Exercise-1

✍ **Marked Questions may have for Revision Questions.**

OBJECTIVE QUESTIONS

Section (A) : Gas Laws

Boyle's law and measurement of pressure :

A-1.✍ At constant temperature, if pressure increases by 1 %, the percentage decrease of volume is % :
(1) 1 % (2) 100/101% (3) 1/101% (4) 1/100%

A-2. At constant temperature, in a given mass of an ideal gas
(1) The ratio of pressure and volume always remains constant
(2) Volume always remains constant
(3) Pressure always remains constant
(4) The product of pressure and volume always remains constant

A-3. If 20 cm^3 gas at 1 atm. is expanded to 50 cm^3 at constant T, then what is the final pressure
(1) $20 \times \frac{1}{50}$ (2) $50 \times \frac{1}{20}$ (3) $1 \times \frac{1}{20} \times 50$ (4) None of these

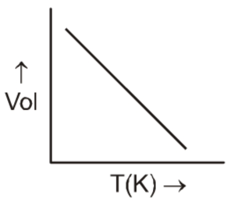
A-4. A volume of 1 m^3 is equal to :
(1) 1000 cm^3 (2) 100 cm^3 (3) 10 dm^3 (4) 10^6 cm^3

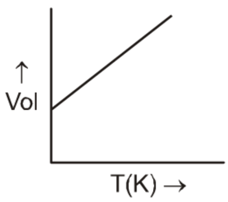
A-5. The temperature at which Celsius and Fahrenheit scales give the same reading is :
(1) 0ºC (2) 32ºF (3) –40ºF (4) 40ºF

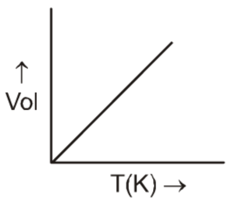
A-6. A gas at 298 K is shifted from a vessel of 250 cm^3 capacity to that of 1 L capacity. The pressure of the gas will:
(1) become double (2) becomes four times
(3) decrease to half of the original value (4) decrease to one-fourth of the original value

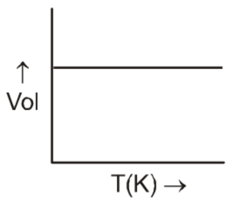
A-7. Air at sea level is dense. This is a practical application of
(1) Boyle's law (2) Charle's law (3) Avogadro's law (4) Dalton's law

A-8.✍ The correct representation of Charles' law is given by :

(1) 

(2) 

(3) 

(4) 

A-9. At constant pressure, the volume of fixed mass of an ideal gas is directly proportional to
(1) Absolute temperature (2) Degree centigrade
(3) Degree Fahrenheit (4) None

A-10. Volume occupied by a gas at one atmospheric pressure and 0°C is V ml. Its volume at 273 K will be :
(1) V ml (2) V/2 ml (3) 2V (4) None of these

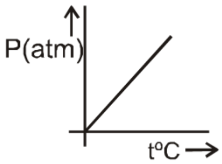
A-11. A sample of gas occupies 100 ml at 27°C and 740 mm pressure. When its volume is changed to 80 ml at 740 mm pressure, the temperature of the gas will be

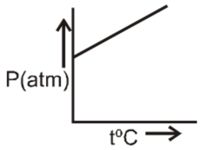
(1) 21.6°C (2) 240°C (3) – 33°C (4) 89.5°C

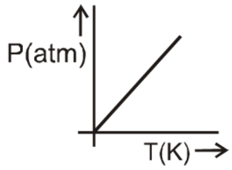
A-12. A certain sample of gas has a volume of 0.2 *litre* measured at 1 *atm*. pressure and 0ºC. At the same pressure but at 273ºC, its volume will be

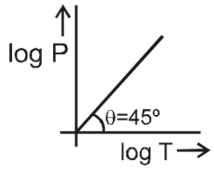
(1) 0.4 *litres* (2) 0.8 *litres* (3) 27.8 *litres* (4) 55.6 *litres*

A-13. Which of the following curve does not represent gay lusacc's law ?

(1) 

(2) 

(3) 

(4) 

A-14. Argon is an inert gas used in light bulbs to retard the vaporization of the filament. A certain light-bulb containing argon at 1.25 atm and 18°C is heated to 85°C is heated to 85°C at constant volume. Calculate its final pressure (in atm).

(1) 1.53 atm (2) 1.25 atm (3) 1.35 atm (4) 2 atm

A-15. A gas cylinder contains 1 mole oxygen gas at 2.46 atm pressure and 27ºC. The mass of oxygen that would escape, if first the cylinder was heated to 127ºC and then the valve was held open until the gas pressure was reduce to 1 atm, the temperature being maintained at 127ºC, is :

(1) 22.4 g (2) 11.2 g (3) 20.8 g (4) 9.6 g

A-16. If 0.2g of a gas 'X' occupies a volume of 440 mL and if 0.1g of CO_2 gas occupies a volume of 320 mL at the same temperature and pressure. X could be –

(1) O_2 (2) NO (3) C_4H_{10} (4) SO_2

A-17. If the pressure and absolute temperature of 2 litres of CO_2 are doubled, the volume of CO_2 would become

(1) 2 litres (2) 4 litres (3) 5 litres (4) 7 litres

A-18.✍ At 0°C and one atm pressure, a gas occupies 100 cc. If the pressure is increased to one and a half-time and temperature is increased by one-third of absolute temperature, then final volume of the gas will be

(1) 80 cc (2) 88.9 cc (3) 66.7 cc (4) 100 cc

A-19. A pre-weighed vessel was filled with oxygen at N.T.P. and weighted. It was then evacuated, filled with SO_2 at the same temperature and pressure, and again weighted. The weight of oxygen will be

(1) The same as that of SO_2 (2) 1/2 that of SO_2

(3) Twice that of SO_2 (4) One fourth that of SO_2

A-20. The pressure and temperature of 4 dm^3 of carbon dioxide gas are doubled. Then the volume of carbon dioxide gas would be

(1) 2 dm^3 (2) 3 dm^3 (3) 4 dm^3 (4) 8 dm^3

A-21.✍ Correct gas equation is

(1) $\frac{V_1T_2}{P_1} = \frac{V_2T_1}{P_2}$ (2) $\frac{P_1V_1}{P_2V_2} = \frac{T_1}{T_2}$ (3) $\frac{P_1T_2}{V_1} = \frac{P_2V_2}{T_2}$ (4) $\frac{V_1V_2}{T_1T_2} = P_1P_2$

A-22. One *litre* of a gas weighs 2 *g* at 300 *K* and 1 *atm* pressure. If the pressure is made 0.75 *atm*, at which of the following temperatures will one *litre* of the same gas weigh one *gram*

(1) 450 *K* (2) 600 *K* (3) 800 *K* (4) 900 *K*

A-23. In the equation of sate of an ideal gas PV = nRT, the value of the universal gas constant would depend only on
(1) The nature of the gas (2) The pressure of the gas
(3) The units of the measurement (4) None of these

A-24. In the equation PV = nRT, which one cannot be the numerical value of *R*
(1) 8.31×10^7 erg $K^{-1}mol^{-1}$ (2) 8.31×10^7 dyne cm $K^{-1}mol^{-1}$
(3) 8.31 $JK^{-1}mol^{-1}$ (4) 8.31 atm.$K^{-1}mol^{-1}$

A-25. The maximum number of molecules is present in
(1) 0.5 g of H_2 gas (2) 10 g of O_2 gas
(3) 15 L of H_2 gas at STP (4) 5 L of N_2 gas at STP

A-26. One litre oxygen gas at STP will weight.
(1) 1.43 g (2) 2.24 g (3) 11.2 g (4) 22.4 g

