1. (c)

$$F = \eta A \frac{dv}{dy}$$

$$[MLT^{-2}] = \eta[L^2][T^{-1}]$$

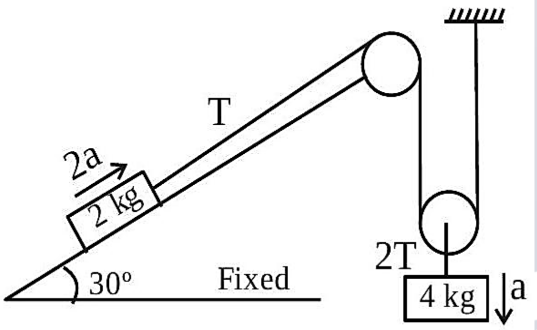
$$\eta = [ML^{-1}T^{-1}]$$

$$S.T = \frac{F}{\ell} = \frac{[MLT^{-2}]}{[L]} = [ML^0T^{-2}]$$

$$L = mvr = [ML^2T^{-1}]$$

$$K.E = \frac{1}{2}I\omega^2 = [ML^2T^{-2}]$$

2. (b)



$$40 - 2T = 4a$$

$$T - 10 = 4a \Rightarrow 20 = 12a$$

$$\Rightarrow a = 5/3 \Rightarrow 2a = \frac{g}{3}$$

3. (c)

$$R_{eq} = 4000\Omega$$

$$i = \frac{4}{4000} = \frac{1}{1000}A$$

$$V_0 = i.R = \frac{1}{1000} \times 500 = 0.5\text{ V}$$

4. (c) Young's modulus depends on the material not length and cross-sectional area. So, young's modulus remains same.

5. (b) For P.E.E.: $\lambda \leq \frac{hc}{W_e}$

$$\lambda \leq \frac{1240\text{ nm} - \text{eV}}{3\text{eV}}$$

$$\lambda \leq 413.33\text{ nm}$$

$\lambda_{max} \approx 414$ nm for P.E.E.

6. (c)

$\frac{1}{2}|PE| = KE$ for each value of n (orbit)

$\therefore \frac{KE}{|PE|} = \frac{1}{2}$

7. (b)

By COME

$KE_A + U_A = KE_B + U_B$

$0 + mg(a) = \frac{1}{2}mv^2 + mg \times 0.5$

$v = \sqrt{g} = \sqrt{10}$ m/s

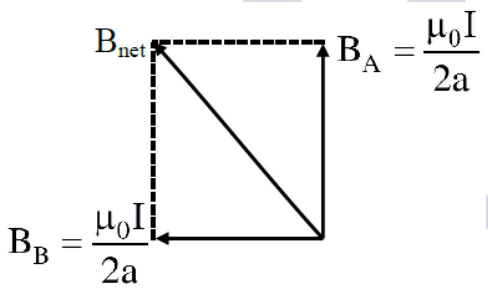
8. (b)

Given $\vec{E} = E_0 \cos(\omega t - kz)\hat{\imath}$

$\vec{B} = \frac{E_0}{C}\cos(\omega t - kz)\hat{\jmath}$

$\hat{C} = \hat{E} \times \hat{B}$

9. (c)



$\because B_{net} = \frac{\sqrt{2}\mu_0 I}{2a}$

10. (a) Width of 1st secondary maxima $= \frac{\lambda}{a}.D$

Here

$a = 0.2 \times 10^{-3}$ m

$\lambda = 400 \times 10^{-9}$ m

$D = 100 \times 10^{-2}$

Width of 1st secondary maxima

$$= \frac{400 \times 10^{-9}}{0.2 \times 10^{-3}} \times 100 \times 10^{-2}$$

$= 2 \text{ mm}$

11. (a)

$\frac{\varepsilon_1}{\varepsilon_2} = \frac{N_1}{N_2} = \frac{100}{10} \Rightarrow \varepsilon_2 = 22 \text{ V}$

$$I = \frac{22}{22 \times 10^3} = 1 \text{ mA}, V_0 = 7 \text{ V}$$

12. (a)

$-\frac{\mathrm{GM_E}}{\mathrm{R_E+h}} = -5.12 \times 10^{-7}$ ... (i)

$\frac{\mathrm{GM_E}}{(\mathrm{R_E+h})^2} = 6.4$ .... (ii)

By (i) and (ii)

$\Rightarrow \mathrm{h} = 16 \times 10^5 \text{ m} = 1600 \text{ km}$

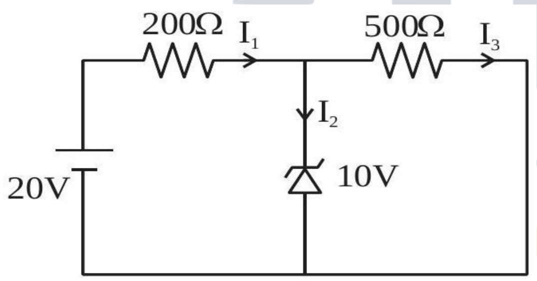
13. (c) $\mathrm{R_{T=27}} = 60\Omega, R_T = \frac{220}{2.75} = 80\Omega$

$\mathrm{R} = \mathrm{R_0}(1 + \alpha\Delta\mathrm{T})$

$80 = 60[1 + 2 \times 10^{-4}(\mathrm{T} - 27)]$

$\mathrm{T} \approx 1694^\circ\mathrm{C}$

14. (c)



Zener is in breakdown region.

$$I_3 = \frac{10}{500} = \frac{1}{50}$$

$$I_1 = \frac{10}{200} = \frac{1}{20}$$

$I_2 = I_1 - I_3$

$$I_2 = \left(\frac{1}{20} - \frac{1}{50}\right) = \left(\frac{3}{100}\right) = 30 \text{ mA}$$

15. (c) For process A

$\log P = \gamma \log \mathrm{V} \Rightarrow \mathrm{P} = \mathrm{V}^{\gamma}, (\gamma > 1)$

$PV^{-\gamma} = \text{Constant}$

$C_A = C_V + \frac{R}{1+\gamma}$.

