# PHYSICS

# BOOKS - MTG PHYSICS (ENGLISH)

# KINETIC THEORY

## Molecular Nature Of Matter

**1.** Molecular motion shows itself as

A. temperature

B. internal energy

C. friction

D. viscosity

**Answer: A**

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**2.** Cooking gas container are kept in a lorry moving with uniform speed. The temperature of the gas molecules inside will

A. increase

B. decrease

C. remains the same

D. decrease for some and increase for others

**Answer: C**

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**Behaviour Of Gases**

**1.** A real gas behaves like an ideal gas if its

A. both pressure and temperature are high

B. both pressure and temperature are low

C. pressure is high and temperature is low

D. pressure is low and temperature is high

**Answer: D**

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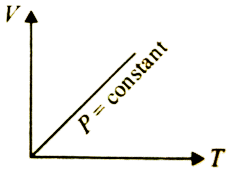
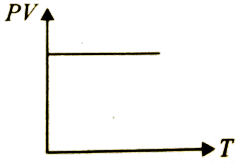
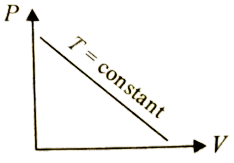
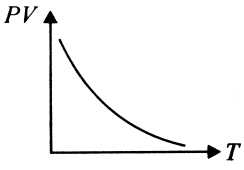
**2.** Which of the following graphs represent the behaviour of an ideal gas ?

A. 1. 


B. 2. 


C. 3. 


D. 4. 


**Answer: A**

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**3.** If the pressure and the volume of certain quantity of ideal gas are halved, then its temperature

A. is doubled

B. becomes one-fourth

C. remains constant

D. become four times

**Answer: B**

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**4.** An air bubble of volume $1.0cm^3$ rises from the bottom of a lake 40 m deep at a temperature of $12^\circ C$. To what volume does it grow when it reaches the surface, which is at a temperature of $35^\circ C$. ? Given $1atm = 1.01 \times 10^5 Pa$.

A. $10.6 \times 10^{-6} m^3$

B. $5.3 \times 10^{-6} m^3$

C. $2.8 \times 10^{-6} m^3$

D. $15.6 \times 10^{-6} m^3$

**Answer: B**

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**5.** The diameter of an oxygen molecule is 3 Ã... The ratio of molecular volume to the actual volume occupied by the oxygen gas at STP is

A. $1.2 \times 10^{-4}$

B. 2. $1 \times 10^{-4}$

C. 3. $1.5 \times 10^{-4}$

D. 4. $4 \times 10^{-4}$

**Answer: D**

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**6.** A balloon contains $1500m^3$ of helium at $27^\circ C$ and 4 atmospheric pressue. The volume of helium at $-3^\circ C$ themperature and 2 atmospheric pressure will be

A. $1500m^3$

B. $1700m^3$

C. $1900m^3$

D. $2700m^3$

**Answer: D**

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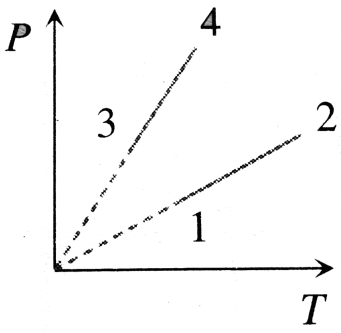
**7.** Pressure versus temperature graph of an ideal gas of equal number of moles of different volumes is plotted as shown in Fig.

Choose the correct alternative.




A. $V_1 = V_2 = V_3 = V_4$

B. $V_4 > V_3 > V_2 > V_1$

C. $V_1 = V_2, V_3 = V_4$ and $V_2 > V_3$

D. $V_1 = V_2, V_3 = V_4$ and $V_2 < V_3$

**Answer: C**

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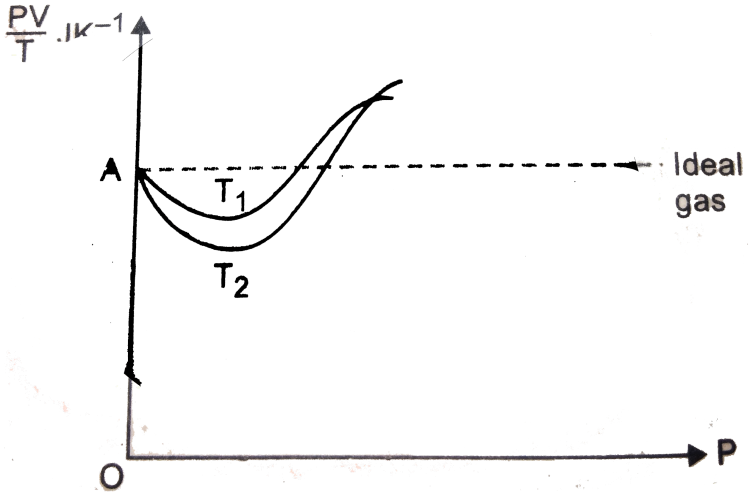
**8.** Given is the graph between $\frac{PV}{T}$ and P for 1 gm of oxygen gas at two different temperatures $T_1$ and $T_2$ Fig. Given, density of oxygen $= 1.427 kgm^{-3}$. The value of $(PV)/(T)$ at the point A and the relation

between $T_1$ and $T_2$ are respectively :