A-27. A bottle of cold drink contains 200 *ml* liquid in which CO_2 is 0.1 molar. Suppose CO_2 behaves like an ideal gas, the volume of the dissolved CO_2 at STP is
(1) 0.224 litre (2) 0.448 litre (3) 22.4 litre (4) 2.24 litre

A-28. Five grams each of the following gases at 87ºC and 750 *mm* pressure are taken. Which of them will have the least volume
(1) HF (2) HCl (3) HBr (4) HI

A–29. The constant *R* is
(1) Work done per molecule (2) Work done per degree absolute
(3) Work done per degree per mole (4) Work done per mole

A-30. If two moles of an ideal gas at 546 *K* occupy a volume of 44.8 *litres*, the pressure must be
(1) 2 *atm* (2) 3 *atm* (3) 4 *atm* (4) 1 *atm*

A-31. How many moles of *He* gas occupy 22.4 *litres* at 30ºC and one atmospheric pressure
(1) 0.90 (2) 1.11 (3) 0.11 (4) 1.0

A-32. Volume of 0.5 *mole* of a gas at 1 *atm*. pressure and 273 K is
(1) 22.4 *litres* (2) 11.2 *litres* (3) 44.8 *litres* (4) 5.6 *litres*

A-33. The volume of 1 g each of methane (CH_4), ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}) was measured at 350 K and 1 atm. What is the volume of butane ?
(1) 495 cm^3 (2) 600 cm^3 (3) 900 cm^3 (4) 1700 cm^3

Section (B) : Daltons law of partial pressure

B-1. The total pressure exerted by a number of non-reacting gases is equal to the sum of the partial pressures of the gases under the same conditions is known as
(1) Boyle's law (2) Charle's law (3) Avogadro's law (4) Dalton's law

B-2. If three unreactive gases having partial pressures P_A, P_B and P_C and their moles are 1, 2 and 3 respectively then their total pressure will be
(1) $P = P_A + P_B + P_C$ (2) $P = \frac{P_A + P_B + P_C}{6}$ (3) $P = \frac{\sqrt{P_A + P_B + P_C}}{3}$ (4) None

B-3. A cylinder is filled with a gaseous mixture containing equal masses of CO and N_2. The partial pressure ratio is :

(1) $P_{N_2} = P_{CO}$ (2) $P_{CO} = 0.875 P_{N_2}$ (3) $P_{CO} = 2 P_{N_2}$ (4) $P_{CO} = 1/2 P_{N_2}$

B-4. The ratio of partial pressure of a gaseous component to the total vapour pressure of the mixture is equal to :
(1) mass of the component (2) mole fraction of the component
(3) mass % of the component (4) molecular mass of the component

B-5. Equal volumes of two gases which do not react together are enclosed in separate vessel. Their pressure at 100 mm and 400 mm respectively. If the two vessel are joined together, then what will be the pressure of the resulting mixture (temperature remaining constant) ?
(1) 125 mm (2) 500 mm (3) 1000 mm (4) 250 mm

B-6. A gaseous mixture contains 56 g of N_2, 44 g CO_2 and 16 g of CH_4. The total pressure of the mixture is 720 mm Hg. The partial pressure of CH_4 is
(1) 180 mm (2) 360 mm (3) 540 mm (4) 720 mm

B-7. Equal weights of two gases of molecular weight 4 and 40 are mixed. The pressure of the mixture is 1.1 atm. The partial pressure of the light gas in this mixture is
(1) 0.55 atm (2) 0.11 atm (3) 1 atm (4) 0.11 atm

B-8. What will be the partial pressure of H_2 in a flask containing 2 g of H_2, 14 g of N_2 and 16 g of O_2 :
(1) 1/2 the total pressure (2) 1/3 the total pressure
(3) 1/4 the total pressure (4) 1/16 the total pressure

B-9. Equal weights of ethane and hydrogen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by hydrogen is :
(1) 1 : 2 (2) 1 : 1 (3) 1 : 16 (4) 15 : 16

B-10. A sample of O_2 gas is collected over water at 23°C at a barometric pressure of 751 mm Hg (vapour pressure of water at 23°C is 21 mm Hg). The partial pressure of O_2 gas in the sample collected is
(1) 21 mm Hg (2) 751 mm Hg (3) 0.96 atm (4) 1.02 atm

B-11. Same mass of CH_4 and H_2 is taken in a container. The partial pressure caused by H_2 (where total pressure is P) is
(1) $\frac{8}{9}P$ (2) $\frac{1}{9}P$ (3) $\frac{1}{2}P$ (4) P

B-12. A closed vessel contains equal number of nitrogen and oxygen molecules at a pressure of *P mm*. If nitrogen is removed from the system then the pressure will be
(1) P (2) *2P* (3) P/2 (4) P^2

Section (C) : Grahams Law of diffusion

C-1. If 4 g of oxygen diffuse through a very narrow hole, how much hydrogen would have diffused under identical conditions ?
(1) 16 g (2) 1 g (3) 1/4 g (4) 64 g

C-2. Two gram of hydrogen diffuse from a container in 10 minutes. How many grams of oxygen would diffuse through the same container in the same time under similar conditions ?
(1) 0.5 g (2) 4 g (3) 6 g (4) 8 g

C-3. If some moles of O_2 diffuse in 18 sec. and same moles of other gas diffuse in 45 sec. then what is the molecular weight of the unknown gas ?

(1) $\frac{45^2}{18^2} \times 32$ (2) $\frac{18^2}{45^2} \times 32$ (3) $\frac{18^2}{45^2 \times 32}$ (4) $\frac{45^2}{18^2 \times 32}$

C-4. The ratio of the rate of diffusion of a given element to that of helium is 1 : 4. The molecular weight of the element is
(1) 32 (2) 64 (3) 16 (4) None of these

C-5. The molecular weight of a gas which diffuse through a porous plug at 1/6th of the speed of hydrogen under identical conditions is
(1) 27 (2) 72 (3) 36 (4) 48

C-6. The time taken for a certain volume of a gas 'X' to diffuse through a small hole is 2 minutes. It takes 5.65 minutes for oxygen to diffuse under the similar conditions. The molecular weight of 'X' is
(1) 8 (2) 4 (3) 16 (4) 32

C-7. The rate of diffusion of SO_2 and O_2 are in the ratio :
(1) $1 : \sqrt{2}$ (2) 1 : 32 (3) 1 : 2 (4) 1 : 4

C-8.✍ The ratio of rates of diffusion of SO_2, O_2 and CH_4 is :
(1) $1 : \sqrt{2} : 2$ (2) 1 : 2 : 4 (3) $1 : \sqrt{2} : 1$ (4) $1 : 2 : \sqrt{2}$

C-9. ✍ X mL of H_2 gas effuses through a hole in a container in 5 sec. The time taken for the effusion of the same volume of the gas specified below under identical conditions is :
(1) 10 sec. He (2) 20 sec. O_2 (3) 25 sec. CO_2 (4) 55 sec. CO_2

C-10. A gas diffuse at a rate which is twice that of another gas *B*. The ratio of molecular weights of *A* to *B* is
(1) 1.0 (2) 0.75 (3) 0.50 (4) 0.25

C-11. 50 mL of gas A diffuse through a membrane in the same time as 40 mL of a gas B under identical pressure-temperature conditions. If the molecular weight of A is 64, that of B would be
(1) 100 (2) 250 (3) 200 (4) 80

C-12. The densities of hydrogen and oxygen are 0.09 and 1.44 g L^{-1}. If the rate of diffusion of hydrogen is 1 then that of oxygen in the same units will be :
(1) 4 (2) 1/4 (3) 16 (4) 1/16

C-13. Molecular weight of a gas that diffuses twice as rapidly as the gas with molecular weight 64 is
(1) 16 (2) 8 (3) 64 (4) 6.4