Likewise for process B $\rightarrow PV^{-1} = \text{Cons} \tan t$

$$C_B = C_v + \frac{R}{1+1}$$

$C_B = C_v + \frac{R}{2}$...

$C_P = C_v + R$

By (i), (ii) & (iii)

$C_P > C_B > C_A > C_v$

16. (b)

$$V = \frac{kP\cos\theta}{r^2}$$

& can also checked dimensionally

17. (d) $\vec{I} = \Delta\vec{P} = \vec{P}_f - \vec{P}_i$

$\mathrm{M} = 0.1 \text{ kg}$

$I = \Delta P = 0.1(\sqrt{2 \times 9.8 \times 5} - (-\sqrt{2 \times 9.8 \times 10}))$

$= 0.1(14 + 7\sqrt{2}) \approx 2.39 \text{ kg ms}^{-1}$

18. (a)

$\mathrm{L} = mu\cos\theta H$

$$= mu\cos\theta \times \frac{u^2 \sin^2\theta}{2g}$$

$$= \frac{mu^3}{2g} \times \frac{\sqrt{3}}{2} \times \left(\frac{1}{2}\right)^2 = \frac{\sqrt{3}mu^3}{16g}$$

19. (d)

$$\sqrt{\frac{3RT}{2}} = \sqrt{\frac{3R(320)}{32}}$$

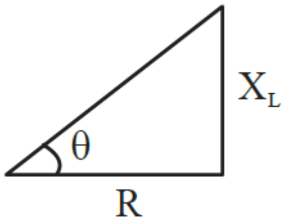
$$T = \frac{320}{16} = 20 \text{ K}$$

20. (c)

$E = 25\sin(1000t)$

$\cos\theta = \frac{1}{\sqrt{2}}$

LR circuit



Initially $\frac{R}{\omega_1 L} = \frac{1}{\tan\theta} = \frac{1}{\tan 45^{\circ}} = 1$

$X_L = \omega_1 L$

$\omega_2 = 2\omega_1$, given

$\tan\theta' = \frac{\omega_2 L}{R} = \frac{2\omega_1 L}{R}$

$\tan\theta' = 2$

$\cos\theta' = \frac{1}{\sqrt{5}}$

21. (35)

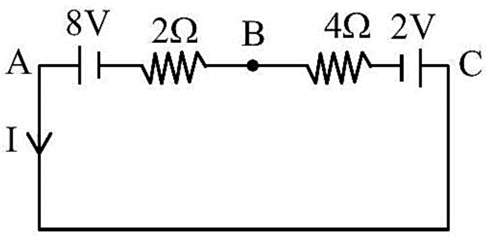
$B_H = 3.5 \times 10^{-5}$ T

$F = i\ell B\sin\theta$, i $= \sqrt{2}$ A

$\frac{F}{\ell} = iB\sin\theta = \sqrt{2} \times 3.5 \times 10^{-5} \times \frac{1}{\sqrt{2}}$

$= 35 \times 10^{-6}$ N/m

22. (6)



$I = \frac{8-2}{2+4} = \frac{6}{6} = 1A$

Applying Kirchhoff from C to B

$V_C - 2 - 4 \times 1 = V_B$

$V_C - V_B = 6V$

$= 6$ V

23. (6)

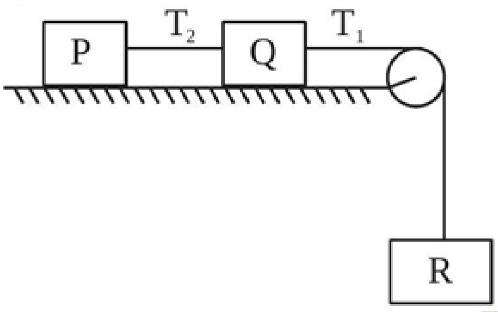
$E_n = -\frac{13.6}{n^2} = -0.85$

$\Rightarrow n = 4$

No of transition

$= \frac{n(n-1)}{2} = \frac{4(4-1)}{2} = 6$

24. (2)



$a = \frac{10}{3} m/s^2$

$30 - T_1 = 3 \times a$

$T_1 = 20N$

strain $= \frac{\text{stress}}{Y}$

$= 2 \times 10^{-4}$

25. (10)

$\frac{v}{u} = -2$

$v = -2u$ ... (i)

$v - u = 45$

$\Rightarrow u = -15$ cm

$v = 30$ cm

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$f = +10$ cm

26. (175)

$v = u + at$

$u + 50 = u + a \Rightarrow a = 50\ m/s^2$

$125 = \mathrm{ut} + \frac{1}{2}\mathrm{at}^2$

$125 = \mathrm{u} + \frac{\mathrm{a}}{2}$

$\Rightarrow \mathrm{u} = 100 \mathrm{~m/s}$

$\therefore \mathrm{S}_{\mathrm{n}^{\mathrm{th}}} = \mathrm{u} + \frac{\mathrm{a}}{2}[2\mathrm{n} - 1]$

$= 175 \mathrm{~m}$

27. (2) Energy loss $= \frac{1}{2}\frac{C_1C_2}{C_1+C_2}(V_1 - V_2)^2$

$= \frac{2}{3} \cdot E$
$\therefore x = 2$

28. (250)

$\vec{L}_i = I\omega_i = \frac{MR^2}{2}.\omega = 100\mathrm{kgm}^2/\mathrm{s}$

$E_i = \frac{1}{2} \cdot \frac{MR^2}{2} \cdot \omega^2 = 500\mathrm{J}$

$\vec{L}_i = \vec{L}_f \Rightarrow 100 = 2I\omega_f$

$\omega_\mathrm{f} = 5\mathrm{rad/sec}$

$E_f = 2 \times \frac{1}{2} \cdot \frac{5(2)^2}{2} \cdot (5)^2 = 250 \mathrm{~J}$

