DPP - Daily Practice Problems

Chapter-wise Sheets

Date : ☐ **Start Time :** ☐ **End Time :** ☐

CHEMISTRY CC05

SYLLABUS : States of Matter

Max. Marks : 180 **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. A compound exists in the gaseous state both as monomer A and dimer A_2. The M. wt. of monomer is 48. In an experiment 96 g of the compound was confined in vessel of 33.6 L and heated to 273 °C. Calculate the pressure developed, if the compound exists as a dimer to the extent of 50% by weight under the conditions

(a) 0.9atm (b) 4.0atm (c) 2.0atm (d) 1.0atm

2. The molecular velocities of two gases at the same temperature are u_1 and u_2 and their masses are m_1 and m_2 respectively. Which of the following expressions are correct ?

(a) $\frac{m_1}{u_1^2}=\frac{m_2}{u_2^2}$ (b) $m_1u_1=m_2u_2$

(c) $\frac{m_1}{u_1}=\frac{m_2}{u_2}$ (d) $m_1u_1^2=m_2u_2^2$

3. A container contains certain gas of mass 'm' at high pressure. Some of the gas has been allowed to escape from the container and after some time the pressure of the gas becomes half and its absolute temperature 2/3rd. The amount of the gas escaped is

(a) 2/3 m (b) 1/2m (c) 1/4m (d) 1/6m

4. Let the most probable velocity of hydrogen molecules at a temperature of t° C be V_0. When the temperature is raised to (2t + 273)°C the new rms velocity is (suppose all the molecules dissociate into atoms at latter temperature)

(a) $2\sqrt{3}V_0$ (b) $\sqrt{6}V_0$

(c) $\sqrt{3\left(2+\frac{273}{t}\right)}V_0$ (d) $\sqrt{\frac{2}{3}}V_0$

5. By what factor does the average velocity of a gaseous molecule increase when the temperature (in Kelvin) is doubled ?

(a) 2.0 (b) 2.8

(c) 4.0 (d) 1.4

RESPONSE GRID

1. ⓐⓑⓒⓓ 2. ⓐⓑⓒⓓ 3. ⓐⓑⓒⓓ 4. ⓐⓑⓒⓓ 5. ⓐⓑⓒⓓ

Space for Rough Work

6. The correct value of the gas constant '*R*' is close to :
   (a) 0.082 litre-atmosphere K
   (b) 0.082 litre-atmosphere K^{-1} mol^{-1}
   (c) 0.082 litre – atmosphere ^{1}K mol ^{1}
   (d) 0.082 litre^{-1} atmosphere^{-1} K mol

7. If 10^{-4} dm^3 of water is introduced into a 1.0 dm^3 flask at 300 K, how many moles of water are in the vapour phase when equilibrium is established?
   (Given : Vapour pressure of H_2O at 300 K is 3170 Pa; $R = 8.314\ J\ K^{-1}\ mol^{-1}$)
   (a) 5.56×10^{-3} mole   (b) 1.53×10^{-2} mole
   (c) 4.46×10^{-2} mole   (d) 1.27×10^{-3} mole

8. A vessel is filled with a mixture of O_2 and N_2. At what ratio of partial pressures will be the mass of gases be identical
   (a) $P_{(O_2)} = 8.75\ P_{(N_2)}$ (b) $P_{(O_2)} = 0.78\ P_{(N_2)}$
   (c) $P_{(O_2)} = 0.875\ P_{(N_2)}$ (d) $P_{(O_2)} = 11.4\ P_{(N_2)}$

9. Helium has the van der Waal's constant $b = 24\ mL\ mol^{-1}$. The molecular diameter of helium will be
   (a) 267pm
   (b) 133.5pm
   (c) 26.7pm
   (d) Data not sufficient for calculation the diameter.