C-14. If rate of diffusion of A is 5 times that of B, what will be the density ratio of A and B ?
(1) 1/25 (2) 1/5 (3) 25 (4) 4

C-15. 50 mL of hydrogen diffuses out through a small hole from a vessel in 20 minutes. The time needed for 40 mL of oxygen to diffuse out is
(1) 12 min (2) 64 min (3) 8 min (4) 32 min

C-16. The densities of two gases are in the ratio of 1 : 16. The ratio of their rates of diffusion is
(1) 16 : 1 (2) 4 : 1 (3) 1 : 4 (4) 1 : 16

C-17. Rate of diffusion of a gas is
(1) Directly proportional to its density
(2) Directly proportional to its molecular mass
(3) Directly proportional to the square root of its molecular mass
(4) Inversely proportional to the square root of its molecular mass

C-18. According to Grahman's law at a given temperature, the ratio of the rates of diffusion r_A / r_B of gases *A* and *B* is given by

(1) $(P_A / P_B)(M_A / M_B)^{1/2}$ (2) $(M_A / M_B)(P_A / P_B)^{1/2}$

(3) $(P_A / P_B)(M_B / M_A)^{1/2}$ (4) $(M_A / M_B)(P_B / P_A)^{1/2}$

(where *P* and *M* are the pressures and molecular weights of gases *A* and *B* respectively)

C-19. A gas diffuse 1/5 times as fast as hydrogen. Its molecular weight is

(1) 50 (2) 25 (3) $25\sqrt{2}$ (4) $50\sqrt{2}$

C-20. At constant temperature and pressure which gas will diffuse first H_2 or O_2?

(1) Hydrogen (2) Oxygen

(3) Both will diffuse in same time (4) None of the above

Section (D) : Kinetic theory of gases

D-1. The ratio of root mean square velocity to average velocity of gas molecules at a particular temperature is

(1) 1.086 : 1 (2) 1 : 1.086 (3) 2 : 1.086 (4) 1.086 : 2

D-2. Kinetic energy of a gas depends upon its

(1) Molecules mass (2) Atomic mass (3) Equivalent mass (4) None of these

D-3.✍ Which of the following is valid at absolute zero ?

(1) Kinetic energy of the gas becomes zero but the molecuar motion does not become zero

(2) Kinetic energy of the gas becomes zero and the molecular motion also becomes zero

(3) Kinetic energy of the gas decreases but does not become zero

(4) None of the above

D-4.✍ If a gas is expanded at constant temperture :

(1) the pressure increase

2) the kinetic energy of the molecules remains the same

(3) the kinetic energy of the molecules decrease

(4) the number of molecules of the gas increases

D-5. At the same temperature and pressure, which of the following gases will have the highest kinetic energy per mole ?

(1) Hydrogen (2) Oxygen (3) Methane (4) All the same

D-6. The ratio amongs most probable velocity, mean velocity and root mean square velocity is given by

(1) 1 : 2 : 3 (2) 1 : $\sqrt{2}$: $\sqrt{3}$ (3) $\sqrt{2}$: $\sqrt{3}$: $\sqrt{8/\pi}$ (4) $\sqrt{2}$: $\sqrt{8/\pi}$: $\sqrt{3}$

D-7. The root mean square speeds at STP for the gases H_2, N_2, O_2 and HBr are in the order :

(1) $H_2 < N_2 < O_2 < HBr$ (2) $HBr < O_2 < N_2 < H_2$ (3) $H_2 < N_2 = O_2 < HBr$ (4) $HBr < O_2 < H_2 < N_2$

D-8.✍ According to kinetic theory of gases,

(1) There are intermolecular attractions

2) Molecules have considerable volume

(3) No intermolecular attractions

4) The velocity of molecules decreases after each collision

D-9. Absolute zero is defined as the temperature

(1) At which all molecular motion ceases (2) At which liquid helium boils

(3) At which ether boils (4) All of the above

D-10. Which is not true in case of an ideal gas

(1) It cannot be converted into a liquid

(2) There is no interaction between the molecules
(3) All molecules of the gas move with same speed
(4) At a given temperature, *PV* is proportional to the amount of the gas

D-11. Among the following gases which one has the lowest root mean square velocity at 25ºC.
(1) SO_2 (2) N_2 (3) O_2 (4) Cl_2

D-12. The r.m.s. velocity of a certain gas is u at 300 K. The temperature, at which the r.m.s. velocity becomes double
(1) 1200 K (2) 900 K (3) 600 K (4) 150 K

D-13. The r.m.s. velocity of a gas depends upon
(1) Temperature only (2) Molecular mass only
(3) Temperature and molecular mass of gas (4) None of these

D-14. The kinetic energy of N molecules of O_2 is x joule at − 123ºC. Another sample of O_2 at 27ºC has a kinetic energy of 2 x. The latter sample contains _______ molecules of O_2
(1) N (2) N/2 (3) 2 N (4) 3 N

D-15. The average kinetic energy in joules of molecules in 8.0 g of methane at 27º C is :
(1) 6.21×10^{-20} J/molecule (2) 6.21×10^{-21} J/molecule
(3) 6.21×10^{-22} J/molecule (4) 3.1×10^{-22} J/molecule

D-16. The kinetic energy for 14 grams of nitrogen gas at 127°C is nearly (mol. mass of nitrogen = 28 and gas constant = 8.31 JK^{-1} mol^{-1})
(1) 1.0 J (2) 4.15 J (3) 2493 J (4) 3.3 J

D-17. The temperature at which RMS velocity of SO_2 molecules is half that of He molecules at 300 K is :
(1) 150 K (2) 600 K (3) 900 K (4) 1200 K

D-18. The rms velocity of an ideal gas at 27°C is 0.3 ms^{-1}. Its rms velocity at 927°C (in ms^{-1}) is :
(1) 3.0 (2) 2.4 (3) 0.9 (4) 0.6

D-19. The average kinetic energy of an ideal gas per molecule in SI units at 25°C will be :
(1) 6.17×10^{-21} kJ (2) 6.17×10^{-21} J (3) 6.17×10^{-20} J (4) 7.16×10^{-20} J

D-20. The density of a gas *A* is three times that of a gas *B*. if the molecular mass of *A* is *M*, the molecular mass of *B* is
(1) 3 *M* (2) $\sqrt{3}\,M$ (3) $M/3$ (4) $M/\sqrt{3}$

D-21. Kinetic energy and pressure of a gas per unit volume are related as
(1) P = $\frac{2}{3}$ K.E. (2) P = $\frac{3}{2}$ K.E. (3) P = $\frac{1}{2}$ K.E. (4) P = 2 K.E

D-22. The translational kinetic energy of an ideal gas depends only on its
(1) Pressure (2) Force (3) Temperature (4) Molar mass

D-23. Helium atom is two times heavier than a hydrogen molecule at 298 *K*, the average kinetic energy of helium is :
(1) Two times that of a hydrogen molecule (2) Same as that of a hydrogen molecule
(3) Four times that of a hydrogen molecule (4) Half that of a hydrogen molecule

D-24. Kinetic energy of molecules is highest in :
(1) Gases (2) Solids (3) Liquids (4) Solution

Section (E) : Real gases

E-1. The values of Vander Waals constant "a" for the gases O_2, N_2, NH_3 & CH_4 are 1.36, 1.39, 4.17, 2.253 L^2 atm $mole^{-2}$ respectively. The gas which can most easily be liquified is:
(1) O_2 (2) N_2 (3) NH_3 (4) CH_4

