# XI - PHYSICS - SOLUTIONS

**1.** **b)** Temperature remains constant and system absorbs heat.
Work done by the system is positive but change in internal energy of the system is zero. Hence system absorbs heat and spends it in doing work only.

**2.** **d)** 42 K
For A, pressure is constant and for B, volume is constant.

Hence, $(dQ)_A = nC_p \Delta T = n \times \frac{7}{2} R \times (30K)$

$(dQ)_B = nC_v \Delta T = n \times \frac{5}{2} R \times \Delta T$

$\because \quad (dQ)_A = (dQ)_B$

$\Rightarrow \quad \Delta T = 42K$

**3.** **d)** $\left(\frac{L_2}{L_1}\right)^{2/3}$

For adiabatic expansion

$T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$

$T_1 (AL_1)^{5/3 - 1} = T_2 (AL_2)^{\frac{5}{3}-1}$

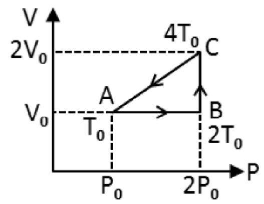
$\frac{T_1}{T_2} = \left(\frac{L_2}{L_1}\right)^{2/3}$

**4.** **a)** U only
Since no external heat is supplied, the internal energy of the gas will remain the same.

**5.** **d)** None of these

$w = \frac{1}{2} P_0 V_0 = \frac{1}{2} R T_0$. Heat supplied

$= Q_{AB} + Q_{BC} = C_V T_0 + C_P 2T_0 = \frac{13}{2} RT_0$




Efficiency = $\frac{\frac{1}{2} P_0 V_0}{4 P_0 V_0} \times 100$

$\left(\because \ \frac{13}{2} P_0 V_0 = \frac{13}{2} RT_0\right)$

$\frac{1}{13} \times 100 = 7.7\%$

**6.** **c)** 300 R

$\Delta Q = \Delta U + \Delta W$

$\because \ \Delta W = 0 \Rightarrow \Delta Q = \Delta U = \frac{f}{2} \mu R \Delta T$

$= \frac{3}{2} \times 2R(373 - 273) = 300R$

**7.** **b)** Zero, $PV_1$

(i) Case $\rightarrow$ Volume = constant $\Rightarrow \int PdV = 0$

(ii) Case $\rightarrow$ P = constant

$\Rightarrow \int_{V_1}^{2V_1} PdV = P \int_{V_1}^{2V_1} dV = PV_1$

**8.** **b)** $10^4$ cal

From FLOT $\Delta Q = \Delta U + \Delta W$

Work done at constant pressure

$(\Delta W)_P = (\Delta Q)_P - \Delta U$

$(\Delta Q)_P - (\Delta Q)_V$ (As we know $(\Delta Q)_V = \Delta U$ )

Also $(\Delta Q)_P = mc_P \Delta T$ and $(\Delta Q)_V = mc_V \Delta T$

$\Rightarrow \ (\Delta W)_P = m(c_P - c_V)\Delta T$

$\Rightarrow \ (\Delta W)_P = 1 \times (3.4 \times 10^3 - 2.4 \times 10^3) \times 10 = 10^4$ cal

**9.** **c)** Negative

$\Delta W = P\Delta V$; here $\Delta V$ is negative so $\Delta W$ will be negative

**10.** **d)** $5 \times 10^6 N/m^2$

Kinetic energy $E = 1.5 \times 10^5 J$, volume, V = 20 L = $20 \times 10^{-3} m^3$

Pressure = $\frac{2}{3}\frac{E}{V} = \frac{2}{3}\left(\frac{1.5 \times 10^5}{20 \times 10^{-3}}\right) = 5 \times 10^6 N/m^2$

**11.** **a)** 250 K

$P_1 = P$, $T_1 = T$, $P_2 = P$ + (0.4% of P)

$P_2 = P + \frac{0.4}{100} P = P + \frac{P}{250}$ and $T_2 = T + 1$

From Gay lussac's law $\frac{P_1}{P_2} = \frac{T_1}{T_2}$

$= \frac{P}{P + \frac{P}{250}} = \frac{T}{T+1}$

(as V = constant for closed vessel )

By solving, we get = T = 250 K

**12. c)** $\frac{19}{13}$

$\mu = 1, \gamma_1 = 5/3$ (for monatomic gas) and

$\mu_2 = 2, \gamma_2 = 7/5$ (for diatomic gas)

