Critical state and Liquefaction of gases										
				•				-		
1	а	2	b	3	d	4	С	5	d	
6	d	7	c	8	C	9	abc	10	c	
11	C									

Critical Thinking Questions

1	a	2	c	3	с	4	C	5	a
6	d	7	b	8	b	9	а	10	а
11	a	12	b	13	b	14	c	15	b
16	а	17	b	18	b	19	а	20	d
21	C	22	C						

Assertion & Reason

1	C	2	C	3	а	4	d	5	а
6	d	7	a	8	b	9	a	10	b
11	а	12	а	13	C	14	е	15	d
16	C								

Answers and Solutions

Characteristics and Measurable properties of gases

- Gases do not have definite shape and volume. Their volume is 1. (c)equal to the volume of the container.
- All the three phases of water can coexist at $0^{\circ}C \& 4.7 mm$ 2. (c) pressure.
- It is characteristic of gases *i.e.* Thermal energy >> molecular 3. (b) attraction
- In gases, molecular attraction is very less and intermolecular 4 (a) spaces are large hence kinetic energy of gases is highest.
- Gases and liquids, both can flow and posses viscosity. (c) 5
- Newton is unit of force. 7. (a)

8. (b)
$$\frac{C^o}{5} = \frac{F^o - 32}{9}$$

- (c) $1L = 10^{-3}m^3 = 10^3 cm^3 = 1dm^3 = 10^3 ml$. 9.
- (a) $1 atm = 10^6$ dynes cm⁴ 10.
- (b) Barometer is used to measure atmospheric pressure of mixture 12. of gases. Staglometer is used to measure surface tension. Only manometer is used to measure pressure of pure gas in a vessel.
- (a) $0^{\circ}C$ is equivalent to $273^{\circ}K$ *i.e.* conditions are same so 13. volume will be V ml.
- The mass of gas can be determined by weighing the container, (d) 14. filled with gas and again weighing this container after removing the gas. The difference between the two weights gives the mass of the gas.
- Nobel gases has no intermolecular forces due to inertness. 15. (c)
- Total volume of two flasks = 1+3=416. (e)

If
$$P_1$$
 the pressure of gas N_2 in the mixture of N_2 and O_2 then

 $P = 100 \ kPa$, $P_1 = ?$, $V = 1 \ litre$, $V_1 = 4 litre$ applying Boyle's law $PV = P_1V_1$ $100 \times 1 = P_1 \times 4$; $P_1 = 25$ If P_2 is the pressure of O_2 gas in the mixture of O_2 and N_2 then, 320 \times 3 = $P_2 \times 4$; $P_2 = 240$ Hence, Total pressure $P = P_1 + P_2 = 25 + 240$

= 265 kPa

1.

2.

3.

4.

7.

11.

15.

Ideal gas equation and Related gas laws

(c) Boyle's law is $V \propto \frac{1}{P}$ at constant T

(d) According to Boyle's law
$$V \propto \frac{1}{P}$$

$$V = \frac{\text{Constant}}{P} \text{ ; } VP = \text{Constant.}$$

- (a) At sea level, because of compression by air above the proximal layer of air, pressure increases hence volume decreases i.e. density increases. It is Boyle's law.
- (a) At constant $T, P_1V_1 = P_2V_2$ $1 \times 20 = P_2 \times 50$; $P_2 = \frac{20}{50} \times 1$
- (a) P.V = constant at constant temperature. As temperature 5. changes, the value of constant also changes.
- 6. (b,c)According to Boyle's Law PV = constant, at constant temperature either P increases or V increases both (b) & (c)may be correct.

(a)
$$\frac{d_1}{d_2} = \frac{1}{2}$$
, $\frac{T_1}{T_2} = \frac{2}{1}$, $\frac{P_1}{P_2} = \frac{V_2}{V_1} \times \frac{T_1}{T_2} = \frac{T_1 \cdot d_1}{T_2 \cdot d_2}$
 $\frac{P_1}{P_2} = \frac{2}{1} \cdot \frac{1}{2} = \frac{1}{1}$

Absolute temperature is temperature measured in ^o Kelvin, 8. (a) expressed by T

(a)
$$T_1 = 273^\circ C = 273 + 273^\circ K = 546^\circ K$$

$$T_{2} = 0^{o} C = 273 + 0^{o} C = 273^{o} K$$

$$P_{1} = 1 ; P_{2} = ?$$
According to Gay-Lussac's law
$$\frac{P_{1}}{T_{1}} = \frac{P_{2}}{T_{2}} \therefore P_{2} = \frac{P_{1}T_{2}}{T_{1}} = \frac{1 \times 273^{o} K}{546^{o} K} \text{ atm}; \frac{1}{2} \text{ atm}.$$

12. (a)
$$V_t = V_o(1 + \alpha_v t)$$

 $\therefore (V_2 - V_1) = \Delta V = V_o \alpha (t_2 - t_1)$
if $t_2 - t_1 = 1^o$ then $\Delta V = \alpha V_o$

For every $1^{\circ}C$ increase in temperature, the volume of a given mass of an ideal gas increases by a definite fraction 1 $\overline{2}$

$$\overline{73.15}$$
 of V_o . Here V_o is volume at $0^{o}C$ temperature

13. (a)
$$\frac{V_1}{V_2} = \frac{T_1}{T_2}$$
 \therefore $V_2 = \frac{T_2}{T_1} V_1 = \frac{546^{\circ} K}{273^{\circ} K} \times 0.2L = 0.4L$

(a)
$$V_2 = \frac{T_2}{T_1} \cdot V_1 = \frac{270^{\circ} K}{300^{\circ} K} \cdot 400 cm^3 = 360 cm^3$$

contraction $= V_1 - V_2 = 400 - 360 = 40 cm^3$

(c) At constant volumes
$$P \propto T$$

$$P = \text{constant } T; \quad PV = nRT \therefore P = \frac{nR}{V}T$$

slope =
$$m = \frac{nR}{V}$$
 :: $V_2 < V_1$

 $\frac{m_1}{m_2} = \frac{V_2}{V_1} \therefore m_1 < m_2~~{\rm is~curve~for~V}$ has a greater slope than for V

16. (c)
$$\frac{P_1}{T_1} + \frac{P_1}{T_1} = \frac{P}{T_1} + \frac{P}{T_2}$$

 $\frac{2P_1}{T_1} = P\left(\frac{T_1 + T_2}{T_1T_2}\right); \quad \therefore P = \frac{2P_1(T_1T_2)}{T_1(T_1 + T_2)} = \frac{2P_1T_2}{T_1 + T_2}$

(c) At constant *V* of a definite mass $\frac{P_1}{T_1} = \frac{P_2}{T_2} \therefore \frac{P_1}{P_2} = \frac{300}{600} = \frac{1}{2}$ *i.e.* pressure increases and on increasing temperature energy of molecules increases so the rate of collisions also increases and number of moles

the rate of collisions also increases and number of moles remains constant because there is neither addition nor removal of gas in the occurring. Avogadro number = $6.0224 \times 10^{\circ}$

18.

