1. (b)

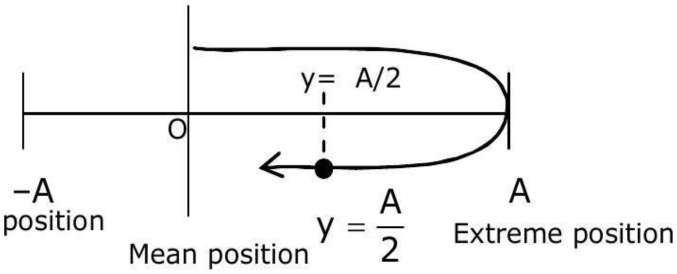
(a)Rectifier: - used to convert a.c voltage into d.c. Voltage.

(b) Stabilizer: - used for constant output voltage even when the input voltage or load current change

(c) Transformer: - used either for stepping up or stepping down the a.c. voltage.

(d) Filter: - used to remove any ripple in the rectified output voltage.

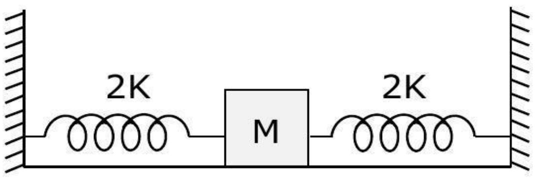
2. (d)



The initial phase angle $\phi_0 = \pi - \frac{\pi}{6}$

$= \frac{5\pi}{6}$

3. (a)



Dut to parallel combination $K_{eff} = 2k + 2k$

$= 4k$

$\because T = 2\pi\sqrt{\frac{m}{k_{eff}}}$

$= 2\pi\sqrt{\frac{m}{4k}}$

$T = \pi\sqrt{\frac{m}{k}}$

4. (d)

$$\Delta E = 10.2 eV$$

$$\frac{hc}{\lambda} = 10.2 ev$$

$$\lambda = \frac{hc}{(10.2)e}$$

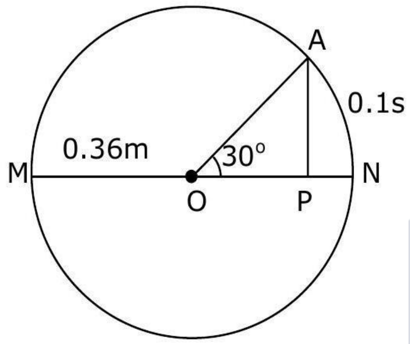
$$= \frac{12400}{10.2} \text{Å}$$

$$= 121.56 \text{ nm}$$

$$\simeq 121.8 \text{ nm}$$

5. **(c)** In a ferromagnetic material, below the curie temperature a domain is defined as a macroscopic region with saturation magnetization.

6. **(c)**



The point a covers 30° in 0.1sec.

Means $\frac{\pi}{6} \longrightarrow 0.1$sec.

$$1 \longrightarrow \frac{0.1}{\frac{\pi}{6}}$$

$$2\pi = \longrightarrow \frac{0.1 \times 6}{\pi} \times 2\pi$$

T = 1.2sec.

We know that $\omega = \frac{2\pi}{T}$

$$\omega = \frac{2\pi}{1.2}$$

Restoration force (F) = $m\omega^2$ A

Then Restoration force per unit mass $\left(\frac{F}{m}\right) = \omega^2 A$

$$\left(\frac{F}{m}\right) = \left(\frac{2\pi}{1.2}\right)^2 \times 0.36$$

$\cong$ 9.87 N

7. **(b)** From the photoelectric effect equation

$\frac{hc}{\lambda} = \phi + ev_s$

so $ev_{s_1} = \frac{hc}{\lambda_1} - \phi$

$ev_{s_2} = \frac{hc}{\lambda_2} - \phi$

Subtract equation (i) from equation (ii)

$ev_{s_1} - ev_{s_2} = \frac{hc}{\lambda_1} - \frac{hc}{\lambda_2}$

$v_{s_1} - v_{s_2} = \frac{hc}{e}\left(\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right)$

$(0.710 - 1.43) = 1240\left(\frac{1}{491} - \frac{1}{\lambda_2}\right)$

$\frac{-0.72}{1240} = \frac{1}{491} - \frac{1}{\lambda_2}$

$\frac{1}{\lambda_2} = \frac{1}{491} + \frac{0.72}{1240}$

$\frac{1}{\lambda_2} = 0.00203 + 0.00058$

$\frac{1}{\lambda_2} = 0.00261$

$\lambda_2 = 383.14$

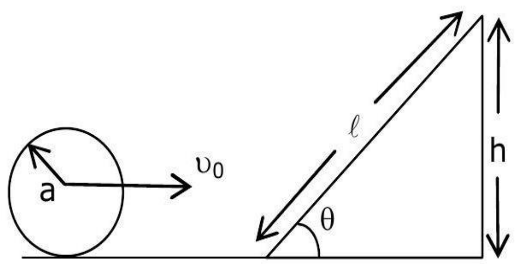
$\lambda_2 \simeq 382$ nm

8. (c) $\phi = \frac{q}{24\varepsilon_0}$

$\phi_T = \left(\frac{q}{24\varepsilon_0} + \frac{q}{24\varepsilon_0}\right) \times \frac{1}{2}$

$\phi_T = \frac{q}{24\varepsilon_0}$

9. (d)



From energy conservation

$$\text{mgh} = \frac{1}{2}\text{ mv}_0^2 + \frac{1}{2}\text{I}\omega^2$$

$$\text{mgh} = \frac{1}{2}\text{ m}v_0^2 + \frac{1}{2}\times\frac{2}{5}\text{ma}^2\times\frac{\text{v}_0^2}{\text{a}^2}$$

$$\text{gh} = \tfrac{1}{2}v_0^2 + \tfrac{1}{5}v_0^2$$

$$\text{gh} = \frac{7}{10}\text{v}_0^2$$

$$\text{h} = \frac{7}{10}\frac{\text{v}_0^2}{\text{g}}$$

from triangle, $\sin\theta = \frac{\text{h}}{\ell}$

then $\text{h} = \ell\sin\theta$

$$\ell\sin\theta = \frac{7}{10}\frac{v_0^2}{g}$$

$$\ell = \frac{7}{10}\frac{v_0^2}{g\sin\theta}$$

10. (a) $\text{Sin}\,\theta = \frac{1.22\lambda}{D}$

If D is increased, then $\sin\theta$ will decreased

∴ size of circular fringe will decrease but intensity increases

11. (b) Given mass of electron $= \text{m}_\text{e}$

Mass of proton $= \text{m}_\text{p}$

∴ given $\text{m}_\text{p} = 1836\ \text{m}_\text{e}$

From de-Broglie wavelength

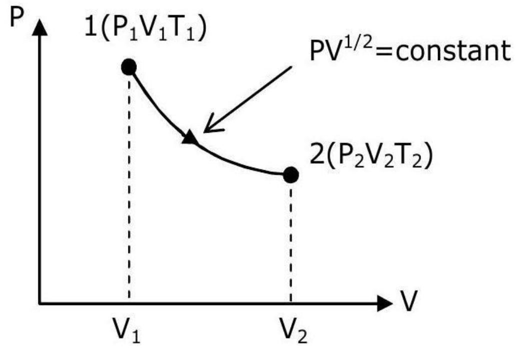
$$\lambda = \frac{\text{h}}{\text{p}} = \frac{\text{h}}{\text{mv}}$$

$$\frac{\lambda_e}{\lambda_p} = \frac{m_p}{m_e}$$

$$= \frac{1836\ \text{m}_\text{e}}{\text{m}_\text{e}}$$

$$\frac{\lambda_\text{e}}{\lambda_\text{p}} = 1836$$

12. (d)