Form formula,

$$\text{Mixture} = \frac{\frac{\mu_1\gamma_1}{\gamma_1 - 1} + \frac{\mu_2\gamma_2}{\gamma_2 - 1}}{\frac{\mu_1}{\gamma_1 - 1} + \frac{\mu_2}{\gamma_2 - 1}}$$

$$= \frac{\frac{1\times\frac{5}{3}}{\frac{5}{3}-1} + \frac{2\times\frac{7}{5}}{\frac{7}{5}-1}}{\frac{1}{\frac{5}{3}-1} + \frac{2}{\frac{7}{5}-1}} = \frac{\frac{5}{2}+7}{\frac{3}{2}+5} = \frac{19}{13}$$

**13. a)** 40 %

$$\frac{\Delta W}{\Delta Q} = \frac{\Delta Q - \Delta U}{\Delta Q}$$

$$= \frac{C_P - C_V}{C_P} = 1 - \frac{1}{\gamma} = 1 - \frac{1}{1 - \frac{5}{3}} = \frac{2}{5}$$

**14. b)** Negative

Work done during process 1 is positive while during process 2 it is negative, because process 1 is enclosed by p – v graph (i.e, work done) in process 1 is smaller, so net work done will be negative.

**15. c)** $TP^{-2/5}$ = constant

For an adiabatic process,

$PV^{\gamma}$ = constant

$TV^{\gamma-1}$ = constant

And $T^{\gamma} P^{1-\gamma}$ = constant

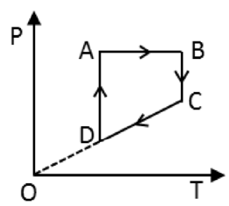
putting, $\gamma$ = 5/3 (argon being a monatomic gas) the equation becomes :

$PV^{5/3}$ = constant

$TV^{-2/3}$ = constant

$T^{5/3} P^{-2/3}$ = constant $\Rightarrow$ $TP^{-2/5}$ = constant

**16. a)**




AB is isobaric process, BC is isothermal process, CD is isochoric process and DA is isothermal process.

These processes are correctly represented by graph (a).

**17. a)** 300 K

It is free expansion, temperature will remain constant.

**18. a)** $P_A < P_B$ and $T_A < T_B$

For adiabatic process $PV_1^{\gamma} = P_A V_2^{\gamma}$

$$P_A = P\left(\frac{V_1}{V_2}\right)^{\gamma} \quad \text{(i)}$$

For isothermal process $PV_1 = P_B V_2$

$$P_B = P\frac{V_1}{V_2} \quad \text{(ii)}$$

Form (i) and (ii). $P_A < P_B$

And by PV = nRT $\quad T_A < T_B$

**19. d)** $2.3 \times 900 R \log_{10} 2$

$$W = \mu RT \log_e \frac{V_2}{V_1}$$

$$= \left(\frac{m}{M}\right) RT \log_e \frac{V_2}{V_1} = 2.3 \times \frac{m}{M} RT \log_{10} \frac{V_2}{V_1}$$

$$= 2.3 \times \frac{96}{32} R(273+27)\log_{10}\frac{140}{70} = 2.3 \times 900 R \log_{10} 2$$

**20. b)** $-\frac{\Delta V}{V}$

Differentiate PV = constant w.r.t. V

$$\Rightarrow P\Delta V + V\Delta P = 0 \Rightarrow \frac{\Delta P}{P} = -\frac{\Delta V}{V}$$

**21. d)** -1572.5 J

$$W = -\mu RT \log_e \frac{V_2}{V_1} = -1 \times 8.31 \times (273+0)\log_e\left(\frac{22.4}{11.2}\right)$$

$$= -8.31 \times 273 \times \log_e 2$$

$$= -1572.5\text{J} \quad [\because \log_e 2 = 0.693]$$

**22. a)** Remains constant

Isothermal Compressibility is given by, $E_\theta = P$, if P = constant, $E_\theta$ = constant

**23. d)** $300(4)^{-0.4/1.4}$

For adiabatic process $\frac{T^{\gamma}}{P^{\gamma-1}}$ = constant

$$\Rightarrow \frac{T_2}{T_1} = \left(\frac{P_1}{P_2}\right)^{\frac{1-\gamma}{\gamma}} \Rightarrow \frac{T_2}{300} = \left(\frac{4}{1}\right)^{\frac{(1-1.4)}{1.4}}$$

$$\Rightarrow T_2 = 300(4)^{-\frac{0.4}{1.4}}$$

**24.** **a)** Increased by 400 J

From FLOT $\Delta Q = \Delta U + \Delta W = \Delta U + P\Delta V$

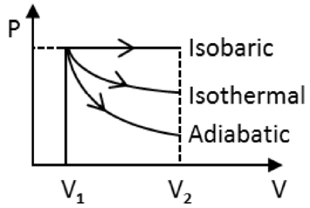
$\Rightarrow 100 = \Delta U + 50 \times (4 - 10) \Rightarrow \Delta U = 400\,J$

**25.** **a)** Adiabatic < Isothermal < Isobaric

In thermodynamic process, work done is equal to the area covered by the PV curve with volume axis.

