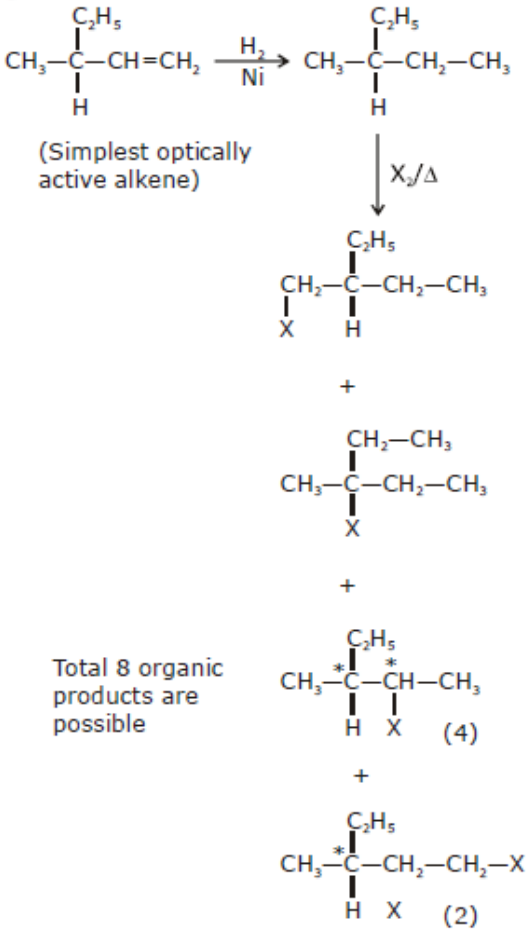
$4R = \sqrt{2} \times a$

$$R = \frac{405}{2\sqrt{2}} \times 10^{-12} = 143.21 \times 10^{-12} \text{ m}$$

$= 143$

**49. (8)**

–




**50. (58)**

Energy of photon $= 2.3 - E_{cell}$ { for Na}

Energy of photon $= 2.25 - E_{cell}$ { for K}

$E_{cell}$ { for 'Na'} $+ 0.05 = E_{cell}$ { forl 'K'}

$0.22 + 0.06\log[H^+][Cl^-] + 0.05 = 0.22 + 0.06\log[H^+][Cl^-]$

$6\log(10^{-2}) + 5 = 6\log[H^+][Cl^-]$

$\log(10^{-12}) + \log(10^5) = \log\{[H^+][Cl^-]\}^6$

$\{[H^+][Cl^-]\}^6 = 10^{-7}$

$[H^+]^{12} = 10^{-7}$

$pH = \frac{7}{12} = 0.58$

$= 58 \times 10^{-2} = 58$ Ans

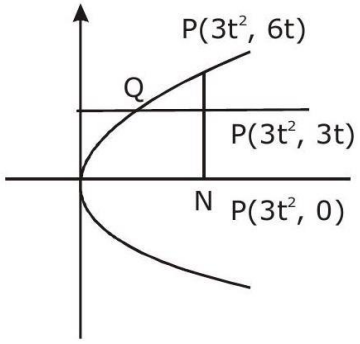
**51. (b)**

2. ${}^1P_0 = 2$
3. ${}^2P_1 = 3$
4. ${}^3P_2 = 4$

$(\lfloor 2 - \lfloor 3 + \lfloor 4 - \lfloor 5 + \cdots \ldots \ldots .52) + (\lfloor 1 - \lfloor 2 + \lfloor 3 - \lfloor 4 \ldots \ldots + \square 51)$

$= \lfloor 52 + 1$

**52. (d)**




Q(h, 3t) lie on

Parabola

$9t^2 = 12\ h$

$h = \frac{3t^2}{4}$

$Q = \left(\frac{3t^2}{4}, 3t\right)$

Equation of NQ

$y = \frac{3t}{\left(\frac{3t^2}{4} - 3t^2\right)}(x - 3t^2)$

$y = \frac{-4t}{3t^2}(x - 3t^2)$

put $x = 0$

$y = \frac{-4}{3t}(-3t^2) = 4t$

$4t = \frac{4}{3} \Rightarrow t = \frac{1}{3}$

$PN = 6t = 6 \cdot \frac{1}{3} = 2$

$M = \left[\frac{1}{3}, 1\right], Q\left[\frac{1}{12}, 1\right]$

$MQ = \frac{1}{3} - \frac{1}{12} = \frac{1}{4}$

**53. (c)**

$$\begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ 2x-3 & 3x-4 & 4x-5 \\ 3x-5 & 5x-8 & 10x-17 \end{vmatrix} = Ax^3 + Bx^2 + Cx + D$$

