1. (a) $\lambda_e = \frac{1.227}{\sqrt{v}}$ Å

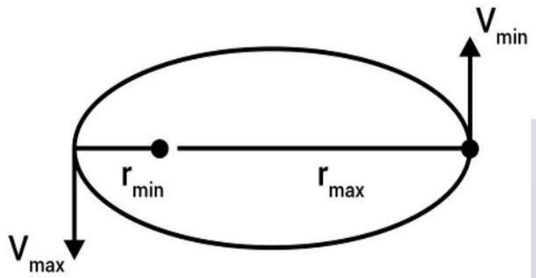
$$\lambda_p = \frac{0.286}{\sqrt{v}} \text{Å}$$

$$\lambda_\alpha = \frac{0.101}{\sqrt{v}} \text{Å}$$

$\therefore \lambda_{e^-} > \lambda_{p^+} > \lambda_\alpha$

2. (c) As at minimum distance v will be maximum. By conservation of angular momentum.

$mv_{\max}r_{\min} = mv_{\min}r_{\max}$



$$v_{\max} = \frac{v_{\min}r_{\max}}{r_{\min}}$$

3. (c) $c(t) = c\sin(2\pi w_c t)$

$m(t) = M\sin(2\pi w_m t)$

Lower side band (LSB) $= w_c - w_m$

Lower side band (USB) $= w_c + w_m$

Band width = USB - LSB

$= (w_c + w_m) - (w_c - w_m)$

$= 2w_c$

$= 2 \times 10^7$ Hz

$= 20$MHz

4. (b) For collision along normal

Impulse $(\Delta p)_1 = 2mv$

For collision at 45°

Impulse $(\Delta p)_2 = 2mv(\sin 45°)$

Ratio $= \frac{2mv}{2mv\sin 45°} = \frac{\sqrt{2}}{1}$

5. (b) $c_{eq} = \frac{\varepsilon_0 A}{\frac{dx}{k_1}+\frac{dx}{k_2}+\frac{dx}{k_3}......}$

Let $m = \frac{dx}{k_1} + \frac{dx}{k_2} + \frac{dx}{k_3} \dots \dots$

$$m = \int_0^{d/2} \frac{dx}{\left[1+\frac{kx}{d}\right]} + \int_{d/2}^{d} \frac{dx}{1+\frac{k(d-x)}{d}}$$

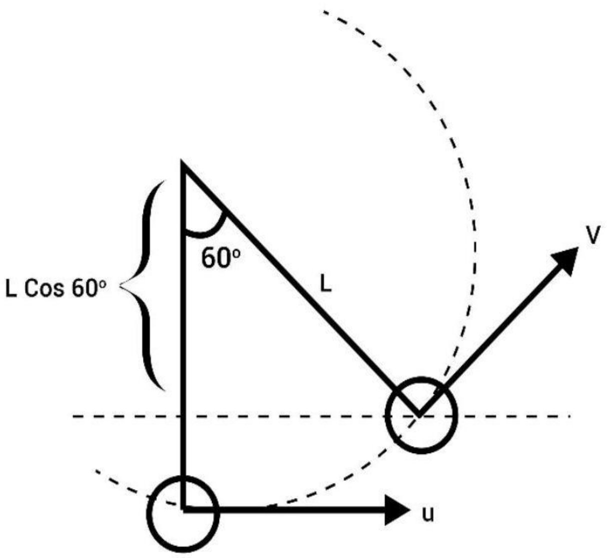
$$= \int_0^{d/2} \frac{ddx}{d+kx} + \int_{d/2}^{d} \frac{ddx}{d+kd-kx}$$

$$= \frac{d}{k}\ln(d+kx)\Big|_0^{d/2} + -\frac{d}{k}\ln(d+kd-kx)\Big|_{d/2}^{d}$$

$$= \frac{2d}{k}\ln\left(1+\frac{k}{2}\right)$$

$$c_{eq} = \frac{k\varepsilon_0 A}{2d}\ln\left[1+\frac{k}{2}\right]$$

6. (d)