E-2. NH_3 gas is liquefied more easily than N_2. Hence :
(1) van der Waal's constants 'a' and 'b' of NH_3 > that of N_2
(2) van der Waal's constants 'a' and 'b' of NH_3 < that of N_2
(3) a (NH_3) > a (N_2) but b (NH_3) < b (N_2)
(4) a (NH_3) < a (N_2) but b (NH_3) > b (N_2)

E-3. The pressure of real gases is less than that of ideal gas because of
(1) increase in the number of collisions (2) finite size of particles
(3) intermolecular attraction (4) increase in kinetic energy of the molecules

E-4. At lower temperature, all gases show
(1) negative deviation (2) positive deviation
(3) positive and negative deviation (4) None

E-5. The units of the van der Waal's constant 'a' are
(1) atm L^2 mol^{-2} (2) atm L^{-2} mol^{-2} (3) atm L mol^{-1} (4) atm mol L^{-1}

E-6 The Vander Waal's equation explains the behaviour of
(1) Ideal gases (2) Real gases (3) Vapour (4) Non-real gases

E-7. Vander Waal's equation of state is obeyed by real gases. For *n* moles of a real gas, the expression will be
(1) $\left(\frac{P}{n}+\frac{na}{V^2}\right)\left(\frac{V}{n-b}\right)=RT$ (2) $\left(P+\frac{a}{V^2}\right)(V-b)=nRT$
(3) $\left(P+\frac{na}{V^2}\right)(nV-b)=nRT$ (4) $\left(P+\frac{n^2a}{V^2}\right)(V-nb)=nRT$

E-8. Any gas shows maximum deviation from ideal gas at
(1) 0ºC and 1 atmospheric pressure (2) 100ºC and 2 atmospheric pressure
(3) –100ºC and 5 atmospheric pressure (4) 500ºC and 1 atmospheric pressure

E-9 A gas is said to behave like an ideal gas when the relation PV / T = constant. When do you expect a real gas to behave like an ideal gas
(1) When the temperature is low
(2) When both the temperature and pressure are low
(3) When both the temperature and pressure are high
(4) When the temperature is high and pressure is low

E-10. The units of the van der Waal's constant 'b' are
(1) atmosphere (2) joules (3) L mol^{-1} (4) mol L^{-1}

E-11. For the non-zero values of force of attraction between gas molecules, gas equation will be :
(1) $PV = nRT - \frac{n^2a}{V}$ (2) PV = nRT + nbP (3) PV = nRT (4) $P = \frac{nRT}{V-b}$

E-12. At low pressures, the van der Waal's equation is written as :

$\left[p + \frac{a}{V^2}\right] V = RT$

The compressibility factor is then equal to:

(1) $\left(1 - \frac{a}{RTV}\right)$ (2) $\left(1 - \frac{RTV}{a}\right)$ (3) $\left(1 + \frac{a}{RTV}\right)$ (4) $\left(1 + \frac{RTV}{a}\right)$

E-13. Gases deviate from the ideal gas behaviour because their molecules

(1) possess negligible volume (2) have forces of attraction between them

(3) are polyatomic (4) are not attracted to one another

E-14. In van der Wall's equation of state for a non-ideal gas, the term that accounts for intermolecular forces is :

(1) (V–b) (2) $(RT)^{-1}$ (3) $\left(p + \frac{a}{V^2}\right)$ (4) RT

E-15.✍A real gas most closely approaches the behaviour of an ideal gas at

(1) 15 atm and 200 K (2) 1 atm and 273 K (3) 0.5 atm and 500 K (4) 15 atm and 500 K

E-16. The temperature at which the second virial coefficient of real gas is zero is called

(1) Critical temperature (2) Freezing point (3) Boiling point (4) Boyle's temperature

E-17. Vander Waal's constants '*a*' and '*b*' are related with..... respectively

(1) Attractive force and bond energy of molecules (2) Volume and repulsive force of molecules

(3) Shape and repulsive forces of molecules (4) Attractive force and volume of the molecules

E-18.. The temperature at which real gases obey the ideal gas laws over a wide range of pressure is called

(1) Critical temperature (2) Boyle temperature

(3) Inversion temperature (4) Reduced temperature

E-19. At high temperature and low pressure, the Vander Waal's equation is reduced to

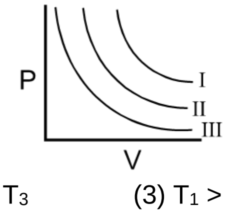
(1) $\left(p + \frac{a}{V_m^2}\right)(V_m) = RT$ (2) $pV_m = RT$ (3) $p(V_m - b) = RT$ (4) $\left(p + \frac{a}{V_m^2}\right)(V_m - b) = RT$

Exercise-2

✍ **Marked Questions may have for Revision Questions.**

OBJECTIVE QUESTIONS

1. I, II, III are three isotherms respectively at T_1, T_2 and T_3. Temperature will be in order :



(1) $T_1 = T_2 = T_3$ (2) $T_1 < T_2 < T_3$ (3) $T_1 > T_2 > T_3$ (4) $T_1 > T_2 = T_3$

2.✍ A vessel of volume 5 litre contains 1.4 g of nitrogen at a temperature 1800 K. The pressure of the gas if 30% of its molecules are dissociated into atoms at this temperature is :

(1) 4.05 atm (2) 2.025 atm (3) 3.84 atm (4) 1.92 atm

3. Which of the following statement is false

(1) The product of pressure and volume of fixed amount of a gas is independent of temperature
(2) Molecules of different gases have the same K.E. at a given temperature
(3) The gas equation is not valid at high pressure and low temperature
(4) The gas constant per molecule is known as Boltzmann constant

4. The molecular weight of O_2 and SO_2 are 32 and 64 respectively. If one *litre* of O_2 at 15ºC and 750 *mm* pressure contains '*N*' molecules, the number of molecules in two *litres* of SO_2 under the same conditions of temperature and pressure will be
(1) N/2 (2) N (3) 2N (4) 4N

5. At what temperature, the sample of neon gas would be heated to double of its pressure, if the initial volume of gas is/are reduced by 15% at 75ºC.
(1) 319ºC (2) 592ºC (3) 128ºC (4) 60ºC

6. Densities of two gases are with equal mass in the ratio 1 : 2 and their temperatures are in the ratio 2 : 1, then the ratio of their respective pressures is
(1) 1 : 1 (2) 1 : 2 (3) 2 : 1 (4) 4 : 1

7. Gas equation PV = nRT is obeyed by
(1) Only isothermal process (2) Only isobaric process
(3) Both (1) and (2) (4) None of these

8. Two separate bulbs contain ideal gases *A* and *B*. The density of gas *A* is twice that of gas *B*. The molecular mass of *A* is half that of gas *B*. The two gases are at the same temperature. The ratio of the pressure of *A* to that of gas *B* is
(1) 2 (2) 1/2 (3) 4 (4) 1/4

9. 16 *g* of oxygen and 3 *g* of hydrogen are mixed and kept at 760 *mm* pressure and 0ºC. The total volume occupied by the mixture will be nearly
(1) 22.4 *litres* (2) 33.6 *litres* (3) 448 *litres* (4) 44800 *ml*

10. A wheather balloon filled with hydrogen at 1 *atm* and 27ºC has volume equal to 12000 *litres*. On ascending it reaches a place where the temperature is –23ºC and pressure is 0.5 *atm*. The volume of the balloon is
(1) 24000 *litres* (2) 20000 *litres* (3) 10000 *litres* (4) 12000 *litres*

11. Under what conditions will a pure sample of an ideal gas not only exhibit a pressure of 1 *atm* but also a concentration of 1 *mole* $litre_{-1}$ (R = 0.082 litre atmmol^{-1} deg^{-1})
(1) At STP (2) When V = 22.4 litres
(3) When T = 12 K (4) Impossible under any conditions

12. A gas is found to have a formula $[CO]_x$. If its vapour density is 70, the value of x is
(1) 2.5 (2) 3.0 (3) 5.0 (4) 6.0

13. Which one of the following statements is wrong for gases ?
(1) Gas do not have a definite shape and volume
(2) Volume of the gas is equal to the volume of the container confining the gas
(3) Confined gas exerts uniform pressure on the walls of its container in alll directions
(4) Mass of the gas connot be determined by weighing a container in which it is enclosed.