From p − v diagram,

Given $Pv^{1/2} = \text{constant}$

We know that

$Pv = nRT$

$P \propto \left(\frac{T}{V}\right)$

Put in equation

$\left(\frac{T}{V}\right)(v)^{1/2} = \text{constant}$

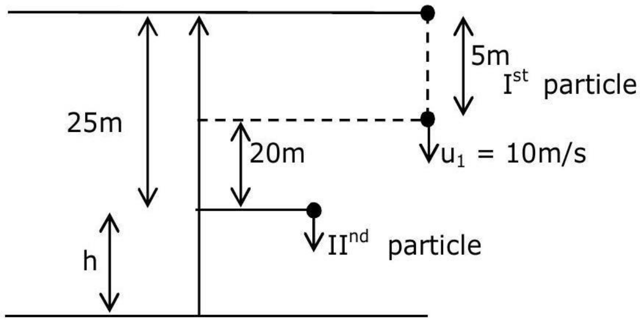
$T \propto V^{1/2}$

$\frac{T_2}{T_1} = \sqrt{\frac{V_2}{V_1}}$

$\frac{T_2}{T_1} = \sqrt{\frac{2v_1}{v_1}}$

$\frac{T_2}{T_1} = \sqrt{2}$

13. (a)



For particle (a)

$20 + h = 10t + \frac{1}{2}gt^2$

For particle (b)

$h = \frac{1}{2}gt^2$

put equation (ii) in equation (i)

$20 + \frac{1}{2}gt^2 = 10t + \frac{1}{2}gt^2$

$t = 2sec.$

Put in equation (ii)

$h = \frac{1}{2}gt^2$

$= \frac{1}{2} \times 10 \times 2^2$

$h = 20$ m

the height of the building $= 25 + 20 = 45$ m

14. (d) Given frequency of massage signal $= f_m$

frequency of carrier signal $= f_c$

the wavelength of the corresponding signal in air is $\Rightarrow \lambda = \frac{c}{f_c}$

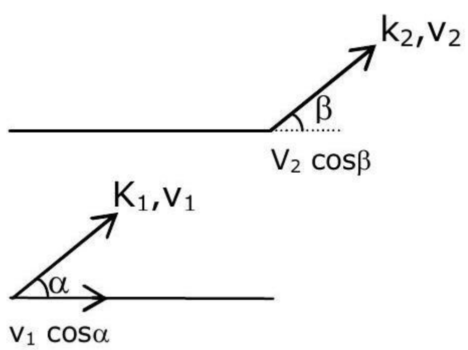
15. (d) The translational kinetic energy & rotational kinetic energy both obey Maxwell's distribution independent of each other.

T.K.E of diatomic molecules $= \frac{3}{2}kT$

R.K.E. of diatomic molecules $= \frac{2}{2}kT$

So statement I is true but statement II is false.

16. (b)



$\because v_1 \cos\alpha = v_2 \cos\beta$

$\frac{v_1}{v_2} = \frac{\cos\beta}{\cos\alpha}$

Then the ratio of kinetic energies

$$\frac{k_1}{k_2}=\frac{\frac{1}{2}mv_1^2}{\frac{1}{2}mv_2{}^2}=\left(\frac{v_1}{v_2}\right)^2=\left(\frac{\cos\beta}{\cos\alpha}\right)^2$$

$$\frac{\mathrm{k}_1}{\mathrm{k}_2}=\frac{\cos^2\beta}{\cos^2\alpha}$$

17. (b)

Since ϕ remain same, circuit is in resonance

$$\therefore \mathrm{I}_{\mathrm{rms}}=\frac{\mathrm{V}_{\mathrm{rms}}}{\mathrm{z}}$$

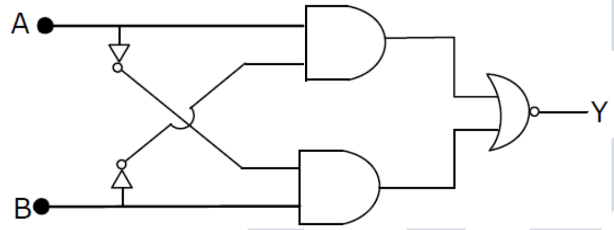
$$=\frac{220}{110}$$

$\mathrm{I}_{\mathrm{rms}}=2\ \mathrm{A}$

18. (b) In n-type semiconductor pentavalent impurity is added. Each pentavalent impurity donates a free electron. So the Fermi-level of n-type semiconductor will go upward.

& In p-type semiconductor trivalent impurity is added. Each trivalent impurity creates a hole in the valence band. So the Fermi-level of p-type semiconductor will go downward.

19. (d)



If $A=B=0$ then output $y=1$

If $A=B=1$ then output $y=1$

20. (b) Given

e = electronic charge

c = speed of light in free space

h = planck's constant

$$\frac{1}{4\pi\varepsilon_0}\frac{\mathrm{e}^2}{\mathrm{hc}}=\frac{\mathrm{ke}^2}{\mathrm{hc}}\times\frac{\lambda^2}{\lambda^2}$$

$$=\frac{\mathrm{F}\times\lambda}{\mathrm{E}}$$

$$=\frac{E}{E}$$

= dimensionless

$=[M^0L^0T^0]$

21. (2) Speed of transverse wave is

$$V = \sqrt{\frac{T}{\mu}}$$

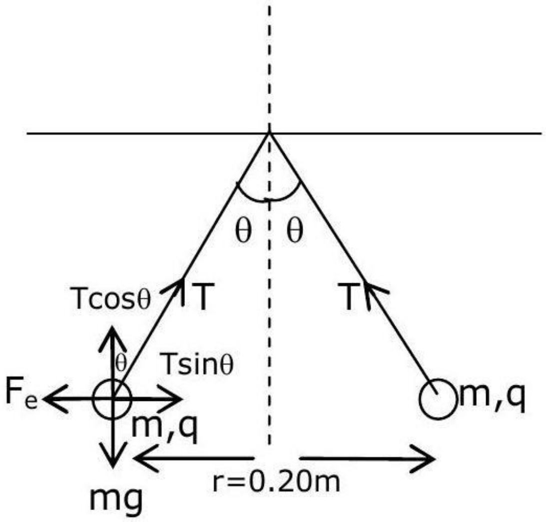
$$\ln v = \frac{1}{2}\ln T - \frac{1}{2}\ln \mu$$

$$\frac{\Delta V}{V} = \frac{1}{2}\frac{\Delta T}{T}$$

$$= \frac{1}{2} \times 4$$

$$\frac{\Delta v}{v} = 2\%$$

22. (20)



$$T\sin\theta = \frac{kq^2}{r^2}$$

$$\mathrm{T}\cos\theta = \mathrm{mg}$$

$$\tan\theta = \frac{\mathrm{kq}^2}{\mathrm{mgr}^2}$$

$$\mathrm{q}^2 = \frac{\tan\theta\,\mathrm{mgr}^2}{\mathrm{k}}$$

$$\because \tan\theta = \frac{0.1}{0.5} = \frac{1}{5}$$

$$\mathrm{q}^2 = \frac{1}{5} \times \frac{10 \times 10^{-6} \times 10 \times 0.2 \times 0.2}{9 \times 10^9}$$

$$\mathrm{q} = \frac{2\sqrt{2}}{3} \times 10^{-8}$$

after comparison from the given equation

$a = 20$

23. (2) $I = \frac{1}{2} c \in_0 E_0^2$

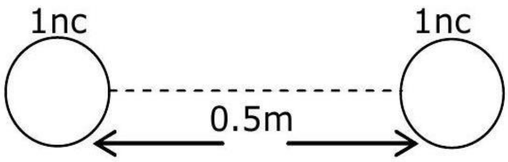
$$\frac{8}{4\pi \times 10^2} = \frac{1}{2} \times C \times \frac{1}{\mu_0 C^2} \times E_0^2$$

$$E_0 = \frac{2}{10}\sqrt{\frac{\mu_0 C}{\pi}}$$

$\Rightarrow x = 2$

24. (36)

When they are brought into contact & then separated by a distance $= 0.5$ m Then charge distribution will be