20. (b) Compressibility =
$$\frac{1}{nRT} < 1$$
 at STP (as given)
 $nRT > PV$
 $N \times 0.0821 \times 273 > 1V_m$
 $22.41 \ litres > V_m$
 $R = 0.821$
 $T = 273 \cdot K$
 $P = I$
 $n = 1$

(c) The value of universal gas constant can be expressed in different units and its value would depend only on the units of the measurement.
 (c) PV = nRT

(c)
$$PV = nKT$$

 $R = \frac{PV}{nT}$ = litre . *atm. K mole*

- **23.** (d) (atm. K mol) is not a unit of R
- **24.** (a) 8.31 *J.K. mol* 1 *cal* = 4.2 *J.* 8.31

$$\therefore \frac{6.51}{4.2} cal. K^{-1} mol^{-1} = 1.987 cal K mol^{-1}$$
(c) $PV = nBT \div \frac{n}{2} = \frac{P}{2}$

30. (c)
$$PV = nRT \therefore \frac{n}{V} = \frac{1}{RT}$$

31. (a) $P = \frac{nRT}{V} = \frac{2 \times 0.0821 \times 546}{44.8 \, l} = 2 \, atm.$

32. (a)
$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2} \therefore n_2 = \frac{P_2V_2T_1}{P_1V_1T_2}n_1$$

at STP n_1 = one mole.
 $P_2 = 1$ atm.
 $V_2 = 22.4$ lt
 $T_2 = 273K$
 $n_2 = \frac{1}{1} \times \frac{22.4}{22.4} \times \frac{273}{303} \times 1 = 0.9$ moles

 $P_2 = 1 = 1 = 0.5 \times 0.082 \times 273^\circ K = 11.21$;

33. (b)
$$V = \frac{P}{P} = \frac{1}{1} = 11.2ht$$

34. (b) $V_2 = \frac{P_1 V_1 T_2}{P_2 T_1} \Rightarrow P_1 = P$; $T_1 = 273^o K$
 $P_2 = \frac{3}{2}P$; $T_2 = T_1 + \frac{T_1}{3} = \frac{4}{3} \times 273^o K$
 $V_2 = \frac{2P}{3P} \times \frac{4}{3} \times \frac{273}{273} \times 100cc = \frac{800}{9}cc = 88.888cc$
 $= 88.9 cc$

35. (b)
$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T} \therefore \frac{P_1V_1}{P_2V_2} = \frac{T_1}{T_2}$$

36. (c) $d_a = 2d_b : 2M_a = M_b$
 $PV = nRT = \frac{m}{M}RT; P = \frac{m}{V} \cdot \frac{RT}{M} = \frac{dRT}{M}$
 $\frac{P_a}{P_b} = \frac{d_a}{d_b} \frac{M_b}{M_a} = \frac{2d_b}{d_b} \times \frac{2M_a}{M_a} = 4$
37. (d) $n \text{ of } O_2 = \frac{16}{32} = \frac{1}{2}$
 $n \text{ of } H_2 = \frac{3}{2}$
Total no. of moles $= \frac{3}{2} + \frac{1}{2} = 2$
 $V = \frac{nRT}{P} = \frac{2 \times .082 \times 273}{1} = 44.8 lit = 44800 \text{ m/}$
38. (c) $n = \frac{PV}{RT} = \frac{m}{M}$
 $m = \frac{MPV}{RT} = \frac{34 \times 2 \times 100}{0.082 \times 293} = 282.4 \text{ gm}$
39. (c) $V_2 = \frac{P_1V_1}{T_1} \frac{T_1}{P_2} = \frac{760}{600} \times \frac{546}{273} \times 273 = 691.6 \text{ml.}$
40. (a) $\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2} \therefore T_2 = \frac{P_2}{P_1} \frac{V_2}{V_1} T_1 \frac{m_1}{m_2}$
 $= \frac{0.75}{1} \times \frac{1}{1} \times \frac{2}{1} \times 300^{\circ} K = 450^{\circ} K$
41. (b) $V_2 = \frac{P_1}{P_2} \frac{T_2}{T_1} V_1 = \frac{1}{0.5} \times \frac{250}{300} \times 12000 lit = 20000 lit$
42. (c) At constant pressure
 $V \propto nT \propto \frac{m}{M}T$
 $\frac{V_1}{V_2} = \frac{m_1T_1}{m_2T_2} \therefore \frac{T_1}{T_2} = \frac{V_1}{m_1} \times \frac{m_2}{V_2} = \frac{d_2}{d_1} \Rightarrow \frac{300^{\circ} K}{T_2} = \frac{0.75d}{d}$
 $T_2 = \frac{300}{0.75} = 400^{\circ} K$
43. (c) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \therefore T_2 = \frac{P_2V_2}{P_1V_1} \times T_1 = \frac{740}{740} \times \frac{80}{100} \times 300$
 $= 240^{\circ} K = -33^{\circ} C$
47. (b) Because H_2 & CI_2 gases may react with each other to produce HCI gas hence Dalton's law is not applicable.

48. (d) Because
$$HCl \& NH_3$$
 gases may react to produce NH_4Cl gas. Dalton's Law is applicable for non reacting gas mixtures.