Applying energy conservation

$$\frac{1}{2}mv^2 + mg(L - L\cos 60^\circ) = \frac{1}{2}mu^2$$

$$\Rightarrow v^2 = u^2 - 2gL\left(1-\frac{1}{2}\right) = u^2 - gL$$

$$\Rightarrow v = \sqrt{3^2 - 10 \times 0.5} = \sqrt{4} = 2 \text{ m/s}$$

7. (c) $T_{1/2} = 3$ days

$= 3 \times 24 \times 60 \times 60\text{sec}$

$m = 2mg = 2 \times 10^{-3} g$

$M = 196.96$

$N = \frac{m}{M} \times$ Avogadro's number

$= 2 \times 10^{-3} \times 6.0233 \times 10^{23}$ atoms

Activity of the sample,

$$R = \lambda N = \frac{0.693}{T_{1/2}} N$$
$$= \frac{0.693 \times 2 \times 10^{-3} \times 6.023 \times 10^{23}}{3 \times 24 \times 60 \times 60 \times 196.96}$$
$$= 163.36 \times 10^{11} \text{ Bq.}$$
$$= \frac{163.36 \times 10^{11}}{3.7 \times 10^{10}} \text{ curie } = 441 \text{ curie}$$

8. (a) $k_{eq} = \frac{k_1 k_2}{k_1 + k_2} = \frac{k \cdot 4k}{k + 4k} = 0.8k$

$$\mu = \frac{m_1 m_2}{m_1 + m_2} = \frac{200 \times 800}{200 + 800} = 160 \text{ g}$$

$$\omega = \sqrt{\frac{k_{eq}}{\mu}} = \sqrt{\frac{0.8 \times 20 \text{ N/m}}{0.160 \text{ kg}}}$$

$= 10 \text{rad/s}$

9. (b)

10. (c) $\vec{r} = 10\alpha t^2 \hat{\imath} + [5\beta t - 5]\hat{\jmath}$

$$\vec{v} = \frac{d\vec{r}}{dt} = 20\alpha t\hat{\imath} + 5\beta\hat{\jmath}$$

$\vec{L} = \vec{r} \times \vec{p} = [\vec{r} \times m\vec{v}] = m[\vec{r} \times \vec{v}]$

For constant m

When $\vec{L} = 0$

$\Rightarrow [10\alpha t^2 \hat{\imath} + [5\beta t - 5]\hat{\jmath}] \times [20\alpha t\hat{\imath} + 5\beta\hat{\jmath}] = 0$

$\Rightarrow (10\alpha t^2 \cdot 5\beta)\hat{k} + [20\alpha t(5\beta t - 5)] - \hat{k} = 0$

$\Rightarrow 10\alpha t^2 \cdot 5\beta = 20\alpha t[5\beta t - 5]$

$\Rightarrow 5\beta t = 2(5\beta t - 5)$

$\Rightarrow 10 = 5\beta t$

$$\Rightarrow t = \frac{2}{\beta}$$

11. (c) $Y = \frac{F}{A}\left(\frac{L}{\Delta L}\right)$

$$\Rightarrow F=\left(\frac{YA}{L}\Delta L\right)$$

$$K_1=\frac{Y_1A}{L}$$

$$K_2=\frac{Y_2A}{l}$$

$K_{\text{net}}=\frac{Y_{\text{net}}A}{2L}$ [$\therefore$ total length = 2 L]

In series $K_{net}=\frac{K_1K_2}{K_1+K_2}$

$$\Rightarrow \frac{\left(\frac{Y_1A}{L}\right)\left(\frac{Y_2A}{L}\right)}{\left(\frac{Y_1A}{L}\right)+\left(\frac{Y_2A}{L}\right)}=\frac{(Y_{net})A}{2L}$$

$$\Rightarrow Y_{net}=\frac{2Y_1Y_2}{Y_1+Y_2}$$

12. (a)

$$N=N_0e^{-\lambda t}$$
$$3\frac{N_0}{4}=N_0e^{-\lambda T_1}$$
$$\Rightarrow e^{-\lambda T_1}=\frac{3}{4}\ldots\text{(i)}$$
$$\frac{N_0}{2}=N_0e^{-\lambda T_2}$$
$$\Rightarrow e^{-\lambda T_2}=\frac{1}{2}\ldots\text{(ii)}$$

Dividing equation (i) and (ii)

$$e^{-\lambda(T_1-T_2)}=\frac{2\times 3}{4}$$

Taking natural log on both sides

$$-\lambda(T_1-T_2)=\ln\left(\frac{3}{2}\right)$$

$$T_2-T_1=\frac{1}{\lambda}\ln\left(\frac{3}{2}\right)$$

13. (b) Rated power of the bulb is 200 W and operating voltage is 100 V.

$$I=\frac{P}{V}=\frac{200}{100}=2\text{ A}$$

$$R=\frac{V}{I}=\frac{100}{2}=50\Omega$$

When this bulb is connected in 200 V supply, we need to ensure the current passing through this bulb is 2 A by connecting additional resistance

Total resistance required to get 2 A from 200 V supply $= 200/2 = 100\Omega$

Since resistance of bulb is 50Ω, we need to add additional 50Ω resistance in series.