The electrostatic force acting b/w the sphere is

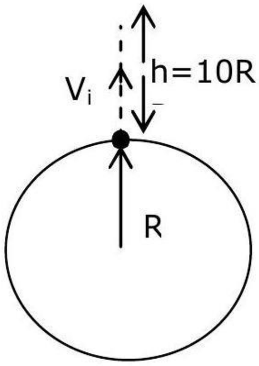
$$F_e = \frac{kq_1q_2}{r^2}$$

$$= \frac{9 \times 10^9 \times 1 \times 10^{-9} \times 1 \times 10^{-9}}{(0.5)^2}$$

$$= \frac{900}{25} \times 10^{-9}$$

$F_e = 36 \times 10^{-9}$ N

25. (10)



Here R = radius of the earth

From energy conservation

$$\frac{-Gm_e m}{R}+\frac{1}{2}mv_i^2=\frac{-Gm_e m}{11R}+0$$

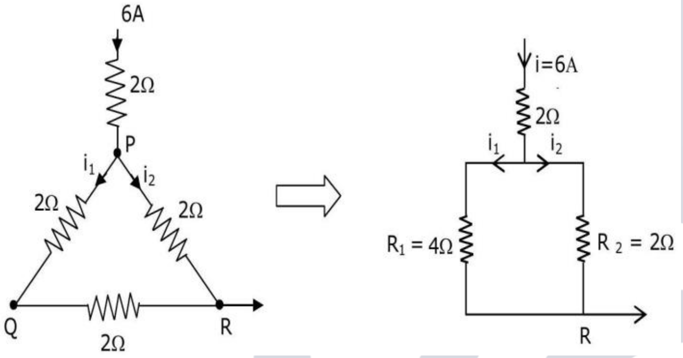
$$\frac{1}{2}mv_i^2=\frac{10}{11}\frac{Gm_e\text{ m}}{R}$$

$$V_i=\sqrt{\frac{20}{11}\frac{Gm_e}{R}}$$

$$\mathrm{v_i}=\sqrt{\frac{10}{11}}\mathrm{v_e}\ \left\{\because \text{escape velocity } \mathrm{v_e}=\sqrt{\frac{2\mathrm{Gm}}{\mathrm{R}}}\right\}$$

Then the value of $x=10$

26. (b)



The current $i_1=\left(\frac{R_2}{R_1+R_2}\right)i$

$$=\left(\frac{2}{4+2}\right)\times 6$$

$\mathrm{i_1}=2\text{ A}$

27. (10) Given wavelength of an x-ray beam = 10Å

$$\because \mathrm{E}=\frac{\mathrm{hc}}{\lambda}=\mathrm{mc^2}$$

$$\mathrm{m}=\frac{\mathrm{h}}{\mathrm{c}\lambda}$$

The mass of a fictitious particle having the same energy as that of the x-ray photons $=\frac{x}{3}hkg$

$$\frac{\mathrm{x}}{3}\mathrm{h}=\frac{\mathrm{h}}{\mathrm{c}\lambda}$$

$$x=\frac{3}{c\lambda}$$

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

$x = 10$

28. (208) $\because \mathrm{n} = \frac{\mathrm{w}}{\mathrm{Q_{in}}} = \frac{1}{4}$

$$\frac{1}{4} = 1 - \frac{\mathrm{T_1}}{\mathrm{T_2}}$$

$$\frac{\mathrm{T_1}}{\mathrm{T_2}} = \frac{3}{4}$$

When the temperature of the sink is reduced by 52k then its efficiency is doubled.

$$\frac{1}{2} = 1 - \frac{(\mathrm{T_1} - 52)}{\mathrm{T_2}}$$

$$\frac{\mathrm{T_1} - 52}{\mathrm{T_2}} = \frac{1}{2}$$

$$\frac{\mathrm{T_1}}{\mathrm{T_2}} \frac{-52}{\mathrm{T_2}} = \frac{1}{2}$$

$$\frac{3}{4} - \frac{52}{\mathrm{T_2}} = \frac{1}{2}$$

$$\frac{52}{\mathrm{T_2}} = \frac{1}{4}$$

$\mathrm{T_2} = 208\mathrm{k}$

29. (1)

$\because$ relation b/w kinetic energy & momentum is

$P = \sqrt{2mKE}$

($\because$ KE = same)

$$\frac{p_1}{p_2} = \sqrt{\frac{m_1}{m_2}}$$

$$\frac{n}{2} = \sqrt{\frac{4}{16}}$$

$n = 1$

30. (180)

If $\vec{\mathrm{P}} \times \vec{\mathrm{Q}} = \vec{\mathrm{Q}} \times \vec{\mathrm{P}}$

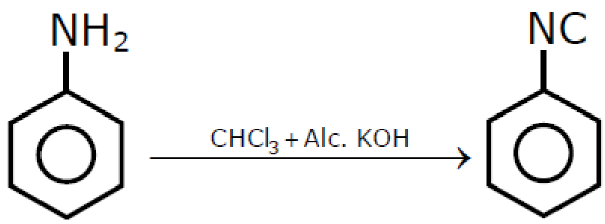
Only if $\vec{P} = 0$

Or $\vec{Q} = 0$

The angle b/w $\vec{P}\&\vec{Q}$ is $\theta(0^\circ < \theta < 360^\circ)$

So $\theta = 180^\circ$

31. (d)
32. (b)



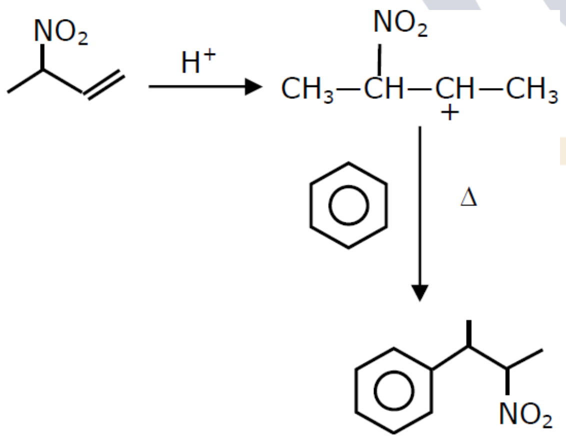
33. (c) F_2 has $F - F, F_2$ involves repulsion of non-bonding electrons & more over its size is small & hence due to high repulsion its bond dissociation energy in very low.
34. (d)
35. (d)

$$H_2O + CO_2 \rightarrow H_2CO_3$$

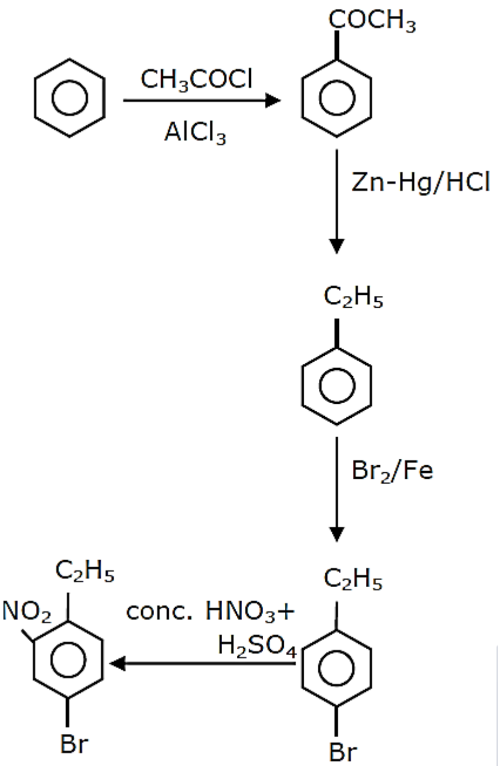
36. (a)

$$\begin{array}{l} CH_2-OH \\ | \qquad\qquad + oxalic\ acid \xrightarrow{210^0 C} CH_2 = CH_2 \\ CH_2-OH \end{array}$$

37. (d) $[FeF_6]^{3-}$ $Fe^{3+}3\ d^5 \rightarrow$ 5-unpaired electrons as $F^-$is weal field legend $[Co(NH_3)_6]^{3+}Co^{3+}3\ d^6 \rightarrow$ No-unpaired electron as NH_3 is strong field light and causes pairing $[NiCl4]^{2-}$ $Ni^{2+}3\ d^8 \rightarrow$ 2-unpaired electrons $[Cu(NH_3)_4]^{2+}Cu^{2+}3\ d^9 \rightarrow$ 1-unpaired electrons
38. (d)



39. (b)

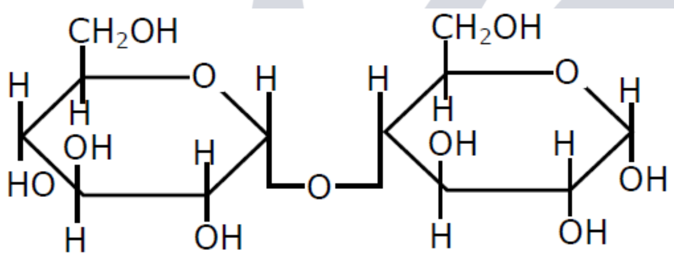


40. (d) German silver is alloy which does not have silver.

