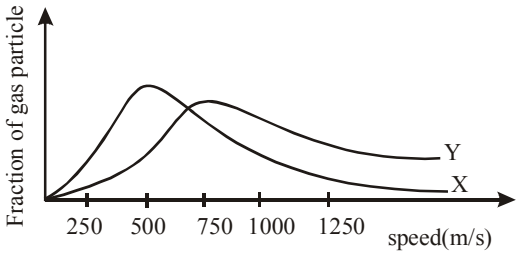
7. REAL GAS & IDEAL GAS

1. The graph below shows the distribution of molecular speed of two ideal gases X and Y at 200K. on the basis of the below graph identify the correct statements -



(A) If gas X is methane, then gas Y can be CO_2

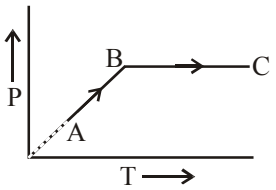
(B) Fraction of molecules of X must be greater than Y in a particular range of speed at 200K

(C) Under identical conditions, rate of effusion of Y is greater than that of X

(D) The molar kinetic energy of gas X at 200K is equal to the molar kinetic energy of Y at 200K

(1) A, B, C (2) A, C (3) B, D (4) C, D

2. A gas is taken isochorically from state A to state C as shown in the graph. Choose the correct statement-



(1) Moles of gas first remains constant and then increases

(2) Moles of gas first increases and then remains constant.

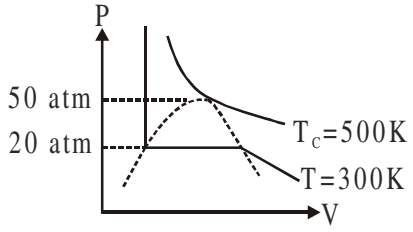
(3) Moles of gas first remains constant and then decreases

(4) Moles of gas first decreases and then remains constant.

3. The density of a gaseous substance at 1 atm pressure and 750 K is 0.30 g/lt. If the molecular weight of the substance is 27, the dominant forces existing among gas molecules is -

(1) Attractive (2) Repulsive (3) Both (1) and (2) (4) None of these

4. For real gas the P–V curve was experiementally plotted and it had the following appearance. With respect to liquification, choose the incorrect statement :



(A) At T = 500 K, P = 40 atm, the state will be liquid

(B) At T = 300 K, P = 50 atm, the state will be gas

(C) At T < 300 K, P = 20 atm, the state will be gas

(D) At 300 K < T < 500 K, P > 50 atm, the state will be liquid

(1) A, B, D (2) B, C, D (3) A, B, C (4) A, C, D

5. Select the incorrect statement (s)

(A) The critical constant for a Vander Waal's gas is V_C = 3b, $P_C = \frac{a}{27b^2}$ and $T_C = \frac{a}{27Rb}$

(B) At 56 K a gas may be liquified if its critical temperature is –156°C.

(C) U_{avg} of gas in a rigid container can be doubled when the pressure is quadrupled by pumping in more gas at constant temperature

(D) At extremely low pressure, all real gases behave ideally.

(1) A, C (2) B, C (3) B, D (4) C, D

6. A 1 litre vessel contains 2 moles of a vanderwaal's gas.

Given data :

a = 2.5 atm-L^2 $mole^{-2}$ T = 240 K

b = 0.4 L-$mole^{-1}$ RT = 20 L-atm $mole^{-1}$

Identify the correct options about the gas sample :

(A) Pressure of gas = 190 atm

(B) Compressibility factor = 4.75

(C) Attraction forces are dominant in the gaseous sample

(D) T_B (Boyle temperature) = 75 K

(1) A, B, C (2) B, C, D (3) A, B, D (4) A, C, D

7. Choose the correct statement(s) among the following -

(A) A gas having higher value T_C is easy to liquify

(B) The radius of molecules of gas having same value of T_C/P_C is same

(C) Hydrogen gas can be liquified at its boyle temperature by application of pressure.

(D) Real gas show negative deviation from ideal behaviour at low pressure condition.

(1) A, B, C (2) B, C, D (3) A, C, D (4) A, B, D

8. Select the INCORRECT statement(s):

(A) At Boyle's temperature a real gas behaves like an ideal gas irrespective of pressure.

(B) At critical condition, a real gas behaves like an ideal gas.

(C) On increasing the temperature four times,collision frequency (Z_1) becomes double at constant volume.

(D) At high pressure Van der Waals constant 'b' dominates over 'a'.

(1) A, B (2) B, C (3) A, C (4) C, D

9. A gas described by Van der Waals equation

(A) behaves similar to an ideal gas in the limit of large molar volumes

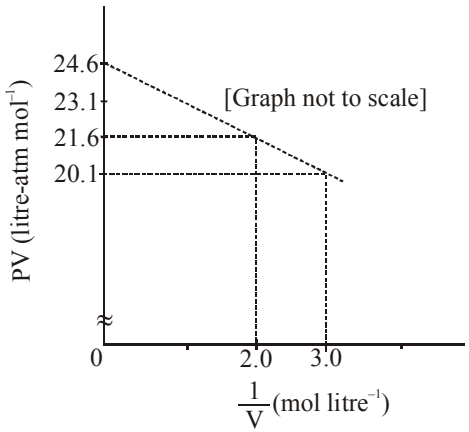
(B) behaves similar to an ideal gas in the limit of large pressures

(C) is characterised by Van der Waals coefficients that are dependent on the identity of the gas but are independent of the temperature

(D) has the pressure that is lower than the pressure exerted by the same gas behaving ideally

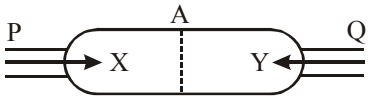
(1) A, C, D (2) B, C, D (3) A, B, C (4) A, B, D

10. For one mole of a Van der Waals gas when b = 0 and T = 300 K, the PV vs. 1/V plot is shown below. The value of the Van der Waals constant a (atm. litre^2 mol^{-2}) is



(1) 1.0 (2) 4.5 (3) 1.5 (4) 3.0

11. 3 mole of gas "X" and 2 moles of gas "Y enters from end "P" and "Q" of the cylinder respectively. The cylinder has the area of cross-section A, shown as under -



The length of the cylinder is 150 cm. The gas "X" intermixes with gas "Y" at the point A. If the molecular weight of the gases X and Y is 20 and 80 respectively, then what will be the distance of point A from Q?