14. (b) Distance moved by 1^{st} drop in 4 second

$$S_1 = \frac{1}{2} \times 9.8 \times 4^2$$

$$S_1 = 9.8 \times 8 = 78.4m$$

Distance moved by 2^{nd} drop

$$S_2 = 78.4 - 34.3$$

$$S_2 = 44.1 \text{ m}$$

$$44.1 = \frac{1}{2} 9.8 \times t^2$$

$$\frac{88.2}{9.8} = t^2$$

$$t = 3\text{sec}$$

That means 2^{nd} drop fall 1 second after the first drop.

So, water drops coming out of tap at 1drop/sec.

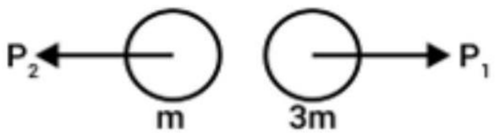
15. (a)

$$I = \frac{V}{R} = \frac{6}{(20 + 0.1 \times 100 \times 10)} = \frac{6}{120} \text{ A}$$

$$EMF = IR' = \frac{1}{120} \times (0.1 \times 100 \times 5.5)$$

$$EMF = \frac{6}{120} \times 55 = 2.75 \text{ V}$$

16. (d)



$$P_i = P_f = 0$$

$$0 = P_1 - P_2$$

$$P_1 = P_2$$

$$\lambda = \frac{h}{P} \Rightarrow \lambda_1 = \frac{h}{P_1}$$

$$\lambda_2 = \frac{h}{P_2}$$

$$\frac{\lambda_1}{\lambda_2} = \frac{1}{1} = 1:1$$

17. (b) Fringe width $(\beta) = \frac{\lambda D}{d}$

$$\beta = \frac{\lambda D}{d_0 + A\sin\omega t}$$

$$\beta_{\max} = \frac{\lambda D}{d_0 - A}$$

$$\beta_{\min} = \frac{\lambda D}{d_0 + A}$$

$$\beta_{\max} - \beta_{\min} = \frac{2\lambda AD}{d_0^2 - A^2}$$

18. (b) $C = \frac{Q}{m\Delta T}$

Where, C = specific heat capacity

Now if mass and energy given are same

Then $C \propto \frac{1}{\Delta T}$

ΔT in A in 3sec = 120°

ΔT in B in 6sec = 90°

As we can see temperature of A is rising faster as compared to B for the same amount of energy given. We can say

$C_B > C_A$

Or $S_B > S_A$

19. (d) Assertion: Radius of gyration is same about all three axes.

$$K_x = \frac{R}{2}\ K_y = \frac{R}{2}\ K_z = \frac{R}{\sqrt{2}}$$

As $mK^2 = I$

$$K = \sqrt{\frac{I}{m}}$$

So, assertion is wrong.

Reason: All axes are symmetric axes.

Reason is true as

About x, y and z axes object is symmetry.

20. (c) $m_1 = 2$ kg

$u_1 = 4m/s$

$e = 1$

$$v_1 = 1m/s$$
$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$
$$2 \times 4 + 0 = 2 \times 1 + m_2v_2$$
$$m_2v_2 = 6\text{kgm/s} \ldots \text{(i)}$$
$$\frac{v_2 - v_1}{u_1 - u_2} = 1$$
$$\frac{v_2 - 1}{4} = 1$$
$$v_2 = 5m/s \ldots \text{(ii)}$$

From eq (i) and (ii)

$m_2 = \frac{6}{5}$ kg

$v_{\text{com}} = \frac{m_1v_1 + m_2v_2}{m_1 + m_2}$

$= \frac{2 \times 1 + \frac{6}{5} \times 5}{2 + \frac{6}{5}}$

$= \frac{8 \times 5}{16} = \frac{40}{16} = \frac{5}{2}$ m/s

21. (b) Since we know that, $C_p - C_v = nR$

Therefore, at temperature P has lesser number of moles of gas than at temperature Q.