14. What will be the partial pressure of H_2 in a flask containing 2g of H_2, 14 g of N_2 and 16 g of O_2 :
(1) 1/2 the total pressure (2) 1/3 the total pressure
(3) 1/4 the total pressure (4) 1/16 the total pressure

15. Two closed vessel A and B of equal volume containing air at pressure P_1 and temperature T_1 are connected to each other through a narrow open tube. If the temperature of one is now maintained at T_1 and other at T_2 (where $T_1 > T_2$) then that what will be the final pressure ?

(1) $\frac{T_i}{2P_1T_2}$ (2) $\frac{2P_1T_2}{T_1+T_2}$ (3) $\frac{2P_1T_1}{T_1-T_2}$ (4) $\frac{2P_1}{T_1+T_2}$

16. A mixture of NO_2 and N_2O_4 has a vapour density of 38.3 at 300 K. What is the number of moles of NO_2 in 100 g of the mixture.

(1) 0.043 (2) 4.4 (3) 3.4 (4) 0.437

17. Containers A and B have same gases. Pressure, volume and temperature of A are all twice that of B, then the ratio of number of molecules of A and B are

(1) 1 : 2 (2) 2 (3) 1 : 4 (4) 4

18. Two flasks of equal volume are connected by a narrow tube (of negligible volume) all at 27ºC and contain 0.70 mole of H_2 at 0.5 atm. One of the flask is then immersed into a bath kept at 127ºC, while the other remains at 27ºC. The final pressure in each flask is :

(1) Final pressure = 0.5714 atm (2) Final pressure = 1.5714 atm
(3) Final pressure = 0.5824 atm (4) None of these

19. Two flasks of equal volume are connected by a narrow tube (of negligible volume) all at 27ºC and contain 0.70 moles of H_2 at 0.5 atm. One of the flask is then immersed into a bath kept at 127ºC, while the other remains at 27ºC. The number of moles of H_2 in flask 1 and flask 2 are :

(1) Moles in flask 1 = 0.4, Moles in flask 2 = 0.3 (2) Moles in flask 1 = 0.2, Moles in flask 2 = 0.3
(3) Moles in flask 1 = 0.3, Moles in flask 2 = 0.2 (4) Moles in flask 1 = 0.4, Moles in flask 2 = 0.2

20. One litre of a gaseous mixture of two gases effuses in 311 seconds while 2 litres of oxygen takes 20 minutes. The vapour density of gaseous mixture containing CH_4 and H_2 is

(1) 4 (2) 4.3 (3) 3.4 (4) 5

21. Three footballs are respectively filled with nitrogen, hydrogen and helium. If the leaking of the gas occurs with time from the filling hole, then the ratio of the rate of leaking of gases $(r_{N_2} : r_{H_2} : r_{He})$ from three footballs (in equal time interval) is

(1) $\left(1:\sqrt{14} : \sqrt{7}\right)$ (2) $\left(\sqrt{14} : \sqrt{7}:1\right)$ (3) $\left(\sqrt{7}:1 : \sqrt{14}\right)$ (4) $\left(1:\sqrt{7} : \sqrt{14}\right)$

22. Which of the following gas will have highest rate of diffusion ?

(1) NH_3 (2) N_2 (3) CO_2 (4) O_2

23. At constant volume and temperature conditions, the rate of diffusion D_A and D_B of gases *A* and *B* having densities ρ_A and ρ_B are related by the expression

(1) $D_A = \left[D_B \cdot \frac{\rho_A}{\rho_B}\right]^{1/2}$ (2) $D_A = \left[D_B \cdot \frac{\rho_A}{\rho_B}\right]^{1/2}$ (3) $D_A = D_B\left(\frac{\rho_A}{\rho_B}\right)^{1/2}$ (4) $D_A = D_B\left(\frac{\rho_B}{\rho_A}\right)^{1/2}$

24. Which of the following pairs will diffuse at the same rate through a porous plug

(1) CO, NO_2 (2) NO_2, CO_2 (3) NH_3, PH_3 (4) NO, C_2H_6

25. If some *moles* of diffuse in 18 *sec* and same moles of other gas diffuse in 45 *sec* then what is the molecular weight of the unknown gas

(1) $\frac{45^2}{18^2} \times 32$ (2) $\frac{18^2}{45^2} \times 32$ (3) $\frac{18^2}{45^2 \times 32}$ (4) $\frac{45^2}{18^2 \times 32}$

26. Pure O_2 diffuses through an aperture in 224 second, whereas mixture of O_2 and another gas containing 80% O_2 diffuses from the same in 234 second. The molecular mass of gas will be
(1) 51.5 (2) 48.6 (3) 55 (4) 46.6

27. 50 *ml* of hydrogen diffuses out through a small hole from a vessel in 20 *minutes*. The time needed for 40 *ml* of oxygen to diffuse out is
(1) 12 *min* (2) 64 *min* (3) 8 *min* (4) 32 *min*

28. The densities of two gases are in the ratio of 1 : 16. The ratio of their rates of diffusion is
(1) 16 : 1 (2) 4 : 1 (3) 1 : 4 (4) 1 : 16

29. If $C_1, C_2, C_3......$ represent the speeds of $n_1, n_2, n_3.....$ molecules, then the root mean square speed is

(1) $\left(\frac{n_1C_1^2+n_2C_2^2+n_3C_3^2+.....}{n_1+n_2+n_3+.....}\right)^{1/2}$ (2) $\frac{(n_1C_1^2+n_2C_2^2+n_3C_3^2+.....)^{1/2}}{n_1+n_2+n_3+.....}$

(3) $\frac{(n_1C_1^2)^{1/2}}{n_1}+\frac{(n_2C_2^2)^{1/2}}{n_2}+\frac{(n_3C_3^2)^{1/2}}{n_3}+......$ (4) $\left[\frac{(n_1C_1+n_2C_2+n_3C_3+....)^2}{(n_1+n_2+n_3+....)}\right]^{1/2}$

30. Molecular velocities of the two gases at the same temperature are u_1 and u_2. Their masses are m_1 and m_2 respectively. Which of the following expression is correct ?

(1) $\frac{m_1}{u_1^2}=\frac{m_2}{u_2^2}$ (2) $m_1u_1 = m_2u_2$ (3) $\frac{m_1}{u_1}=\frac{m_2}{u_2}$ (4) $m_1u_1^2 = m_2u_2^2$

31. Which out of the following statements is false ?
(1) Avogadro number = 6.02×10^{21}
(2) The relationship between average velocity $(\bar{v})$ and root mean square velocity (u) is $\bar{v}$ = 0.9213 u
(3) the mean kinetic energy of an ideal gas is independent of the pressure of the gas
4) The root mean square velocity of the gas can be calculated by the formula $(3\ RT/M)^{1/2}$

32. In a closed flask of 5 *litres*, 1.0 *g* of H_2 is heated from 300 to 600 *K*. which statement is not correct.
(1) Pressure of the gas increases (2) The rate of collision increases
(3) The number of moles of gas increases (4) The energy of gaseous molecules increases