50. (c) No. of moles of lighter gas
$$=\frac{m}{4}$$

No. of moles of heavier gas $=\frac{m}{40}$

Total no. of moles
$$= \frac{m}{4} + \frac{m}{40} = \frac{11m}{40}$$

Mole fraction of lighter gas $= \frac{\frac{m}{4}}{\frac{11m}{40}} = \frac{10}{11}$

Partial pressure due to lighter gas $= P_o \times \frac{10}{11}$ $=1.1 \times \frac{10}{11} = 1$ atm. (a) *m. wt.* of $NH_3 = 17$; *m.wt.* of $N_2 = 28$ 52. *m.wt.* of $CO_2 = 44$; *m.wt.* of $O_2 = 32$ beacuse NH_3 is lightest gas out of these gases $r \propto \frac{1}{\sqrt{\text{MolecularWeight}}}$ (a) $\frac{r_g}{r_{He}} = \sqrt{\frac{M_{He}}{M_g}} \therefore M_g = M_{He} \cdot \frac{r^2_{He}}{r_g^2} = \frac{4}{(1.4)^2} = \frac{4}{1.96} = 2$ 55. Note : $1.4 = \sqrt{2}$ (a) $r_g = \frac{1}{5} . r_{H_2}$ 56. $\frac{M_g}{M_{H_2}} = \left[\frac{r_{H_2}}{r_g}\right]^2 = (5)^2 = 25 ; M_g = 2 \times 25 = 50$ (b) $r_g = \frac{1}{6}r_{H_2}; M_g = M_{H_2} \left[\frac{r_{H_2}}{r_e}\right]^2 = 2 \times 6^2 = 2 \times 36 = 72$ 57. (a) $M_1 = 64$; $r_2 = 2r_1$ 58. $M_2 = M_1 \left[\frac{r_1}{r_2} \right]^2 = 64 \times \frac{1}{4} = 16$ (b) $r_O = r_H \sqrt{\frac{d_H}{d_O}} = 1 \sqrt{\frac{0.09}{1.44}} = \sqrt{\frac{1}{16}} = \frac{1}{4}$ 59. (a) $r_a = 5r_b$; $\frac{d_a}{d_a} = \left[\frac{r_b}{r}\right]^2 = \left(\frac{1}{5}\right)^2 = \frac{1}{25}$ 60. (b) $\frac{d_1}{d_2} = \frac{1}{16}$; $\frac{r_1}{r_2} = \sqrt{\frac{d_2}{d_1}} = \sqrt{16} = \frac{4}{1}$ 61. (d) $\frac{D_A}{D_B} = \sqrt{\frac{\rho_B}{\rho_A}} = \left[\frac{\rho_B}{\rho_A}\right]^{\frac{1}{2}}; \quad \therefore D_A = D_B \left(\frac{\rho_B}{\rho_A}\right)^{\frac{1}{2}}$ 62. (c) Gases may be separated by this process because of different rates of 63. diffusion due to difference in their densities. (b) NH_4Cl ring will first formed near the HCl bottle because 64.

- rate of diffusion of NH_3 is more than that of HCl because $M_{NH_3}: M_{HCl} = 17:36.5$). SO NH_3 will reach first to the HCl bottle & will react there with HCl to form NH_4Cl ring
- **65.** (d) Because both *NO* and C_2H_6 have same molecular weights $\lfloor M_{NO} = M_{C_2H_6} = 30 \rfloor$ and rate of diffusion \propto molecular weight.

67. (d)
$$\frac{M_A}{M_B} = \left(\frac{r_B}{r_A}\right)$$
 $\because r_A = 2r_B$ $\therefore \frac{r_B}{r_A} = \frac{1}{2} = \frac{1}{(2)^2} = \frac{1}{4} = .25$
68. (a) $r_H = \frac{2gm}{10 \text{ min}}$ if $r_O = \frac{xgm}{10 \text{ min}}$

 $r_{O} = r_{H} \sqrt{\frac{M_{H_{2}}}{M_{O_{2}}}} = \frac{2}{10} \sqrt{\frac{2}{32}}$

$$\frac{x}{10} = \frac{2}{10 \times 4} = \frac{1}{2} gm. = .5gm$$
69. (a) $r_{CH_4} = 2r_g$

$$M_g = M_{CH_4} \left(\frac{r_{CH_4}}{r_g}\right)^2 = 16 \times 2^2 = 64$$
70. (b) $r \propto \frac{1}{\sqrt{M}}$ $\therefore r = \frac{Volume effused}{time taken} = \frac{V}{t}$
 $\frac{V}{t} \propto \frac{1}{\sqrt{M}}$ \therefore for same volumes (V constant)
 $t \propto \sqrt{M} \therefore \frac{t_1}{t_2} = \sqrt{\frac{M_1}{M_2}}$
 $t_{H_e} = t_{H_2} \sqrt{\frac{M_{H_e}}{M_{H_2}}} = 5\sqrt{\frac{4}{2}} = 5\sqrt{2s}.$
 $t_{O_2} = t = 5\sqrt{\frac{32}{2}} = 20s$
 $t_{CO} = 5\sqrt{\frac{28}{2}} = 5\sqrt{14s}$; $t_{CO_2} = 5\sqrt{\frac{44}{2}} = 5\sqrt{22s}$
71. (c) $\frac{r_{N_2}}{r_{SO_2}} = \frac{V_{mn}N_2}{V_{mn}} = \sqrt{\frac{T_{N_2}}{T_{SO_2}}} \cdot \frac{M_{SO_2}}{M_{N_2}} = \sqrt{\frac{T_{N_2}}{323} \times \frac{64}{28}}$
 $1.625 = \sqrt{\frac{T_{N_2}}{16}} \cdot \frac{16}{7}$
 $T_{N_2} = \frac{(1.625)^2 \times 323 \times 7}{16} = 373^{\circ} K$
72. (a) $C + H_2O \rightarrow CO(g) + H_{2(g)}$
 $12gm \rightarrow 1mol + 1mol$
 $12 gm C may produce \frac{48}{12} \times 2 = 4 \times 2 = 8mole$
 $= 22.4 \times 8 L \text{ gases} = 179.2 L \text{ gas.}$
73. (d) Molecular weight $= \frac{mRT}{PV} = \frac{4.4 \times .082 \times 273}{1 \times 2.24} = 44$
So the gas should be CO_2
74. (c) $PV = nRT$
 $P = \frac{n}{V}RT \therefore \frac{n}{V} = C \Rightarrow P = CRT$
 $T = \frac{P}{CR} = \frac{1}{1 \times .821} = 12^{\circ} K$
75. (a) 6.02×10^{23} moles of each N_2, O_2 and H_2
 $= \frac{6.02 \times 10^{23}}{6.02 \times 10^{23}}$ moles of each N_2, O_2 and H_2
 $= \frac{6.02 \times 10^{23}}{6.02 \times 10^{23}}$ moles of each N_2, O_2 and H_2
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 $= \frac{6.02 \times 10^{23}}{6.02 \times 10^{23}}$ moles of each N_2, O_2 and H_2
 $= \frac{6.02 \times 10^{23}}{6.02 \times 10^{23}}$ moles of each N_2, O_2 and H_2