A. $0.259JK^{-1}$ and $T_1 < T_2$

B. $8.314gJmol^{-1}K^{-1}$ and $T_1 > T_2$

C. $0.259JK^{-1}$ and $T_1 > T_2$

D. $4.28gJK^{-1}$ and $T_1 < T_2$

**Answer: C**

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**9.** A vessel has 6gm of oxygen at pressure P and temperature 400 K.A small hole is made in it so that oxygen leaks out. How much oxygen leaks out if the final pressure is $\frac{P}{2}$ and temperauture 300 K ?

A. A. 5 g

B. B. 4 g

C. C. 2 g

D. D. 3 g

**Answer: C**

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**10.** A vessel has 6g of hydrogen at pressure P and temperature 500K. A small hole is made in it so that hydrogen leaks out. How much hydrogen leaks out if the final pressure is P/2 and temperature falls to 300 K ?

A. 2 g

B. 3 g

C. 4 g

D. 1 g

**Answer: D**

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**11.** A vessel contains two non-reactive gases neon (monoatomic) and oxygen (diatomic). The ratio of their partial pressures is 3:2. Estimate the ratio of

(i) number of molecules, and

(ii) mass density of neon and oxygen in the vessel.

Atomic mass of neon = 20.2 u, and molecular mass of oxygen = 32.0 u.

A. $\frac{3}{2}$

B. $\frac{2}{3}$

C. $\frac{1}{3}$

D. $\frac{1}{2}$

**Answer: A**

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**12.** A cylinder contained $10kg$of gas at pressure $10^7 \frac{N}{m^2}$. The quantity of gas taken out of cylinder if final pressure is $2.5 \times 10^6 N/m^2$ is (Assume temperature of gas is constant)

A. $9.5$ kg

B. $7.5$ kg

C. $14.2$ kg

D. zero

**Answer: B**

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**13.** A gas at 300 K has pressure $4 \times 10^{-10} N/m^2$. IF $k = 1.38 \times 10^{-23} J/K$, the number of $\text{molecule}/cm^3$ is of the order of

A. $10^3$

B. $10^5$

C. $10^6$

D. $10^9$

**Answer: B**

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**14.** The volume of vessel A is twice the volume of another vessel B and both of them are filled with the same gas. If the gas in A is at twice the temperature and twice the pressure in comparison to the gas in B, what is the ratio of number of gas molecule in A and B ?

A. $\frac{1}{2}$

B. $\frac{2}{1}$

C. $\frac{3}{2}$

D. $\frac{2}{3}$

**Answer: B**

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**15.** When the temperature of a gas, filled in a closed vessel is increased by $1^{\circ}C$ its pressure

increases by $0.4\%$. The initial temperature of the gas is,

A. $250^\circ C$

B. $25^\circ C$

C. 250 K

D. 25 K

**Answer: C**

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**16.** The equation of state for 5 g of oxygen at a pressure P and temperature T, when occupying a volume V, wll be

A. PV =(5/32) TR

B. PV=5RT

C. PV=(5/2) RT

D. PV= (5/16) RT

**Answer: A**

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**17.** A vessel contains 1 mole of $O_2$ gas (relative molar mass 32) at a temperature T. The pressure of the gas is P. An identical vessel containing one mole of He gas (relative molar mass 4) at temperature 2T has a pressure of

A. $\frac{P}{8}$

B. P

C. 2P

D. 8P

**Answer: C**

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**18.** In a certain region of space there are only 5 gaseous molecules per cm^3 on average. The temperature there is 3 K. The pressure of this gas is

$\left(k_B = 1.38 \times 10^{-23} Jmol^{-1} K^{-1}\right)$

A. $20.7 \times 10^{-17} Nm^{-2}$

B. $20.4 \times 10^{-17} Nm^{-2}$

C. $10.7 \times 10^{-16} Nm^{-2}$

D. $10.7 \times 10^{-17} Nm^{-2}$

**Answer: B**

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**19.** A sample of an ideal gas occupies a volume V at pressure P and absolute temperature T. The masss of each molecule is m, then the density of the gas is

A. mKT

B. $\frac{Pm}{KT}$

C. $\frac{P}{km}$

D. $\frac{P}{KT}$

**Answer: B**

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**20.** One half mole each of nitrogen, oxygen and carbon dioxide are mixed in enclosure of volume 5 litres and temperature $27^{\circ}C$.

Calculate the pressure exerted by the mixture.

Given $R = 8.31 Jmol^{-1}K^{-1}$.