$R_2 \to R_2 - 2R_1, R_3 \to R_3 - 3R_1$

$$\begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ 1 & -x+2 & -2x+3 \\ 1 & -x+1 & x-5 \end{vmatrix}$$

$R_3 \to R_3 - R_2$

$$\begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ 1 & -x+2 & -2x+3 \\ 0 & -1 & 3x-8 \end{vmatrix} = Ax^3 + Bx^2 + Cx + D$$

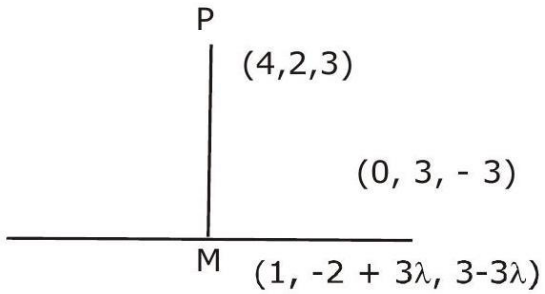
$\Rightarrow -1[(3-2x)(x-2) - (3x-4)] + (3x-8)[(x-2)(-x+2) - (2x-3)] = Ax^3 + Bx^2 + Cx + D$

$\Rightarrow 3x - 2x^2 - 6 + 4x - 3x + 4 + (3x-8)[-x^2 + 4x - 4 - 2x + 3] = Ax^3 + Bx^2 + Cx + D$

$A = -3, B = 12, C = -15$

$B + C = -3$

**54. (c)** $\vec{r} = (1,-2,3) + \lambda(0,3,-3)$




$\overrightarrow{pm} \perp \vec{b}$

$\overrightarrow{pm} \cdot \vec{b} = 0$

$(-3,3\lambda - 4, -3\lambda) \cdot (0,3,-3) = 0$

$\Rightarrow 0 + 9\lambda - 12 + 9\lambda = 0 \Rightarrow \lambda = \frac{12}{18} = \frac{2}{3}$

$m = (1,0,1)$ are on $2x + y - z = 1$

**55. (d)** $2yy' + 2(-\tan x) = y'$

diff. w.r.t.x

$2yy'' + 2(y')^2 - 2\sec^2 x = y''$

Put $x = 0$ in given equation we get $y = 0,1$

from (a) $x = 0, y = 0 \Rightarrow y'(0) = 0$

$x = 0, y = 1, \Rightarrow y'(0) = 0$

from (b) $x = 0, y = 0, y'(0) = 0 \Rightarrow y''(0) = -2$

$x = 0, y = 1, y'(0) = 0 \Rightarrow y''(0) = 2$

$|y''(0)| = 2$

**56. (b)**

$$2\pi - \left[\tan^{-1}\left(\frac{4}{3}\right) + \tan^{-1}\left(\frac{5}{12}\right) + \tan^{-1}\frac{16}{63}\right]$$

$$2\pi - \tan^{-1}\left(\frac{\frac{4}{3}+\frac{5}{12}}{1-\frac{4}{3}\cdot\frac{5}{12}}\right) - \tan^{-1}\left(\frac{16}{63}\right)$$

$$\Rightarrow 2\pi - \tan^{-1}\left(\frac{48+15}{36-20}\right) - \tan^{-1}\left(\frac{16}{63}\right)$$

$$\Rightarrow 2\pi - \left[\tan^{-1}\left(\frac{63}{16}\right) + \cot^{-1}\left(\frac{63}{16}\right)\right]$$

$$\Rightarrow 2\pi - \frac{\pi}{2}$$

$$= \frac{3\pi}{2}$$

**57. (a)** $\frac{x^2}{4} + \frac{y^2}{3} = 1$

$b_1^2 = a_1^2(1 - e_1^2)$

$3 = 4(1 - e_1{}^2)$

$e_1 = \frac{1}{2}$

focus $= (\pm a_1 e_1, 0)$

$= (\pm 1, 0)$

Length of transverse axis $2a_2 = \sqrt{2} \rightarrow a_2 = \frac{1}{\sqrt{2}}$

$a_2 e_2 = 1$

$= e_2 = \sqrt{2}$

$b_2^2 = a_2^2(e_2^2 - 1)$

$b_2^2 = \frac{1}{2}(2 - 1) = \frac{1}{2}$

equation of Hyperbola

$$x^2 - y^2 = \frac{1}{2}$$

**58. (c)** $\sigma^2 \leq \frac{1}{4}(M - m)^2$

( $M$ = upper bound of value of any random variable,

m = Lower bound of value of any random variable)