$\Delta E = 250J$

29. (400)

$\frac{V}{4\ell_1} = 30 \Rightarrow \ell_1 = \frac{11}{4}m$

$\frac{V}{4\ell_2} = 110 \Rightarrow \ell_2 = \frac{3}{4}m$

$\Delta\ell = 2m,$

Change in volume $= A \triangle \ell = 400 \mathrm{~cm}^3$

$M = 400 \mathrm{~g}; (\because \rho = 1 \mathrm{~g/cm}^3)$

30. (32)

$B_v = B\sin 30 = \frac{1}{4} \times 10^{-4}$

$\omega = 2\pi \times f = \frac{2\pi}{60} \times 1200 \text{rad/s}$

$\varepsilon = \frac{1}{2} B_V \omega \ell^2$

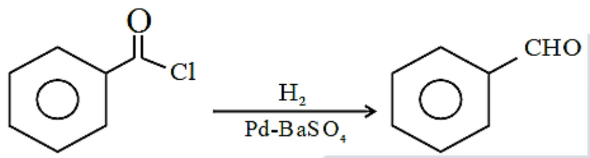
$= 32\pi \times 10^{-5}$ V

31. (c)

$Na_2S + H_2SO_4 \rightarrow Na_2SO_4 + H_2S$

$(CH_3COO)_2Pb + H_2S \rightarrow \underset{\text{Black lead sulphide}}{PbS} + 2CH_3COOH$

32. (a)



It is known as rosenmund reduction that is the partial reduction of acid chloride to aldehyde

33. (a) Sucrose do not contain hemiacetal group.

Hence it does not give test with Fehling solution.

While all other give positive test with Fehling solution

34. (b)

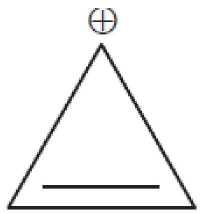
According to NCERT,

Statement-I: Factual data,

Statement-II is true.

But correct explanation is presence of completely filled d and f-orbitals of heavier members

35. (a)


it is aromatic species

36. (b)

Ce : $[Xe]4f^1 5d^1 6s^2$; Ce^{4+} diamagnetic

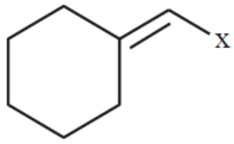
La: $[Xe]4f^0 5d^1 6s^2$; La^{3+} diamagnetic

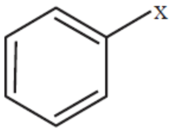
37. (a) $AlCl_3$ in acidified aqueous solution forms octahedral geometry $[Al(H_2O)_6]^{3+}$

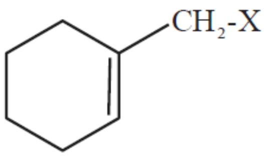
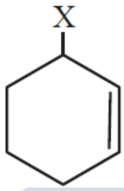
38. (a) For single electron species the energy depends upon principal quantum number ' n ' only. So, statement II is false.

Statement I is correct definition of degenerate orbitals.

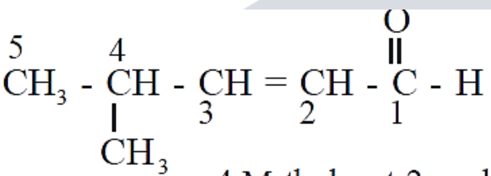
39. (a) Vinyl carbon is sp^2 hybridized aliphatic carbon


is vinyl halide

While  is aryl halide

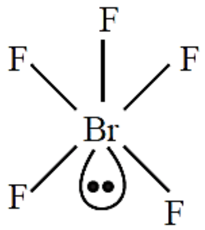
and   are allyl halide

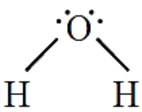
40. (d)

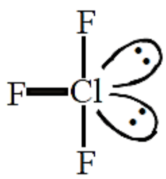


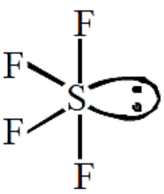
4-Methylpent-2-enal

41. (d)