Hence, according to graph shown

$W_{adiabatic} < W_{isothermal} < W_{isobaric}$




**26.** **a)** $\Delta Q = \Delta U$

Isometric Process is the other name of Isochoric Process.

For isochoric process $\Delta V = 0 \Rightarrow \Delta W = 0$

From FLOT $\Delta Q = \Delta U + \Delta W \Rightarrow \Delta Q = \Delta U$

**27.** **c)** $3m_A = 2m_B$

Process is isothermal. Therefore,

T = constant,

$\left(P \propto \frac{1}{V}\right)$ volume is increasing, therefore pressure will decreases.

In chamber A :

$$\Delta P = P_i - P_f = \frac{\mu_A RT}{V} - \frac{\mu_A RT}{2V} = \frac{\mu_A RT}{2V} \quad \text{..... (i)}$$

In chamber B :

$$1.5\Delta P = P_i - P_f = \frac{\mu_B RT}{V} - \frac{\mu_B RT}{2V} = \frac{\mu_B RT}{2V} \quad \text{..... (ii)}$$

From equations (i) and (ii) $\frac{\mu_A}{\mu_B} = \frac{1}{1.5} = \frac{2}{3}$

$$\Rightarrow \frac{m_A/M}{m_B/M} = \frac{2}{3} \Rightarrow 3m_A = 2m_B$$

**28.** **a)** $nRT\log_e\left(\frac{V_2 - n\beta}{V_1 - n\beta}\right) + \alpha n^2\left(\frac{V_1 - V_2}{V_1V_2}\right)$

According to given van der Waal's equation

$$P = \frac{nRT}{V - n\beta} - \frac{\alpha n^2}{V^2}$$

Work done,

$$W = \int_{V_1}^{V_2} PdV = nRT\int_{V_1}^{V_2}\frac{dV}{V - n\beta} - \alpha n^2 \int_{V_1}^{V_2}\frac{dV}{V^2}$$

$$= nRT\left[\log_e(V - n\beta)\right]_{V_1}^{V_2} + \alpha n^2\left[\frac{1}{V}\right]_{V_1}^{V_2}$$

$$= nRT\log_e\frac{V_2 - n\beta}{V_1 - n\beta} + \alpha n^2\left(\frac{V_1 - V_2}{V_1V_2}\right)$$

**29.** **c)** 3 R

P – V diagram of the gas is a straight line passing through origin. Hence $P \propto V$ or

$PV^{-1}$ = constant

Molar heat capacity in the process

$PV^x$ = constant is

$$C = \frac{R}{\gamma - 1} + \frac{R}{1 - x}; \text{ Here } \gamma = 1.4$$

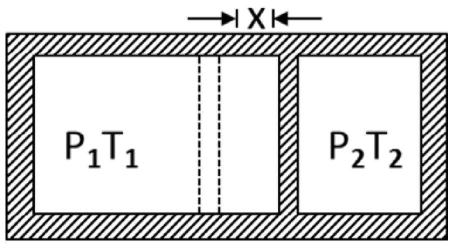
(For diatomic gas)

$$\Rightarrow C = \frac{R}{1.4 - 1} + \frac{R}{1 + 1} \Rightarrow C = 3R$$

**30.** **c)** $\dfrac{P_1\left(\frac{V_0}{2}\right)^\gamma}{\left(\frac{V_0}{2} + Ax\right)^\gamma}$

As finally the piston is in equilibrium, both the gases must be at same pressure $P_f$. It is given that displacement of piston be in final state x and if A is the area of cross-section of the piston. Hence the final volumes of the left and right part finally can be given by figure as

$$V_L = \frac{V_0}{2} + Ax \text{ and } V_R = \frac{V_0}{2} - Ax$$




As it if given that the container walls and the piston are adiabatic in left side and the gas undergoes adiabatic expansion and on the right side the gas undergoes adiabatic compression. Thus we have for initial and final state of gas on left side

$$P_1\left(\frac{V_0}{2}\right)^\gamma = P_f\left(\frac{V_0}{2} + Ax\right)^\gamma \quad \text{.... (i)}$$