$\sigma^2 \leq \frac{1}{4}(10-0)^2$

$\sigma^2 < 25$

$-5 < \sigma < 5$

$\sigma \neq 6$

**59. (d)** Total Possibilities $= (1,3), (3,1), (2,2),$

$(2,6), (6,2)(4,4)$

$(3,5), (5,3)(6,6)$

fav. $= 1 = (4,4)$

prob. $= \frac{1}{9}$

**60. (c)**

$T_{r+1} = {}^{n}C_r \left(3^{\frac{1}{2}}\right)^{n-r} \left(5^{\frac{1}{8}}\right)^{r}$

$\frac{n-r}{2} \rightarrow n - r = 0,2,4,6,8, \ldots \ldots$

$\frac{r}{8} \rightarrow r = 0,8,16,24 \ldots \ldots \ldots \ldots \ldots$

common $r = 0,8,16,24$

no. of integral term $= 33.$

$L = 0 + (33-1) \times 8 \rightarrow L = 32 \times 8$

$= 256$

**61. (a)**

$\int_{-\pi}^{\pi} |\pi - |x||dx$

even function

$$2\int_0^{\pi} |\pi - x|dx$$

$$= 2\int_0^{\pi} (\pi - x)dx \Rightarrow 2\left[\pi x - \frac{x^2}{2}\right]_0^{\pi}$$

$$= 2\left[\frac{\pi^2}{2}\right] = \pi^2$$

**62. (a)** $D \geq 0$

$(m+1)^2 - 4(m+4) \geq 0$

$\Rightarrow m^2 - 2m - 15 \geq 0$

$(m-5)(m+3) \geq 0$

$m \in (-\infty, -3] \cup [5, \infty)$

$A = (-\infty, -3] \cup [5, \infty)$

$B = [-3, 5)$

$A - B = (-\infty, -3) \cup [5, \infty)$

$A \cup B = R$

**63. (d)**

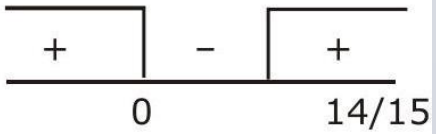
$\sim (p \wedge \sim q) \rightarrow \sim p \vee q$
$p \rightarrow (\sim p \vee q)$
$\Rightarrow \sim p \vee (\sim p \vee q)$
$\Rightarrow \sim p \vee q$

**64. (c)**

$$f(x) = (3x-7) \cdot \frac{2}{3x^{\frac{1}{3}}} + x^{\frac{2}{3}} \cdot 3$$

$$= \frac{6x - 14 + 9x}{3x^{\frac{1}{3}}}$$

$$= \frac{15x - 14}{3x^{\frac{1}{3}}}$$




$f(x) > 0 \uparrow \Rightarrow x \in (-\infty, 0) \cup \left(\frac{14}{15}, \infty\right)$

**65. (a)**

$a = 3$

$$\frac{25}{2}[2a + 24d] = \frac{15}{2}[2 \times (a + 25d) + 14d]$$
$$\Rightarrow 50a + 600d = 15[2a + 50d + 14d]$$
$$\Rightarrow 20a + 600d = 960d$$
$$\Rightarrow 60 = 360d$$
$$d = \frac{1}{6}$$