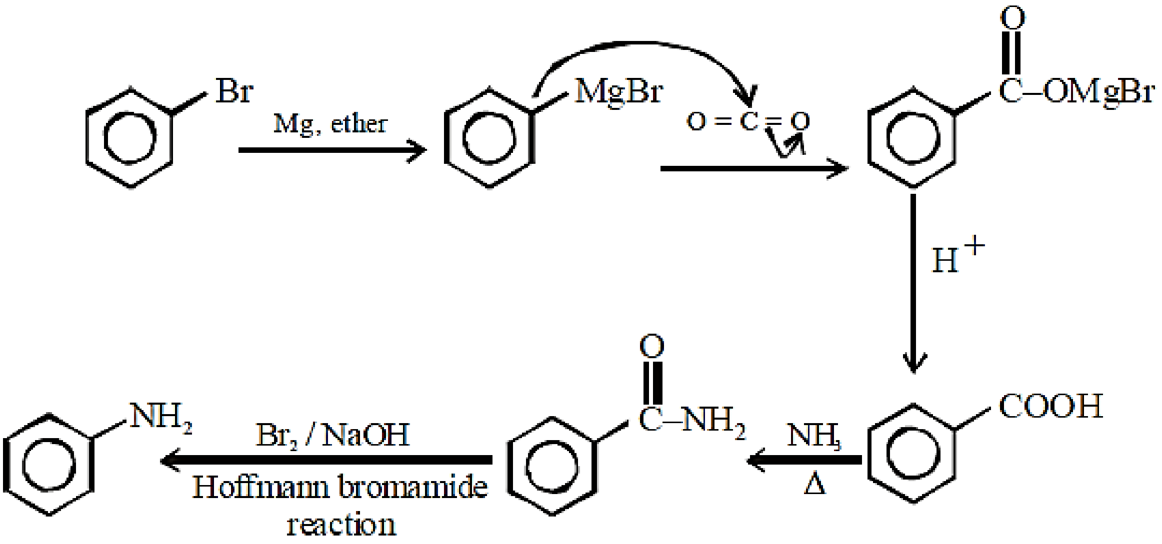
BrF_5  Square pyramidal

H_2O  Bent

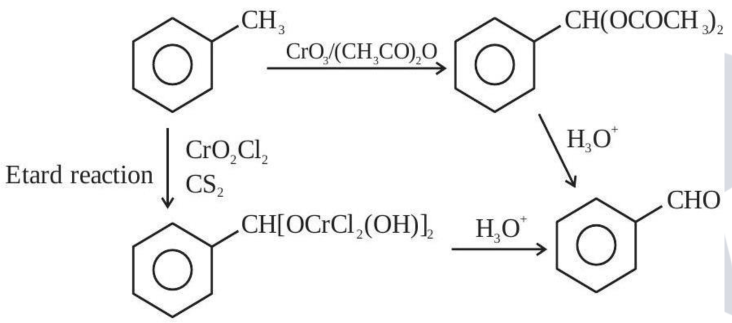
ClF_3  T-shape

SF_4,  See-saw

42. (b)



43. (b)



44. (a) $CH_2 = CH - CH_2 - Cl$

$\uparrow$

It is allyl carbon and sp^3 hybridized

45. (d) On addition of naphthalene to benzene there is depression in freezing point of benzene.

46. (b)

$_{24}Cr \rightarrow [Ar]3\ d^5 4\ s^1; Cr^{2+} \rightarrow [Ar]3\ d^4$

$_{25}Mn \rightarrow [Ar]3\ d^5 4\ s^2; Mn^{+} \rightarrow [Ar]3\ d^5 4\ s^1$

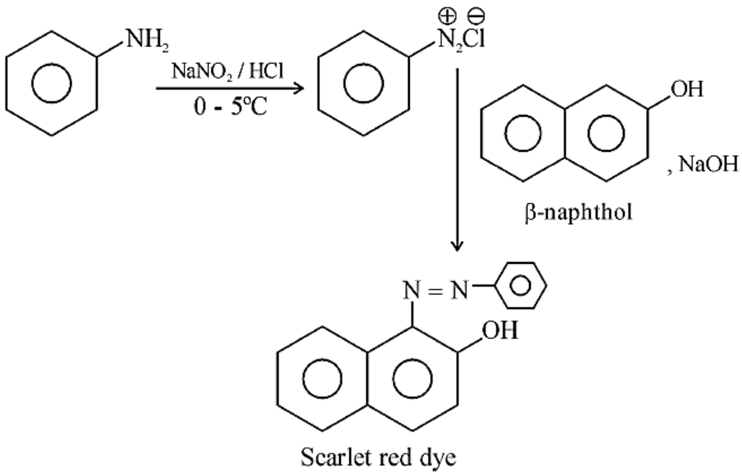
$_{28}Ni \rightarrow [Ar]3\ d^8 4\ s^2; Ni^{2+} \rightarrow [Ar]3\ d^8$

$_{23}\ V \rightarrow [Ar]3\ d^3 4\ s^2; V^{+} \rightarrow [Ar]3\ d^3 4\ s^1$

47. (a)

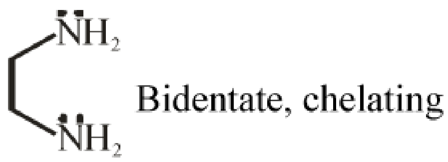
$$CH_3 - C \equiv CH \xrightarrow{Na} CH_3 - C \equiv C^{-}Na^{+} \xrightarrow{CH_3CH_2CH_2-Br} NaBr + CH_3 - C \equiv C - CH_2CH_2CH_3$$

48. (d)



49. (d) If nitrogen or sulphur is also present in the compound, the sodium fusion extract is first boiled with concentrated nitric acid to decompose cyanide or sulphide of sodium during Lassaigne's test

50. (c)



Based on Hall-Heroults process $[Rh(PPh_3)_3Cl]$ Wilkinson's catalyst

$Ag_2S + NaCN \overset{Air}{\rightleftharpoons} Na[Ag(CN)_2] + Na_2S$

Ca^{++}ion forms more stable complex with EDTA

51. (24)

$0.04 = k[A]_0 e^{-k\times10\times60}$

$0.03 = k[A]e e^{-k\times20\times60}$

(a)/(b)

$\frac{4}{3} = e^{600k(2-1)}$

$\frac{4}{3} = e^{600\,K}$

$\ln\frac{4}{3} = 600k$

$\ln\frac{4}{3} = 600 \times \frac{\ln 2}{t_{1/2}}$

$t_{1/2} = 600\frac{\ln 2}{\ln\frac{4}{3}}\text{sec}$

$t_{1/2} = 600 \times \frac{\log 2}{\log 4 - \log 3}\text{sec.} = 10 \times \frac{0.3010}{0.6020-0.477}\text{ min } t_{1/2} = 24.08\text{ min}$

52. (9)

Precipitation when $Q_{sp} = K_{sp}$

$[Mg^{2+}][OH^-]^2 = 10^{-11}$

$0.1 \times [OH^-]^2 = 10^{-11} \Rightarrow [OH^-] = 10^{-5}$

$\Rightarrow pOH = 5 \ \Rightarrow pH = 9$

53. (200)

Work done is given by area enclosed in the P vs V cyclic graph or V vs P cyclic graph.

Sign of work is positive for clockwise cyclic process for V vs P graph.

$W = \frac{1}{2} \times (30 - 10) \times (30 - 10) = 200 kPa - dm^3$

$= 200 \times 1000 \ Pa - L = 2 \ L - bar = 200 \ J$

54. (11) 111 belongs to 11^{th} group

55. (08)

Two molecular orbitals $\sigma 2$ s and $\sigma * 2$ s.