A. $7.48 \times 10^5 Nm^{-2}$

B. $5 \times 10^5 Nm^2$

C. $6 \times 10^5 Nm^2$

D. $3 \times 10^5 Nm^{-2}$

**Answer: A**

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**21.** From a certain apparatus, the diffusion rate of hydrogen has an average value of $28.7 cm^3 s^{-1}$. The diffusion of another gas under the same condition is measured to have an average rate of $7.2 cm^3 s^{-1}$. Identify the gas.

A. Nitrogen

B. Helium

C. Argon

D. Oxygen

**Answer: D**

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**22.** The volume of water molecule is

(Take, density of water is $10^3 kgm^{-3}$ and Avogadro' number `=6 X 10^(23) mole^(-1))

A. $3 \times 10^{-28} m^3$

B. $3 \times 10^{-29} m^3$

C. $1.5 \times 10^{-28} m^3$

D. $1.5 \times 10^{-29} m^3$

**Answer: B**

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## Kinetic Theory Of An Ideal Gas

**1.** Which one of the following is not an assumption in the kinetic theory of gases? a) The volume occupied by the molecules of the gas is negligible. b) The force of attraction between the molecules is negligible. c) The

collision between the molecules are elastic. d) All molecules have same speed.

A. The volume occupied by the molecules of the gas is negligible.

B. The force of attraction between the molecules is negligable.

C. The collision between the molecules are elastic.

D. All molecules have same speed.

**Answer: D**

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**2.** Pressure of a gas at constant volume is proportional to a) total internal energy of the gas b) average kinetic energy of the molecules c) average potential energy of the molecules d) total energy of the gas

A. total internal energy of the gas

B. averatge kinetic energy of the molecules

C. average potential energy of the molecules

D. total energy of the gas

**Answer: A**

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**3.** The kinetic theory of gases gives the formula $PV = \frac{1}{3}Nmv^2$ for the pressure P exerted by a gas enclosed in a volume V. The term Nm represents

A. the mass of a mole of the gas

B. the mass of the present in the volume V

C. the averatge mass of one molecule of the gas

D. the total number of molecules present in volume V

**Answer: B**

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**4.** When an ideal gas is compressed adiabatically , its temperature rises the molecules on the average have more energy than before. The kinetic energy increases,

A. because of collision with moving parts of the wall only.

B. because of collisionws with the entire wall.

C. because the molecules gets accelerated in their motion inside the volume.

D. because the redistribution of energy amongst the molecules.

**Answer: A**

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**5.** A gas is filled in a container at pressure $P_0$. If the mass of molecules is halved and their rms speed is doubled, then the resultant pressure would be

A. $2P_0$

B. $4P_0$

C. $\frac{P_0}{4}$

D. $\frac{P_0}{2}$

**Answer: A**

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**6.** A vessel is filled with a gas at a pressure of 76 cm of mercury at a certain temperature. The mass of the gas is increased by 50% by

introducing more gas in the vessel at the same temperature. Find the resultant pressure of the gas. a) 76 cm of mercury b) 108 cm of mercury c) 112 cm mercury d) 114 cm of mercury

A. 76 cm of mercury

B. 108 cm of mercury

C. 112 cm mercury

D. 114 cm of mercury

**Answer: D**

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**7.** $0.014$ kg of nitrogen is enclosed in a vessel at a temperature of $24^\circ C$. At which temperature the rms velocity of nitrogen gas is twice itâ€™s the rms velocity at $27^\circ C$? a) 1200 K b) 600 K c) 300 K d) 150 K

A. 1200 K

B. 600 K

C. 300 K

D. 150 K

**Answer: A**

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**8.** At what temperature is the rms velocity of a hydrogen molecule equal to that of an oxygen molecule at $47^{\circ} C$? a) 10 K b) 20 K c) 30 K d) 40 K

A. 10 K

B. 20 K

C. 30 K

D. 40 K

**Answer: B**

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**9.** If three molecules have velocities $0.5kms^{-1}, 1kms^{-1}$ and $2kms^{-1}$, the ratio of the rms speed and average speed is a) 2.15 b) 1.13 c) 0.53 d) 3.96

A. $2.15$

B. $1.13$

C. $0.53$

D. $3.96$

**Answer: B**

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**10.** The kinetic energy of 1 g molecule of a gas, at normal temperature and pressure, is

A. $0.56 \times 10^{-4} J$

B. $2.4 \times 10^{-2} J$

C. $1.3 \times 10^{2} J$

D. $3.4 \times 10^{3} J$

**Answer: D**

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**11.** An insulated container containing monoatomic gas of molar mass m is moving with a velocity $V_0$. If the container is suddenly stopped , find the change in temperature .