10. A bubble of the gas released at the bottom of a lake increases to eight times the original volume when it reaches at the surface. Assuming that the atmospheric pressure is equivalent to pressure exerted by a column of water 10 m high, what is the depth of the lake
    (a) 80m   (b) 90m   (c) 10m   (d) 70m

11. Air at sea level is dense. This is a practical application of
    (a) Boyle's law   (b) Charle's law
    (c) Kelvin's law   (d) Brown's law

12. Which of the following represents Gay Lussac's law ?
    I. $\frac{P}{T} =$ constant   II. $P_1T_2 = P_2T_1$
    III. $P_1V_1 = P_2V_2$
    Choose the correct option.
    (a) I, II and III   (b) II and III
    (c) I and III   (d) I and II

13. A bubble of air is underwater at temperature 15°C and the pressure 1.5 bar. If the bubble rises to the surface where the temperature is 25°C and the pressure is 1.0 bar, what will happen to the volume of the bubble ?
    (a) Volume will become greater by a factor of 1.6.
    (b) Volume will become greater by a factor of 1.1.
    (c) Volume will become smaller by a factor of 0.70.
    (d) Volume will become greater by a factor of 2.5.

14. When *r*, *P* and *M* represent rate of diffusion, pressure and molecular mass, respectively, then the ratio of the rates of diffusion (r_A / r_B) of two gases *A* and *B*, is given as :
    (a) $(P_A / P_B)(M_B / M_A)^{1/2}$
    (b) $(P_A / P_B)^{1/2}(M_B / M_A)$
    (c) $(P_A / P_B)(M_A / M_B)^{1/2}$
    (d) $(P_A / P_B)^{1/2}(M_A / M_B)$

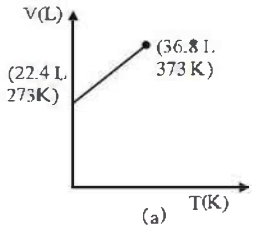
15. Longest mean free path stands for :
    (a) H_2 (b) N_2 (c) O_2 (d) Cl_2

16. The root mean square velocity of an ideal gas at constant pressure varies with density (d) as
    (a) d^2 (b) d (c) $\sqrt{d}$ (d) $1/\sqrt{d}$

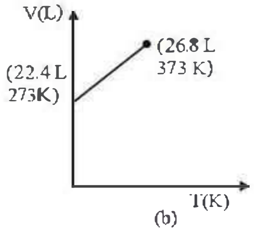
17. The correct order of viscosity of the following liquids will be
    (a) Water < methyl alcohol < dimethyl ether < glycerol
    (b) methyl alcohol < glycerol < water < dimethyl ether
    (c) dimethyl ether < methyl alcohol < water < glycerol
    (d) glycerol < dimethyl ether < water < methyl alcohol

18. The molecular velocity of any gas is
    (a) inversely proportional to absolute temperature.
    (b) directly proportional to square of temperature.
    (c) directly proportional to square root of temperature.
    (d) inversely proportional to the square root of temperature.

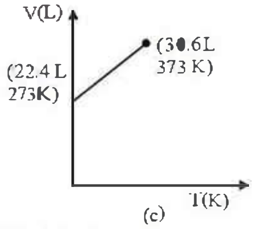
19. Which of the following volume (V) - temperature (T) plots represents the behaviour of one mole of an ideal gas at one atmospheric pressure ?



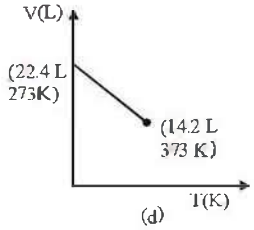
(a)



(b)



(c)



(d)

20. Match the columns

	Column-I		Column-II
A.	Boyle's law	I.	$V \propto n$ at constant T and P
B.	Charle's law	II.	$p_{total} = p_1 + p_2 + p_3 + \ldots$ at constant T, V
C.	Dalton's law	III.	$\frac{pV}{T} \cdot$ Constant
D.	Avogadro law	IV.	$V \propto T$ at constant n and p
		V.	$p \cdot \frac{1}{V}$ at constant n and T

    (a) A – V; B – IV; C – II; D – I
    (b) A – IV; B – II; C – I; D – V
    (c) A – III; B – V; C – II; D – I
    (d) A – V; B – II; C – IV; D – III

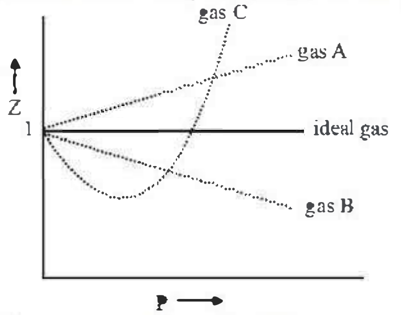
RESPONSE GRID					
	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ
	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ
	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ	20. ⓐⓑⓒⓓ