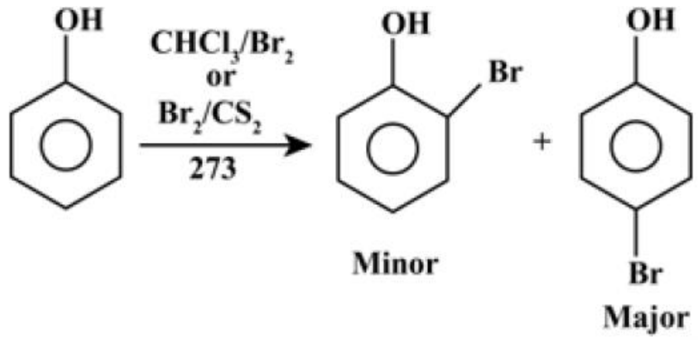
So, temperature in state P will be greater than the temperature in state Q

Since, $T \propto \frac{1}{n}$ So, $P > Q$

22. (d) Carboxylic acids and enols react with sodium bicarbonate to liberate carbon dioxide.

23. (d) $SiF_6{}^{2-}$ is known to be existed because of small size of F. As we go down the group in halides their existence is less stable because of large size of halogen that is the reason why $SiCl_6{}^{2-}$ do not exist.

24. (b, C) product



25. (a) Albumin is water soluble protein. Albumin is a protein that is produced in the liver. Albumin enters the bloodstream where it helps carry vitamins, enzymes, and other important substances.

26. (a) in the leaching process the bauxite ore is made to digest with a concentrated solution of NaOH that produces a complex named sodium aluminate. When this complex is made to bear CO2, a hydrated compound that is hydrated alumina is precipitated

27. (c) $2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(g)$

116 g butane gives 180 g water

72 g water will get release by = 46.4 g

28. (a) During Gabriel phthalimide synthesis, the reaction between phthalimide and ethanolic potassium hydroxide gives potassium salt of phthalimide. The salt on heating with alkyl halide followed by alkaline hydrolysis gives corresponding primary amine. Aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis as aryl halides do not undergo nucleophilic substitution with the salt formed by phthalimide.

29. (a) $CrO_3\ Cr^{+6}$

$V_2O_5\ V^{+5}$

$MnO_2\ Mn^{+4}$

$Fe_2O_3\ Fe^{+3}$

30. (b) Hydrogen peroxide (H_2O_2) is an oxidizing agent that can be used as laundry.

Tetrachloroethylene is the most used chemical solvent in dry cleaning process.

Liquid carbon dioxide cleaning is a method that uses pressurized liquid CO_2 in place of perc,

in combination with other cleaning agents.

31. (b) Beryllium hydroxide dissolves in excess NaOH, So this is due to the formation of a complex, $Be(OH)_2 + 2NaOH \rightarrow Na_2[Be(OH)_4]$

Solubility of alkaline earth metal hydroxide increase with increasing atomic number from $Mg(OH)_2 To Ba(OH)_2$
$\rightarrow S_1$ is wrong

$\rightarrow S_2$ is wrong

32. (d) $[Co(CN)_6]^{3-} \Rightarrow d^6 \rightarrow$ Strong field all paired electrons.

$[Ni(CO)_4] \Rightarrow d^{10} \rightarrow$ Strong field all paired electrons

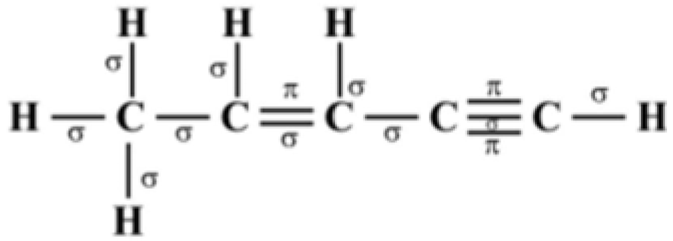
$[Ni(CN)_4]^{2-} \Rightarrow d^8 \rightarrow$ Strong field all paired electrons

$[Fe(H_2O)_6]^{3+} \Rightarrow d^5 \rightarrow$ weak field 5 unpaired electrons

33. (a)