$Cu - 50\%; Ni - 30\%; Zn - 20\%$

41. (c) Ga, In, Si, Ge are refined by zone refining or vaccume refining.

42. (d)



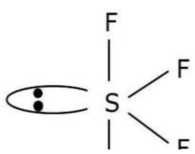
[α-Anomer of maltose]

43. (c)

$$CH_3 - CH_2 - CH = CH_2 \xrightarrow[Rh\ catalyst]{H_2/CO} CH_3CH_2CH_2CHO$$

44. (a)

45. (d)

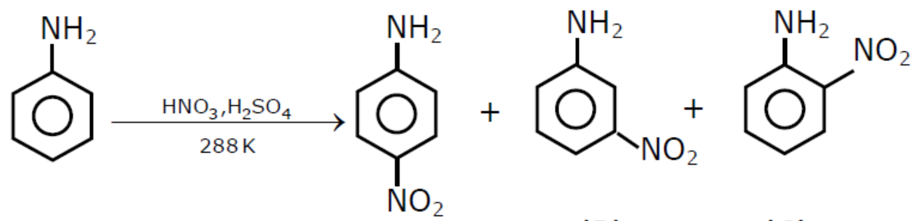


Sp^{3}d Hybridisation Sea-saw shape & axial bond length is more than equitorial bond length

46. (b)

$$\underset{\alpha-sulphur}{S_{Rhambic}} \underset{95.6^0 c}{\rightleftharpoons} \underset{\beta-sulphur}{S_{Monoclinic}}$$

47. (a)



(A) (B) (C)

51% 47% 2%

48. (a) $NaCN + HNO_3 \rightarrow NaNO_3 + HCN \uparrow$

$Na_2\,S + HNO_3 \rightarrow NaNO_3 + H_2\,S \uparrow$

Nilnic acid decomposed $NaCN$&$Na_2\,S$, else they precipitate in test & misquite the resolve

49. (b)

50. (d) $Ca(OH)_2 \rightleftharpoons Ca_s^{+2} + \underset{(2s+10^{-7})}{2OH^-}$

$$s(2s+10^{-7})^2 = 55 \times 10^{-7}$$

$$4s^3 = 55 \times 10^{-7}$$

$$s^3 = \frac{5500}{4} \times 10^{-9}$$

$$s = \left(\frac{2250}{2}\right)^{1/3} \times 10^{-3}$$

$$s = (1125)^{1/3} \times 10^{-3}$$

$$s = 1.11 \times 10^{-2}$$

51. (3)

$AB \rightarrow A^+ + B^-$

$1-\alpha \ \alpha \ \alpha$

$\alpha = 3/4$

$N = 2$

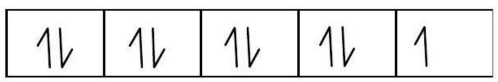
$i = [1+(2-1)\alpha]$

$2.5 = [1+(2-1)3/4] \times 0.52 \times m$

$$m = \frac{2.5}{0.52 \times 7/4} = \frac{10}{3.64} = 2.747$$

$m = 2.747 \simeq 3\ mol/kg$

52. (2) ${}_{29}Cu^{+2} \rightarrow [Ar]^{18}\underline{3d^9}$

$d^9 \longrightarrow$ 

No. of unpaired e^- = 1

Magnetic moment $= \mu = \sqrt{n(n+2)}$

$\mu = \sqrt{(a)(1+2)} = \sqrt{3} B.M.$

$= 1.73$

53. (1)

54. (9077)

$a = 3.596 Å$

$$d = \frac{Z \times GMM}{N_A \times a^3}$$

$$d = \frac{4 \times 63.54 \times 10^{-3}}{6.022 \times 10^{23} \times (3.596 \times 10^{-10})^3}$$

$d = 0.9076 \times 10^4 = 9076.2\ kg/m^3$

55. (6)

Eq. of NaOH = Eq. of oxalic acid

$$[NaOH] \times 1 \times 4.4 = \frac{5}{4} \times 2 \times 10$$

$$[NaOH] = \frac{100}{4 \times 4.4} = \frac{25}{4.4} = 5.68$$

Nearest integer = 6M

56. (180)

Energy req. to ionize an atom of metal 'A' $= \frac{hc}{\lambda} = \frac{hc}{663\ nm}$

for 1 mole atoms of ' A '

Total energy required $= N_A \times \frac{hc}{\lambda}$

$$= \frac{6.023 \times 10^{23} \times 6.63 \times 10^{-34} \times 3 \times 10^8}{663 \times 10^{-9}}$$

$= 6.023 \times 3 \times 10^{23-34+8+7}$

$= 18.04 \times 10^4\ J/mol$

$= 180.4 KJ/mol$

Nearest Integer = 180KJ/Mol.

57. (52)

$$\frac{K_{52°C}}{K_{27°C}} = 5$$

$$\ln\left\{\frac{k_{T_2}}{k_{T_1}}\right\} = \frac{E_a}{R}\left\{\frac{1}{T_1} - \frac{1}{T_2}\right\}$$

$$\ln(5) = \frac{E_a}{R}\left\{\frac{1}{300} - \frac{1}{325}\right\}$$

$$\frac{2.303 \times 0.7 \times 8.314 \times 300 \times 325}{25} = E_a$$

$E_a = 51524.96$ J/mol

$E_a = 51.524$KJ/mol

58. (1)

Anode

$Cu(s) \rightarrow Cu^{+2} + 2e^-$

Cathode (a)

$$\frac{3e^- + 4H^+ + NO_3^- \rightarrow NO + 2H_2O}{8H^- + 2NO_3^- + 3Cu(s) \rightarrow 3Cu^{+2} + 2NO + 4H_2O}$$

$$Q = \frac{[Cu^{+2}]^3 \times (p_{NO})^2}{[NO_3^-]^2[H^+]^8}$$

$\epsilon^0_{cell} = 1.3$

$$\epsilon_{cell} = 1.3 - \frac{0.059}{6}\log\frac{(Cu^{+2})^3(p_{NO})^2}{(NO_3^-)^2 \times (H^+)^8}$$

Anode $Cu(s) \rightarrow Cu^{+2} + 2e^-$

Cathode $\frac{e^- + 2n^+ + NO_3^- \rightarrow NO_2 + H_2O}{Cu(s) + 4H^+ + 2NO_3^- \rightarrow 2NO_2 + 2H_2O + Cu^{+2}}$

$\epsilon^0_{cell} = 1.13$

$$Q = \frac{(Cu^{+2})(p_{NO_2})^2}{(NO_3^-)^2(H^+)^4}$$

$$\epsilon_{cell} = 1.13 - \frac{0.059}{2}\log\frac{(Cu^{+2})(p_{NO_2})^2}{(NO_3^-)^2(H^+)^4}$$