Space for Rough Work

21. The rms velocity of hydrogen is $\sqrt{7}$ times the rms velocity of nitrogen. If T is the temperature of the gas, then
(a) $T(H_2)=T(N_2)$ (b) $T(H_2)>T(N_2)$
(c) $T(H_2)<T(N_2)$ (d) $T(H_2)=\sqrt{7}\,T(N_2)$

22. If Z is a compressibility factor, van der Waals equation at low pressure can be written as:
(a) $Z=1+\frac{RT}{Pb}$ (b) $Z=1-\frac{a}{VRT}$
(c) $Z=1-\frac{Pb}{RT}$ (d) $Z=1+\frac{Pb}{RT}$

23. Refer to the figure given :
Which of the following statements is wrong?



(a) For gas A, $a=0$ and Z will linearly depend on pressure
(b) For gas B, $b=0$ and Z will linearly depend on pressure
(c) Gas C is a real gas and we can find '*a*' and '*b*' if intersection data is given
(d) All van der Waal gases will behave like gas C and give positive slope at high pressure

24. Equal masses of H_2, O_2 and methane have been taken in a container of volume V at temperature 27°C in identical conditions. The ratio of the volumes of gases $H_2 : O_2$: methane would be:
(a) 8 : 16 : 1 (b) 16 : 8 : 1 (c) 16 : 1 : 2 (d) 8 : 1 : 2

25. Which one of the following statements is NOT true about the effect of an increase in temperature on the distribution of molecular speeds in a gas?
(a) The area under the distribution curve remains the same as under the lower temperature
(b) The distribution becomes broader
(c) The fraction of the molecules with the most probable speed increases
(d) The most probable speed increases

26. As the temperature is raised from 20°C to 40°C, the average kinetic energy of neon atoms changes by a factor of which of the following ?
(a) 313/293 (b) $\sqrt{(313/293)}$
(c) 1/2 (d) 2

27. The ratio between the root mean square speed of H_2 at 50 K and that of O_2 at 800 K is,
(a) 4 (b) 2 (c) 1 (d) 1/4

28. Positive deviation from ideal behaviour takes place because of
(a) Molecular interaction between atoms and PV/nRT > 1
(b) Molecular interaction between atoms and PV/nRT < 1
(c) Finite size of atoms and PV/nRT > 1
(d) Finite size of atoms and PV/nRT < 1

29. Equal masses of methane and oxygen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by oxygen is
(a) 1/2 (b) 2/3 (c) $\frac{1}{3}\times\frac{273}{298}$ (d) 1/3.

30. The rate of diffusion of SO_2, CO_2, PCl_3 and SO_3 are in the following order
(a) $PCl_3 > SO_3 > SO_2 > CO_2$
(b) $CO_2 > SO_2 > PCl_3 > SO_3$
(c) $SO_2 > SO_3 > PCl_3 > CO_2$
(d) $CO_2 > SO_2 > SO_3 > PCl_3$

31. The van der Waal's equation for n = 1 mole may be expressed as $V^3-\left(b+\frac{RT}{P}\right)V^2+\frac{aV}{P}-\frac{ab}{P}=0$
Where V is the molar volume of the gas. Which of the following is correct?
(a) For a temperature less than T_c, V has three real roots
(b) For a temperature more than T_c, V has one real and two imaginary roots
(c) For a temperature equal to T_c all three roots of V are real and identical
(d) All of these

32. By how many folds the temperature of a gas would increase when the root mean square velocity of the gas molecules in a container of fixed volume is increased from 5 × 10^4 cm/s to 10 × 10^4 cm/s ?
(a) Two (b) Three (c) Six (d) Four

33. The density of neon will be highest at
(a) S.T.P. (b) 0°C, 2 atm
(c) 273 °C, 1 atm. (d) 273 °C, 2 atm.

34. Above Boyle point, real gases show ____X____ from ideality and Z values are ____Y____ than one.
(a) X = Negative deviation, Y = Less
(b) X = Negative deviation, Y = Greater
(c) X = Positive deviation, Y = Less
(d) X = Positive deviation, Y = Greater

35. Induced dipole moment depend upon the
I. dipole moment present in the permanent dipole.
II polarisability of the electrically neutral molecules.
Identify the correct option.
(a) I is correct but II is wrong
(b) I is wrong and II is correct
(c) Both I and II are wrong
(d) Both I and II are correct

RESPONSE GRID	21. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ	25. ⓐⓑⓒⓓ
	26. ⓐⓑⓒⓓ	27. ⓐⓑⓒⓓ	28. ⓐⓑⓒⓓ	29. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ
	31. ⓐⓑⓒⓓ	32. ⓐⓑⓒⓓ	33. ⓐⓑⓒⓓ	34. ⓐⓑⓒⓓ	35. ⓐⓑⓒⓓ

Space for Rough Work

36. Following table represents critical temperature of some gases. Arrange these gases in their increasing order of liquification.