Six molecular orbitals $\sigma 2p_z$ and $\sigma * 2p_z$.

$\pi 2p_x, \pi 2p_y$ and $\pi * 2p_x, \pi * 2p_y$

56. (07)

$$\text{Retardation factor} = \frac{\text{Distance travelled by sample/organic compound}}{\text{Distance travelled by solvent}}$$

$= \frac{3.5}{5} = 7 \times 10^{-1}$

57. (03)

$$CH_3\text{-}\underset{\underset{H}{|}}{C} = \boxed{O + H_2N} - NH - \overset{\overset{O}{||}}{C} - NH_2 \longrightarrow$$

Semicarbazide

$$CH_3 - CH = N - NH - \overset{\overset{O}{||}}{C} - NH_2$$

58. (11) Volume of silver coating $= 0.05 \times 0.05 \times 10000 = 25 \ cm^3$

Mass of silver deposited $= 25 \times 7.9$ g

Moles of silver atoms $= \frac{25\times7.9}{108}$

Number of silver atoms $= \frac{25\times7.9}{108} \times 6.023 \times 10^{23}$

$= 11.01 \times 10^{23}$

59. (08)

Reduction Half   Oxidation Half

$2MnO_4^- \rightarrow 2MnO_2$ $2I^- \rightarrow I_2 + 2e^-$

$2MnO_4^- + 4H_2O + 6e^- \rightarrow 2MnO_2 + 8OH^-$ $6I^- \rightarrow 3I_2 + 6e^-$

Adding oxidation half and reduction half, net reaction is

$2MnO_4^- + 6I^- + 4H_2O \rightarrow 3I_2 + 2MnO_2 + 8OH^-$

$\Rightarrow z = 8$

60. (7)

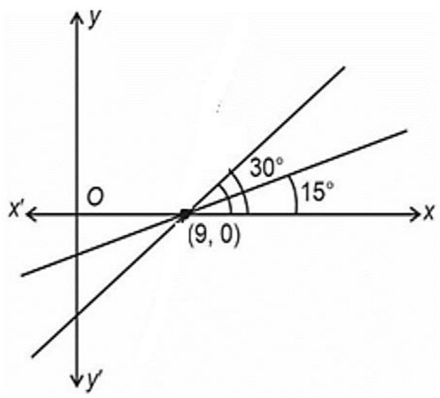
Moles $=$ Molarity $\times$ Volume in litres

$= 0.35 \times 0.25$

Mass $=$ moles $\times$ molar mass

$= 0.35 \times 0.25 \times 82.02 = 7.18$ g

61. (a)



Eq ^{n}: $y - 0 = \tan 15°(x-9) \Rightarrow y = (2-\sqrt{3})(x-9)$

62. (a)

$S_{20} = \frac{20}{2}[2a + 19\,d] = 790$

$2a + 19d = 79$

$S_{10} = \frac{10}{2}[2a + 9\,d] = 145$

$2a + 9d = 29$

From (a) and (b) $a = -8, d = 5$

$S_{15} - S_5 = \frac{15}{2}[2a + 14\,d] - \frac{5}{2}[2a + 4\,d]$

$= \frac{15}{2}[-16 + 70] - \frac{5}{2}[-16 + 20]$

$= 405 - 10$

$= 395$

63. (b)

$z^2 = -i\bar{z}$

$|z^2| = |i\bar{z}|$

$|z^2| = |z|$

$|z|^2 - |z| = 0$

$|z|(|z| - 1) = 0$

$|z| = 0$ (not acceptable)

$\therefore |z| = 1$

$\therefore |z|^2 = 1$

64. (c) Given $|\vec{a}| = 1, |\vec{b}| = 4, a.\vec{b} = 2$

$\vec{c} = 2(\vec{a} \times \vec{b}) - 3\vec{b}$

Dot product with a a on both sides

$\vec{c}.\vec{a} = -6$

Dot product with $\vec{b}$ on both sides

$\vec{b}.\vec{c} = -48$

$\vec{c}.\vec{c} = 4|\vec{a} \times \vec{b}|^2 + 9|\vec{b}|^2$

$|\vec{c}|^2 = 4\left[|a|^2|\vec{b}|^2 - (a.\vec{b})^2\right] + 9|\vec{b}|^2$

$|\vec{c}|^2 = 4[(a)(4)^2 - (d)] + 9(16)$

$|\vec{c}|^2 = 4[12] + 144$

$|\vec{c}|^2 = 48 + 144$

$|\vec{c}|^2 = 192$

$\therefore \cos\theta = \frac{\vec{b}\cdot\vec{c}}{|\vec{b}||\vec{c}\,|}$

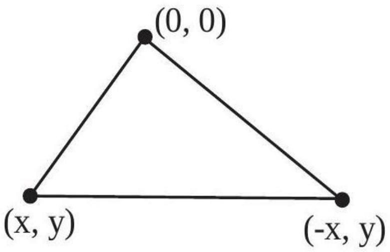
$\therefore \cos\theta = \frac{-48}{\sqrt{192.4}}$

$\therefore \cos\theta = \frac{-48}{8\sqrt{3}.4}$

$\therefore \cos\theta = \frac{-3}{2\sqrt{3}}$

$\therefore \cos\theta = \frac{-\sqrt{3}}{2} \Rightarrow \theta = \cos^{-1}\left(\frac{-\sqrt{3}}{2}\right)$

65. (d)



Area of Δ

$= \frac{1}{2}\begin{vmatrix} 0 & 0 & 1 \\ x & y & 1 \\ -x & y & 1 \end{vmatrix}$

$\Rightarrow \left|\frac{1}{2}(xy + xy)\right| = |xy|$

$\text{Area}(\Delta) = |xy| = |x(-2x^2 + 54)|$

$\frac{d(\Delta)}{dx} = |(-6x^2 + 54)| \Rightarrow \frac{d\Delta}{dx} = 0 \text{ at } x = 3$