**66. (d)**

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

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

$$\Rightarrow \frac{-1}{y} + y = \ln|e^x+1| + c$$

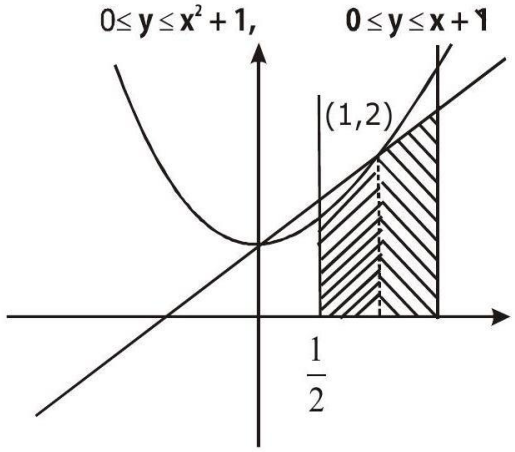
$x = 0, y = 1$

$$\Rightarrow -1 + 1 = \ln 2 + c \Rightarrow c = -\ln 2$$

$$\Rightarrow \frac{-1}{y} + y = \ln|e^x+1| - \ln 2$$

$$\Rightarrow y^2 = 1 + y\left[\ln\left(\frac{e^x+1}{2}\right)\right]$$

**67. (d)**




$$A = \int_{\frac{1}{2}}^{1}(x^2+1)dx + \int_{1}^{2}(x+1)dx$$

$$\left(\frac{x^3}{3}+x\right)_{\frac{1}{2}}^{1} + \left(\frac{x^2}{2}+x\right)_{1}^{2}$$

$$= \left(\frac{1}{3}+1\right) - \left(\frac{1}{24}+\frac{1}{2}\right) + \left((2+2) - \left(\frac{3}{2}\right)\right)$$

$$= \left(\frac{4}{3} - \frac{13}{24}\right) + \left(\frac{5}{2}\right)$$

$$= \left(\frac{32-13}{24}\right) + \left(\frac{5}{2}\right) = \frac{19+60}{24} = \frac{79}{24}$$

**68. (c)**

$\alpha+\beta=-p, \alpha\beta=2$

$\frac{1}{\alpha}+\frac{1}{\beta}=-q, \frac{1}{\alpha\beta}=\frac{1}{2}$

$\frac{\alpha+\beta}{\alpha\beta}=-q \Rightarrow \frac{-p}{2}=-q$

$\Rightarrow p=2q$

$\left(\alpha+\frac{1}{\beta}\right)\left(\beta+\frac{1}{\alpha}\right)=\alpha\beta+\frac{1}{\alpha\beta}+2$

$=2+\frac{1}{2}+2=\frac{9}{2}$

$\left(\alpha-\frac{1}{\alpha}\right)\left(\beta-\frac{1}{\beta}\right)=\alpha\beta+\frac{1}{\alpha\beta}-\frac{\alpha}{\beta}-\frac{\beta}{\alpha}$

$=2+\frac{1}{2}-\left[\frac{\alpha^2+\beta^2}{\alpha\beta}\right]$

$=\frac{5}{2}-\left[\frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha\beta}\right]$

$=\frac{5}{2}-\left[\frac{p^2-4}{2}\right]$

$=\frac{9-\mathrm{p}^2}{2}$

$\left(\alpha-\frac{1}{\alpha}\right)\left(\beta-\frac{1}{\beta}\right)\left(\alpha+\frac{1}{\beta}\right)\left(\beta+\frac{1}{\alpha}\right)=\left(\frac{9-\mathrm{p}^2}{2}\right)\left(\frac{9}{2}\right)$

$=\frac{9}{4}(9-\mathrm{p}^2)$

**69. (a)** $\frac{2}{1}\neq\frac{0}{1}\neq\frac{1}{-1}\rightarrow$ lines are intersecting

$\vec{r}=(1+2l)\hat{\imath}-\hat{\jmath}+|\,\hat{k}$

$\vec{\mathrm{r}}=(2+\mathrm{m})\hat{\imath}+(\mathrm{m}-1)\hat{\jmath}-\mathrm{m}\hat{\mathrm{k}}$

compare coff. of $\hat{\imath},\hat{\jmath},\hat{k}$

$1+21=2+m\ \left|\begin{matrix}-1=m-1\\ m=0\end{matrix}\right|\ I=0$

Lines do not intersect

**70. (b)** $\lim_{x\to0}\left|\frac{1-x+|x|}{\lambda-x+[x]}\right|=L$

$\lim_{h\to0}\left|\frac{1-h+h}{\lambda-h+[h]}\right|$

$\lim_{h\to0}\left|\frac{1}{\lambda-h+0}\right|=\left|\frac{1}{\lambda}\right|[x]=0$