Gas	T_c / K
H_2	33.2
He	5.3
N_2	126
O_2	154.3

(a) $He < N_2 < H_2 < O_2$ (b) $H_2 < He < N_2 < O_2$
(c) $He < H_2 < N_2 < O_2$ (d) $O_2 < N_2 < H_2 < He$

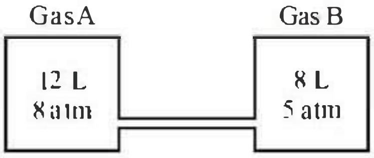
37. Which of the following liquid will exhibit highest vapour pressure?
(a) $C_2H_5OH(l)$ (b) $NH_3(l)$
(c) $HF(l)$ (d) $H_2O(l)$

38. Generally, liquid drops assume spherical shape because:
(a) a sphere has maximum surface area
(b) a sphere has minimum surface area
(c) sphere is symmetrical in shape
(d) None of these

39. Internal energy and pressure of a gas per unit volume are related as :

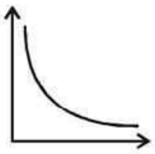
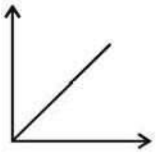
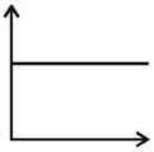
(a) $P = \frac{2}{3}E$ (b) $P = \frac{3}{2}E$ (c) $P = \frac{1}{2}E$ (d) $P = 2E$

40. Two vessels containing gases A and B are interconected as shown in the figure. The stopper is opened, the gases are allowed to mix homogeneously. The partial pressures of A and B in the mixture will be, respectively



(a) 8 and 5 atom (b) 9.6 and 4 atm
(c) 4.8 and 2 atm (d) 6.4 and 4 atm

41. Match the following graphs of ideal gas (Column-I) with their co-ordinates (Column-II) :

Column-I (Graphical representation)	**Column-II (x and y co-ordinates)**
A. 	I. pV vs. V
B. 	II. p vs. V
C. 	III. p vs. $\frac{1}{V}$

(a) A – III; B – I; C – II
(b) A – III; B – II; C – I
(c) A – II; B – III; C – I
(d) A – I; B – III; C – II

42. Which of the following statement(s) is/are true for London force ?
(i) These forces are always attractive.
(ii) These forces are important for long distance too.
(iii) Their magnitude depends on the polarisability of the particle.
(a) (i) and (ii) (b) (i) only
(c) (iii) only (d) (i) and (iii)

43. Kinetic theory of gases presumes that the collisions between the molecules to be perfectly elastic because
(a) the gas molecules are tiny particles and not rigid in nature
(b) the temperature remains constant irrespective of collision
(c) collision will not split the molecules
(d) the molecules are large particle and rigid in nature

44. Which of the following statements are correct ?
(i) Real gases show deviations from ideal gas law because molecules interact with each other.
(ii) Due to interaction of molecules the pressure exerted by the gas is given as :

$$p_{real} = p_{ideal} + \frac{an^2}{V^2}$$

(iii) Value of 'a' is measure of magnitude of intermolecular attractive forces within the gas and depends on temperature and pressure of gas.
(iv) At high pressure volume occupied by the molecules also becomes significant because instead of moving in volume *V*, these are now restricted to volume (*V-nb*)
(a) (i) and (iv) (b) (i), (ii) and (iii)
(c) (i), (iii) and (iv) (d) (i) and (iii)

45. The units of constant a in van der Waal's equation is
(a) $dm^6\,atm\,mol^{-2}$ (b) $dm^3\,atm\,mol^{-1}$
(c) $dm\,atm\,mol^{-1}$ (d) $atm\,mol^{-1}$