76. (c) *M.wt* of
$$CO_2 = 12+16+16 = 44$$

Volume of 44 gm of CO_2 at NTP = 22.4 *litre*
1 gm of CO_2 at NTP = $\frac{22.4}{44}$

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4.4 gm of CO_2 at N.T.P $\Rightarrow \frac{22.4}{44} \times 4.4 \text{ litre} = 2.24 \text{ litre}$

78. (b) No. of moles of CO_2 present in 200 *ml* solution

= molarity × Volume (in *lt*) =
$$0.1 \times \frac{200}{1000} = .02$$

Volume of 0.02 mole of *CO*₂ = 22.4 × .02*lt* = 0.448*lit*

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79. (b) Molecular weight = $V.d. \times 2 = 11.2 \times 2 = 22.4$ Volume of 22.4 *gm* Substance of NTP = 22.4 *litre* 1 *gm* substance at NTP = $\frac{22.4}{22.4}$ *litre*

(b)
$$\frac{M.wt.of O_2}{M.wt.of SO_2} \Rightarrow \frac{M_1}{M_2} \Rightarrow \frac{32}{64} = \frac{1}{2}$$

The weight of oxygen will be
$$\frac{1}{2}$$
 that of SO_2

- **81.** (b) For *HI* has the least volume because of greater molecular weight $V \propto \frac{1}{M}$
- 83. (c) Since no. of molecules is halved so pressure should also be halved.
- 84. (c) H_2 will be filled first because of lower molecular weight
- 85. (a) Mixture of SO₂ and Cl₂ are reacted chemically and forms SO₂Cl₂. That is why mixture of these gases is not applicable for Dalton's law.
 86. (d) According to Boyle's law

$$P_1 V_1 = P_2 V_2 \implies P_1 \times 60 = 720 \times 100$$
$$P_1 = \frac{720 \times 100}{60} = 1200 mm$$

87. (a) Rate of diffusion
$$\propto \frac{1}{\sqrt{\text{Molecular Mass}}}$$

that is why H_2 gas diffuse first

88. (a) Solution level will rise, due to absorption of CO_2 by sodium hydroxide.

$$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$$
89. (c)
$$CaCo_3 \rightarrow CaO + CO_2 \uparrow$$

$$\therefore \text{ At S.T.P. 100g } CaCO_3 \text{ produce} = 22.4 litreof CO_2$$

$$\therefore \text{ At S.T.P. 1g } CaCO_3 \text{ produce} = \frac{22.4}{100} = .224 litre$$

$$CO_2$$

90. (c) The density of gas
$$= \frac{Molecularwt.Of Metal}{Volume} = \frac{45}{22.4}$$

 $= 2gmlitre^{-1}$

91. (a)
$$M_1 = 32g$$
 for O_2 , $M_2 = 2g$ for r

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}; \qquad \frac{r_1}{r_2} = \sqrt{\frac{2}{32}} = \sqrt{\frac{1}{16}} = \frac{1}{4}$$
(c) In 22.4*l* of *H*₂ maximum number of

92. (c) In 22.4*l* of
$$H_2$$
 maximum number of molecules
= 6.023×10^{23}

 H_2

In 1*l* of H_2 maximum number of molecules = $\frac{6.023 \times 10^{23}}{22.4}$

In 15*l* of H_2 maximum number of molecules = $\frac{6.023 \times 10^{23}}{22.4} \times 15 = 4.03 \times 10^{23}$ molecules.

93. (a) 22.4*l*
$$O_2$$
 at S.T.P. = 32gm of O_2

11
$$O_2$$
 at S.T.P. = $\frac{32}{22.4} = 1.43 gm$ of O_2

95 (a) We know that molecular mass of hydrogen $M_1 = 2$ and that of helium $M_2 = 4$, we also know that Graham's law of diffusion

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}} = \sqrt{\frac{4}{2}} = \sqrt{2} = 1.4; \quad r_1 = 1.4m$$
(a) $\frac{r_A}{r_H} = \sqrt{\frac{M_H}{M_A}} = \frac{r}{6r} = \sqrt{\frac{2}{M_A}}$

$$\begin{split} M_A &= 6 \times 6 \times 2 = 72g \\ (d) & \text{Given that:} \\ V_1 &= 100ml, P_1 = 720mm, V_2 = 84ml, P_2 = ? \\ \text{By using } P_1V_1 &= P_2V_2 \ \text{[According to the Boyle's law]} \end{split}$$

$$P_2 = \frac{P_1 V_1}{V_2} = \frac{720 \times 100}{84} = 857.142$$

Hence, $P_2 = 857.14mm$

98. (b) According to gas law

96.

97.

99.

100.

of

$$PV = nRT, \ n = \frac{P_V}{RT}$$

$$\frac{n_A}{n_B} = \frac{\frac{P_1V_1}{RT_1}}{\frac{P_2V_2}{RT_2}}; \ \frac{n_A}{n_B} = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2V_2}$$

$$\frac{n_A}{n_B} = \frac{2P \times 2V}{2T} \times \frac{T}{PV}; \ \frac{n_A}{n_B} = \frac{2}{1}$$
(e) No. of molecules $= 2 \times V.d$
 $2 \times 38.3 = 76.3$
wt. of $NO_2 = x$
So that wt. of $N_2O_4 = 100 - x$
Hence, $\frac{x}{46} + \frac{100 - x}{92} = \frac{100}{76.6} = \frac{2x + 100 - x}{92} = \frac{100}{76.6}$
 $x = 20.10$, no. of mole. of $NO_2 = \frac{20.10}{46} = 0.437$
(a) Given that
 $P_1 = 76cm$ of Hg (Initial pressure at N.T.P.)