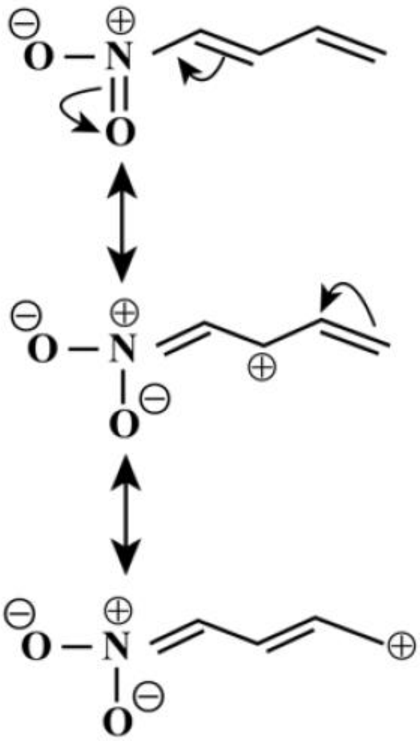
$\begin{cases} Al^{+3} < \quad Mg^{+2} < \quad Na^{+} < \quad K^{+} \\ 53.5pm \quad 72pm \; 102pm \quad 138pm \end{cases}$

34. (10.00)

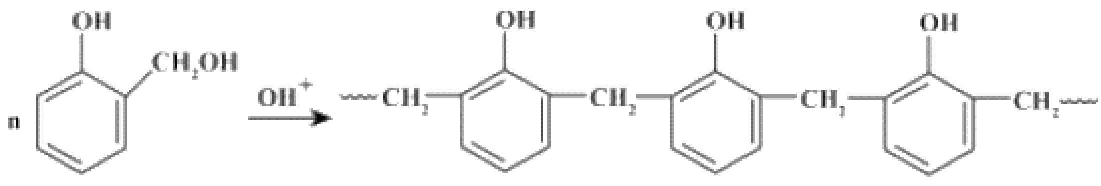


35. (6.00)

36. (a)



37. (a)



Novolac

38. (101)

$X_{(s)} \longrightarrow X_{\text{liq}} \xrightarrow{\Delta H_{vap}=98.2\text{kj/mole}} X_{(\text{gas})}$

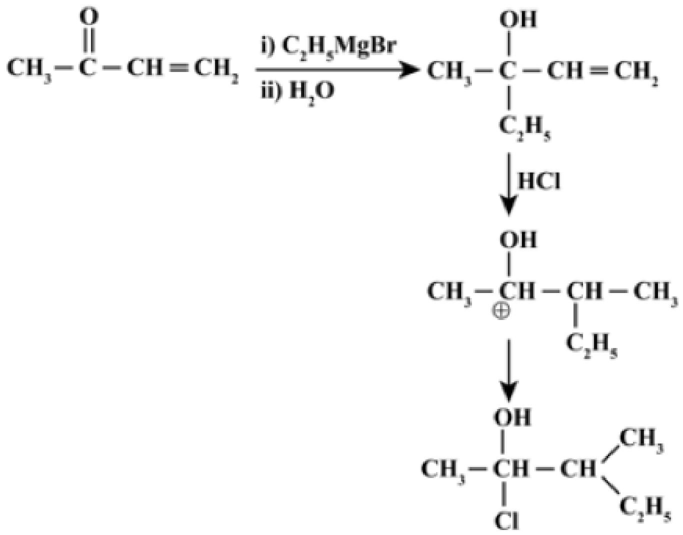
$\Delta H_{\text{Fusion}} = 2.8 \text{ kJ/mole}$

$\Delta H_{\text{fusion}} + \Delta H_{\text{vap}} = 2.8 + 98.2 = 101 \text{ kJ/mol}$

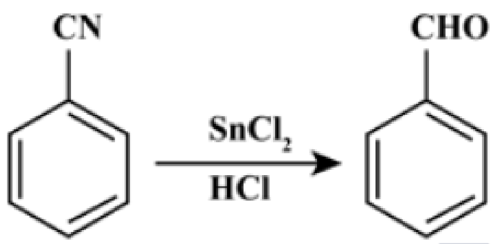
39. (d) Bond dissociation enthalpy

$\underset{443.35\text{kj/mol}}{D_2} > \underset{435.88\text{kj/mol}}{H_2}$

40. (a)