A. $\frac{mv_0^2}{2R}$

B. $\frac{mv(0)^2}{3R}$

C. $\frac{R}{mv_0^2}$

D. $\frac{3mv_0^2}{2R}$

**Answer: B**

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**12.** Two moles of gas A at $27^\circ C$ mixed with a 3 moles of gas at $37^\circ C$. If both are monatomic

ideal gases, what will be the temperature of the mixture ?

A. $66^\circ C$

B. $11^\circ C$

C. $22^\circ C$

D. $33^\circ C$

**Answer: D**

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**13.** The average kinetic energy of $O_2$ at a particular temperatures is $0.768$ eV. The average kinetic energy of $N_2$ molecules in eV at the same temperature is

A. $0.0015$

B. $0.0030$

C. $0.048$

D. $0.768$

**Answer: D**

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**14.** Calculate the rms speed of smoke particles of mass $5 \times 10^{-17} kg$ in their Brownian motion in air at NTP. Given $k_B = 1.38 \times 10^{-23} J/K$

A. $3 \times 10^{-2} ms^{-1}$

B. $1.5 \times 10^{-2} ms^{-1}$

C. $3 \times 10^{-3} ms^{-1}$

D. $1.5 \times 10^{-3} ms^{-1}$

**Answer: B**

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**15.** The molecules of a given mass of a gas have root mean square speeds of $100ms^{-1}$ at $27^{\circ}C$ and 1.00 atmospheric pressure. What will be the root mean square speeds of the molecules of the gas at $127^{\circ}C$ and 2.0 atmospheric pressure?

A. $\frac{200}{\sqrt{3}}ms^{-1}$

B. $\frac{100}{\sqrt{3}} ms^{-1}$

C. $\frac{400}{3} ms^{-1}$

D. $\frac{200}{3} ms^{-1}$

**Answer: A**

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**16.** The temperature of an ideal gas is increased from $27^{\circ} C \rightarrow 127^{\circ} C$, the percentage increase in $V_{rms}$ is [2013]

A. $37\ \%$

B. $11\ \%$

C. $33\ \%$

D. $15.5\ \%$

**Answer: D**

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**17.** At what temperature is the root mean square speed of an atom in an argon gas cylinder equal to the r.m.s. speed of a helium

gas atom at $-20^{\circ}C$ ? (Atomic mass of Ar = 39.9 u, of He = 4.0 u).

A. $2.52 \times 10^{3} K$

B. $2.52 \times 10^{2} K$

C. $4.03 \times 10^{3} K$

D. $4.03 \times 10^{2} K$

**Answer: A**

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**18.** The temperature of an ideal gas is increased from 120 K to 480 K. If at 120 K the root mean square velocity of the gas molecules is v, at 480 K it becomes

A. $4v_{rms}$

B. $2v_{rms}$

C. $\frac{2v_{rms}}{2}$

D. $\frac{v_{rms}}{4}$

**Answer: B**

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## Law Of Equipartition Of Energy

**1.** According to the law of equipartition of energy, the energy associated with each degree of freedom is :

A. $E = k_B T$

B. $E = \frac{1}{2} k_B T$

C. $E = 3k_B T$

D. $E = \frac{3}{2} k_B T$

**Answer: D**

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**2.** The internal energy of one gram of helium at 100 K and one atmospheric pressure is

A. 100 J

B. 1200 J

C. 300 J

D. 500 J

**Answer: C**

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**3.** One kg of a diatomic gas is at pressure of $8 \times 10^4 N/m^2$. The density of the gas is $4kg/m^3$. What is the energy of the gas due to its thermal motion?

A. $3 \times 10^4 J$

B. $5 \times 10^4 J$

C. $6 \times 10^4 J$

D. $4 \times 10^4 J$

**Answer: B**

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**4.** A gas mixture consists of 2 moles of oxygen and 4 of Argon at temperature T. Neglecting all vibrational modes, the total internal energy of the system is

A. 4 RT

B. 9 RT

C. 11 RT

D. 15 RT

**Answer: C**

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**5.** The average energy per molecule of a triatomic gas at room temperature T is

A. 3kT

B. $\frac{1}{2}kT$

C. $\frac{3}{2}kT$

D. $\frac{5}{2}kT$

**Answer: A**

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## Specific Ceat Capacity

**1.** If for a gas, $\frac{R}{C_V} = 0.67$, the gas is

A. monatomic

B. diatomic

C. polyatomic

D. mixture of aiatomic and polyatomic molecules

**Answer: A**

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**2.** If $C_p$ and $C_v$ denoted the specific heats of unit mass of nitrogen at constant pressure and volume respectively, then

A. $C_p = C_v = \frac{R}{28}$

B. $C_p - C_v = \frac{R}{7}$

C. $C_p - C_v = \frac{R}{14}$

D. $C_p - C_v = R$

**Answer: A**

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**3.** The ratio of the molar heat capacities of a diatomic gas at constant pressure to that at constant volume is

A. $\frac{7}{5}$

B. $\frac{3}{2}$

C. $\frac{3}{5}$

D. $\frac{5}{2}$

**Answer: A**

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**4.** The heat capacity per mole of water is (R is universal gas constant)

A. 9R

B. $\frac{9}{2}R$

C. 6R

D. 5R

**Answer: A**

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**5.** Three moles of oxygen ar mixed with two moles of helium. What will be the ratio of specific heats at constant pressure and constant volume for the mixture ?