$\epsilon_{cell\,T} = \epsilon_{cell\,2}$

$$1.3 - \frac{0.059}{6}\log(Q_1) = 1.13 - \frac{0.059}{2}\log(Q_2)$$

$$0.17 = \frac{0.059}{6}\{\log(Q_1) - 3\log(Q_2)\}$$

$$=\frac{0.059}{6}\left\{\log\frac{(\mathrm{Cu}^{+2})^3\times(p_{\mathrm{NO}})^2\times(\mathrm{NO}_3^-)^6(\mathrm{H}^+)^{12}}{(\mathrm{NO}_3^-)^2(\mathrm{H}^+)^8\times(\mathrm{Cu}^{+2})^3\times\left(p_{\mathrm{NO}_2}\right)^6}\right\}$$

$$=\frac{0.059}{6}\left\{\log\frac{[\mathrm{NO}_3^-]^4[\mathrm{H}^+]^4}{\left(P_{\mathrm{NO}_2}\right)^4}\right\}$$

$$0.17=\frac{0.059}{6}\times 8\log(HNO_3)$$

$$\log(\mathrm{HNO}_3)=2.16$$

$$[\mathrm{HNO}_3]=10^{2.16}=10^x$$

$$x=2.16\Rightarrow 2x=4.32\approx 4$$

59. (15)

Moles $(n)=5$

$\mathrm{T}=293\mathrm{k}$

Process = IsoT.→ Irreversible

$P_{\text{ini}}=2.1\mathrm{MPa}$

$\mathrm{P_t}=1.3\mathrm{MPa}$

$P_{\text{ext}}=4.3\mathrm{mPa}$

Work $=-P_{\text{ext}}\,\Delta\mathrm{V}$

$$=-4.3\times\left(\frac{5\times 293R}{1.3}-\frac{5\times 293}{2.1}\right)$$
$$=-5\times 293\times 8.314\times 43\left(\frac{1}{13}-\frac{1}{21}\right)$$
$$=\frac{5\times 293\times 8.314\times 43\times 8}{21\times 13}$$
$$=-15347.7049\ \mathrm{J}$$
$$=-15.34\mathrm{KJ}$$

Isothermal process, so $\Delta\mathrm{U}=0$

$\mathrm{W}=-\mathrm{Q}$

$\mathrm{Q}=15.34\mathrm{KJ/mol}$

So answer is 15

60. (1) Cs is used in photoelectric cell due to its very low ionization potential.

61. (c)

$A(1,2,3), B(2,3,1), C(2,4,2), O(0,0,0)$

Equation of plane passing through A, B, C will be

$$\begin{vmatrix} x-1 & y-2 & z-3 \\ 2-1 & 3-2 & 1-3 \\ 2-1 & 4-2 & 2-3 \end{vmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} x-1 & y-2 & z-3 \\ 1 & 1 & -2 \\ 1 & 2 & -1 \end{vmatrix} = 0$$

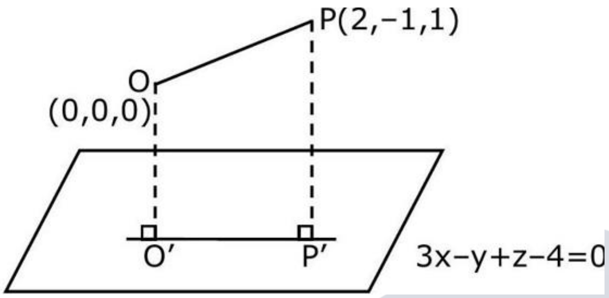
$\Rightarrow (x-1)(-1+4) - (y-2)(-1+2) + (z-3)(2-1) = 0$

$\Rightarrow (x-1)(\mathrm{c}) - (y-2)(\mathrm{a}) + (z-3)(\mathrm{a}) = 0$

$\Rightarrow 3x - 3 - y + 2 + z - 3 = 0$

$\Rightarrow 3x - y + z - 4 = 0$, is the required plane.

Now, given $O(0,0,0) \& P(2,-1,1)$



Plane is $3x - y + z - 4 = 0$

O′&P′ are foot of perpendiculars.
for O′

$$\frac{x-0}{3} = \frac{y-0}{-1} = \frac{z-0}{1} = \frac{-(0-0+0-4)}{9+1+1}$$

$$\frac{x}{3} = \frac{y}{-1} = \frac{z}{1} = \frac{4}{11}$$

$$\Rightarrow O'\left(\frac{12}{11}, \frac{-4}{11}, \frac{4}{11}\right)$$

for P′

$$\frac{x-2}{3}=\frac{y+1}{-1}=\frac{z-1}{1}=\frac{-(3(\mathrm{b})-(-1)+1-4)}{9+1+1}$$
$$\frac{x-2}{3}=\frac{y+1}{-1}=\frac{z-1}{1}=\left(\frac{-4}{11}\right)$$
$$P'\left(\frac{-12}{11}+2,\frac{4}{11}-1,\frac{-4}{11}+1\right)$$
$$\Rightarrow P'\left(\frac{10}{11},\frac{-7}{11},\frac{7}{11}\right)$$
$$O'P'=\sqrt{\left(\frac{10}{11}-\frac{12}{11}\right)^2+\left(\frac{-7}{11}+\frac{4}{11}\right)^2+\left(\frac{7}{11}-\frac{4}{11}\right)^2}$$
$$\Rightarrow O'P'=\frac{1}{11}\sqrt{4+9+9}$$
$$\Rightarrow O'P'=\frac{\sqrt{22}}{11}$$
$$\Rightarrow O'P'=\frac{\sqrt{2}\times\sqrt{11}}{11}$$
$$\Rightarrow O'P'=\sqrt{\frac{2}{11}}$$

62. (a) Contrapositive of $p \to q$ is $\sim q \to \sim p$

p → you will work

q → you will earn money

$\sim q$ → you will not earn money

$\sim p$ → you will not work

$\sim q \to \sim p \Rightarrow$ if you will not earn money, you will not work.

63. (d)

$(1-2i)^2+\alpha(1-2i)+\beta=0$

$1-4-4i+\alpha-2i\alpha+\beta=0$

$(\alpha+\beta-3)-\mathrm{i}(4+2\alpha)=0$

$\alpha+\beta-3=0\ \&\ 4+2\alpha=0$

$\alpha=-2\ \beta=5$

$\alpha-\beta=-7$

64. (b)

$$I_{n+2}+I_n=\int_{\frac{\pi}{4}}^{\frac{\pi}{2}}\cot^n x\cdot\operatorname{cosec}^2 x dx=\left[\frac{-(\cot x)^{n+1}}{n+1}\right]_{\frac{\pi}{4}}^{\frac{\pi}{2}}$$

$$I_{n+2}+I_n=\frac{1}{n+1}$$

$$I_2+I_4=\frac{1}{3}, I_3+I_5=\frac{1}{4}, I_4+I_6=\frac{1}{5}$$

65. (a)

$$\begin{bmatrix}1 & -\alpha\\ \alpha & \beta\end{bmatrix}\begin{bmatrix}1 & \alpha\\ -\alpha & \beta\end{bmatrix}=\begin{bmatrix}1+\alpha^2 & \alpha-\alpha\beta\\ \alpha-\alpha\beta & \alpha^2+\beta^2\end{bmatrix}=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$$

$1+\alpha^2=1$

$\alpha^2=0$

$\alpha^2+\beta^2=1$

$\beta^2=1$

$\alpha^4=0$

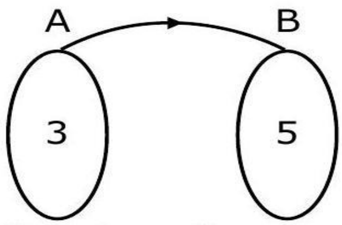
$\beta^4=1$

$\alpha^4+\beta^4=1$

66. (b) Number of elements in $A=3$

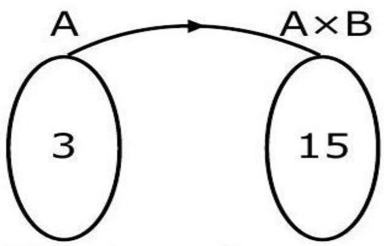
Number of elements in $B=5$

Number of elements in $A\times B=15$



Number of one-one function $x=5\times 4\times 3$

$x=60$



Number of one-one function

$y=15\times 14\times 13$

$y = 15 \times 4 \times \frac{14}{4} \times 13$

$y = 60 \times \frac{7}{2} \times 13$

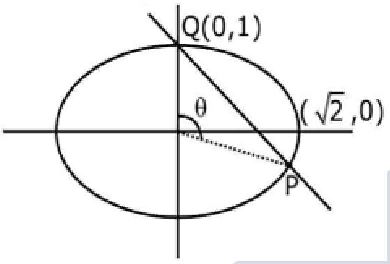
$2y = (13)(7x)$

$2y = 91x$

67. (a)