$\text{Area} = 3(-2 \times 9 + 54) = 108$

66. (b)

$\lim_{n\to\infty} \sum_{k=1}^{n} \frac{n^3}{n^4\left(1 + \frac{k^2}{n^2}\right)\left(1 + \frac{3k^2}{n^2}\right)}$

$= \lim_{n\to\infty} \frac{1}{n}\sum_{k=1}^{n} \frac{n^3}{\left(1 + \frac{k^2}{n^2}\right)\left(1 + \frac{3k^2}{n^2}\right)}$

$= \int_0^1 \frac{dx}{3(1 + x^2)\left(\frac{1}{3} + x^2\right)}$

$$= \int_0^1 \frac{1}{3} \times \frac{3}{2} \frac{(x^2+1)-\left(x^2+\frac{1}{3}\right)}{(1+x^2)\left(x^2+\frac{1}{3}\right)} dx$$

$$= \frac{1}{2}\int_0^1 \left[\frac{1}{x^2+\left(\frac{1}{\sqrt{3}}\right)^2} - \frac{1}{1+x^2}\right] dx$$

$$= \frac{1}{2}\left[\sqrt{3}\tan^{-1}(\sqrt{3}x)\right]_0^1 - \frac{1}{2}(\tan^{-1}x)_0^1$$

$$= \frac{\sqrt{3}}{2}\left(\frac{\pi}{3}\right) - \frac{1}{2}\left(\frac{\pi}{4}\right) = \frac{\pi}{2\sqrt{3}} - \frac{\pi}{8}$$

$$= \frac{13\pi}{8.(4\sqrt{3}+3)}$$

67. (a)

$f'(x) = \frac{g'(x)-g'(2-x)}{2}, f'\left(\frac{3}{2}\right) = \frac{g'\left(\frac{3}{2}\right)-g'\left(\frac{1}{2}\right)}{2} = 0$ Also $f'\left(\frac{1}{2}\right) = \frac{g'\left(\frac{1}{2}\right)-g'\left(\frac{3}{2}\right)}{2} = 0, f'\left(\frac{1}{2}\right) = 0 \Rightarrow f'\left(\frac{3}{2}\right) = f'\left(\frac{1}{2}\right) = 0 \Rightarrow$ rootsin $\left(\frac{1}{2},1\right)$ and $\left(1,\frac{3}{2}\right)$

$\Rightarrow f''(x)$ is zero at least twice in $\left(\frac{1}{2},\frac{3}{2}\right)$

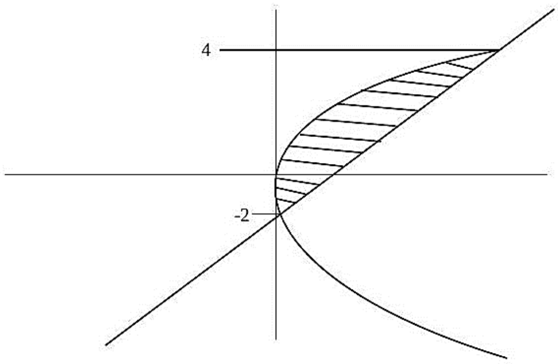
68. (b)

Let X = x − 2

$y^2 = 4x,\ y = 2(x+2) - 8$

$y^2 = 4x,\ y = 2x - 4$

$A = \int_{-2}^{4} \frac{y^2}{4} - \frac{y+4}{2}$



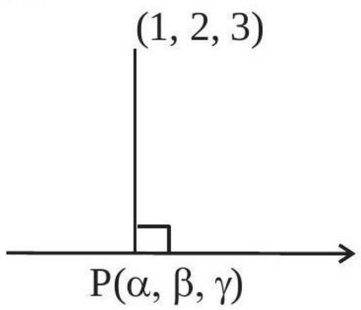
$= 9$

69. (a) $\frac{dy}{dx} = 2(x-1)\sin x + (x^2-2x)\cos x$

Now both side integrate

$$y(x)=\int 2(x-1)\sin x\,dx+\left[(x^2-2x)(\sin x)-\int (2x-2)\sin x\,dx\right]$$
$$y(x)=(x^2-2x)\sin x+\lambda$$
$$y(0)=0+\lambda \Rightarrow 2=\lambda$$
$$y(x)=(x^2-2x)\sin x+2$$
$$y(2)=2$$

70. (b)



Let foot P(5k − 3,2k + 1,3k − 4)

DR 's → AP: 5k − 4,2k − 1,3k − 7

DR's → Line: 5, 2, 3

Condition of perpendicular lines $(25k-20)+(4k-2)+(9k-21)=0$

Then k $=\frac{43}{38}$

Then $19(\alpha+\beta+\gamma)=\mathbf{101}$

71. (a) If $x=0, y=6,7,8,9,10$

If $x=1, y=7,8,9,10$

If $x=2, y=8,9,10$

If $x=3, y=9,10$

If $x=4, y=10$

If $x=5, y=$ no possible value

Total possible ways $=(5+4+3+2+1)\times 2=30$

Required probability $=\frac{30}{11\times 11}=\frac{30}{121}$

72. (c)

$$-1\le\left|\frac{2-|x|}{4}\right|\le 1$$

$$\Rightarrow\left|\frac{2-|x|}{4}\right|\le 1$$

$$-4\le 2-|x|\le 4$$

$-6 \leq -|x| \leq 2$

$-2 \leq |x| \leq 6$

$|x| \leq 6$

$\Rightarrow x \in [-6,6]$

Now, $3 - x \neq 1$

And $x \neq 2$

and $3 - x > 0$

$x < 3$

From (a), (b) and (c)