$\lim_{h\to0}\left|\frac{1+h+h}{\lambda+h+[-h]}\right|$

$=\left|\frac{1}{\lambda-1}\right|\ [-\mathrm{h}]=-1$

$\because |\lambda| = |\lambda - 1|$

$\lambda^2 = \lambda^2 - 2\lambda + 1 \Rightarrow \lambda = \frac{1}{2}$

L = 2

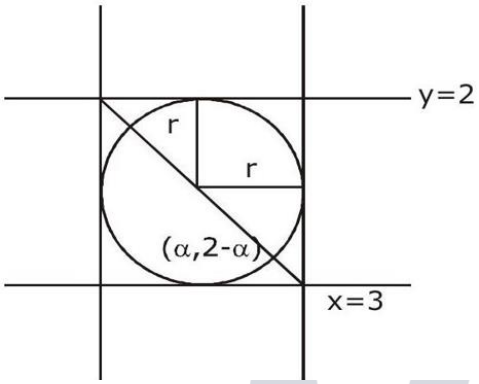
**71. (8)**

$\lim_{x\to 0} \frac{\left(1-\cos\frac{x^2}{2}\right)}{\left(\frac{x^2}{2}\right)^2}\frac{\left(1-\cos\frac{x^2}{4}\right)}{\left(\frac{x^2}{4}\right)^2}\cdot\frac{\left(\frac{x^2}{2}\right)\cdot\left(\frac{x^2}{4}\right)^2}{x^8}$

$\lim_{x\to 0} \frac{1}{4}\cdot\frac{1}{4}\cdot\frac{1}{16} \Rightarrow \frac{1}{256} = 2^{-k}$

$2^{-8} = 2^{-k} \Rightarrow k = 8$

**72. (2)**




p = r

for $y = 2$

$r = \left|\frac{2-\alpha-2}{1}\right| = |\alpha|$

for $x = 3$

$r = \left|\frac{\alpha-3}{1}\right| = |\alpha - 3|$

$|\alpha| = |\alpha - 3|$

$\Rightarrow \alpha^2 + \alpha^2 - 6\alpha + 9 \Rightarrow \alpha = \frac{3}{2}$

$2\alpha = 3 = 2r$

**73. (4)**

$$\frac{1}{3}+\frac{1}{3^2}+\frac{1}{3^3}+\cdots\ldots\infty=\frac{\frac{1}{3}}{1-\frac{1}{3}}=\frac{1}{2}$$

$$\log_{2.5}\left(\frac{1}{2}\right)\Rightarrow\log_{\frac{5}{2}}\frac{1}{2}$$

$$.16=\frac{16}{100}=\frac{4}{25}=\left(\frac{2}{5}\right)^2$$

$$\Rightarrow\left(\frac{2}{5}\right)^{2\log_{\frac{5}{2}}\frac{1}{2}}=\left(\frac{5}{2}\right)^{-2\log_{\frac{5}{2}}\frac{1}{2}}$$

$$\Rightarrow\left(\frac{5}{2}\right)^{\log_{\frac{5}{2}}\left(\frac{1}{2}\right)^{-2}}$$

$$=4$$

**74. (10)**

$$A=\begin{bmatrix}x & 1\\ 1 & 0\end{bmatrix}$$

$$A^2=\begin{bmatrix}X & 1\\ 1 & 0\end{bmatrix}\begin{bmatrix}X & 1\\ 1 & 0\end{bmatrix}=\begin{bmatrix}X^2+1 & x\\ X & 1\end{bmatrix}$$

$$A^3=\begin{bmatrix}X^2+1 & x\\ x & 1\end{bmatrix}\begin{bmatrix}x & 1\\ 1 & 0\end{bmatrix}$$

$$=\begin{bmatrix}x^3+x+x & x^2+1\\ x^2+1 & x\end{bmatrix}$$

$$A^4=\begin{bmatrix}X^3+2x & x^2+1\\ x^2+1 & x\end{bmatrix}\begin{bmatrix}X & 1\\ 1 & 0\end{bmatrix}$$

$$\begin{bmatrix}x^4+2x^2+x^2+1 & x^3+2x\\ x^3+x+x & x^2+1\end{bmatrix}$$

$$a_{11}\Rightarrow x^4+3x^2+1=109$$

$$x^4+3x^2-108=0$$

$$\Rightarrow(x^2+12)(x^2-9)=0$$

$$x=\pm3$$

$$a_{11}=x^2+1=10$$

**75. (4)**

$$\left[\frac{(1+i)(1+i)}{(1+i)(1-i)}\right]^{\frac{m}{2}}=\left[\left(\frac{1+i}{-1+i}\right)\left(\frac{-1-i}{-1-i}\right)\right]^{\frac{n}{3}}=1$$

$$=\left(\frac{2i}{2}\right)^{\frac{m}{2}}=1\mid\left(\frac{-1-i-i+1}{1+1}\right)^{\frac{n}{3}}=1$$

$$\mathrm{m}=8$$

$$(-i)^{n/3}=1$$

$$n=12$$

greatest common divisor of $m\&n$ is 4