Ellipse $\frac{x^2}{2} + \frac{y^2}{1} = 1$

Line $x + y = 1$



Using homogenisation

$x^2 + 2y^2 = 2(1)^2$

$x^2 + 2y^2 = 2(x + y)^2$

$x^2 + 2y^2 = 2x^2 + 2y^2 + 4xy$

$x^2 + 4xy = 0$

for $ax^2 + 2hxy + by^2 = 0$

$\tan\theta = \left|\frac{2\sqrt{h^2 - ab}}{a + b}\right|$

$\tan\theta = \left|\frac{2\sqrt{(2)^2 - 0}}{1 + 0}\right|$

$\tan\theta = -4$

$\cot\theta = -\frac{1}{4}$

$\theta = \cot^{-1}\left(-\frac{1}{4}\right)$

$\theta = \pi - \cot^{-1}\left(\frac{1}{4}\right)$

$\theta = \pi - \left(\frac{\pi}{2} - \tan^{-1}\left(\frac{1}{4}\right)\right)$

$\theta = \frac{\pi}{2} + \tan^{-1}\left(\frac{1}{4}\right)$

68. (c) $\int \frac{e^{3\log_e 2x} + 5e^{2\log_e 2x}}{e^{4\log_e x} + 5e^{3\log_e x} - 7e^{2\log_e x}} dx$

$= \int \frac{8x^3 + 5(4x^2)}{x^4 + 5x^3 - 7x^2}$

$= \int \frac{8x^3 + 20x^2}{x^4 + 5x^3 - 7x^2}$

$= \int \frac{8x + 20}{x^2 + 5x - 7}$

$= \int \frac{4(2x+5)}{x^2 + 5x - 7} \left\{\begin{matrix}\text{Let } x^2 + 5x - 7 = t \\ (2x+5)dx = dt\end{matrix}\right\}$

$= \int \frac{4dt}{t}$

$= 4\ln|t| + C$

$= 4\ln|(x^2 + 5x - 7)| + c$

69. (b)

$e_1 = \sqrt{1 - \frac{16}{25}} = \frac{3}{5}$ foci $(\pm ae, 0)$

Foci $= (\pm 3, 0)$

Let equation of hyperbolabe $\frac{x^2}{A^2} - \frac{y^2}{B^2} = 1$

Passes through $(\pm 3, 0)$

Sol. $A^2 = 9, A = 3, e_2 = \frac{5}{3}$

$e_2^2 = 1 + \frac{B^2}{A^2}$

$\frac{25}{9} = 1 + \frac{B^2}{9} \Rightarrow B^2 = 16$

$\frac{x^2}{9} - \frac{y^2}{16} = 1$

70. (c)

$\text{Lim}_{x\to\infty} \sum_{r=0}^{n-1} \frac{n}{(n+r)^2} = \text{Lim}_{x\to\infty} \sum_{r=0}^{n-1} \frac{n^2}{n^2\left(1+\frac{r}{n}\right)^2} = \int_0^1 \frac{dx}{(1+x)^2}$

$= -\left[\frac{1}{1+x}\right]_0^1 \Rightarrow -\left[\frac{1}{2} - 1\right] = \frac{1}{2}$

71. (d) Based on Baye's theorem

$$\text{Probability } = \frac{\left(160 \times \frac{35}{100}\right)}{\left(160 \times \frac{35}{100}\right) + \left(100 \times \frac{20}{100}\right) + \left(140 \times \frac{10}{100}\right)}$$
$$= \frac{5600}{9000}$$
$$= \frac{28}{45}$$

72. (b)

$$\Delta = \begin{vmatrix} 2 & 3 & 2 \\ 3 & 2 & 2 \\ 1 & -1 & 4 \end{vmatrix} = -20 \neq 0 \ \therefore \text{unique solution}$$

$$\Delta_x = \begin{vmatrix} 9 & 3 & 2 \\ 9 & 2 & 2 \\ 8 & -1 & 4 \end{vmatrix} = 0$$
$$\Delta_y = \begin{vmatrix} 2 & 9 & 2 \\ 3 & 9 & 2 \\ 1 & 8 & 4 \end{vmatrix} = -20$$
$$\Delta_z = \begin{vmatrix} 2 & 3 & 9 \\ 3 & 2 & 9 \\ 1 & -1 & 8 \end{vmatrix} = -40$$
$$\therefore \ x = \frac{\Delta_x}{\Delta} = 0$$
$$y = \frac{\Delta_y}{\Delta} = 1$$
$$z = \frac{\Delta_z}{\Delta} = 2$$

Unique solution: (0,1,2)

73. (d) $AM \geq GM$

$$\frac{a^{ax} + \frac{a}{a^{ax}}}{2} \geq \left(a^{ax} \cdot \frac{a}{a^{ax}}\right)^{1/2} \Rightarrow a^{ax} + a^{1-ax} \geq 2\sqrt{a}$$

74. (c) $f(x) = \frac{5^x}{5^x+5}$ ... (i)

$$f(2-x) = \frac{5^{2-x}}{5^{2-x}+5}$$

$f(2-x) = \frac{5}{5^x+5}$ ... ... (ii)

Adding equation (i) and (ii)

$\mathrm{f(x) + f(2-x) = 1}$

$$f\left(\frac{1}{20}\right) + f\left(\frac{39}{20}\right) = 1$$

$$f\left(\frac{2}{20}\right) + f\left(\frac{38}{20}\right) = 1$$

:

$$f\left(\frac{19}{20}\right)+f\left(\frac{21}{20}\right)=1$$

and $f\left(\frac{20}{20}\right)=f(a)=\frac{1}{2}$

$$\Rightarrow 19+\frac{1}{2}\Rightarrow\frac{39}{2}$$

75. (c) $x^2-6x-2=0<^{\alpha}_{\beta}$ $\quad \begin{matrix}\alpha+\beta=6\\ \alpha\beta=-2\end{matrix}$

and $\alpha^2-6\alpha-2=0\Rightarrow\alpha^2-2=6\alpha$ $\beta^2-6\beta-2=0\Rightarrow\beta^2-2=6\beta$

$$\begin{aligned}\frac{a_{10}-2a_8}{3a_9}&=\frac{(\alpha^{10}-\beta^{10})-2(\alpha^8-\beta^8)}{3(\alpha^9-\beta^9)}\\ &=\frac{(\alpha^{10}-2\alpha^8)-(\beta^{10}-2\beta^8)}{3(\alpha^9-\beta^9)}\\ &=\frac{\alpha^8(\alpha^2-2)-\beta^8(\beta^2-2)}{3(\alpha^9-\beta^9)}\\ &=\frac{\alpha^8(6\alpha)-\beta^8(6\beta)}{3(\alpha^9-\beta^9)}=\frac{6(\alpha^9-\beta^9)}{3(\alpha^9-\beta^9)}=\frac{6}{3}=2\end{aligned}$$

76. (a)

$$A=\begin{bmatrix}R_{11}&R_{12}&R_{13}\\R_{21}&R_{22}&R_{23}\\R_{31}&R_{32}&R_{33}\end{bmatrix}$$

$$2A=\begin{bmatrix}2R_{11}&2R_{12}&2R_{13}\\2R_{21}&2R_{22}&2R_{23}\\2R_{31}&2R_{32}&2R_{33}\end{bmatrix}$$

$R_2\to 2R_2+5R_3$

$$B=\begin{bmatrix}2R_{11}&2R_{12}&2R_{13}\\4R_{21}+10R_{31}&4R_{22}+10R_{32}&4R_{23}+10R_{33}\\2R_{31}&2R_{32}&2R_{33}\end{bmatrix}$$