41. (d)



42. (0.9M)

$Cr_2O_7^{2-} \xrightarrow{H^+} 2Cr^{+3}$

$+6 \xrightarrow{H^+} +3$

$+6 \longrightarrow \underset{(n_1=6)}{\longrightarrow} +3$

$Fe^{+2} \underset{(n_2=1)}{\overset{\rightarrow}{\rightarrow}} Fe^{+3}$

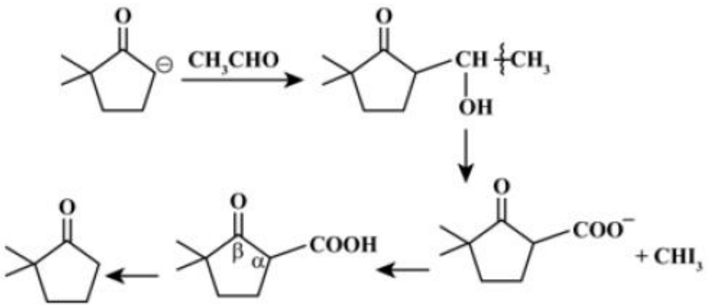
eq. of $K_2Cr_2O_7 = eq.$ of Fe^{+2}

$N_1V_1 = N_2V_2$

$n_1m_1v_1 = n_2m_2v_2$

$6 \times 0.1 \times 15 \times 10^{-3} = 1 \times m_2 \times 10 \times 10^{-3}$

43. (a)



44. ($\frac{30x}{9}$)

$A + B \rightleftharpoons 2C$

at

$$a = \frac{(C)^2}{(A)(B)} = 1\ a$$

Reaction will go forward ($a < k_c$) ($k_c = 100$)

$A + B \rightleftharpoons 2C$
Initially $a\ a\ a$

At equilibrium $a - x\ a - x\ a + 2x$
Therefore, $\frac{(a+2x)^2}{(a-x)^2} = 100$
Or, $\frac{(a+2x)}{(a-x)} = 10$
On solving, $a = \frac{12x}{9}$

$$[C]_{eq} = \frac{12x}{9} + 2x = \frac{30x}{9}$$

45. (a) For 1st order reaction half- life does not depend on concentration but for zero order reaction half life ∝ concentration

46. (d) $I = \int_{\frac{\pi}{24}}^{\frac{5\pi}{24}} \frac{\sqrt[3]{\sin 2x}dx}{\sqrt[3]{\sin 2x}+\sqrt[3]{\cos 2x}} = \int_{\frac{\pi}{24}}^{\frac{5\pi}{24}} \frac{\sqrt[3]{\cos 2x}dx}{\sqrt[3]{\sin 2x}+\sqrt[3]{\cos 2x}}$

$$\therefore 2I = \int_{\frac{\pi}{24}}^{\frac{5\pi}{24}} dx = \frac{\pi}{6} \Rightarrow I = \frac{\pi}{12}$$

47. (a) $a = 2, y^2 = 8(x-2)$

∴ origin lies on directrix of parabola.
∴ Area of $\triangle\ OPQ = \frac{1}{2} \times 2a \times 4a = 4a^2 = 16$

48. (c) $e^2 = 1 - \frac{b^2}{a^2} \Rightarrow \frac{b^2}{a^2} = \frac{2}{3}$

$$\frac{3}{2a^2} + \frac{3}{2a^2} = 1 \Rightarrow a^2 = 3, b^2 = 2 \Rightarrow \frac{x^2}{3} + \frac{y^2}{2} = 1$$

$\therefore$ focus $= (1,1,0)$

$\therefore$ Equation of circle is $(x-1)^2 + y^2 = \frac{4}{3}$

$\Rightarrow 3(x-1)^2 + 6x^2 = 4$

$\Rightarrow x^2 - 6x + 5 = 0 \Rightarrow x = 1,5$

$\therefore P\left(1, \frac{2}{\sqrt{3}}\right), Q = \left(1, \frac{-2}{\sqrt{3}}\right)$

$PQ = \frac{4}{\sqrt{3}} \Rightarrow PQ^2 = \frac{16}{3}$

49. (a)

$$\begin{aligned}&(p \to q) \wedge (q \to \sim p)\\&= (\sim p \vee q) \wedge (\sim q \vee \sim p)\\&= \sim p \vee (q \wedge \sim q)\\&= \sim q\end{aligned}$$