$$P_2 = ?, V_1 = 5litre, V_2 = 30 + 5 = 35litres$$

According to Boyle's law
$$P_1V_1 = P_2V_2; 76 \times 5 = P_2 \times 35$$

$$P_2 = \frac{76 \times 5}{35} \Rightarrow P_2 = 10.8 cm \text{ of } Hg$$

101. (c) Given initial volume $(V_1) = 300cc$, initial temperature $(T_1) = 27^{\circ}C = 300K$, initial pressure $(P_1) = 620mm$, final

temperature
$$T_2 = 47^{\circ}C = 320K$$
 and final pressure
 $(P_2) = 640mm$. We know from the general gas equation
 $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} = \frac{620 \times 300}{300} = \frac{640 \times V_2}{320} \Rightarrow V_2 = 310cc$
102. (c) $NH_3 + HCl \rightarrow NH_4Cl$
 $4litre 1.5litre$
 HCl is a limiting compound. That's why 1.5litre of HCl
reacts with 1.5litre of NH_3 and forms NH_4Cl . Thus (4 –
1.5) 2.5litre NH_3 remains after the reaction.
103. (c) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$; $\frac{P_1 \times 4}{T_1} = \frac{2P_1 \times V_2}{2T_1}$
 $8 = 2 \times V_2$ so $V_2 = 4dm^3$
104. (c) $P_1 = P, V_1 = V, T_1 = T$
 $P_2 \frac{P}{2}, V_2 = ?, T_2 = T$
According to gas equation
 $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ or $\frac{PV}{T} = \frac{PV_2}{2T}$
 $\therefore V_2 = 4V$
105. (a) $P_1 = P, V_1 = V, T_1 = 273 + 75 = 348K$
 $P_2 = 2P, V_2 = \frac{85}{100}, T_2 = ?$
 $\frac{P \times V}{398} = \frac{2P \times 85V}{T_2 \times 100} \Rightarrow T_2 = \frac{348 \times 2 \times 85}{100}$
 $\therefore T_2 = 591.6K = 318.6^{\circ}C$
106. (a) Boyle's law $-PV$ = constant
On differentiating the equation,
 $d(PV) = d(C) \Rightarrow PdV + VdP = 0$
 $\Rightarrow VdP = -PdV \Rightarrow \frac{dP}{P} = -\frac{dV}{V}$.

Kinetic molecular theory of gases and Molecular collisions

4. (d) Kinetic energy
$$=\frac{3}{2}RT$$

5. (b) $KE = \frac{3}{2}RT$ it means that *K.E* depends upon *T* (absolute temperature) only.

7. (a)
$$KE = \frac{3}{2}RT = \frac{3}{2}PV$$

 $\therefore P = \frac{2}{3}\frac{E}{V}$ for unit volume $(V = 1) \implies P = \frac{2}{3}E$

- 8. (c) Tr. $K.E. = \frac{3RT}{2}$ it means that the Translational Kinetic energy of Ideal gas depends upon temperature only.
- 9. (b) $\frac{E_{He}}{E_{H_2}} = \sqrt{\frac{T_{He}}{T_{H_2}}}$ so energies will be same for *He* & *H*₂ at same temperature.

n. (a)
$$K.E. = \frac{3}{2}.RT = \frac{3}{2}.2.T$$
 $\therefore R \approx 2calK^{-1}mol^{-1}$
 $K.E. = 3T$

- 12. (d) All molecules of an ideal gas show random motion. They collide with each other and walls of container during which they lose or gain energy so they may not have same kinetic energy always.
- 13. (a) For same temperature kinetic energies of H_2 & He molecules will be same because kinetic energy depends only on temperature.
- 14. (a) For same temp. kinetic energies would be equal for all molecules, what ever their molecular weights will be, it doesn't matter.
- (a,c,d)Kinetic energies per molecule will be same because it is proportional to absolute temperature only.

$$\frac{d_{N_2}}{d_{CO_2}} = \frac{M_{N_2}}{M_{CO_2}} = \frac{28}{44} \text{ i.e. } dN_2 < dCO_2$$

Total translational kinetic energy will also be same because at same temperature & pressure number of molecules present in same volume would be same (according to Avogadro's Law)

- (a) On increasing pressure, the volume decreases and density increases. So molecules get closer to each other hence mean free path also decreases.
- 17. (b) Most probable velocity increase and fraction of molecule possessing most probable velocity decrease.

18. (d)
$$PV = nRT = \frac{m}{M}RT$$

 $\therefore \frac{m}{V} = \frac{PM}{RT} = \text{density}$

16.

1

9. (b)
$$d \propto \frac{P}{T}$$
 the value of $\frac{P}{T}$ is maximum for (b)

- **20.** (d) If inversion temperature is $80^{o}C = 193^{o}K$ then the temperature, at which it will produce cooling under Joule Thomson's effect, would be below inversion temperature except $173^{o}K$ all other values given as
- **21.** (a) Since $\frac{C_P}{C_V} = 1.4$, the gas should be diatomic.

If volume is 11.2 *lt* then, no. of moles =
$$\frac{1}{2}$$

 \therefore no. of molecules = $\frac{1}{2} \times$ Avagadro's No.

no. of atoms = $2 \times no.$ of molecules

$$2 \times \frac{1}{2} \times \text{Avagadro's No.}$$

$$= 6.0223 \times 10^{23}$$

22. (d) Density = $\frac{M}{V}$ $d = \frac{v.d \times 2}{V} \qquad (M = V.d \times 2)$

$$V = \frac{V}{V} = (W - V \cdot W \times 2)^{-1}$$
$$V = \frac{d \times V}{2}$$
$$V = \frac{0.00130 \times 22400}{2} = 14.56 gm^{-1}$$

23. (c) Volume of steam =
$$1h = 10^3 cm^3$$

 $\therefore m = d.V$
 \therefore mass of $10^3 cm^3$ steam = density × Volume
 $= \frac{0.0006gm}{cm^3} \times 10^3 cm^3 = 0.6gm$

IVERSAL

scorer 254 Gaseous State

Actual volume occupied by $H_2 {\cal O}\,$ molecules is equal to volume of water of same mass

- \therefore Actual volume of $\,H_2O\,$ molecules in $\,6\,gm\,$ steam $\,$
- = mass of steam/density of water = $0.6 gm / 1 gm/cm \Rightarrow 0.6 cm^3$

24. (b)
$$r = \frac{C_P}{C_V} = \frac{5}{3} = 1.66$$
 (For Monoatomic as He, Ne, Ar)

25. (b) The density of neon will be highest at $0^{o}C$ 2 *atm* according to $d \propto \frac{P}{T}$

29. (d) *K.E.* per mole
$$=\frac{3}{2}RT$$

so all will have same K.E. at same temperature.

