PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 35

Total Marks : 26

Max. Time : 27 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5,8	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.6	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]

1. Vander waal's equation for 1 mole of a real gas under given conditions :

(a) high pressure — (i) $PV = RT + Pb$

(b) low pressure — (ii) $PV = RT - a/V$

(c) force of attraction between gas molecules is negligible — (iii) $PV = RT + a/V$

(c) volume of gas molecules is negligible — (iv) $[P - (a/V^2)](V - b) = RT$.

(A) (a)-(i), (b)-(ii), (c)-(i), (d)-(ii) (B) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

(C) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i) (D) (a)-(iv), (b)-(ii), (c)-(iii). (d)-(i).

2. Four different identical vessels at same temperature contains one mole each of C_2H_6, CO_2, Cl_2 and H_2S at pressures P_1, P_2, P_3 and P_4 respectively. The value of Vander waal's constant 'a' for C_2H_6, CO_2, Cl_2 and H_2S is 5.562, 3.640, 6.579 and 4.490 $atm.L^2.mol^{-2}$ respectively. If value of Vander waal's constant 'b' is taken to be same for all gases, then :

(A) $P_3 < P_1 < P_4 < P_2$ (B) $P_1 < P_3 < P_2 < P_4$ (C) $P_2 < P_4 < P_1 < P_3$ (D) $P_1 = P_2 = P_3 = P_4$

3. Consider the following statements :

1. $(a)_{NH_3} > (a)_{H_2O}$ [(a) is Vander waal's constant]

2. Pressure of the real gas is always more than the ideal gas for same temperature and volume of the container.

3. Compresssibilty factor for H_2 (g) is never less than unity at any temperature.

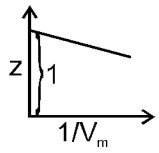
The above statements 1, 2, 3 respectively are : (T = True, F = False)

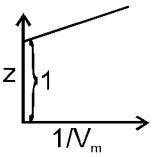
(A) T F F (B) F F F (C) F T F (D) T T F

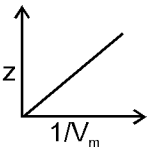
4. For a real gas with very large value of molar volume, which of the following equation can most suitably be applied:

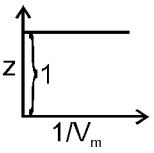
(A) $Z = 1 - \frac{a}{V_m RT}$ (B) $PV_m = RT$ (C) $Z = 1 + \frac{Pb}{RT}$ (D) $PV_m - RT = \frac{a}{V_m}$

5. For a real gas under low pressure conditions, which of the following graph is correct :

(A) 

(B) 

(C) 

(D) 

6.* Which of the following statements is/are correct about Boyle temperature (T_B) :

(A) Temperature at which 1st virial cofficient becomes Zero

(B) Temperature at which 2nd virial cofficient becomes Zero

(C) According to Vander waal's equation, value of T_B = a\Rb

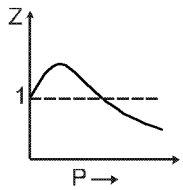
(D) T_B of a gas depends upon the nature of gas

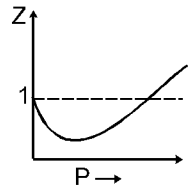
7. A hypothetical real gas A, having molar mass 16 g, has a density of 0.8 kg/m^3 at 2 atm pressure and a temperature of 127ºC. Determine : [Take R = 1/12 L atm K^{-1} mol^{-1}]

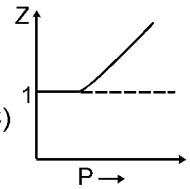
(i) the value of compressibility factor Z for gas A.

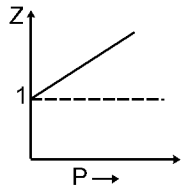
(ii) which forces are dominating among gas molecules, attractive or repulsive ?

8. Plot at Boyle's temperature for a real gas will be :

(A) 

(B) 

(C) 

(D) 

Answer Key

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1.	(A)	**2.**	(A)	**3.**	(B)	**4.**	(B)	**5.**	(A)
6.*	(B,C,D)	**7.**	(i) Z = 1.2 (ii) repulsive forces						

Hints & Solutions

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4. For very large value of molar volume (V_m)

$\frac{a}{V_m}$ and b can be neglected, so gas behaves as Ideal

$\therefore PV_m = RT$

5. At low pressure vander waal's equivalent for a real gas is given as

$$Z = 1 - \frac{a}{RTV}$$

intercept = 1

slop = –ve

7. (i) $Z = \frac{PM}{dRT} = \frac{2 \times 16}{0.8 \times \frac{1}{12} \times 400} = 1.2$

(ii) As Z > 1, so repulsive forces are dominating among gas molecules.

8. At Boyle's temperature, for low pressure regions, Z = 1. However, for high pressure regions, Z > 1.