Similarly for gas in right side, we have

$$P_2\left(\frac{V_0}{2}\right)^{\gamma} = P_f\left(\frac{V_0}{2} - Ax\right)^{\gamma} \qquad .... \text{(ii)}$$

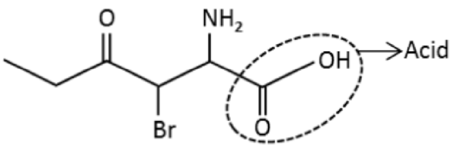
From eq. (i) and (ii)

$$\frac{P_1}{P_2} = \frac{\left(\frac{V_0}{2} + Ax\right)^{\gamma}}{\left(\frac{V_0}{2} - Ax\right)^{\gamma}} \Rightarrow Ax = \frac{V_0}{2}\left[\frac{P_1^{1/\gamma} - P_2^{1/\gamma}}{P_1^{1/\gamma} + P_2^{1/\gamma}}\right]$$

Now from equation (i) $P_f = \dfrac{P_1\left(\frac{V_0}{2}\right)^{\gamma}}{\left[\frac{V_0}{2} + Ax\right]^{\gamma}}$

**31. b)** 2,2 – dimethyl cyclohexanol
–OH is principal functional group
Numbering should start forth –OH. Carbon and following lowest locant rule for substituents.

**32. c)** 3
Except principal functional group, remaining all are substituents.



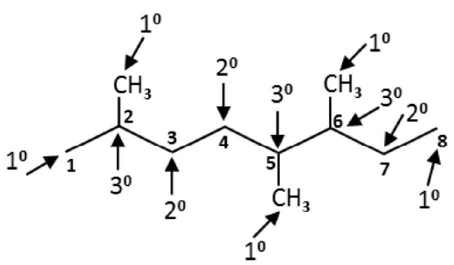

(principal functional group).

**33. c)** $Li^{\oplus} < Na^{\oplus} < K^{\oplus} < Rb^{\oplus}$
Down the group $(\downarrow)$ with decrease in positive charge density of $M^{\oplus}$ ion tendency to get hydrated decrease and hence the size of hydrated ion decreases. Thus mobility increases.
$Li_{(aq)} < Na^{\oplus}_{(aq)} < K^{\oplus}_{(aq)} < Rb^{\oplus}_{(aq)}$

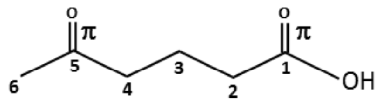
**34. b)** 2 - Bromo - 1 - chloro - 5 - fluoro - 3 - iodobenzene
All are Halogens (equal Priority)
Lowest locant rule for numbering and Alphabetical order for writing

**35. c)** i > ii > iv > iii
self – explanatory

**36. b)** 15, 6, 3




**37. a)** 18, 2




**38. b)** LiH > NaH > KH > RbH > CsH
As the size of alkali metal ion increases, lattice enthalpy decreases and hence the stability of the corresponding metal hydride decreases.

**39. b)** $NaHSO_3$, $Na_2SO_3$, $Na_2S_2O_3$

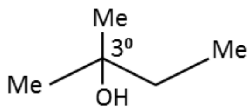
$$Na_2CO_3 + 2SO_2 + H_2O \longrightarrow \underset{(A)}{2NaHSO_3} + CO_2$$

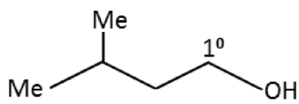
$$\underset{(A)}{2NaHSO_3} + Na_2CO_3 \longrightarrow \underset{(B)}{2Na_2SO_3} + H_2O + CO_2$$

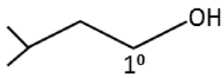
$$\underset{(B)}{2Na_2SO_3} + S \xrightarrow{\text{Heat}} \underset{(C)}{2Na_2S_2O_3}$$

**40. b)** 2 - Methyl propan - 2 - ol

a. $Me_3C - \overset{1^0}{CH_2} - OH$ (carbinol → $CH_3OH$)

b. 


c. 


d. 


**41. c)** $sp - sp^2$

$\overset{sp}{HC} \equiv \overset{sp}{C} - \overset{sp^2}{CH} = \overset{sp^2}{CH_2}$

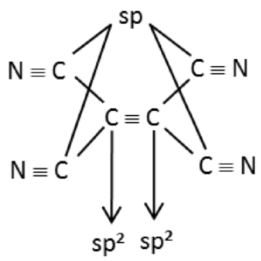
**42. b)** RbCl, $BeCl_2$
Out of $Li^{\oplus}, Rb^{\oplus}, Be^{2+}$ and $Mg^{2+}$, $Rb^{\oplus}$ has the Least charge/radius ratio and these polarize $Cl^{\ominus}$ ion to least extent hence maximum ionic
$Be^{2+}$ having highest charge/radius ratio forms Maximum covalent or least ionic compound with $Cl^{\ominus}$

**43. c)** But - 1 - en - 3 - yne
Among = & ≡, ' = ' is more prior.

$\overset{1}{CH_2} = \overset{2}{CH} - \overset{3}{C} \equiv \overset{4}{CH}$

When double & triple bonds are at equivalent positions, start numbering from double bond.