(1) 75cm (2) 50cm (3) 37.5 cm (4) 90 cm

12. Under identical experiment conditions which of the following pairs of gases will be most easy to separate by using effusion process -

(1) H_2 and T_2 (2) SO_2 and SO_3 (3) NH_3 and CH_4 (4) $U^{235}O_2$ and $U^{238}O_2$

13. Consider the following pairs of gases A and B.

	A	B
(a)	CO	N_2
(b)	O_2	O_3
(c)	$^{235}UF_6$	$^{238}UF_6$

Relative rates of effusion of gases A to B under similar condition is in the order:

(1) a < b < c (2) a < c < b (3) a > b > c (4) a > c > b

14. Four particles have speed 2, 3, 4 and 5 cm/s respectively. Their rms speed is :

(1) 3.5 cm/s (2) $\left(\frac{27}{2}\right)$ cm/s (3) $\sqrt{54}$ cm/s (4) $\left(\frac{\sqrt{54}}{2}\right)$ cm/s

15. When an equimolar mixture of two gases A and B [$M_A > M_B$] is allowed to effuse through a Pin hole

select incorrect statement -

(1) B comes out at a faster rate

(2) Relative rate of effusion of A increases with time

(3) Rate of effusion of B will always be greater

(4) Initially, with equal molar ratio rate of effusion of B is greater than rate of effusion of A.

16. Select the correct option(s) for an ideal gas

(A) Most probable speed increases with increase in temperature

(B) Fraction of particles moving with most probable speed increases with increase in temperature

(C) Fraction of particles moving with most probable speed are more for Cl_2 than H_2 under similar condition of T, P & V.

(D) Most probable speed is more for Cl_2 than H_2 at same temperature

(1) A, C (2) B, C (3) C, D (4) A, D

17. A closed vessel at temperature T contain a mixture of two diatomic gases A and B. Molar mass of A is 16 times that of B and mass of gas A contained in the vessel is 2 times that of B. Which of the following statements are correct-

(A) Average kinetic energy per molecule of A is equal to that of B.

(B) Root mean square velocity of B is four times that of A

(C) Pressure exerted by B is eight time of that exerted by A

(D) Number of molecules of B, in the cylinder, is eight time that of A

(1) A, B, C, D (2) B, C (3) A, C, D (4) B, C, D

18. Which of the following quantities is the same for all ideal gases at the same temperature :

(A) The kinetic energy of 1 mol (B) The kinetic energy of 1 g

(C) The number of molecules in 1 mol (D) The number of molecules in 1 g

(1) A, C (2) B, C (3) A, D (4) B, D

19. Which statement is/are correct for postulates of kinetics theory of gases -

(A) Gases are composed of molecules whose size is negligible compared with the average distance between them

(B) Molecules moves randomly in straight lines in all directions and at various speeds.

(C) When molecules collide with one another the collisions are elastic. In an elastic collision the loss of kinetic energy takes place

(D) The average kinetic energy of a molecule is proportional to the absolute temperature.

(1) A, B, D (2) A, B, C (3) B, C, D (4) A, C

20. Which of the following statements is (are) true -

(A) The ratio of the average speed to the rms speed is independent of the temperature

(B) The square of the mean squared speed of the molecule is equal to the mean square speed at a certain temperature

(C) Mean kinetic energy of the gas molecules at any given temperature is independent of the mean speed

(D) The difference between rms speed and average speed at any temperature for different gases diminished as larger molar masses are considered

(1) A, B, C (2) B, C, D (3) A, B, D (4) A, C, D

21. At 300 K, the density of a certain gaseous molecule at 2 bar is double to that of dinitrogen (N_2) at 4 bar. The molar mass of gaseous molecule is :-

(1) 28 g mol^{-1} (2) 56 g mol^{-1} (3) 224 g mol^{-1} (4) 112 g mol^{-1}

22. Assuming ideal gas behaviour, the ratio of density of ammonia to that of hydrogen chloride at same temperature and pressure is :

(Atomic wt. of Cl = 35.5 u)

(1) 0.64 (2) 1.64 (3) 1.46 (4) 0.46

23. Let the most probable velocity of hydrogen molecules at a temperature t^0C is V_0. Suppose all the molecules dissociate into atoms when temperature is raised to $(2t + 273)^0C$ then the new r.m.s velocity is

(1) $\sqrt{2/3}\ V_0$ (2) $\sqrt{3(2+273/t)}\ V_0$ (3) $2\sqrt{3}\ V_0$ (4) $\sqrt{6}\ V_0$

ANSWER KEY															
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**4**	**3**	**2**	**3**	**1**	**3**	**4**	**1**	**1**	**3**	**3**	**1**	**2**	**4**	**3**
Que.	16	17	18	19	20	21	22	23							
Ans.	**1**	**1**	**1**	**1**	**4**	**4**	**4**	**4**							