50. (b) $(\sin x + \sin 3x) + (\sin 2x + \sin 4x) = 0$

$2\sin 2x\cos x + 2\sin 3x\cos x = 0$

$2\cos x \cdot 2\sin\frac{5x}{2}\cos\frac{5x}{2} = 0$

$\Rightarrow \cos x \cdot \cos\frac{x}{2} \cdot \sin\frac{5x}{2} = 0$

(i) $\cos x = 0 \Rightarrow x = \frac{\pi}{2}, \frac{3\pi}{2}$

(ii) $\cos\frac{x}{2} = 0 \Rightarrow x = \pi$

(iii) $\sin\frac{5x}{2} = 0 \Rightarrow x = 0, \frac{2\pi}{5}, \frac{4\pi}{5}, \frac{6\pi}{5}, \frac{8\pi}{5}, 2\pi$

$\therefore$ sum of roots $= 9\pi$

51. (c) $S_{3n} = 3S_{2n}$

$\left(\frac{3n}{2}\right)[2a + (3n-1)d] = 3\left(\frac{2n}{2}\right)[2a + (2n-1)d]$

$2a + 3nd - d = 4a + 4nd - 2d$

$2a = d - nd \Rightarrow d = \frac{2a}{1-n}$

Now, $\frac{S_{4n}}{S_{2n}} = 2\left[\frac{2a+(4n-1)d}{2a+(2n-1)d}\right] = \frac{2\times 3}{1} = 6$

52. (a)

$$\frac{1}{a}\left[\left(1-\left(\frac{b}{a}\right)\right)^{-1}+\left(1-2\left(\frac{b}{a}\right)\right)^{-1}+\left(1-3\left(\frac{b}{a}\right)\right)^{-1}+\cdots\left(1-n\left(\frac{b}{a}\right)\right)^{-1}\right]$$

$$=\frac{1}{a}\left[\left(1+\frac{b}{a}+\frac{b^2}{a^2}\right)+\left(1+\frac{2b}{a}+\frac{4b^2}{a^2}\right)+\left(1+\frac{3b}{a}+\frac{9b^2}{a^2}\right)+\cdots\ldots\right]$$

$$=\frac{1}{a}\left[n+\frac{n(n+1)b}{2a}+\frac{n(n+1)(2n+1)}{6}\frac{b^2}{a^2}\right]$$

$\therefore$ coefficient of $n^3=r=\frac{b^2}{3a^3}$

53. (1.00)

$$A={}^{20}C_{10}, B={}^{19}C_9, C={}^{19}C_{10}$$
$$\therefore \frac{A}{B+C}=\frac{{}^{20}C_{10}}{2\cdot {}^{19}C_9}=1$$

54. (238.00)

$${}^5C_2[{}^6C_3\times {}^8C_5+{}^6C_2\times {}^8C_6]+{}^5C_3[{}^6C_2\times {}^8C_5]$$

$=10[1540]+10[840]$

$=23800$

$\therefore k=238$

55. (1)

$16x^2+32x-9y^2+36y=164$

$16(x^2+2x)-9(y^2-4y)=164$

$16(x+1)^2-9(y-2)^2=164+16-36$

$$\therefore \frac{(x+1)^2}{9}-\frac{(y-2)^2}{16}=1$$

$\therefore$ Any point on hyperbola is $(-1,3+\sec\theta, 2+4\tan\theta)$ and foci $=(-1\pm 5,2)$, i.e.,

$(-6,2)\&(4,2)$

$\therefore A(4,2), B(-6,2), C(-1+3\sec\theta, 2+4\tan\theta)$

$\therefore$ Centroid $\Rightarrow \left(\frac{-3+3\sec\theta}{3},\frac{6+4\tan\theta}{3}\right)$

$\therefore$ locus is $(x+1)^2-9\frac{(y-2)^2}{16}=1$

56. (22.00)

$$\begin{bmatrix}0 & i\\ i & 0\end{bmatrix}^n=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}=I$$

If n is multiple of 4

Thus, 2 digit number which are multiple of 4 are

$S = \{12,16,20, \ldots ,96\}$

So, thus, S contains 22 , two digit numbers.