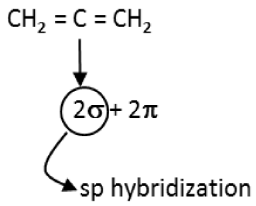
**44. c)** sp and $sp^2$ hybridised




**45. a)** NaIO + NaI

$\underset{\text{(cold and concentrated)}}{2NaOH} + I_2 \longrightarrow NaI + NaOI + H_2O$

**46. b)** both terminal C-atoms are $sp^2$-hybridized while central C-atom is sp-hybridized




**47. b)** $NaHCO_3$

Factual statement.

**48. a)** i > ii > iii > iv

self explanatory

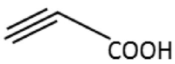
**49. c)** iv > iii > ii > i

No. of electron releasing group $\alpha$ +I effect

**50.** c) Mg and Ba

MgO is insoluble, whereas $MgSO_4$ is soluble, whereas BaO is soluble, but $BaSO_4$ is insoluble.

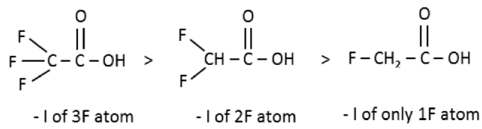
**51. a)**




–I groups $\alpha$ Acidity

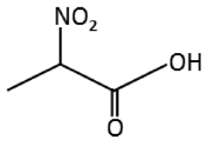
–I → ≡ > = > –

**52. c)** I > II > III




**53. d)** all of these

**54. b)**




–I group $\alpha$ acidity

**55. b)** Two moles of $NH_3$

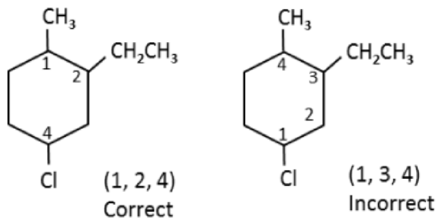
$Mg_3N_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + 2NH_3$

**56. d)** 3-ethyl-4, 4-dimethylheptane

**57. b)** $Mg_2C_3$

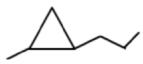
$Mg_2C_3 + 4H_2O \longrightarrow 2Mg(OH)_2 + HC \equiv C - CH_3$

**58. b)** 4 – chloro – 2 – ethyl – 1 –methylcyclohexane

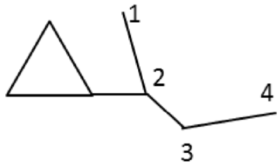



**59. b)** $Ba(OH)_2 > Sr(OH)_2 > Ca(OH)_2 > Mg(OH)_2$

Basic character increase down the group due to increase in polarity of M-OH bond.

**60. c)**  ; 1 – methyl–2–propylcyclopropane

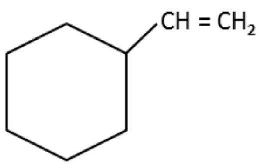
**A)**




Parent chain will be straight chain as it has more no. of C than cyclic structure.

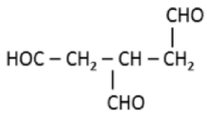
Correct name : 2-cyclopropylbutane

**B)**




Has functional group so it will be treated as parent chain

Correct name : Cyclohexylethene

**D)**  propane -1, 2, 3 - trial

## XI - MATHS - SOLUTIONS

**61. c)** $-1$

$e^{iA}e^{iB}e^{iC}=e^{i(A+B+C)}=e^{i\pi}$

$=\cos\pi+i\sin\pi$

$=-1$

**62. b)** 0

$z^4=1$

$z=1,\ e^{\pi i/2},\ e^{\pi i},\ e^{3\pi i/2}$

$z_1=1$

$z_2=i$

$z_3=-1$

$z_4=-i$

$z_1^2+z_2^2+z_3^2+z_4^2=1^2+i^2+1+(-i)^2=0$

**63. b)** circle

$\arg\frac{z-1}{z+1}=\frac{\pi}{3}$

$\arg(z-1)-\arg(z+1)=\frac{\pi}{3}$

$\tan^{-1}\left(\frac{y}{x-1}\right)-\tan^{-1}\left(\frac{y}{x+1}\right)=\frac{\pi}{3}$

