

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.

- A compound exists in the gaseous state both as monomer A and dimer A₂. 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
- The molecular velocities of two gases at the same temperature are u₁ and u₂ and their masses are m₁ and m₂ respectively. Which of the following expressions are correct ?
(a) $\frac{m_1}{u_1^2} = \frac{m_2}{u_2^2}$ (b) m₁u₁ = m₂u₂
(c) $\frac{m_1}{u_1} = \frac{m_2}{u_2}$ (d) m₁u₁² = m₂u₂²
- 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) 2/3m (b) 1/2m (c) 1/4m (d) 1/6m
- Let the most probable velocity of hydrogen molecules at a temperature of t° C be V₀. 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√3V₀ (b) √6V₀
(c) $\sqrt{3\left(2 + \frac{273}{t}\right)}V_0$ (d) $\sqrt{\frac{2}{3}}V_0$
- 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. (a)(b)(c)(d) 2. (a)(b)(c)(d) 3. (a)(b)(c)(d) 4. (a)(b)(c)(d) 5. (a)(b)(c)(d)

Space for Rough Work

C-18

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6. The correct value of the gas constant 'R' is close to :
 (a) 0.082 litre-atmosphere K
 (b) 0.082 litre-atmosphere $K^{-1} \text{ mol}^{-1}$
 (c) 0.082 litre-atmosphere $^{\circ}K \text{ mol}^{-1}$
 (d) 0.082 litre-atmosphere $^{\circ}K \text{ mol}$
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; $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$)
 (a) $5.56 \times 10^{-3} \text{ mole}$ (b) $1.53 \times 10^{-2} \text{ mole}$
 (c) $4.46 \times 10^{-2} \text{ mole}$ (d) $1.27 \times 10^{-3} \text{ mole}$
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) $P_{(\text{O}_2)} = 8.75 P_{(\text{N}_2)}$ (b) $P_{(\text{O}_2)} = 0.78 P_{(\text{N}_2)}$
 (c) $P_{(\text{O}_2)} = 0.875 P_{(\text{N}_2)}$ (d) $P_{(\text{O}_2)} = 11.4 P_{(\text{N}_2)}$
9. Helium has the van der Waal's constant $b = 24 \text{ mL mol}^{-1}$. The molecular diameter of helium will be
 (a) 267 pm
 (b) 133.5 pm
 (c) 26.7 pm
 (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) 80 m (b) 90 m (c) 10 m (d) 70 m
11. Air at sea level is dense. This is a practical application of
 (a) Boyle's law (b) Charles's law
 (c) Kelvin's law (d) Brown's law
12. Which of the following represents Gay Lussac's law ?
 I. $\frac{P}{T} = \text{constant}$ II. $P_1 T_2 = P_2 T_1$
 III. $P_1 V_1 = P_2 V_2$
 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. Charles's law | II. $P_{\text{total}} = p_1 + p_2 + p_3 + \dots$ at constant T, V |
| C. Dalton's law | III. $\frac{pV}{T} = \text{Constant}$ |
| D. Avogadro law | IV. $V \propto T$ at constant n and p |
| | V. $p \propto \frac{1}{V}$ 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. (a)(b)(c)(d) | 7. (a)(b)(c)(d) | 8. (a)(b)(c)(d) | 9. (a)(b)(c)(d) | 10. (a)(b)(c)(d) |
| 11. (a)(b)(c)(d) | 12. (a)(b)(c)(d) | 13. (a)(b)(c)(d) | 14. (a)(b)(c)(d) | 15. (a)(b)(c)(d) |
| 16. (a)(b)(c)(d) | 17. (a)(b)(c)(d) | 18. (a)(b)(c)(d) | 19. (a)(b)(c)(d) | 20. (a)(b)(c)(d) |

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) $T(\text{H}_2) = T(\text{N}_2)$ (b) $T(\text{H}_2) > T(\text{N}_2)$
 (c) $T(\text{H}_2) < T(\text{N}_2)$ (d) $T(\text{H}_2) = \sqrt{7} T(\text{N}_2)$
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 Waals 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 $\text{H}_2 : \text{O}_2 : \text{methane}$ 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) $\text{PCl}_3 > \text{SO}_3 > \text{SO}_2 > \text{CO}_2$
 (b) $\text{CO}_2 > \text{SO}_2 > \text{PCl}_3 > \text{SO}_3$
 (c) $\text{SO}_2 > \text{SO}_3 > \text{PCl}_3 > \text{CO}_2$
 (d) $\text{CO}_2 > \text{SO}_2 > \text{SO}_3 > \text{PCl}_3$
31. The van der Waals 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 $5 \times 10^4 \text{ cm/s}$ to $10 \times 10^4 \text{ cm/s}$?
 (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. (a) (b) (c) (d)	22. (a) (b) (c) (d)	23. (a) (b) (c) (d)	24. (a) (b) (c) (d)	25. (a) (b) (c) (d)
26. (a) (b) (c) (d)	27. (a) (b) (c) (d)	28. (a) (b) (c) (d)	29. (a) (b) (c) (d)	30. (a) (b) (c) (d)
31. (a) (b) (c) (d)	32. (a) (b) (c) (d)	33. (a) (b) (c) (d)	34. (a) (b) (c) (d)	35. (a) (b) (c) (d)