A. $2.5$

B. $3.5$

C. $1.5$

D. 1

**Answer: C**

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**6.** A gaseous mixture enclosed in a vessel consists of one gram mole of a gas A with $\gamma = \left(\frac{5}{3}\right)$ and some amount of gas B with $\gamma = \frac{7}{5}$ at a temperature T.

The gases A and B do not react with each other and are assumed to be ideal. Find the number of gram moles of the gas B if $\gamma$ for the gaseous mixture is $\left(\frac{19}{13}\right)$.

A. 2

B. 12

C. 16

D. 8

**Answer: A**

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**7.** A cylinder of fixed capacity $44.8$ litres constains helium gas at standard temperature and pressure. What is the amount of heat needed to raise the temperature of the gas in the cylinder by $15^{\circ}C$ ? Given

$R = 8.31 jmole^{-1}K^{-1}$ . (For monoatomic gas, $C_v = 3R/2$)

A. 265 J

B. $310.10J$

C. $373.95J$

D. $387.97J$

**Answer: C**

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**8.** $(1/2)$ mole of helium is contained in a container at STP how much heat energy is needed to double the pressure of the gas, keeping the volume constant? Heat capacity of gas is $3Jg^{-1}K^{-1}$.

A. 1436 J

B. 736 J

C. 1638 J

D. 5698 J

**Answer: C**

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**9.** One mole of an ideal monoatomic gas at temperature $T_0$ expands slowly according to the law $\frac{p}{V}$ = constant. If the final temperature is $2T_0$, heat supplied to the gas is

A. $2RT_0$

B. $RT_o$

C. $\frac{3}{2}RT_0$

D. $\frac{1}{2}RT_0$

**Answer: A**

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**10.** If a gas has n degrees of freedom ratio of specific heats of gas is

A. $\frac{1+n}{2}$

B. $1+\frac{1}{n}$

C. $1+\frac{n}{2}$

D. $1+\frac{2}{n}$

**Answer: D**

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**11.** 1 mole of a gas with $\gamma = 7/5$ is mixed with 1 mole of a gas with $\gamma = 5/3$, then the value of $\gamma$ for the resulting mixture is

A. $\frac{7}{5}$

B. $\frac{2}{5}$

C. $\frac{3}{2}$

D. $\frac{12}{7}$

**Answer: C**

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**12.** A lomecole of a gas has six degrees of freedom. Then the molar specific heat of the gas at constant volume is

A. $\frac{R}{2}$

B. R

C. $\frac{3R}{2}$

D. 3R

**Answer: D**

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**13.** Two moles of oxygen are mixed with eight moles of helium. The effective specific heat of the mixture at constant volume is

A. $1.3R$

B. $1.4R$

C. $1.7R$

D. $1.9R$

**Answer: C**

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## Hots

**1.** N molecules each of mass m of gas A and 2 N molecules each of mass 2m of gas B are contained in the same vessel which is maintined at a temperature T. The mean square of the velocity of the molecules of B type is denoted by $v^2$ and the mean square of

the x-component of the velocity of a tye is denoted by $\omega^2$. What is the ratio of $\omega^2 / v^2 = ?$

A. $3:2$

B. $1:3$

C. $2:3$

D. $1:1$

**Answer: C**

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**2.** Two cylinder having $m_1 g$ and $m_2 g$ of a gas at pressure $P_1$ and $P_2$ respectively are put in cummunication with each other, temperature remaining constant. The common pressure reached will be

A. $\dfrac{P_1 P_2 (m_1 + m_2)}{P_2 m_1 + P_1 m_2}$

B. $\dfrac{P_1 P_2 m_1}{P_2 m_1 + P_1 m_2}$

C. $\dfrac{m_1 m_2 (P_1 + P_2)}{P_2 m_1 (P_1 + P_2)}$

D. $\dfrac{m_1 m_2 P_2}{P_2 m_1 + P_1 m_2}$

**Answer: A**

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**3.** A gas in a cylinder. Its temperature is increased by $20\%$ on kelvin sacle and volume is reduced to $90\%$ how much percentage of the gas has to leak for pressure to remain constant?

A. $20\%$

B. $25\%$

C. $30\%$

D. $40\%$

**Answer: B**

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**4.** A thin tube of uniform cross-section is sealed at both ends. It lies horizontally, the middle 5 cm containing mercury and the two equal end containing air at the same pressure P. When the tube is held at an angle of $60^\circ$ with the vetical direction, the length of the air column above and below the mercury column are 46 cm and 44.5 cm respectively. Calculate

the pressure P in centimeters of mercury. (The temperature of the system is kept at $30^{\circ} C$).