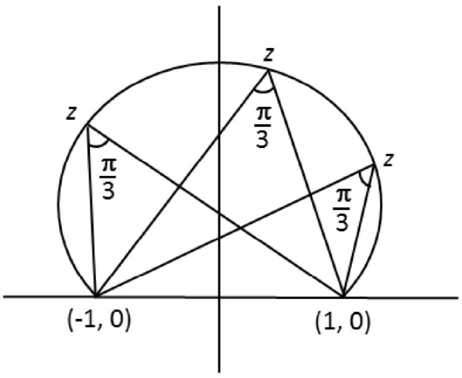
$\tan^{-1}\frac{y\left\{\frac{1}{x-1}-\frac{1}{x+1}\right\}}{1+\frac{y^2}{x^2-1}}=\frac{\pi}{3}$

$\tan^{-1}\frac{2y}{x^2+y^2-1}=\frac{\pi}{3}$

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

which is equation of circle.

Alt :




**64. d)** none of these

$z_2=z_1e^{2\pi i/3}=z_1\omega$

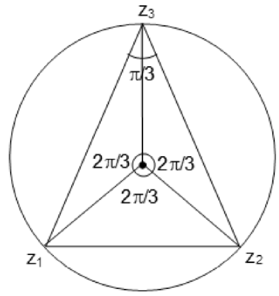
$z_3=z_1e^{4\pi i/3}=z_1\omega^2$

$z_1z_2z_3=z_1^3 1\cdot\omega\cdot\omega^2=z_1^3$

$z_1+z_2+z_3=z_1(1+\omega+\omega^2)=0$

$z_1z_2+z_2z_3+z_3z_1=z_1^2\left(\omega+\omega^3+\omega^2\right)=0$

$=-128\omega^2$




**65. a)** $2\sqrt{5}$

For a circle $z\bar{z}+\bar{g}z+g\bar{z}+c=0$

Radius of circle

$z\bar{z}+(4+3i)z+(4-3i)\bar{z}+5=0$ will be

$\sqrt{25-5}=\sqrt{20}$

$=2\sqrt{5}$

**66. d)** $\frac{n}{2}+1$

$(1+i)^n+(1-i)^n=2^k\cos\frac{n\pi}{4}$

L.H.S. $=(1+i)^n+(1-i)^n$

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

$=\left(\sqrt{2}\right)^n\left(\cos\frac{n\pi}{4}+i\sin\frac{n\pi}{4}+\cos\frac{n\pi}{4}-i\sin\frac{n\pi}{4}\right)$

$=2^{\frac{n}{2}+1}\cos\frac{n\pi}{4}$

$\Rightarrow k=\frac{n}{2}+1$

**67. b)** $\beta+i\alpha$

$(a+ib)^5=\alpha+i\beta$

Taking complex conjugate

$(a-ib)^5=\alpha-i\beta$

$\left(-i^2a-ib\right)^5=\alpha-i\beta$

$\left(-i\right)^5\left(b+ai\right)^5=\alpha-i\beta$

$\left(b+ai\right)^5=-\frac{\alpha}{i}+\beta$

$=\alpha i+\beta$

**68. a)** $e^{-\pi/2}$

$i^i$

$\log z=i\log i$

$=i\log e^{i\pi/2}$

$\log z=i^2\frac{\pi}{2}=-\frac{\pi}{2}$

$z=e^{-\pi/2}$

**69. b)** 2

Hint : $|z_1-z_2|\le|z_1|+|z_2|$

$|z-(z-2)|\le|z|+|z-2|$

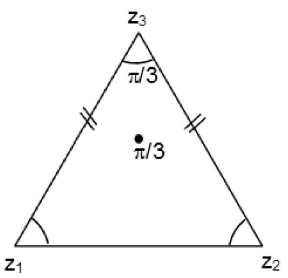
$2\le|z|+|z-2|$

Minimum value of $|z|+|z-2|$ is 2

**70. c)** equilateral

Hint : In equilateral triangle

$\arg\frac{z_1-z_3}{z_2-z_3}=-\frac{\pi}{3}$ and $|z_1-z_3|=|z_2-z_3|$




$\arg\frac{z_1-z_3}{z_2-z_3}=-\frac{\pi}{3}$

$\left(z_1-z_3\right)=\left(z_2-z_3\right)e^{-\pi/3i}$

$\frac{\left(z_1-z_3\right)}{\left(z_2-z_3\right)}=\cos\frac{\pi}{3}-i\sin\frac{\pi}{3}=\frac{1-i\sqrt{3}}{2}$

$\left|\frac{z_1-z_3}{z_2-z_3}\right|=\left|\frac{1-i\sqrt{3}}{2}\right|=1$

$|z_1-z_3|=|z_2-z_3|$

Triangle is equilateral

**71. b)** a hyperbola

Hint: $|z-z_1|-|z-z_2|=\left(a-b\right)\ne|z_1-z_2|$

locus of $z$ is hyperbola.