$\Rightarrow x \in [-6,3) - \{2\}$

$\alpha = 6$

$\beta = 3$

$\gamma = 2$

$\alpha + \beta + \gamma = 11$

73. (b) $x + y + z = 4\mu, x + 2y + 2\lambda z = 10\mu, x + 3y + 4\lambda^2 z = \mu^2 + 15,$

$$\Delta = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 2 & 2\lambda \\ 1 & 3 & 4\lambda^2 \end{vmatrix} = (2\lambda - 1)^2$$

For unique solution $\Delta \neq 0, 2\lambda - 1 \neq 0, \left(\lambda \neq \frac{1}{2}\right)$

Let $\Delta = 0, \lambda = \frac{1}{2}$

$$\Delta_y = 0, \Delta_x = \Delta_z = \begin{vmatrix} 4\mu & 1 & 1 \\ 10\mu & 2 & 1 \\ \mu^2 + 15 & 3 & 1 \end{vmatrix}$$

$= (\mu - 15)(\mu - 1)$

For infinite solution $\lambda = \frac{1}{2}, \mu = 1$ or 15

74. (c)

If two circles intersect at two distinct points

$\Rightarrow |r_1 - r_2| < C_1C_2 < r_1 + r_2$

$|r - 2| < \sqrt{9 + 16} < r + 2$

$|r - 2| < 5$ and $r + 2 > 5$

$-5 < r - 2 < 5\ r > 3\ -3 < r < 7$

From (1) and (2)

$3 < r < 7$

75. (d)

$2\text{ b} = \text{ae}$

$\frac{b}{a} = \frac{e}{2}$

$e = \sqrt{1 - \frac{e^2}{4}}$

$e = \frac{2}{\sqrt{5}}$

76. (d)

Class	Frequency	Cumulative frequency
$0 - 4$	3	**3**
$4 - 8$	9	**12**
$8 - 12$	10	**22**
$12 - 16$	8	**30**
$16 - 20$	6	**36**

$M = l + \left(\frac{\frac{N}{2} - C}{f}\right)h$

$M = 8 + \frac{18 - 12}{10} \times 4$

$M = 10.4$

$20M = 208$

77. (a)

$$\begin{vmatrix} 2\cos^4 x & 2\sin^4 x & 3 + \sin^2 2x \\ 3 + 2\cos^4 x & 2\sin^4 x & \sin^2 2x \\ 2\cos^4 x & 3 + 2\sin^2 4x & \sin^2 2x \end{vmatrix}$$

$R_2 \rightarrow R_2 - R_1, R_3 \rightarrow R_3 - R_1$

$$\begin{vmatrix} 2\cos^4 x & 2\sin^4 x & 3+\sin^2 2x \\ 3 & 0 & -3 \\ 0 & 3 & -3 \end{vmatrix}$$

$f(x) = 45$

$f'(x) = 0$

78. (b) Area $= |AC \times BD|$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 5 & -1 & 7 \\ 1 & 2 & 3 \end{vmatrix}$$

$$= \frac{1}{2}|-17\hat{i} - 8\hat{j} + 11\hat{k}| = \frac{1}{2}\sqrt{474}$$

79. (b)

$2\sin^3 x + 2\sin x \cdot \cos^2 x + 4\sin x - 4 = 0$

$2\sin^3 x + 2\sin x \cdot (1-\sin^2 x) + 4\sin x - 4 = 0$

$6\sin x - 4 = 0$

$\sin x = \frac{2}{3}$

n = 5 (in the given interval)

$x^2 + 5x + 2 = 0$

$$x = \frac{-5 \pm \sqrt{17}}{2}$$

Required interval $(-\infty, 0)$

80. (b) $\lim_{x\to 0} \frac{x\int_0^x f(t)dt}{\left(\frac{e^{x^2}-1}{x^2}\right)\times x^2}$

$$\lim_{x\to 0} \frac{\int_0^x f(t)dt}{x} \left(\lim_{x\to 0} \frac{e^{x^2}-1}{x^2} = 1\right)$$

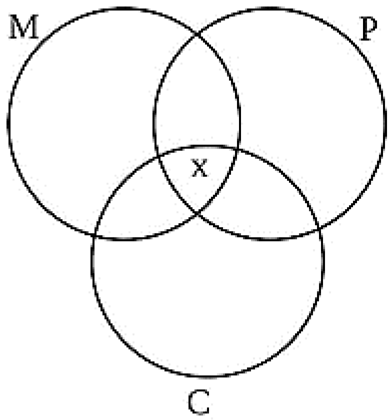
$= \lim_{x\to 0} \frac{f(x)}{1}$ (using L Hospital)

$f(0) = \frac{1}{2}$

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

$8\alpha^2 = 2$

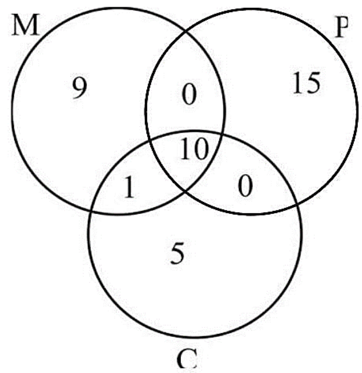
81. (10)



$11 - x \geq 0$ (Maths and Physics) $x \leq 11$

$x = 11$ does not satisfy the data.

For $x = 10$



Hence maximum number of students passed in all the three subjects is 10.