57. (3.00)

$$\left(1+\frac{2}{3}+\frac{6}{3^2}+\frac{10}{3^3}+\cdots.\infty\right)^{\log_{0.25}\left(1+\frac{1}{3}+\frac{1}{3^2}+\cdots\infty\right)} = l$$

$$x = \frac{1}{3}+\frac{1}{3^2}+\frac{1}{3^3}+\cdots\infty = \frac{\frac{1}{3}}{1-\frac{1}{3}} = \frac{1}{2} = 0.5$$

Also,

$y = 1+\frac{2}{3}+\frac{6}{3^2}+\frac{10}{3^3}+\cdots..$

$\frac{y}{3} = 1+\frac{2}{3}+\frac{6}{3^2}+\cdots..$

$$\frac{2y}{3} = \frac{4}{3}+\frac{4}{3^2}+\frac{4}{3^3}+\cdots\infty = \frac{\frac{4}{3}}{1-\frac{1}{3}} = 2$$

$\therefore y = 3$

$\Rightarrow (3)^{\log_{0.25}(0.5)} = \sqrt{3}$

$\therefore l^2 = 3$

58. (210.00)

$$\left[\left(x^{\frac{1}{3}}+1\right)-\frac{\left(x^{\frac{1}{2}}+1\right)}{x^{\frac{1}{2}}}\right]^{10} = \left(x^{\frac{1}{3}}-x^{\frac{-1}{2}}\right)^{10}$$

$$\therefore T_{r+1} = {}^{10}C_r\left(x^{\frac{1}{3}}\right)^r\cdot\left(-x^{\frac{1}{2}}\right)^{10-r}$$

$$= {}^{10}C_r(-1)^{10-r}\cdot x^{\frac{1r}{r3}-5}$$

For term independent $\Rightarrow \frac{r}{3}+\frac{r}{2} = 5 \Rightarrow r = 6$

$\therefore$ Term independent $= T_7 = {}^{10}C_6 = 210$

59. ($\frac{16}{7^4}$)

$|A| = ad - bc$

(I) $a = \pm 3, d = \pm 3, b = \pm 2, c = \mp 3 \rightarrow 4$ cases

(II) $a = \pm 3, d = \pm 3, b = \mp 3, c = \pm 2 \rightarrow 4$ cases

(III) $a = \pm 2, d = \pm 3, b = \mp 3, c = \pm 3 \rightarrow 4$ cases

(IV) $a = \pm 3, d = \pm 2, b = \mp 3, c = \pm 3 \rightarrow 4$ cases

$\therefore$ Total favourable cases $= 16$

$\therefore$ Probability $= \frac{16}{7^4}$

60. (3.00)

$\vec{p} + \vec{q} = 5\hat{\imath} + 3\hat{\jmath} + 2\hat{k}; \vec{p} - \vec{q} = \hat{\imath} + \hat{\jmath}$

$$\therefore \vec{r} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 5 & 3 & 2 \\ 1 & 1 & 0 \end{vmatrix} = \lambda(-2\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$$

$$|\vec{r}| = 2\lambda\sqrt{3} = \sqrt{3} \Rightarrow \lambda = \frac{1}{2}$$

$$\therefore \vec{r} = -\hat{\imath} + \hat{\jmath} + \hat{k}$$

$$\therefore |\bar{a}| + |\bar{b}| + |\bar{c}| = 3$$

61. (47)

62. (2.00)

$$e^{\frac{\tan(x-2)}{(x-1)}} = \mu = \frac{\lambda}{\mu} = 1$$

$\therefore \lambda = \mu = 1 \Rightarrow \lambda + \mu = 2$

63. (1.00)

$$x^2 + 5\sqrt{2}x + 10 = 0; P_n = \alpha^n - \beta^n$$

$$\frac{P_{17}[P_{20} + 5\sqrt{2}P_{19}]}{P_{18}[P_{19} + 5\sqrt{2}P_{18}]} = \frac{P_{17}}{P_{18}}\left[\frac{(\alpha^{20} - \beta^{20}) + 5\sqrt{2}(\alpha^{19} - \beta^{19})}{(\alpha^{19} - \beta^{19}) + 5\sqrt{2}(\alpha^{18} - \beta^{18})}\right]$$

$$\Rightarrow \frac{P_{17}}{P_{18}}\left[\frac{-10\alpha^{18} + 10\beta^{18}}{-10\alpha^{17} + 10\beta^{17}}\right] = 1$$