RESPONSE GRID
36. ⓐⓑⓒⓓ 37. ⓐⓑⓒⓓ 38. ⓐⓑⓒⓓ 39. ⓐⓑⓒⓓ 40. ⓐⓑⓒⓓ
41. ⓐⓑⓒⓓ 42. ⓐⓑⓒⓓ 43. ⓐⓑⓒⓓ 44. ⓐⓑⓒⓓ 45. ⓐⓑⓒⓓ

Space for Rough Work

1. **(c)** Wt. of compound is 96 g. The compound exists as 50% monomer and 50% dimer.

$$\text{Moles of monomer} = \frac{48}{48} = 1,$$

$$\text{Moles of dimer} = \frac{48}{96} = 0.5$$

$$\therefore \quad P = \frac{1.5 \times 0.0821 \times (273+273)}{33.6} = 2.00 \text{ atm}$$

2. **(d)** $u_1 \propto \sqrt{\frac{1}{m_1}}$ and $u_2 \propto \sqrt{\frac{1}{m_2}}$

$$\therefore \frac{u_1^2}{u_2^2} = \frac{m_2}{m_1} \quad \therefore m_1u_1^2 = m_2u_2^2$$

3. **(c)** Gas equation is $PV = \frac{m}{M}RT$ ...(i)

Again $\frac{P}{2}V = \frac{m_1}{M}R.\frac{2}{3}T$ ...(ii)

Divide (i) by (ii)

$2 = \frac{m}{m_1} \times \frac{3}{2} \; \therefore m_1 = \frac{3}{4}m$. Gas escaped is then $= \frac{1}{4}m$

4. **(b)** $V_0 = \sqrt{\frac{2RT}{M}} = \sqrt{R(273+t)}$

$$u_{rms} = \sqrt{\frac{3(2t+273+273)R}{1}}$$

$$= \sqrt{6(t+273)R} = \sqrt{6}V_0$$

5. **(d)** Average velocity $= \sqrt{\frac{8RT}{\pi M}}$

i.e., $v \propto \sqrt{T}$

$$\therefore \frac{v_2}{v_1} = \sqrt{\frac{2T}{T}} = 1.41$$

6. **(b)** $R = 0.0082$ litre atm K^{-1} mol^{-1}.

7. **(d)** From the ideal gas equation :

$$PV = nRT$$

$$\text{or } n = \frac{PV}{RT} = \frac{3170 \times 10^{-3}}{8.314 \times 300} = 1.27 \times 10^{-3}$$

8. **(c)** $\frac{x}{32} + \frac{x}{28} = \frac{60x}{32 \times 28}$,

PV = nRT;

$$P_1V = \frac{x}{32}RT; \; P_2V = \frac{x}{28}RT$$

$$\therefore \quad 32P_{O_2} = 28P_{N_2}$$

or, $P_{O_2} = 0.875\,P_{N_2}$

9. **(a)** Since b = 4 × volume occupied by molecules of 1 mole of a gas

$$b = 4\,N_A\left(\frac{4}{3}\pi r^3\right)$$

$$\therefore r = \left(\frac{3b}{16N_A\pi}\right)^{\frac{1}{3}} = \left[\frac{3 \times 24\text{cm}^3\text{mol}^{-1}}{16(6.023 \times 10^{23}\text{mol}^{-1} \times 3.14)}\right]^{\frac{1}{3}}$$

$$= 1.335 \times 10^{-8}\text{ cm} = 133.5\text{ pm}$$

Molecular diameter, d = 2r = 267 pm.

10. **(d)** Let V be the original volume of bubble. The final volume will be 8 V. Let P be the atmospheric pressure and P_1 the pressure at the bottom

$\therefore \quad P \times 8V = P_1 \times V;$
$8p = P_1$

P_1 = atmospheric pressure + pressure due to water lake

$= P + 7p$

The P = 10 m high, the 7p will be = 70 m high

So the depth = 70 m

11. **(a)** $d \propto P$, Boyle's law, $\left(d = \frac{MP}{RT}\right)$. At sea level pressure is more, hence density of air is more.