Let $\omega$ be centre of circle, r-radius of circle

$\Rightarrow|\omega-z_1|=a+r,|\omega-z_2|=b+r$

$\Rightarrow|\omega-z_1|-|\omega-z_2|=a-b$

$\Rightarrow$ Locus of '$\omega$' is

$|z-z_1|-|z-z_2|=a-b$

which is hyperbola.

**72. a)** the x-axis

Hint : $|z-z_1|=|z-z_2|$ locus of $z$ will be $\perp$' bisector of line joining $z_1$ and $z_2$

$\left|x+i\left(y-3\right)\right|=\left|x+i\left(y+3\right)\right|$

$x^2+\left(y-3\right)^2=x^2+\left(y+3\right)^2$

$y=0$

**73. c)** $-2\sqrt{3}+2i$

Hint $z=re^{i\theta}$

r = |z|

θ = arg z

|z| = 4

$\theta=\frac{5\times180}{6}=150$

$z=4e^{5\pi i/6}$

$=4\left(\cos\frac{5\pi}{6}+i\sin\frac{5\pi}{6}\right)$

$=4\left(-\sin\frac{\pi}{3}+i\cos\frac{\pi}{3}\right)$

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

$=-2\sqrt{3}+2i$

**74. d)** none of these.

Hint: $\left(a+ib\right)^n=c+id$ if $n\ne0$

= complex can't be real

$\left(3+4i\right)^n=25^n$

$\left(3+4i\right)^n$ = complex $\forall\ n\ne0, n\in I$

So it will not satisfy for any n

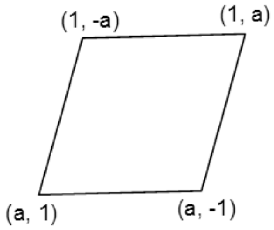
**75. d)** 9

Hint: $|z_1+z_2|\le|z_1|+|z_2|$

$|iz+3-4i|\le|iz|+|3-4i|\le|z|+|3-4i|$

$<4+5=9$

**76. b)** $a=-1$




Hint : Diagonals of Parallelogram intersects at midpoint

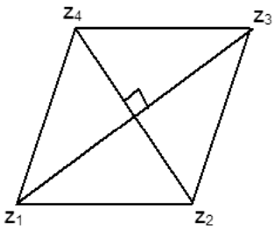
$$\frac{a+1}{2}=\frac{a+1}{2}$$
$$\frac{-1-a}{2}=\frac{a+1}{2}$$
$$2a=-2$$
$$a=-1$$

**77.** **a)** 1

Hint: $A^2+B^2=(A+iB)(A-iB)$

$$A+iB=\frac{1-i\alpha}{1+i\alpha}$$
$$A-iB=\frac{1+i\alpha}{1-i\alpha}$$
$$A^2+B^2=\frac{1+\alpha^2}{1+\alpha^2}=1$$

**78.** **a)** $z_1-z_3=ik(z_2-z_4)$




Diagonals of rhombus are perpendicular

Solution : $\arg\frac{z_1-z_3}{z_2-z_4}=\frac{\pi}{2}$ or $\frac{z_1-z_3}{z_2-z_4}$

= pure Imaginary

$$\frac{z_1-z_3}{z_2-z_4}=ki$$
$$(z_1-z_3)=ki(z_2-z_4)$$

**79.** **d)** 0

We know that $|z_1-z_2|\geq||z_1|-|z_2||$.
Equality is valid when points are collinear with origin $\Rightarrow \arg z_1=\arg z_2$

**80.** **b)** line segment

Hint: $|z-z_1|+|z_1-z_2|=|z_2-z_1|$

z lies on line segment joining $z_1$ and $z_2$.