30. (c)
$$\because W = P.dV = E$$

 \therefore Energy per unit volume = P
31. (c) $d \propto M \implies \frac{d_1}{d_2} = \frac{M_1}{M_2}; \frac{3d}{d} = \frac{M}{M_2}; M_2 = \frac{M}{3}.$

Molecular speeds

1. (a)
$$V_{ms} = \sqrt{\frac{3RT}{M}}, V_{av} = \sqrt{\frac{8RT}{\pi M}}; \frac{V_{ms}}{V_{av}} = \sqrt{\frac{3\pi}{8}}$$
$$= \sqrt{\frac{66}{5}} \Rightarrow \frac{1.086}{5}$$

$$=\sqrt{\frac{1}{56}} \Rightarrow \frac{1}{1}$$

 $\textbf{3.} \qquad (d) \quad most \ probable \ velocity: mean \ velocity: V_{_}$

$$= \sqrt{\frac{2RT}{M}} : \sqrt{\frac{8RT}{\pi M}} : \sqrt{\frac{3RT}{M}} = \sqrt{2} : \sqrt{\frac{8}{\pi}} : \sqrt{3}$$
4. (d) $V_{ms} = \sqrt{\frac{3RT}{M}} \therefore V_{ms} \propto \frac{1}{\sqrt{M}}$ at same T

because H_2 has least molecular weight so its r.m.s. velocity should be maximum.

5. (d)
$$\frac{U_{SO_2}}{U_{He}} = \frac{1}{2} = \sqrt{\frac{M_{He}}{M_{SO_2}}} \frac{T_{SO_2}}{T_{He}} = \sqrt{\frac{4}{64}} \cdot \frac{T_{SO_2}}{300}$$

 $= \frac{4}{64} \cdot \frac{T_{SO_2}}{300} = \frac{1}{4}; \quad T_{SO_2} = 1200^o K$
6. (c) $\frac{U_{O_3}}{U_{O_2}} = \sqrt{\frac{M_{O_2}}{M_{O_3}}} = \sqrt{\frac{32}{48}} = \sqrt{\frac{2}{3}}$

7. (b) Average kinetic energy per molecule

$$= \frac{3}{2} KT = \frac{3}{2} \times 1.38 \times 10^{-23} \times 300 J = 6.17 \times 10^{-21} J$$

8. (b)
$$\frac{U_{SO_2}}{U_{O_2}} = \sqrt{\frac{M_{O_2}T_{SO_2}}{M_{SO_2}T_{O_2}}} = \sqrt{\frac{32 \times T_{SO_2}}{64 \times 303}} = 1$$

 $1 = \frac{32 \times T_{SO_2}}{64 \times 303} \Rightarrow T_{SO_2} = 606$

9. (d) Among these Cl_2 has the highest molecular weight so it will posses lowest root mean square velocity.

10. (b)
$$\frac{U_1}{U_2} = \sqrt{\frac{T_1}{T_2}}$$
 $\therefore \frac{T_1}{T_2} = \left(\frac{5 \times 10^4}{10 \times 10^4}\right)^2 = \frac{1}{4}$

12. (c)
$$V_{ms} = \sqrt{\frac{3KT}{Molecularweight}}$$
 i.e. $V_{ms} \propto \frac{1}{\sqrt{m}} \propto (m)^{-\frac{1}{2}}$

(a) When average speed of molecule is increased due to increase in temperature then the change in momentum during collision between wall of container and molecules of gas also increases.

14. (d)
$$\frac{U_1}{U_2} = \sqrt{\frac{m_2}{m_1} \cdot \frac{T_1}{T_2}} \quad \because T_1 = T_2$$

 $\frac{U_1^2}{U_2^2} = \frac{m_2}{m_1} \qquad \because m_1 U_1^2 = m_2 U_2^2$
15. (d) $U_2 = U_{12} \sqrt{\frac{T_2}{m_2}} = U_{12} \sqrt{\frac{1200}{2220}} = U_1 \times 2$

$$T_1 = V T_1 = V 300$$

r.m.s. velocity will be doubled. $U_{\text{Tr}} = \sqrt{T_{\text{Tr}} - M_{\text{Tr}}} = \sqrt{50}$

16. (c)
$$\frac{O_{H_2}}{U_{O_2}} = \sqrt{\frac{T_{H_2}}{M_{H_2}}} \cdot \frac{M_{O_2}}{T_{H_2}} = \sqrt{\frac{50}{2}} \cdot \frac{32}{800} = 1$$

17. (d)
$$U = \sqrt{\frac{3RI}{M}} = \sqrt{\frac{3PV}{M}} = \sqrt{\frac{3P}{d}} \therefore U \propto \frac{1}{\sqrt{d}}$$

19. (b)
$$\frac{U_1}{U_2} = \sqrt{\frac{n_1 T_1}{n_2 T_2}} = \sqrt{\frac{n \times T}{2n \times 2T}} = \sqrt{\frac{1}{4}} = \frac{1}{2}$$

 $U_2 = 2U_1 = 2U$
 $\sqrt{2RT}$

21. (c)
$$\frac{V_{mp}}{V_{av}} = \frac{\sqrt{\frac{2RT}{M}}}{\sqrt{\frac{8RT}{\pi M}}} = \frac{\sqrt{\pi}}{2}$$

22. (a) $V_{ms} = \sqrt{\frac{3RT}{M}} \Rightarrow V_{ms} = \sqrt{T}$
Given $V_1 = V_2$, $T_1 = 300K_2$, V_2

26.