33. The root mean square velocity of an ideal gas in a closed container of fixed volume is increased from $5 \times 10^4\ cms^{-1}$ to $10 \times 10^4\ cms^{-1}$. Which of the following statement correctly explains how the change is accomplished.
(1) By heating the gas, the temperature is doubled
(2) By heating the gas, the pressure is quadrupled (*i.e.* made four times)
(3) By heating the gas, the temperature is quadrupled
(4) By heating the gas, the pressure is doubled

34. The ratio between the root mean square velocity of H_2 at 50 *K* and that of at 800 *K* is
(1) 4 (2) 2 (3) 1 (4) 1/4

35. According to kinetic theory of gases, for a diatomic molecule
(1) The pressure exerted by the gas is proportional to the mean velocity of the molecules
(2) The pressure exerted by the gas is proportional to the root mean square velocity of the molecules
(3) The root mean square velocity is inversely proportional to the temperature
(4) The mean translational kinetic energy of the molecules is proportional to the absolute temperature

36. The *rms* speed of N_2 molecules in a gas is *u*. If the temperature is doubled and the nitrogen molecules dissociate into nitrogen atoms, the *rms* speed becomes

(1) u/2 (2) 2*u* (3) 4*u* (4) 14*u*

37. If the v_{rms} is 30 $R^{1/2}$ at 27ºC then calculate the molar mass of gas in kilogram.

(1) 1 (2) 2 (3) 4 (4) 0.001

38. At what temperature will the average speed of CH_4 molecules have the same value as O_2 has at 300 *K.*

(1) 1200 *K* (2) 150 *K* (3) 600 *K* (4) 300 *K*

39. The compressibility factor for an ideal gas is

(1) 1.5 (2) 1.0 (3) 2.0 (4) ∞

40. An ideal gas can't be liquefied because

(1) its critical temperature is always above 0°C

(2) its molecules are relatively smaller in size

(3) it solidifies before becoming a liquid

(4) forces operative between its molecules are negligible

41. When is deviation more in the behaviour of a gas from the ideal gas equation PV = nRT ?

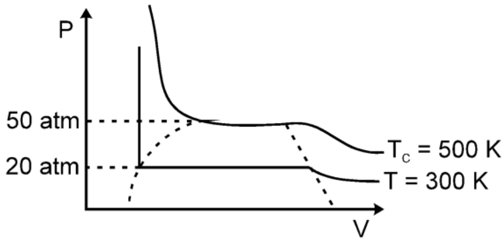
(1) At high temperature and low pressure

(2) At low temperature and high pressure

(3) At high temperature and high pressure

(4) At low temperature and low high pressure

42. For a real gas the P-V curve was experimentally plotted, and it had the following appearance. With respect to liquefaction. Choose the ***correct*** statement.



(1) at T = 500 K, P = 40 atm, the state will be liquid.

(2) at T = 300 K, P = 50 atm, the state will be gas

(3) at T < 300 K, P > 20 atm, the state will be gas

(4) at 300 K < T < 500 K, P > 50 atm, the state will be liquid.

43. The van der Waal's parameters for gases W, X, Y and Z are

Gas	a (atm L^2 mol^{-2})	b (L mol^{-1})
W	4.0	0.027
X	8.0	0.030
Y	6.0	0.032
Z	12.0	0.027

Which one of these gases has the highest critical temperature ?

(1) W (2) X (3) Y (4) Z

44. An ideal gas obeying kinetic theory of gases can be liquefied if

(1) Its temperature is more than critical temperature T_C
(2) Its pressure is more than critical pressure P_C
(3) Its pressure is more than P_C at a temperature less than T_C
(4) It cannot be liquefied at any value of P and T

Exercise-3

PART - I : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

OFFLINE JEE-MAIN

1. Value of gas constant R is : **[AIEEE 2002, 3/225]**
(1) 0.082 litre atm. (2) 0.987 cal $mol^{-1} K^{-1}$ (3) 8.3 J $mol^{-1} K^{-1}$ (4) 83 erg $mol^{-1} K^{-1}$

2. Kinetic theory of gases proves : **[AIEEE 2002, 3/225]**
(1) Only Boyle's law (2) Only Charles law
(3) Only Avagadro's law (4) All of these

3. For an ideal gas, number of moles per litre in terms of its pressure P, gas constant R and temperature T is: **[AIEEE 2002, 3/225]**
(1) PT/R (2) PRT (3) P/RT (4) RT/P

4. According to kinetic theory of gases in an ideal gas between two successive collisions a gas molecule travels: **[AIEEE 2003, 3/225]**
(1) In a straight line path (2) With an accelerated velocity
(3) In a circular path (4) In a wavy path

5. What volume of hydrogen gas, at 273 K and 1 atm pressure will be consumed in obtaining 21.6 g of elemental boron (atomic mass = 10.8) from the reduction of boron trichloride by hydrogen? **[AIEEE 2003, 3/225]**
(1) 89.6 L (2) 67.2 L (3) 44.8 L (4) 22.4 L

6. As the temperature is raised from 20°C to 40°C, the average kinetic energy of neon atoms changes by a factor : **[AIEEE 2004, 3/225]**
(1) 2 (2) $\sqrt{\frac{313}{293}}$ (3) $\frac{313}{293}$ (4) $\frac{1}{2}$

7. Which one of the following statements regarding helium is incorrect ? **[AIEEE 2004, 3/225]**
(1) It is used to fill gas balloons instead of hydrogen because it is lighter and non-inflammable
(2) It is used as a cryogenic agent for carrying out experiments at low temperatures
(3) It is used to produce and sustain powerful superconducting magnets
(4) It is used in gas-cooled nuclear reactors

8. In vander Waal's equation of state of the gas law, the constant 'b' is a measure of :**[AIEEE 2004, 3/225]**
(1) Intermolecular collisions per unit volume (2) Intermolecular attractions
(3) Volume occupied by the molecules (4) Intermolecular repulsions

9. 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 ? **[AIEEE 2005, 3/225]**

(1) The area under the distribution curve remains the same as under the lower temperature

(2) The distribution becomes broader

(3) The fraction of the molecules with the most probable speed increases

(4) The most probable speed increases

10. A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g. of CO_2. The empirical formula of the hydrocarbon is : **[JEE(Main) 2013, 4/120]**

(1) C_2H_4 (2) C_3H_4 (3) C_6H_5 (4) C_7H_8

11. For gaseous state, if most probable speed is denoted by C*, average speed by and mean square speed by C, then for a large number of molecules the ratios of these speeds are :

[JEE(Main) 2013, 4/120]

(1) $C^* : \bar{C} : C = 1.225 : 1.128 : 1$ (2) $C^* : \bar{C} : C = 1.128 : 1.225 : 1$

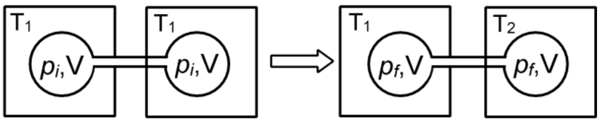
(3) $C^* : \bar{C} : C = 1 : 1.128 : 1.225$ (4) $C^* : \bar{C} : C = 1 : 1.225 : 1.128$

12. If Z is a compressibility factor, vander Waals equation at low pressure can be written as :

[JEE(Main) 2014]

(1) $Z = 1 + \frac{RT}{Pb}$ (2) $Z = 1 - \frac{a}{VRT}$ (3) $Z = 1 - \frac{Pb}{RT}$ (4) $Z = 1 + \frac{Pb}{RT}$

13. Two closed bulbs of equal volume (V) containing an ideal gas initially at pressure p_i and temperature T_1 are connected through a narrow tube of negligible volume as shown in the figure below. The temperature of one of the bulbs is then raised to T_2. The final pressure p_f is: **[JEE(Main) 2016]**



(1) $2p_i\left(\frac{T_1}{T_1+T_2}\right)$ (2) $2p_i\left(\frac{T_2}{T_1+T_2}\right)$ (3) $2p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$ (4) $p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$

ONLINE JEE-MAIN

1. Vander Waal's equation for a gas is stated as, $P = \frac{nRT}{V-nb} - a\left(\frac{n}{V}\right)^2$.

This equation reduces to the perfect gas equation, $P = \frac{nRT}{V}$ when,

[JEE(Main) 2014 Online (09-04-14), 4/120]

(1) temperature is sufficiently high and pressure is low.