12. **(d)** $\frac{P}{T}$ = constant (Gay Lussac's law)

$$\Rightarrow \frac{P_1}{T_1} = \frac{P_2}{T_2} \Rightarrow P_1T_2 = P_2T_1$$

PV = constant

$P_1V_1 = P_2V_2$ [Boyle's law]

13. **(a)** Given

$P_1 = 1.5$ bar $T_1 = 273 + 15 = 288$ K $V_1 = V$

$P_2 = 1.0$ bar $T_1 = 273 + 25 = 298$ K $V_2 = ?$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{1.5 \times V}{288} = \frac{1 \times V_2}{298}$$

$V_2 = 1.55$ V i.e., volume of bubble will be almost 1.6 time to initial volume of bubble.

14. **(a)** $r \propto \frac{P}{\sqrt{m}}$

$$\frac{r_A}{r_B} = \frac{P_A}{P_B}\sqrt{\frac{M_B}{M_A}}$$

15. **(a)** The mean free path, $\lambda = \frac{1}{\sqrt{2}\,\pi a^2 N}$

or $\lambda \propto \frac{1}{a^2}$, where a = molecular diameter

$\therefore$ Smaller the molecular diameter, longer the mean free path. Hence H_2 is the answer.

16. **(d)** $u_{rms} = \sqrt{\frac{3RT}{M}}$ Using ideal gas equation,

$PV = nRT = \frac{w}{M}RT$; $\frac{RT}{M} = \frac{PV}{w} = \frac{P}{d}$ where d is the density of the gas

$\therefore$ $u_{rms} = \sqrt{\frac{3P}{d}}$ at constant pressure, $u_{rms} \propto \frac{1}{\sqrt{d}}$

17. **(c)** The correct order of viscosity of the given liquids is dimethyl ether < methyl alcohol < water < glycerol.

18. **(c)** The different type of molecular velocities possessed by gas molecules are

(i) Most probable velocity (α) $= \sqrt{\frac{2RT}{M}}$

(ii) Average velocity $\bar{v} = \sqrt{\frac{8RT}{\pi M}}$

(iii) Root mean square velocity in all three cases

$$v = \sqrt{\frac{3RT}{M}}$$

In all the above cases

Velocity $\propto \sqrt{T}$

19. **(c)** $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ at const. pressure

$\Rightarrow \frac{22.4}{273} = \frac{V_2}{373}$, $V_2 = 30.6$ litre

20. **(a)**

21. **(c)** $u_{rms} = \sqrt{\frac{3RT}{M}} \Rightarrow \sqrt{\frac{3RT_{H_2}}{2}} = \sqrt{7}\sqrt{\frac{3RT_{N_2}}{28}}$;

$\therefore$ $T_{N_2} = 2T_{H_2}$ or $T_{N_2} > T_{H_2}$

22. **(b)** Compressibility factor $(Z) = \frac{PV}{RT}$

(For one mole of real gas)

van der Waals equation

$$\left(P + \frac{a}{V^2}\right)(V - b) = RT$$

At low pressure, volume is very large and hence correction term b can be neglected in comparison to very large volume of V.

i.e. $V - b \approx V$

$$\left(P + \frac{a}{V^2}\right)V = RT$$

$$PV + \frac{a}{V} = RT$$

$$PV = RT - \frac{a}{V}$$

$$\frac{PV}{RT} = 1 - \frac{a}{VRT}$$

Hence, $\boxed{Z = 1 - \frac{a}{VRT}}$

23. **(b)** For gas A, $a = 0$, $Z = 1 + \frac{Pb}{RT}$ implies Z varies linearly with pressure.

For gas B, $b = 0$, $Z = 1 - \frac{a}{VRT}$. Hence, Z does not vary linearly with pressure.

Given the intersection data for gas C, it is possible to find the values of 'a' and 'b'. All van der Waal gases, like gas C, give positive slope at high pressures.

24. **(c)** According to Avogadro's law "At same temperature and pressure Volume ∝ no. of moles"

$$n_{H_2} = \frac{w}{2};\quad n_{O_2} = \frac{w}{32};\quad n_{CH_4} = \frac{w}{16}$$

$$\because V_{H_2} : V_{O_2} : V_{CH_4} = n_{H_2} : n_{O_2} : n_{CH_4}$$

$$= \frac{w}{2} : \frac{w}{32} : \frac{w}{16} = 16 : 1 : 2$$

25. **(c)** As temperature rises the most probable speed increases and the fraction of molecules possessing most probable speed decreases.