A. $75.4$

B. $45.8$

C. $67.5$

D. $89.3$

**Answer: A**

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**5.** An insulated container containing monoatomic gas of molar mass m is moving with a velocity $V_0$. If the container is suddenly stopped , find the change in temperature .

A. $\frac{mv_0^2}{2R}$

B. $\frac{mv_0^2}{3R}$

C. $\frac{3mv_0^2}{2R}$

D. $\frac{1}{2}\frac{mv_0^2}{R}$

**Answer: B**

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**6.** A gas has molar heat capacity $C = 37.55 J \text{mole}^{-1} K^{-1}$, in the process PT = constant, find the number of degree of freedom of the molecules of the gas.

A. 6

B. 3

C. 1

D. 5

**Answer: D**

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**7.** Calculate the mean free path of nitogen at $27^{\circ}C$ when pressure is 1.0 atm. Given, diameter of nitogen molecule = $1.5\text{Å}$, $k = 1.38 \times 10^{-23} JK^{-1}$. If the average speed of nitrogen molecules is $675 ms^{-1}$, find the time taken by the molecule between two successive collsions and the frequency of collisions.

A. 0.6 ns

B. 0.4 ns

C. 0.8 ns

D. 0.3 ns

**Answer: A**

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**8.** Ten small planes are flying at a speed of $150km/h$ in total darkness in an air space that is $20 \times 20 \times 1.5km^3$ in volume. You are in

one of the planes, flying at random within this space with no way of knowing where the other planes are, On the average about how long a time will elapse between near collision with your plane. Assume for this rough computation that a safety region around the plane can be approximately by a sphere of radius 10 m.

A. 125 h

B. 220 h

C. 432 h

D. 225 h

**Answer: D**

View Text Solution

**9.** Two identical containers A and B with frictionless pistons contain the same ideal gas at the same temperature and the same velocity V. The mass of the gas in A is $m_A$, and that in B is $m_B$. The gas in each cylinder is now allowed to expand isothermally to the same

final volume 2V. The changes in the pressure in A and B are found to be $\Delta P$ and $1.5\Delta P$ respectively. Then

A. 1. $4m_A = 9m_B$

B. 2. $2m_A = 3m_B$

C. 3. $3m_A = 2m_B$

D. 4. $9m_A = 4m_B$

**Answer: C**

Watch Video Solution

**10.** Consider a rectangular block of wood moving with a velocity $v_0$ in a gas at temperature T and mass density p. Assume the velocity is along x-axis and the are of cross-section of the block perpendicular to $v_0$ is A. show that the drag force on the block is $4rAv_0\sqrt{\frac{kT}{m}}$ where,m is the mass of the gas molecule.

A. $4pAv_0\sqrt{\frac{kT}{m}}$

B. $2pAv_0\sqrt{\frac{kT}{3m}}$

C. $\frac{pA}{2v_0}\sqrt{\frac{kT}{m}}$

D. $\frac{v_0}{pA}\sqrt{\frac{kT}{2m}}$

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Watch Video Solution

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**1.** A cubic vessel (with face horizontal + vetical ) contains an ideal gas at NTP. The vessel is being carried by a rocket which is moving at a speed of $500ms^{-1}$ in vertical direction. The

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C. will increase by a factor equal to $\left[v_{rms}^2 + (500)^2\right] / v_{rms}^2$, where $v_{rms}$ was

the original mean square velocity of the gas

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Watch Video Solution

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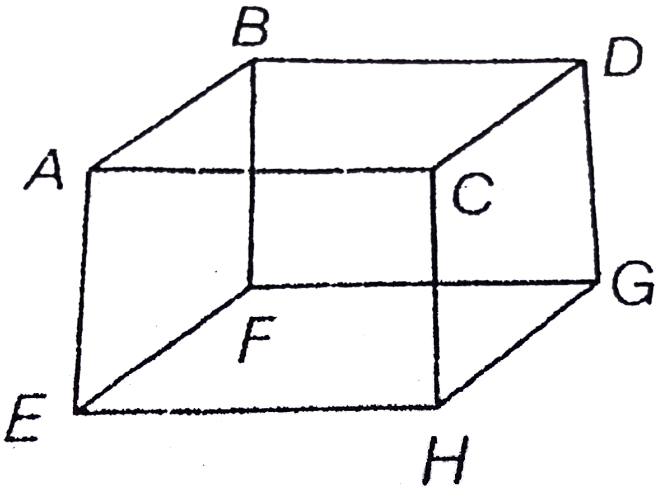
material which totally absorbs any gas molecule incident on it .At any given time.