82. (16)

$L_1 : \frac{x+1}{1} = \frac{y}{1/2} = \frac{z}{-1/12}$, $L_2 : \frac{x}{1} = \frac{y+2}{1} = \frac{z-1}{\frac{1}{6}}$

d_1 = shortest distance between L_1 & L_2

$$= \left| \frac{(\vec{a}_2 - \vec{a}_1) \cdot (\vec{b}_1 \times \vec{b}_2)\ |}{|(\vec{b}_1 \times \vec{b}_2)|} \right|$$

$d_1 = 2$

$L_3 : \frac{x-1}{2} = \frac{y+8}{-7} = \frac{z-4}{5}$, $L_4 : \frac{x-1}{2} = \frac{y-2}{1} = \frac{z-6}{-3}$

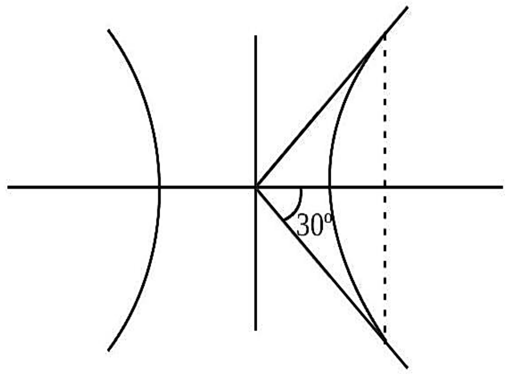
d_2 = shortest distance between L_3 & L_4

$d_2 = \frac{12}{\sqrt{3}}$ Hence

$$=\frac{32\sqrt{3}d_1}{d_2}=\frac{32\sqrt{3}\times 2}{\frac{12}{\sqrt{3}}}=16$$

83. (182)

LR subtends 60° at centre



$$\Rightarrow \tan 30^\circ=\frac{b^2/a}{ae}=\frac{b^2}{a^2e}=\frac{1}{\sqrt{3}}$$

$$\Rightarrow e=\frac{\sqrt{3}\,b^2}{9}$$

Also, $e^2=1+\frac{b^2}{9}\Rightarrow 1+\frac{b^2}{9}=\frac{3b^4}{81}$

$$\Rightarrow b^4=3\,b^2+27$$

$$\Rightarrow b^4-3\,b^2-27=0$$

$$\Rightarrow b^2=\frac{3}{2}(1+\sqrt{13})$$

$$\Rightarrow \ell=3, m=2, n=13$$

$$\Rightarrow \ell^2+m^2+n^2=182$$

84. (44)

$f: A\rightarrow P(A)$

$a\in f(a)$

That means ' a ' will connect with subset which contain element ' a '.

Total options for 1 will be 2^6. (Because 2^6 subsets contains 1)

Similarly, for every other element

Hence, total is $2^6\times 2^6\times 2^6\times 2^6\times 2^6\times 2^6\times 2^6=2^{42}$

Ans. $2+42=44$

85. (155)

$$\frac{10x}{x+1}=1 \Rightarrow x=\frac{1}{9}$$

$$\frac{10x}{x+1}=4 \Rightarrow x=\frac{2}{3}$$

$$\frac{10x}{x+1}=9 \Rightarrow x=9$$

$$I=9\left(\int_0^{1/9} 0dx+\int_{1/9}^{2/3} 1.dx+\int_{2/3}^{9} 2dx\right)$$

$$=155$$

86. (138)

General term in expansion of $\left((7)^{1/2}+(11)^{1/6}\right)^{824}$ is $t_{r+1} = {}^{824}C_r(7)^{\frac{824-r}{2}}(11)^{r/6}$

For integral term, r must be multiple of 6.

Hence $r=0,6,12,$ …………822

87. (97)

$$\frac{dy}{dx}-\frac{xy}{1-x^2}=\frac{(x^3+2)\sqrt{3(1-x^2)}}{1-x^2}$$

$$\mathrm{IF}=e^{-\int \frac{x}{1-x^2}dx}=e^{+\frac{1}{2}\ln(1-x^2)}=\sqrt{1-x^2}$$

$$y\sqrt{1-x^2}=\sqrt{3}\int (x^3+2)dx$$

$$y\sqrt{1-x^2}=\sqrt{3}\left(\frac{x^4}{4}+2x\right)+c$$

$$\Rightarrow y(0)=0 \therefore c=0$$

$$y\left(\frac{1}{2}\right)=\frac{65}{32}=\frac{m}{n}$$

$m+n=97$

88. (60)

$x^2-70x+\lambda=0$

$$\alpha+\beta=70$$
$$\alpha\beta=\lambda$$

$\therefore \alpha(70-\alpha)=\lambda$

Since, 2 and 3 does not divide $\lambda \therefore \alpha=5, \beta=65, \lambda=325$

By putting value of α,β,λ we get the required value 60

89. (15)

$$f(x)\begin{cases}\frac{1}{x}; x \geq 2\\ ax^2+2b; -2<x<2\\ -\frac{1}{x}; x \leq -2\end{cases}$$

Continuous at $x = 2 \Rightarrow \frac{1}{2} = \frac{a}{4} + 2b$

Continuous at $\mathrm{x} = -2 \Rightarrow \frac{1}{2} = \frac{\mathrm{a}}{4} + 2\ \mathrm{b}$

Since, it is differentiable at $\mathrm{x} = 2$

$$-\frac{1}{\mathrm{x}^2} = 2\mathrm{ax}$$

Differentiable at $\mathrm{x} = 2 \Rightarrow \frac{-1}{4} = 4\mathrm{a} \Rightarrow \mathrm{a} = \frac{-1}{16}, \mathrm{b} = \frac{3}{8}$

90. (353)

$\alpha = 1^2 + 4^2 + 8^2$ ....

$\mathrm{t_n} = \mathrm{an}^2 + \mathrm{bn} + \mathrm{c}$

$$\begin{aligned}1 &= a+b+c\\ 4 &= 4a+2b+c\\ 8 &= 9a+3b+c\end{aligned}$$

On solving we get, $\mathrm{a} = \frac{1}{2}, \mathrm{b} = \frac{3}{2}, \mathrm{c} = -1$

$$\alpha = \sum_{n=1}^{10}\left(\frac{n^2}{2}+\frac{3n}{2}-1\right)^2$$

$$4\alpha = \sum_{n=1}^{10}(n^2+3n-2)^2, \beta = \sum_{n=1}^{10} n^4$$

$$4\alpha - \beta = \sum_{n=1}^{10}(6n^3+5n^2-12n+4) = 55(353)+40$$