Given
$$V_1 = V$$
, $T_1 = 300K$, $V_2 = 2V$, $T_2 = ?$
 $\frac{V_1}{V_2} = \sqrt{\frac{T_1}{T_2}}$; $\left(\frac{V}{2V}\right)^2 = \frac{300}{T_2} \Rightarrow T_2 = 300 \times 4 = 1200K$
24. (b) $\left(P - \frac{n^2 a}{V^2}\right)(V - nb) = nRT$
 $\left(P - \frac{(2)^2 \times 4.17}{(5)^2}\right)(5 - 2 \times .03711) = 2 \times .0821 \times 300$

$$P = \frac{2 \times .0821 \times 300}{5 - 2 \times .03711} - \frac{4.7 \times 2^2}{5^2} \Rightarrow 10 - 0.66 = 9.33 atm$$
(a) Average speed : most probable speed

$$\sqrt{\frac{8RT}{\pi M}} : \sqrt{\frac{2RT}{M}} \Rightarrow \sqrt{\frac{8}{\pi}} : \sqrt{2} \Rightarrow 1.128 : 1.$$

27. (d)
$$v_{ms} = \sqrt{\frac{3RT}{M}}$$

 $\sqrt{30^2 R} = \sqrt{\frac{3RT}{M}} \Rightarrow 30 \times 30R = \frac{3R \times 300}{M}$
 $\Rightarrow M = \frac{3 \times 300}{30 \times 30} 1 gm = 0.001 kg$.

Real gases and Vander waal's equation

2. (b) Because molecules of real gases have intermolecular forces of attraction so the effective impact on the wall of container is

diminished. Pressure of real gas is reduced by $\frac{a}{v^2}$ factor hence

behaviour of real gas deviate from ideal behaviour. DV

3. (c)
$$Z = \frac{PV}{RT}$$
 : for ideal gas $PV = RT$ so $Z = I$
12. (b) $Z = \frac{PV}{RT}$; for ideal gas $PV = RT$; so $Z = 1$

- 13. (b) Ideal gas has no attractive force between the particles
- PV = nRT is a ideal gas equation it is allowed when the 14. (d) temperature is high and pressure is low.
- 16. (b) At Boyle temperature real gas is changed into ideal gas When pressure is low 17. (a)

$$\begin{bmatrix} P + \frac{a}{V^2} \end{bmatrix} (V - b) = RT$$

or $PV = RT + Pb - \frac{a}{V} + \frac{ab}{V^2}$ or $\frac{PV}{RT} = 1 - \frac{a}{VRT}$
 $Z = -\frac{a}{VRT} \quad \left(\because \frac{PV}{RT} = Z \right)$

- 18. (b) At high temperature and low pressure, Vander Waal's equation is reduced to ideal gas equation. PV = nRT
 - PV = RT (For 1 mole of gas)
- Vander waal's constant for volume correction b is the measure 20. (a) of the effective volume occupied by the gas molecule.

22. (a)
$$\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$$

 $\left(P + \frac{2.253}{0.25 \times 0.25}\right)(0.25 - 0.0428) = 0.0821 \times 300$
or $(P + 36.048)(0.2072) = 24.63$

 $\Rightarrow P + 36.048 = 118.87 \Rightarrow P = 82.82$ atm.

Critical state and Liquefaction of gases

- A diabatic demagnetisation is a technique of liquefaction of (b) 2. gases in which temperature is reduced.
- (d) An ideal gas can't be liquefied because molecules of ideal gas 3. have not force of attraction between them.
- At above critical temperature, substances are existing in 4 (c) gaseous state, since gas cannot be liquefied above it.
- 5 (d) Absence of inter molecular attraction ideal gas cannot be liquefied at any volume of *P* and *T*. 6.
 - (d) For Z gas of given gases, critical temperature is highest

$$T_c = \frac{8a}{27Rb} \Rightarrow T_c = \frac{8 \times 12}{27 \times .0821 \times .027} = 1603.98K$$

- (c) Value of constant a is greater than other for NH_3 that's why 7. $N\!H_3$ can be most easily liquefied.
- The temperature below which the gas can be liquefied by the 8. (c) application of pressure alone is called critical temperature.

10. (c)
$$d = \frac{M}{V} \implies M = d \times V$$

 $M = 2.68 \times 22.4$ at N.T.P. (:: $V = 22.41$)
 $M = 60.03 \, gm$
 m wt of $COS = 12 + 16 + 32 = 60$

11. (c) 22400 *ml* is the volume of
$$O_2$$
 at N.T.P =32*gm* of O_2

1*ml* is the volume of
$$O_2$$
 at NTP = $\frac{32}{22400}$
112 *ml* is the volume of O_2 at NTP = $\frac{32}{22400} \times 112$

= 0.16 gm of O_2

(a) Average kinetic energy
$$\propto$$
 (*T* Kelvin)
(Factor) $\frac{K.E_2}{K.E} = \frac{T_2}{T} = \frac{40 + 273}{20 + 273} = \frac{313}{293}$

(c)
$$M.$$
 wt. = $V.d. \times 2$

1.

2

3.

4.

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8.

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$$= 70 \times 2 = 140 \implies x = \frac{m.wt.}{wt.of[CO]} = \frac{140}{[12+16]} = 5$$

- Gas deviate from ideal gas behaviour to real gas (according to (c) Vander Waal's at low temperature and high pressure)
- (c) At same temperature and pressure, equal volumes have equal number of molecules. If 1lit. of oxygen consists N molecules then at same temperature and pressure 1 lit of SO_2 will consists N molecules. So 2 lit. of SO_2 will contain 2Nmolecules.

(a)
$$V_{av}: V_{mss}: V_{mss} = V: U: \alpha$$

 $\sqrt{\frac{8RT}{\pi M}}: \sqrt{\frac{3RT}{M}}: \sqrt{\frac{2RT}{M}}$
 $\alpha: V: U = \sqrt{2}: \sqrt{\frac{8}{\pi}}: \sqrt{3} = 1:1.128:1.224$

6. (d)
$$\frac{C_p}{C_v}$$
 ratio for diatomic gases is 1.40 at lower temperature

(b)
$$PV = nRT$$
 (For ideal gas)

$$Z = \frac{PV}{nRT} = 1$$
 (For ideal gas)

(b) If
$$Z < 1$$
 then molar volume is less than 22.4 L

9. (a)
$$r_{O_2} = \frac{x}{18} mole / \sec \Rightarrow r_g = \frac{x}{45} mol / \sec$$

$$M_g = M_{O2} \left(\frac{r_{O_2}}{r_g}\right)^2 = 32 \left(\frac{x}{18} \times \frac{45}{x}\right)^2 = 32 \times \frac{45^2}{18^2}$$

$$\mathbf{0.} \quad (\mathbf{a}) \quad r_{SO_2} : r_{CH_4} = \frac{1}{\sqrt{M_{SO_2}}} : \frac{1}{\sqrt{O_2}} : \frac{1}{\sqrt{CH_4}}$$
$$= \frac{1}{\sqrt{64:32:16}} = \frac{1}{\sqrt{4:2:1}}$$
$$\frac{1}{2} : \frac{1}{\sqrt{2}} : \frac{1}{1}; \quad \frac{2}{2} : \frac{2}{\sqrt{2}} : \frac{2}{1}; \quad 1:\sqrt{2}:2$$