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Watch Video Solution

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D. isochoric process

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Watch Video Solution

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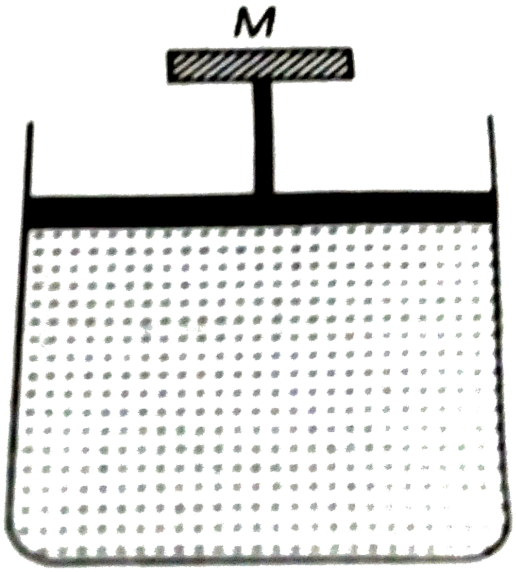


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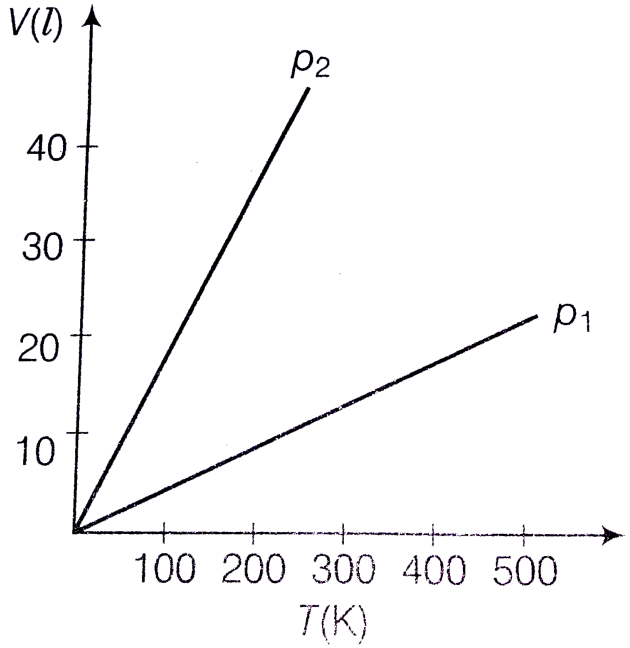


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Watch Video Solution

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Watch Video Solution

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C. less than P

D. between P and 1.1 P.

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Watch Video Solution

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Reason: There is no attraction between the molecules in an ideal gas.

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**Answer: D**

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Reason: $c_{rms}c_{av}$.

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D. If both assertion and reason are false.

**Answer: B**

 Watch Video Solution

**7.** Assertion: For a mixture of non reactive ideal gases, the total pressure gets contribution from each gas in the mixture.

Reason: In equilibrium, the average kinetic energy of the molecules of different gases will be equal.

A. If both assertion and reason are true and reason is the correct explanation os assertion.

B. If both assertion and reason are true but reason is not be correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: B**

 Watch Video Solution

**8.** Assertion: Each vibrational mode gives two degrees of freedom.

Reason: By law of equipartition of energy, the energy for each degree of freedom in thermal equlibrium is $2k_BT$.

A. If both assertion and reason are true and reason is the correct explanation os assertion.

B. If both assertion and reason are true but reason is not be correct explanation of

assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: C**

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**9.** Assetion : Specific heat of a gas at constant pressure is greater than its specific heat at constant volume.

This is because at constant pressure, some heat is spent in expansion of the gas.

A. If both assertion and reason are true and reason is the correct explanation os assertion.

B. If both assertion and reason are true but reason is not be correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: A**

Watch Video Solution

**10.** Assertion : The ratio $C_P / C_v$ for a diatomic gas is more than that for a monoatomic gas.

Reason : The moleculess of a monoatomic gas have more degrees of freedom than those of a diatomic gas.

A. If both assertion and reason are true and reason is the correct explanation os

assertion.

B. If both assertion and reason are true but reason is not be correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: D**

 Watch Video Solution

## Specific Heat Capacity

**1.** If for a gas, $\frac{R}{C_V} = 0.67$, the gas is

A. monatomic

B. diatomic

C. polyatomic

D. mixture of aiatomic and polyatomic molecules

**Answer: A**

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**2.** If $C_p$ and $C_v$ denoted the specific heats of unit mass of nitrogen at constant pressure and volume respectively, then

A. $C_p = C_v = \frac{R}{28}$

B. $C_p - C_v = \frac{R}{7}$

C. $C_p - C_v = \frac{R}{14}$

D. $C_p - C_v = R$

**Answer: A**

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**3.** The ratio of the molar heat capacities of a diatomic gas at constant pressure to that at constant volume is

A. $\frac{7}{5}$

B. $\frac{3}{2}$

C. $\frac{3}{5}$

D. $\frac{5}{2}$

**Answer: A**

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**4.** The heat capacity per mole of water is (R is universal gas constant)

A. 9R

B. $\frac{9}{2}R$

C. 6R

D. 5R

**Answer: A**

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**5.** Three moles of oxygen ar mixed with two moles of helium. What will be the ratio of specific heats at constant pressure and constant volume for the mixture ?