$R_2\to R_2-5R_3$

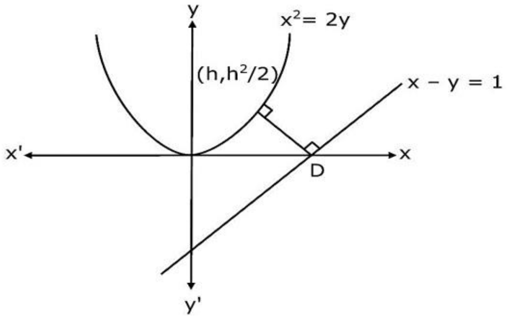
$$B=\begin{bmatrix}2R_{11}&2R_{12}&2R_{13}\\4R_{21}&4R_{22}&4R_{23}\\2R_{31}&2R_{32}&2R_{33}\end{bmatrix}$$

$$|B|=\begin{vmatrix}2R_{11}&2R_{12}&2R_{13}\\4R_{21}&4R_{22}&4R_{23}\\2R_{31}&2R_{32}&2R_{33}\end{vmatrix}$$

$$|B|=2\times2\times4\begin{vmatrix}R_{11}&R_{12}&R_{13}\\R_{21}&R_{22}&R_{23}\\R_{31}&R_{32}&R_{33}\end{vmatrix}$$

$$=16\times4$$
$$=64$$

77. (c) Shortest distance must be along common normal



m_1(slope of line $x - y = 1$) $= 1 \Rightarrow$ slope of perpendicular line $= -1$

$m_2 = \frac{2x}{2} = x \Rightarrow m_2 = h \Rightarrow$ slope of normal $-\frac{1}{h}$

$-\frac{1}{h} = -1 \Rightarrow h = 1$

sopoint is $\left(1, \frac{1}{2}\right)$

$$D = \left|\frac{1 - \frac{1}{2} - 1}{\sqrt{1+1}}\right| = \frac{1}{2\sqrt{2}}$$

78. (c) Total cases

$$\text{Probability} = \frac{(4 \times 9 \times 9 \times 9) - (3 \times 9 \times 9)}{\dfrac{(3 \times 9 \times 9) - (2 \times 9) + (8 \times 9 \times 9)}{(4 \times 9^3) - (3 \times 9^2)}}$$

$$= \frac{97}{217}$$

79. (b) cosec$\left(2\cot^{-1}(5) + \cos^{-1}\left(\frac{4}{5}\right)\right)$

$$\operatorname{cosec}\left(2\tan^{-1}\left(\frac{1}{5}\right) + \cos^{-1}\left(\frac{4}{5}\right)\right)$$

$$= \operatorname{cosec}\left(\tan^{-1}\left(\frac{2\left(\frac{1}{5}\right)}{1 - \left(\frac{1}{5}\right)^2}\right) + \cos^{-1}\left(\frac{4}{5}\right)\right)$$

$$= \operatorname{cosec}\left(\tan^{-1}\left(\frac{5}{12}\right) + \cos^{-1}\left(\frac{4}{5}\right)\right)$$

Let $\tan^{-1}(5/12) = \theta \Rightarrow \sin\theta = \frac{5}{13}, \cos\theta = \frac{12}{13}$

and $\cos^{-1}\left(\frac{4}{5}\right) = \phi \Rightarrow \cos\phi = \frac{4}{5}$ and $\sin\phi = \frac{3}{5}$

$= \operatorname{cosec}(\theta + \phi)$

$$=\frac{1}{\sin\theta\cos\phi+\cos\theta\sin\phi}$$

$$=\frac{1}{\frac{5}{13}\cdot\frac{4}{5}+\frac{12}{13}\cdot\frac{3}{5}}=\frac{65}{56}$$

80. (a) $2\cos\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)-\left[2\cos^2\left(\frac{x+y}{2}\right)-1\right]=\frac{3}{2}$

$$2\cos\left(\frac{x+y}{2}\right)\left[\cos\left(\frac{x-y}{2}\right)-\cos\left(\frac{x+y}{2}\right)\right]=\frac{1}{2}$$

$$2\cos\left(\frac{x+y}{2}\right)\left[2\sin\left(\frac{x}{2}\right)\cdot\sin\left(\frac{y}{2}\right)\right]=\frac{1}{2}$$

$$\cos\left(\frac{x+y}{2}\right)\cdot\sin\left(\frac{x}{2}\right)\cdot\sin\left(\frac{y}{2}\right)=\frac{1}{8}$$

Possible when $\frac{x}{2}=30^\circ \& \frac{y}{2}=30^\circ$

$x=y=60^\circ$

$$\sin x+\cos y=\frac{\sqrt{3}}{2}+\frac{1}{2}=\frac{\sqrt{3}+1}{2}$$

81. (5)

$$\lim_{x\to 0}\frac{\mathrm{ax}-(e^{4x}-1)}{\mathrm{ax}(e^{4x}-1)}$$

Applying L' Hospital Rule

$\lim_{x\to 0}\frac{a-4e^{4x}}{a(e^{4x}-1)+ax(4e^{4x})}$ So $a=4$

Sol. Applying L' Hospital Rule

$$\lim_{x\to 0}\frac{-16e^{4x}}{a(4e^{4x})+a(4e^{4x})+ax(16e^{4x})}$$

$$\frac{-16}{4a+4a}=\frac{-16}{32}=-\frac{1}{2}=b$$

$$a-2b=4-2\left(\frac{-1}{2}\right)=4+1=5$$

82. (9) Circle: $(x-3)^2+y^2=9$

Parabola: $y^2=4x$

Let tangent $y=mx+\frac{a}{m}$

$$y=mx+\frac{1}{m}$$

$m^2x - my + 1 = 0$

the above line is also tangent to circle

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

$\therefore \perp$ from $(3,0) = 3$

$\left|\frac{3m^2 - 0 + 1}{\sqrt{m^2 + m^4}}\right| = 3$

$(3m^2 + 1)^2 = 9(m^2 + m^4)$
$6m^2 + 1 + 9m^4 = 9m^2 + 9m^4$

$3m^2 = 1$

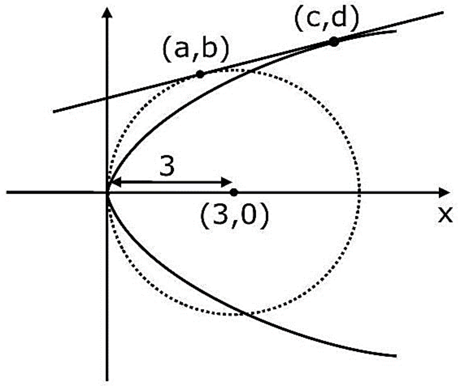
$m = \pm\frac{1}{\sqrt{3}}$

$\therefore$ tangent is

$y = \frac{1}{\sqrt{3}}x + \sqrt{3}$ or $y = -\frac{1}{\sqrt{3}}x - \sqrt{3}$

(it will be used) (rejected)

$\text{m} = \frac{1}{\sqrt{3}}$



for Parabola $\left(\frac{a}{m^2}, \frac{2a}{m}\right) \equiv (3, 2\sqrt{3})$

(c, d)

for Circle $y = \frac{1}{\sqrt{3}}x + \sqrt{3}$ & $(x-3)^2 + y^2 = 9$

solving, $(x-3)^2 + \left(\frac{1}{\sqrt{3}}x + \sqrt{3}\right)^2 = 9$

$$x^2+9-6x+\frac{1}{3}x^2+3+2x=9$$
$$\frac{4}{3}x^2-4x+3=0$$
$$4x^2-12x+9=0$$
$$4x^2-6x-6x+9=0$$
$$2x(2x-3)-3(2x-3)=0$$
$$(2x-3)(2x-3)=0$$
$$x=\frac{3}{2}$$

$$\therefore\ y=\frac{1}{\sqrt{3}}\left(\frac{3}{2}\right)+\sqrt{3}$$
$$y=\frac{\sqrt{3}}{2}+\sqrt{3}$$
$$y=\frac{3\sqrt{3}}{2}$$
$$(a,b)\equiv\left(\frac{3}{2},\frac{3\sqrt{3}}{2}\right)$$
$$2(a+c)=2\left(\frac{3}{2}+3\right)$$
$$=2\left(\frac{3}{2}+\frac{6}{2}\right)$$
$$=9$$

83. (19) $3\int_{-2}^{2}|x^2-x-2|dx\ x^2-x-2$

$\oplus_{-1}^{\oplus}$

$$=3\left\{\int_{-2}^{-1}(x^2-x-2)dx+\int_{-1}^{2}(-x^2+x+2)dx\right\}$$
$$=3\left[\left(\frac{x^3}{3}-\frac{x^2}{2}-2x\right)_{-2}^{-1}-\left(\frac{x^3}{3}-\frac{x^2}{2}-2x\right)_{-1}^{2}\right]$$
$$=19$$

84. (1) Let $x=4k+3$

$(2020+x)^{2022}$

$=(2020+4\mathrm{k}+3)^{2022}$

$=(4(505)+4\mathrm{k}+3)^{2022}$

$=(4\mathrm{P}+3)^{2022}$

$=(4\mathrm{P}+4-1)^{2022}$

$=(4\ \mathrm{A}-1)^{2022}$

${}^{2022}\mathrm{C}_0(4\ \mathrm{A})^0(-1)^{2022}+{}^{2022}\mathrm{C}_1(4\ \mathrm{A})^1(-1)^{2021}+\cdots$ ....