26. **(a)** $\frac{\text{K.E of neon at } 40°C}{\text{K.E of neon at } 20°C} = \frac{\frac{3}{2}K \times 313}{\frac{3}{2}K \times 293} = \frac{313}{293}$

27. **(c)** The expression of root mean square speed is

$$u_{rms} = \sqrt{\frac{3RT}{M}}$$

Hence,

$$\frac{u_{rms}(H_2)}{u_{rms}(O_2)} = \left[\frac{3R(50K)/(2\,g\,mol^{-1})}{3R(800K)/(32\,g\,mol^{-1})}\right]^{1/2} = 1$$

28. **(c)** For positive deviation: $PV = nRT + nPb$

$$\Rightarrow \frac{PV}{nRT} = 1 + \frac{Pb}{RT}$$

Thus, the factor nPb is responsible for increasing the PV value, above ideal value. b is actually the effective volume of molecule. So, it is the finite size of molecules that leads to the origin of 'b' and hence positive deviation at high pressure.

29. **(d)** Let the mass of methane and oxygen = m g

Mole fraction of O_2

$$= \frac{\text{Moles of } O_2}{\text{Moles of } O_2 + \text{Moles of } CH_4}$$

$$= \frac{m/32}{m/32 + m/16} = \frac{m/32}{3m/32} = \frac{1}{3}$$

Partial pressure of O_2 = Total pressure × mole fraction

of O_2, $P_{O_2} = P \times \frac{1}{3} = \frac{1}{3}P$

30. **(d)** Rate $\propto \sqrt{\frac{1}{M}}$. The smaller the value of M the more is the rate of diffusion

31. **(d)** The given equation is cubic equation in the variable V and, therefore, for a single value of P and T, there should be three values of V, all of which may be real or one real and two imaginary.

At T_c there values of V become identical.

32. **(d)** r.m.s. velocity $v_{rms} = \sqrt{\frac{3RT}{M}}$

i.e., $\frac{v_1}{v_2} = \sqrt{\frac{T_1}{T_2}}$

$$\frac{5\times10^4}{10\times10^4} = \frac{1}{2} = \sqrt{\frac{T_1}{T_2}}$$

$\therefore\ T_2 = 4T_1$

33. **(b)** $d = \frac{PM}{RT}$

It means density of gas is directly proportional to pressure and inversely proportional to temperature.

Density of neon will be maximum at highest pressure and lowest temperature.

34. **(d)** Above Boyle point, real gases show positive deviation from ideality and Z values are greater than one.

35. **(d)** Induced dipole moment depends upon the dipole moment present in the permanent dipole and the polarisability of the electrically neutral molecule. Molecules of large size can be easily polarized. High polarisability increases the strength of attractive interactions.

36. **(c)** More will be critical temperature easier is the liquification of the gas. Hence correct order will be $He < H_2 < N_2 < O_2$

37. **(b)** The strength of H-bonding is in the order N....H < O....H < F....H

38. **(b)** Liquid drops assume spherical shape because a sphere has minimum surface area.

39. **(a)** $PV = \frac{1}{3}mnu^2 = \frac{1}{3}Mu^2$

$$= \frac{2}{3}\cdot\frac{1}{2}Mu^2 = \frac{2}{3}E \text{ or } P = \frac{2}{3}E \text{ per unit vol.}$$

40. **(c)** Moles of A, $(n_A) = \frac{p_A v_A}{RT} = \frac{8\times12}{RT} = \frac{96}{RT}$

Moles of B, $(n_B) = \frac{p_B v_B}{RT} = \frac{8\times5}{RT} = \frac{40}{RT}$

Total pressure × total volume = $(n_A + n_B) \times RT$

$$P\times(12+8) = \frac{1}{RT}(96+40)RT$$

$P = 6.8$

Partial pressure of A = P × mole fraction of A

$$= 6.8\left(\frac{96}{RT}\Big/\frac{96+40}{RT}\right)$$

= 4.8 atm

Partial pressure of B = 6.8 − 4.8 = 2 atm.

41. **(c)**

42. **(d)** These forces are important only at short distances (~500pm)

43. **(a)** The gas molecules are tiny particles and not rigid in nature rather they are perfect elastic bodies.

44. **(a)** For statement (ii), $p_{real} = p_{ideal} - \frac{an^2}{V^2}$

For statement (iii), value of 'a' is independent of temperature and pressure.

45. **(a)** $P = \frac{n^2 a}{V^2}$; $a = \frac{PV^2}{n^2}$ = atm dm^6 mol^{-2}