(2) temperature is sufficiently low and pressure is high.

(3) both temperature and pressure are very high.

(4) both temperature and pressure are very low.

2. The temperature at which oxygen molecules have the same root mean square speed as helium atoms have at 300 K is : (Atomic masses : He = 4 u, O = 16 u) **[JEE(Main) 2014 Online (09-04-14), 4/120]**
(1) 300 K (2) 600 K (3) 1200 K (4) 2400 K

3. The initial volume of a gas cylinder is 750.0 mL. If the pressure of gas inside the cylinder changes from 840.0 mm Hg to 360.0 mm Hg, the final volume the gas will be :
[JEE(Main) 2014 Online (11-04-14), 4/120]
(1) 1.750 L (2) 3.60 L (3) 4.032 L (4) 7.50 L

4. Sulphur dioxide and oxygen were allowed to diffuse through a porpus partition. 20 dm^3 of SO_2 diffuses through the porous partition is 60 seconds. The volume of O_2 in dm^3 which diffuses under the similar condition in 30 seconds will be (atomic mass of sulphur = 32 u) :
[JEE(Main) 2014 Online (19-04-14), 4/120]
(1) 7.09 (2) 14.1 (3) 10.0 (4) 28.2

5. Which of the following is not an assumption of the kinetic theory of gases ?
[JEE(Main) 2015 Online (10-04-15), 4/120]
(1) Gas particles have negligible volume
(2) A gas consists of many identical particels which are in continual motion
(3) At high pressure, gas particles are difficult to compress
(4) Collisions of gas particles are perfectly elastic

6. When does a gas deviate the most from its ideal behaviour ?
[JEE(Main) 2015 Online (11-04-15), 4/120]
(1) At low pressure and low temperature (2) At low pressure and high temperature
(3) At high pressure and low temperature (4) At high pressure and high temperature

7. At very high pressures, the compressibility factor of one mole of a gas is given by :
[JEE(Main) 2016 Online (09-04-16), 4/120]
(1) $1 + \frac{pb}{RT}$ (2) $\frac{pb}{RT}$ (3) $1 - \frac{b}{(VRT)}$ (4) $1 - \frac{pb}{RT}$

8. Initially, the root mean square (rms) velocity of N_2 molecules at certain temperature is u. If this temperature is doubled and all the nitrogen molecules dissociate into nitrogen atoms, then the new *rms* velocity will be : **[JEE(Main) 2016 Online (10-04-16), 4/120]**
(1) 2 u (2) 14 u (3) u / 2 (4) 4 u

9. 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 : **[JEE(Main) 2017 Online (09-04-17), 4/120]**
(1) 56 g mol^{-1} (2) 112 g mol^{-1} (3) 224 g mol^{-1} (4) 28 g mol^{-1}

PART - II : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

1. The compressibility of a gas is less than unity at S.T.P. therefore, **[JEE-2000(S), 1/35]**
(A) V_m > 22.4 litres (B) V_m < 22.4 litres (C) V_m = 22.4 litres (D) V_m = 44.8 litres

2. The rms velocity of hydrogen is $\sqrt{7}$ times the rms velocity of nitrogen. If T is the temperature of the gas, then **[JEE-2000(S), 1/35]**
(A) $T_{(H_2)} = T_{(N_2)}$ (B) $T_{(H_2)} > T_{(N_2)}$ (C) $T_{(H_2)} < T_{(N_2)}$ (D) $T_{(H_2)} = \sqrt{7}\ T_{(N_2)}$

3. At 100°C and 1 atm, if the density of liquid water is 1.0 g cm^{-3} and that of water vapour is 0.0006 g cm^{-3}, that the volume occupied by water molecules in 1 liter of st eam at that temperature is :

[JEE-2000(S), 1/35]

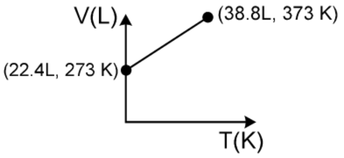
(A) 6 cm^3 (B) 60 cm^3 (C) 0.6 cm^3 (D) 0.06 cm^3

4. The root mean square velocity of an ideal gas at constant pressure varies with density (d) as :

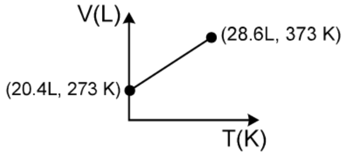
[JEE-2001(S), 1/35]

(A) d^2 (B) d (C) $\sqrt{d}$ (D) $1/\sqrt{d}$

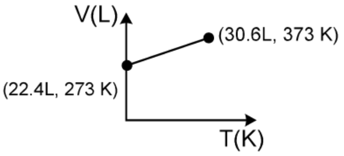
5. Which of the following volume (V)-temperature (T) plots represent the behaviour of one mole of an ideal gas at one atmospheric pressure. **[JEE-2002(S), 3/90]**



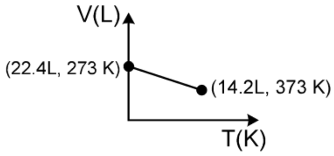
(A)



(B)



(C)



(D)

6. For one mole of gas the average kinetic energy is given as E. The U_{rms} of gas is : **[JEE-2004(S), 3/84]**

(A) $\sqrt{\frac{2E}{M}}$ (B) $\sqrt{\frac{3E}{M}}$ (C) $\sqrt{\frac{2E}{3M}}$ (D) $\sqrt{\frac{3E}{2M}}$

7. Ratio of rates of diffusion of He and CH_4 (under identical conditions). **[JEE-2005(S), 3/84]**

(A) $\frac{1}{2}$ (B) 3 (C) $\frac{1}{3}$ (D) 2

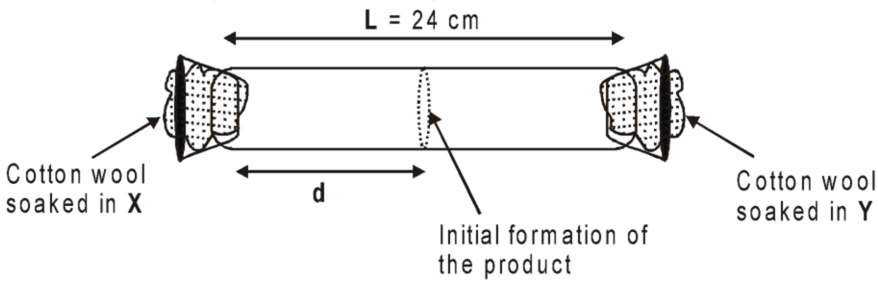
8. The term that corrects for the attractive forces present in a real gas in the vander Waals equation is :

[JEE-2009, 3/160]

(A) nb (B) $\frac{an^2}{V^2}$ (C) $-\frac{an^2}{V^2}$ (D) –nb

Paragraph for questions 9 and 10

X and **Y** are two volatile liquids with molar weights of 10 g mol^{-1} and 40 g mol^{-1} respectively. Two cotton plugs, one soaked in **X** and the other soaked in **Y**, are simultaneously placed at the ends of a tube of length **L** = 24 cm, as shown in the figure. The tube is filled with an inert gas at 1 atmosphere pressure and a temperature of 300 K. Vapours of **X** and **Y** react to form a product which is first observed at a distance **d** cm from the plug soaked in **X**. Take **X** and **Y** to have equal molecular diameters and assume ideal behaviour for the inert gas and the two vapours.