I. (a) Root mean square speed =
$$\begin{bmatrix} n_1c_1^2 + n_2c_2^2 + n_3c_3^2 + \dots \\ n_1 + n_2 + n_3 + \dots \\ n_1 + n_2 + n_3 + \dots \end{bmatrix}$$

12. (b) If 40 ml
$$O_2$$
 will diffuse in t min. then. $r_{O_2} = \frac{40}{t}$

$$r_{H} = \frac{50}{20} \implies r_{O} = r_{H} 2\sqrt{\frac{M_{H_{2}}}{M_{O_{2}}}} = \frac{50}{20}\sqrt{\frac{2}{32}} = \frac{50}{20} \cdot \frac{1}{4}$$
$$\frac{40}{t} = \frac{50}{80} \therefore t = \frac{40 \times 80}{50} = 60 \text{ min.}$$

13. (b)
$$\frac{V_{av}CH_4}{V_{ab}O_2} = \sqrt{\frac{T_{CH_4}}{T_{O_2}}} \cdot \frac{M_{O_2}}{M_{CH_4}} = 1$$

 $\frac{T_{CH_4}}{300} \cdot \frac{32}{16} = 1 ; T_{CH_4} = 150^{\circ} K$

(c) Pressure of O_2 (dry) = 751-21 = 730 mm Hg 14.

&

256 Gaseous State $=\frac{730}{760}=0.96atm$ (b) PV = nRT, $n = \frac{PV}{RT} = \frac{1 \times 145}{0.082 \times 3} = 5.8 \approx 6 \text{ mole}$. 15. (a) $V = \frac{nRT}{P} = \frac{m}{M} \cdot \frac{RT}{P} = \frac{1}{58} \times \frac{0.82 \times 350}{1} = 0.495 lit$ 16. (b) $\frac{r_{He}}{r_{CH}} = \sqrt{\frac{M_{CH_4}}{M_{He}}} = \sqrt{\frac{16}{4}} = 2$ 17. (b) $\frac{V_1}{V_2} = \frac{T_1}{T_2}$: $T_2 = \frac{T_1V_2}{V_2} = 300^{\circ} K, \frac{2V}{V} = 600^{\circ} K$ 18. $T_2 = 600^{\circ} K = (600 - 273)^{\circ} C = 327^{\circ} C$ (a) no. of moles of $O_2 = \frac{4}{32} = 0.125$ 19. no. of moles of $H_2 = \frac{2}{2} = 1$ total no. of moles = 1 + 0.125 = 1.125 $P = \frac{nRT}{V} = \frac{1.125 \times 0.082 \times 273}{1} = 25.184 atm.$ (d) $\frac{P_1}{P_2} = \frac{1}{2}, \because \frac{V_1}{V_2} = \frac{P_2}{P_1} = \frac{2}{1}$ 20. $\frac{2L}{V_1} = \frac{2}{1}$; $V_2 = 1L$ (c) $\frac{V_2}{V_1} = \frac{T_2}{T_1}$ 21. :: $V_2 = \frac{T_2}{T_1} V_1 = \frac{310^{\circ} K}{300^{\circ} K} \times 300 cm^3 = 310 cm^3$

22. (c)
$$V_2 = \frac{T_2}{T_1} \cdot V_1 = \frac{270^o K}{300^o K} \times 300ml = 270ml$$

Assertion & Reason

- **1.** (c) Pressure is inversly proportional to volume (Boyle's law). $p \alpha \frac{1}{V}$ (*n*, *T* constant).
- (c) The air pressure decreases with increase in altitude. So the partial pressure of Oxygen is not sufficient for breathing at higher altitude and thus pressurization is needed.
- (a) At a given temperature and pressure the volume of a gas is directly proportional to the amount of gas Van (P and T constant).
- (d) According to Dalton's law of partial pressure, the pressure exerted by a mixture of non interacting gases is equal to the sum of their partial pressures (pressure exerted by individual gases in mixture) P_{Total} = P₁ + P₂ + P₃ ... (*T* and *V* constant). Both the gases if non-interacting would spread uniformly to occupy the whole volume of the vessel.
- 5. (a) Considering the attractive force pressure in ideal gas equation (PV = nRT) is correct by introducing a factor of $\frac{an^2}{V^2}$ where *a* is a vander waal's constant.

6. (d)
$$\mu_{ms} = \sqrt{\frac{3RT}{M}}$$
 is inversiy related to molecular mass.
Therefore, $\mu_{ms} (CO) > \mu_{ms} (CO_2)$.

8. (b) $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ (Initial fraction $\frac{V_1}{V_2} = 1$ when temperature is $27^{\circ} C$. At $127^{\circ} C$ the new fraction is $\frac{V_1}{V_2} = \frac{300}{400} = \frac{3}{4}$.

ir expelled
$$\Rightarrow 1 - \frac{3}{4} = \frac{1}{4}$$

9.

11.

- (a) In case of H, compressibility factor increases with the pressure. At 273 K, Z > 1 which shows that it is difficult to compress the gas as compared to ideal gas. In this case repulsive forces dominate.
- 10. (b) In real gases, the intermolecular forces of attraction and the volume occupied by the gas molecules cannot be neglected.
 - (a) When the temperature increase, the average speed of gas molecules increases and by this increase the pressure of gas is also increases.
- (a) It is correct that gases do not settle to the bottom of container and the reason for this is that due to higher kinetic energy of gaseous molecules they diffuse.
- 13. (c) The assertion, that a mixture of helium and oxygen is used for deep sea divers, is correct. The *He* is not soluble in blood. Therefore, this mixture is used.
- (e) Dry air is heavier than wet air because the density of dry air is more than water.
- 15. (d) All molecule of a gas have different speed. Therefore, they move by its own speed.
- 16. (c) Assertion is true but reason is false because of effusion rate
 - $\propto \frac{1}{\sqrt{M}}$ (Molecular weight) but it does not depend on molecular size.