Space for Rough Work

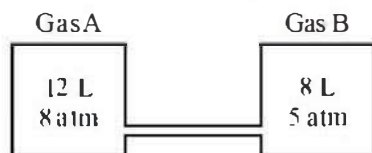
C-20

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

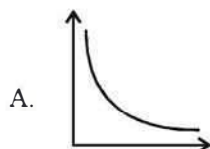
Gas	T_c / K
H ₂	33.2
He	5.3
N ₂	126
O ₂	154.3

- (a) He < N₂ < H₂ < O₂ (b) H₂ < He < N₂ < O₂
 (c) He < H₂ < N₂ < O₂ (d) O₂ < N₂ < H₂ < He
37. Which of the following liquid will exhibit highest vapour pressure?
 (a) C₂H₅OH(l) (b) NH₃(l)
 (c) HF(l) (d) H₂O(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 interconnected 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 atm (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):

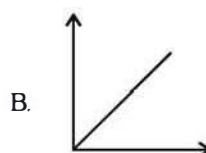
Column-I
(Graphical representation)



A.

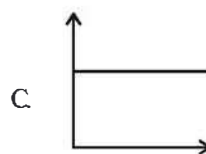
Column-II
(x and y co-ordinates)

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 :

$$p_{\text{real}} = p_{\text{ideal}} + \frac{a n^2}{V^2}$$

 (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) dm⁶ atm mol⁻² (b) dm³ atm mol⁻¹
 (c) dm³ atm mol⁻¹ (d) atm mol⁻¹

RESPONSE
GRID

36. (a) (b) (c) (d)
 41. (a) (b) (c) (d)

37. (a) (b) (c) (d)
 42. (a) (b) (c) (d)

38. (a) (b) (c) (d)
 43. (a) (b) (c) (d)

39. (a) (b) (c) (d)
 44. (a) (b) (c) (d)

40. (a) (b) (c) (d)
 45. (a) (b) (c) (d)

Space for Rough Work

DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

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

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

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

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

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

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

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

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

Divide (i) by (ii)

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

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

$$u_{\text{rms}} = \sqrt{\frac{3(21 + 273 + 273)R}{1}} = \sqrt{6(t + 273)R} = \sqrt{6}V_0$$

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) $R = 0.00821 \text{ liter atm K}^{-1} \text{ mol}^{-1}$

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) $\frac{x}{32} + \frac{x}{28} = \frac{60x}{32 \times 28}$

$$PV = nRT;$$

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

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

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

9. (a) Since $b = 4 \times$ volume occupied by molecules of 1 mole of a gas

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

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

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

$$\text{Molecular diameter, } d = 2r = 267 \text{ pm.}$$

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

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

$$8p = P_1$$

$$P_1 = \text{atmospheric pressure} + \text{pressure due to water lake}$$

$$= P + 7p$$

$$\text{The } P = 10 \text{ m high, the } 7p \text{ will be } = 70 \text{ m high}$$

$$\text{So the depth} = 70 \text{ m}$$

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) $\frac{P}{T} = \text{constant}$ (Gay Lussac's law)

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

$$PV = \text{constant}$$

$$P_1 V_1 = P_2 V_2 \text{ [Boyle's law]}$$

13. (a) Given

$$P_1 = 1.5 \text{ bar } T_1 = 273 + 15 = 288 \text{ K } V_1 = V$$

$$P_2 = 1.0 \text{ bar } T_2 = 273 + 25 = 298 \text{ K } V_2 = ?$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

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

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

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s-15

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 (u) = $\sqrt{\frac{2RT}{M}}$

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

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 \propto no. of moles"

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

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

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

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

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

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

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

Hence,

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

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 \times mole fraction

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

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 these values of V become identical.

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

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

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

$$\therefore T_2 = 4T_1$$

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 $N \dots H < O \dots H < F \dots H$

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

39. (a) $PV = \frac{1}{3} m n u^2 = \frac{1}{3} M u^2$
 $= \frac{2}{3} \cdot \frac{1}{2} M u^2 = \frac{2}{3} E$ or $P = \frac{2}{3} E$ per unit vol.

40. (c) Moles of A, $(n_A) = \frac{P_A V_A}{RT} = \frac{8 \times 12}{RT} = \frac{96}{RT}$

$$\text{Moles of B, } (n_B) = \frac{P_B V_B}{RT} = \frac{8 \times 5}{RT} = \frac{40}{RT}$$

$$\text{Total pressure} \times \text{total volume} = (n_A + n_B) \times RT$$

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

$$P = 6.8$$

$$\text{Partial pressure of A} = P \times \text{mole fraction of A}$$

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

$$= 4.8 \text{ atm}$$

$$\text{Partial pressure of B} = 6.8 - 4.8 = 2 \text{ atm.}$$

41. (c)

42. (d) These forces are important only at short distances ($\sim 500 \text{ pm}$)

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

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

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

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