$1+8\lambda$

Reminder is 1.

85. (44)

$\ell_1: \vec{r} = (3+t)\hat{\imath} + (-1+2t)\hat{\jmath} + (4+2t)\hat{k}$

$\ell_1: \frac{x-3}{1} = \frac{y+1}{2} = \frac{z-4}{2} \Rightarrow$ D.R. of $\ell_1 = 1,2,2$

$\ell_2: \vec{r} = (3+2s)\hat{\imath} + (3+2s)\hat{\jmath} + (2+s)\hat{k}$

$\ell_2: \frac{x-3}{2} = \frac{y-3}{2} = \frac{z-2}{1} \Rightarrow$ D.R. of $\ell_2 = 2,2,1$

D.R. of ℓ is $\perp$ to $\ell_1 \& \ell_2$

$\therefore$ D.R. of $\ell \parallel (\ell_1 \times \ell_2) \Rightarrow \langle -2,3,-2 \rangle$

$\therefore$ Equation of $\ell: \frac{x}{2} = \frac{y}{-3} = \frac{z}{2}$

Solving ℓ & ℓ_1

$(2\lambda, -3\lambda, 2\lambda) = (\mu+3, 2\mu-1, 2\mu+\mu)$
$\Rightarrow 2\lambda = \mu+3$
$-3\lambda = 2\mu-1$
$2\lambda = 2\mu+4$
$\Rightarrow \mu+3 = 2\mu+4$
$\mu = -1$
$\lambda = 1$

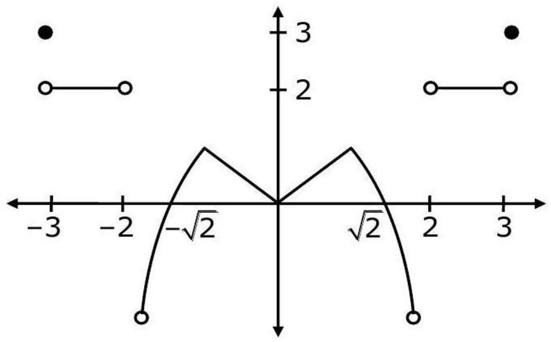
$P(2,-3,2)$ {intersection point}

Let, $Q(2v+3, 2v+3, v+2)$ be point on ℓ_2

Now, PQ $= \sqrt{(2v+3-2)^2 + (2v+3+3)^2 + (v+2-2)^2} = \sqrt{17}$
$\Rightarrow (2v+1)^2 + (2v+6)^2 + (v)^2 = 17$
$\Rightarrow 9v^2 + 28v + 36 + 1 - 17 = 0$
$\Rightarrow 9v^2 + 28v + 20 = 0$
$\Rightarrow 9v^2 + 18v + 10v + 20 = 0$
$\Rightarrow (9v+10)(v+2) = 0$
$\Rightarrow v = -2$(rejected), $-\frac{10}{9}$ (accepted)

$Q\left(3 - \frac{20}{9}, 3 - \frac{20}{9}, 2 - \frac{10}{9}\right)$
$\left(\frac{7}{9}, \frac{7}{9}, \frac{8}{9}\right)$
$\therefore 18(a+b+c)$
$= 18\left(\frac{7}{9} + \frac{7}{9} + \frac{8}{9}\right)$
$= 44$

86. (5)



Points of non-differentiability in $(-3,3)$ are at $x=-2,-1,0,1,2$.

i.e. 5 points.

87. (4)

$$4y^3\frac{dy}{dx}=1 \;\&\; x\frac{dy}{dx}+y=0$$

$$m_1=\frac{1}{4y^3} \qquad \frac{dy}{dx}=\frac{-y}{x}=m_2$$

$$m_1m_2=-1$$

$$\frac{1}{4\cdot y^3}\times\frac{-y}{x}=-1 \qquad \because x=y^4$$

$$\frac{1}{4\cdot y^6}=1 \qquad \text{and } xy=k$$

$$y^6=\frac{1}{4} \qquad \Rightarrow k=y^5$$

$$\Rightarrow k^6=y^{30}$$

$$\Rightarrow k^6=\left(\frac{1}{4}\right)^5$$

$\therefore (4\mathrm{k})^6=4^6\times \mathrm{k}^6=4$

88. (45)

$\because 7^n=(10-3)^n=10K+(-3)^n$

$\therefore 7^n+3^n=10K+(-3)^n+3^n$

$10K$ if $n=$ odd

$10K+2.3^n$ if $n=$ even

Let $n=2t; t\in N$

$\therefore 3^n=3^{2t}=(10-1)^t$

$=10p+(-1)^t$

$=10p\pm 1$

$\therefore$ if $\mathrm{n}=$ even then $7^{\mathrm{n}}+3^{\mathrm{n}}$ will not be multiply of 10

So if n is odd then only 7^n+3^n will be multiply of 10

$\therefore$ n = 11,13,15 99

$\therefore$ 45

89. (2)

. $\vec{a} = \hat{\imath} + \alpha\hat{\mathbf{j}} + 3\hat{k}$

$\vec{b} = 3\hat{\imath} - \alpha\hat{\jmath} + \hat{k}$

Area of parallelogram $= |\vec{a} \times \vec{b}|$

$= |(\hat{\imath} + \alpha\hat{\jmath} + 3\hat{k}) \times (3\hat{\imath} - \alpha\hat{\jmath} + \hat{k})|$

$8\sqrt{3} = |(4\alpha)\hat{\imath} + 8\hat{\jmath} - (4\alpha)\hat{k}|$

$(64)(c) = 16\alpha^2 + 64 + 16\alpha^2$

$(64)(c) = 32\alpha^2 + 64$

$6 = \alpha^2 + 2$

$\alpha^2 = 4$

$\therefore\ \vec{a} = \hat{\imath} + \alpha\hat{\jmath} + 3\hat{k}$

$\vec{b} = 3\hat{\imath} - \alpha\hat{\jmath} + \hat{k}$

$\vec{a} \cdot \vec{b} = 3 - \alpha^2 + 3$

$= 6 - \alpha^2$

$= 6 - 4$

$= 2$

90. (1) Given,

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

$$\frac{1}{y} = z$$
$$-\frac{1}{y^2}\frac{dy}{dx} = \frac{dz}{dx}$$

$$\Rightarrow \frac{dz}{dx} + z\left(\frac{1}{x}\right) = 2$$

I.F. $= e^{\int \frac{1}{x}dx} = x$

$\therefore\ z(x) = \int 2(x)dx = x^2 + c$

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

As it passes through P(2,1)

[Point of intersection of $2x - 3y = 1$ and $3x + 2y = 8$]

$\therefore \frac{2}{1} = 4 + \mathrm{c}$

$\Rightarrow \mathrm{c} = -2$

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

Put $x = 1$

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

$\Rightarrow \mathrm{y(a)} = -1$

$\Rightarrow |y(\mathrm{a})| = 1$