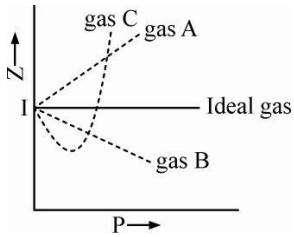
Date Planned : __ / __ / __	Daily Tutorial Sheet-5	Expected Duration : 90 Min
Actual Date of Attempt : __ / __ / __	JEE Advanced (Archive)	Exact Duration :_____

61. The ratio of the rate of diffusion of helium and methane under identical condition of pressure and temperature will be: **(2005)**

(A) 4 **(B)** 2 **(C)** 1 **(D)** 0.5

62. The given graph represents the variations of compressibility factor $Z = pv / nRT$ vs P for three real gases A, B and C. Which of the following statements is wrong? **(2006)**



(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) At high pressure, the slope is positive for all real gases

63. Match gases under specified conditions listed in Column I with their properties/laws in Column II. **(2007)**

Column I		Column II	
(A)	Hydrogen gas $(P = 200\,atm,\ T = 273\,K)$	**(p)**	Compressibility factor $\neq 1$
(B)	Hydrogen gas $(P \to 0\,atm,\ T = 273\,K)$	**(q)**	Attractive forces are dominant
(C)	$CO_2(P = 1\,atm,\ T = 273\,K)$	**(r)**	$PV = nRT$
(D)	Real gas with very large molar volume	**(s)**	$P(V - nb) = nRT$

64. A gas described by van der Waals equation: **(2008)**

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

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

(C) is characterized 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

65. If a gas is expanded at constant temperature: **(2008)**

(A) the pressure decreases

(B) the kinetic energy of the molecules remains the same

(C) the kinetic energy of the molecules decreases

(D) the number of molecules of the gas increases

66. At $400\,K$, the root mean square (rms) speed of a gas X (molecular weight $= 40$) is equal to the most probable speed of gas Y at $60\,K$. The molecular weight of the gas Y is : **(2009)**

67. The term that corrects for the attractive forces present in a real gas in the van der Waals equation is :

(A) nb **(B)** $\frac{an^2}{V^2}$ **(C)** $-\frac{an^2}{V^2}$ **(D)** $-nb$ **(2009)**

68. To an evacuated vessel with movable piston under external pressure of 1atm, 0.1mol of He and 0.1mol of an unknown compound (vapour pressure 0.68 atm at 0°C) are introduced. Considering the ideal behaviour, the volume (in litre) of the gases at 0°C is close to: **(2011)**

69. According to kinetic theory of gases: **(2011)**

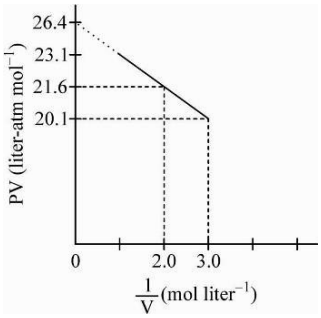
(A) collisions are always elastic

(B) heavier molecules transfer more momentum to the wall of the container

(C) only a small number of molecules have very high velocity

(D) between collisions, the molecules move in straight lines with constant velocities

70. 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 ($atm.litre^2mol^{-2}$) is: **(2012)**



(A) 1.0

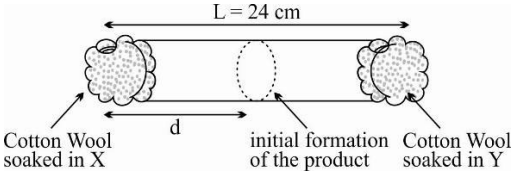
(B) 4.5

(C) 1.5

(D) 3.0

Paragraph for Questions No. 71-72

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 the 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 behavior for the inert gas and the two vapours. **(2014)**



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

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

72. The experimental value of d is found to be smaller than the estimate obtained using Graham's law. This is due to:

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

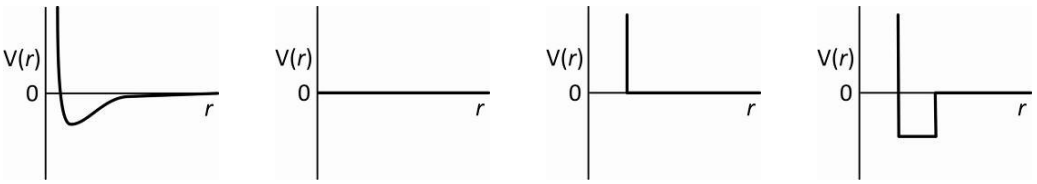
(B) larger mean free path for Y as compared to that of X

(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

73. If the value of Avogadro number is $6.023 \times 10^{23}\ mol^{-1}$ and the value of Boltzmann constant is $1.380 \times 10^{-23} JK^{-1}$, then the number of significant digits in the calculated value of the universal gas constant is: **(2014)**

74. 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: **(2015)**



(A) **(B)** **(C)** **(D)**

75. 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 _____. **(2016)**

76. A closed tank has two compartments **A** and **B**, both filled with oxygen (assumed to be ideal gas). The partition separating the two compartments is fixed and is a perfect heat insulator (Figure 1). If the old partition is replaced by a new partition which can slide and conduct heat but does **NOT** allow the gas to leak across (Figure 2), the volume (in m^3) of the compartment **A** after the system attains equilibrium is_____. **(2018)**

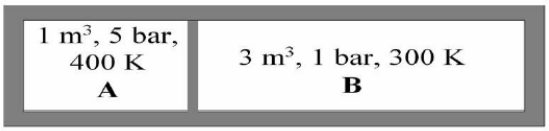


Figure 1

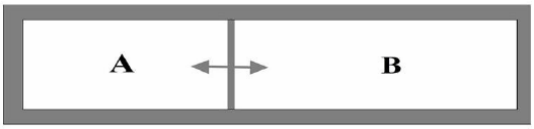


Figure 2

77. Which of the following statement(s) is(are) correct regarding the root mean square speed (U_{rms}) and average translational kinetic energy U_{avg} of a molecule in a gas at equilibrium? **(2019)**

(A) U_{rms} is inversely proportional to square root of its molecular mass

(B) U_{avg} at a given temperature does not depend on its molecular mass

(C) U_{avg} is doubled when its temperature is increased four times

(D) U_{rms} is doubled when its temperature is increased four times