$|z-1|+|z+1|=2$

$$|(x-1)+iy|+|(x+1)+iy|=2$$
$$\sqrt{(x-1)^2+y^2}+\sqrt{(x+1)^2+y^2}=2$$
$$\Rightarrow \sqrt{(x-1)^2+y^2}=2-\sqrt{(x+1)^2+y^2}$$
$$\Rightarrow (x-1)^2+y^2=$$
$$4+(x+1)^2+y^2-4\sqrt{(x+1)^2+y^2}$$
$$\Rightarrow \sqrt{(x+1)^2+y^2}=(x+1)$$
$$\Rightarrow (x+1)^2+y^2=(x+1)^2$$
$$y^2=0$$
$$y=0$$
$$(x+1)^2+y^2-(x-1)^2-y^2=4x$$

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

**81.** **b)** collinear

$$\bar{c}=\frac{(1-\lambda)a+\lambda b}{1-\lambda+\lambda}$$

$\bar{c}$ divides $\bar{a}$ and $\bar{b}$ in ratio $\lambda$ : 1 - $\lambda$

So $\bar{a},\bar{b}\bar{c}$ are collinear.

**82.** **d)** none of these

There is no. order relation in the system of complex no.

**83.** **d)** $-128\ \omega^2$

Hint: Use of $\omega$

$$\omega^2=1;\ 1+\omega+\omega^2=0$$
$$(1+\omega-\omega^2)^7=(-\omega^2-\omega^2)^7$$
$$=(-2\omega^2)^7$$
$$=-2^7\omega^{14}$$
$$=-128\omega^2$$

**84.** **a)** 2

$$(x-1)^4=16$$
$$(x-1)=(2^4)^{1/4}$$
$$=2(1)^{1/4}$$
$$=2,\ 2i,\ -2,\ -2i$$
$$x_1=1+2i$$

$x_2 = 1 - 2i$

are two complex values

$x_1 + x_2 = 2$

**85. a)** $z$

$|z| = 1 \Rightarrow z\bar{z} = |z|^2 = 1$

$\Rightarrow \bar{z} = \dfrac{1}{z}$

$\Rightarrow \dfrac{1+z}{1+\bar{z}} = \dfrac{1+z}{1+\left(\dfrac{1}{z}\right)} = z$

**86. c)** a straight line

$\left|\dfrac{z-1}{z+1}\right| = 1$

$|z-1| = |z+1|$

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

$x = 0$

Straight line

**Alt :**

$|z - z_1| = |z - z_2|$ represents $\perp$ bisector of line joining $z_1$ and $z_2$. Hence it is a straight line.

**87. b)** three collinear point

$2z_1 - 3z_2 + z_3 = 0$

$2z_1 = 3z_2 - z_3$

$z_1 = \dfrac{3z_2 - z_3}{3-1}$

$z_1$ divides line joining $z_2$ and $z_3$ externally in the ratio 3 : 1

$\Rightarrow z_1, z_2, z_3$ are collinear points

**88. d)** Re $(z) > 3$

Hint: $z = x + iy$

$|z| = x^2 + y^2$

$|z - 4| < |z - 2|$

$|x - 4 + iy| < |(x - 2) + iy|$

$(x-4)^2 + y^2 < (x-2)^2 + y^2$

$(x-4)^2 - (x-2)^2 < 0$

$x^2 + 16 - 8x - x^2 - 4 + 4x < 0$

$12 - 4x < 0$

$12 < 4x$

$x > 3$

$\text{Re}(z) > 3$

**Alt :**

$|z - 4| = |z - 2|$ represents $\perp$ bisector of line joining (4, 0) and (2, 0).

i.e. the line $x = 3$.

$\Rightarrow |z - 4| < |z - 2|$ represents $x > 3$.

i.e. $\text{Re}(z) > 3$

**89. c)** a line-segment

$|3z - 2| + |3z + 2| = 4$

$3\left|z - \dfrac{2}{3}\right| + 3\left|z + \dfrac{2}{3}\right| = 4$

$\left|z - \dfrac{2}{3}\right| + \left|z + \dfrac{2}{3}\right| = \dfrac{4}{3}$

$\left|z - \dfrac{2}{3}\right| + \left|z + \dfrac{2}{3}\right| = \dfrac{4}{3}$

$|z - z_1| + |z - z_2| = |z_1 - z_2|$

$\Rightarrow$ $z$ lies between line segment joining $-\dfrac{2}{3}$ to $\dfrac{2}{3}$

**90. a)** $z_2 = kz_1^{-1} \ (k > 0)$

$\arg(\bar{z}_1) = \arg(z_2)$

$\arg\left(\dfrac{\bar{z}_1 z_1}{z_1}\right) = \arg(z_2)$

$\Rightarrow \arg\left(\dfrac{|z_1|^2}{z_1}\right) = \arg(z_2)$

$\arg(z_1^{-1}) = \arg(z_2) \ (\because |z_1|^2 = real)$

$\Rightarrow z_2 = kz_1^{-1}$