9. The value of **d** in cm (shown in the figure), as estimated from Graham's law, is :

[JEE(Advanced)-2014, 3/120]

(A) 8 (B) 12 (C) 16 (D) 20

10. The experimental value of **d** is found to be smaller than the estimate obtained using Graham's law. This is due to **[JEE(Advanced)-2014, 3/120]**

(A) larger mean free path for **X** as compared to that of **Y**.

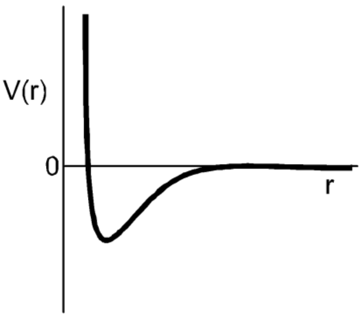
(B) larger mean free path for **Y** as compared to that of **X**.

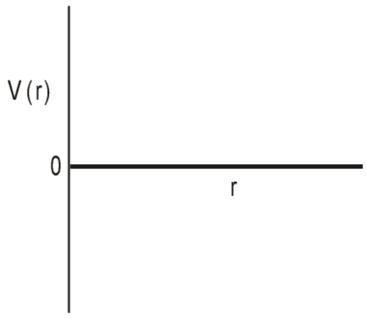
(C) increased collision frequency of **Y** with the inert gas as compared to that of **X** with the inert gas.

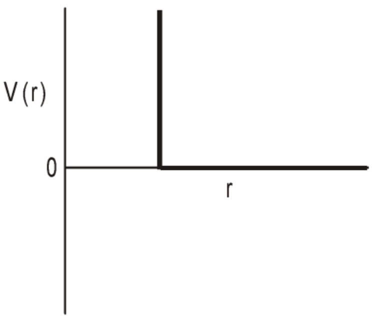
(D) increased collision frequency of **X** with the inert gas as compared to that of **Y** with the inert gas.

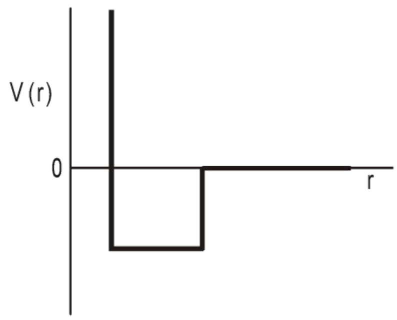
11. One mole of a monoatomic real gas satisfies the equation p(V – b) = RT where b is a constant. The relationship of interatomic potential V(r) and interatomic distance r for the gas is given by

[JEE(Advanced)-2015, 4/168]

(A) 

(B) 

(C) 

(D) 

12. The diffusion coefficient of an ideal gas is proportional to its mean free path and mean speed. The absolute temperature of an ideal gas is increased 4 times and its pressure is increased 2 times. As a result, the diffusion coefficient of this gas increases x times. The value of x is

[JEE(Advanced)-2016, 3/124]

Answers

EXERCISE - 1

A-1.	(2)	**A-2.**	(4)	**A-3.**	(1)	**A-4.**	(4)	**A-5.**	(3)
A-6.	(4)	**A-7.**	(1)	**A-8.**	(3)	**A-9.**	(1)	**A-10.**	(1)
A-11.	(3)	**A-12.**	(1)	**A-13.**	(1)	**A-14.**	(1)	**A-15.**	(1)
A-16.	(4)	**A-17.**	(1)	**A-18.**	(2)	**A-19.**	(2)	**A-20.**	(3)
A-21.	(2)	**A-22.**	(1)	**A-23.**	(3)	**A-24.**	(4)	**A-25.**	(3)
A-26.	(1)	**A-27.**	(2)	**A-28.**	(4)	**A–29.**	(3)	**A-30.**	(1)
A-31.	(1)	**A-32.**	(2)	**A-33.**	(1)	**B-1.**	(4)	**B-2.**	(1)
B-3.	(1)	**B-4.**	(2)	**B-5.**	(4)	**B-6.**	(1)	**B-7.**	(3)
B-8.	(1)	**B-9.**	(4)	**B-10.**	(3)	**B-11.**	(1)	**B-12.**	(3)
C-1.	(2)	**C-2.**	(4)	**C-3.**	(1)	**C-4.**	(2)	**C-5.**	(2)
C-6.	(2)	**C-7.**	(1)	**C-8.**	(1)	**C-9.**	(2)	**C-10.**	(4)
C-11.	(1)	**C-12.**	(2)	**C-13.**	(1)	**C-14.**	(1)	**C-15.**	(2)
C-16.	(2)	**C-17.**	(4)	**C-18.**	(3)	**C-19.**	(1)	**C-20.**	(1)
D-1.	(1)	**D-2.**	(4)	**D-3.**	(2)	**D-4.**	(2)	**D-5.**	(4)
D-6.	(4)	**D-7.**	(2)	**D-8.**	(3)	**D-9.**	(1)	**D-10.**	(3)
D-11.	(4)	**D-12.**	(1)	**D-13.**	(3)	**D-14.**	(1)	**D-15.**	(2)
D-16.	(3)	**D-17.**	(4)	**D-18.**	(4)	**D-19.**	(2)	**D-20.**	(3)
D-21.	(1)	**D-22.**	(3)	**D-23.**	(2)	**D-24.**	(1)	**E-1.**	(3)
E-2.	(3)	**E-3.**	(3)	**E-4.**	(1)	**E-5.**	(1)	**E-6**	(2)
E-7.	(4)	**E-8.**	(3)	**E-9**	(4)	**E-10.**	(3)	**E-11.**	(1)
E-12.	(1)	**E-13.**	(2)	**E-14.**	(3)	**E-15.**	(3)	**E-16.**	(4)
E-17.	(4)	**E-18..**	(2)	**E-19.**	(2)				

EXERCISE - 2

1.	(3)	**2.**	(4)	**3.**	(1)	**4.**	(3)	**5.**	(1)
6.	(1)	**7.**	(3)	**8.**	(3)	**9.**	(4)	**10.**	(2)
11.	(3)	**12.**	(3)	**13.**	(4)	**14.**	(1)	**15.**	(2)
16.	(4)	**17.**	(2)	**18.**	(1)	**19.**	(1)	**20.**	(2)
21.	(1)	**22.**	(1)	**23.**	(4)	**24.**	(4)	**25.**	(1)
26.	(1)	**27.**	(2)	**28.**	(2)	**29.**	(1)	**30.**	(4)
31.	(1)	**32.**	(3)	**33.**	(2)	**34.**	(3)	**35.**	(4)
36.	(2)	**37.**	(4)	**38.**	(2)	**39.**	(2)	**40.**	(4)
41.	(2)	**42.**	(4)	**43.**	(4)	**44.**	(4)		

EXERCISE - 3

PART - I

OFFLINE JEE-MAIN

1.	(3)	**2.**	(4)	**3.**	(3)	**4.**	(1)	**5.**	(2)
6.	(3)	**7.**	(1)	**8.**	(3)	**9.**	(3)	**10.**	(4)
11.	(3)	**12.**	(2)	**13.**	(2)				

ONLINE JEE-MAIN

1.	(1)	**2.**	(4)	**3.**	(1)	**4.**	(2)	**5.**	(3)
6.	(3)	**7.**	(1)	**8.**	(1)	**9.**	(2)		

PART - II

1.	(B)	**2.**	(C)	**3.**	(C)	**4.**	(D)	**5.**	(C)
6.	(A)	**7.**	(D)	**8.**	(B)	**9.**	(C)	**10.**	(D)
11.	(C)	**12.**	4						