A. $2.5$

B. $3.5$

C. $1.5$

D. $1$

**Answer: C**

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**6.** A gaseous mixture enclosed in a vessel consists of one gram mole of a gas A with $\gamma = \left(\frac{5}{3}\right)$ and some amount of gas B with $\gamma = \frac{7}{5}$ at a temperature T.

The gases A and B do not react with each other and are assumed to be ideal. Find the number of gram moles of the gas B if $\gamma$ for the gaseous mixture is $\left(\frac{19}{13}\right)$.

A. 2

B. 12

C. 16

D. 8

**Answer: A**

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**7.** A cylinder of fixed capacity $44.8$ litres constains helium gas at standard temperature and pressure. What is the amount of heat

needed to raise the temperature of the gas in the cylinder by $15^{\circ}C$ ? Given $R = 8.31 jmole^{-1}K^{-1}$ . (For monoatomic gas, $C_v = 3R/2$)

A. 265 J

B. $310.10J$

C. $373.95J$

D. $387.97J$

**Answer: C**

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**8.** $(1/2)$ mole of helium is contained in a container at STP how much heat energy is needed to double the pressure of the gas, keeping the volume constant? Heat capacity of gas is $3Jg^{-1}K^{-1}$.

A. 1436 J

B. 736 J

C. 1638 J

D. 5698 J

**Answer: C**

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**9.** One mole of an ideal monoatomic gas at temperature $T_0$ expands slowly according to the law $\frac{p}{V}$ = constant. If the final temperature is $2T_0$, heat supplied to the gas is

A. $2RT_0$

B. $RT_o$

C. $\frac{3}{2}RT_0$

D. $\frac{1}{2}RT_0$

**Answer: A**

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**10.** If a gas has n degrees of freedom ratio of specific heats of gas is

A. $\frac{1+n}{2}$

B. $1+\frac{1}{n}$

C. $1+\frac{n}{2}$

D. $1 + \frac{2}{n}$

**Answer: D**

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**11.** 1 mole of a gas with $\gamma = 7/5$ is mixed with 1 mole of a gas with $\gamma = 5/3$, then the value of $\gamma$ for the resulting mixture is

A. $\frac{7}{5}$

B. $\frac{2}{5}$

C. $\frac{3}{2}$

D. $\frac{12}{7}$

**Answer: C**

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**12.** A lomecole of a gas has six degrees of freedom. Then the molar specific heat of the gas at constant volume is

A. $\frac{R}{2}$

B. R

C. $\frac{3R}{2}$

D. 3R

**Answer: D**

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**13.** Two moles of oxygen are mixed with eight moles of helium. The effective specific heat of the mixture at constant volume is

A. $1.3R$

B. $1.4R$

C. $1.7R$

D. $1.9R$

**Answer: C**

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## Higher Order Thinking Skills

**1.** N molecules each of mass m of gas A and 2 N molecules each of mass 2m of gas B are contained in the same vessel which is maintined at a temperature T. The mean square of the velocity of the molecules of B type is denoted by $v^2$ and the mean square of the x-component of the velocity of a tye is denoted by $\omega^2$. What is the ratio of $\omega^2 / v^2 = ?$

A. $3:2$

B. $1:3$

C. $2:3$

D. $1:1$

**Answer: C**

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**2.** Two cylinder having $m_1 g$ and $m_2 g$ of a gas at pressure $P_1$ and $P_2$ respectively are put in cummunication with each other, temperature remaining constant. The common pressure reached will be

A. $\frac{P_1P_2(m_1+m_2)}{P_2m_1+P_1m_2}$

B. $\frac{P_1P_2m_1}{P_2m_1+P_1m_2}$

C. $\frac{m_1m_2(P_1+P_2)}{P_2m_1(P_1+P_2)}$

D. $\frac{m_1m_2P_2}{P_2m_1+P_1m_2}$

**Answer: A**

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**3.** A gas in a cylinder. Its temperature is increased by $20\,\%$ on kelvin sacle and volume is reduced to $90\,\%$ how much percentage of

the gas has to leak for pressure to remain constant?

A. $20\ \%$

B. $25\ \%$

C. $30\ \%$

D. $40\ \%$

**Answer: B**

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**4.** A thin tube of uniform cross-section is sealed at both ends. It lies horizontally, the middle 5 cm containing mercury and the two equal end containing air at the same pressure P. When the tube is held at an angle of $60^\circ$ with the vetical direction, the length of the air column above and below the mercury column are 46 cm and 44.5 cm respectively. Calculate the pressure P in centimeters of mercury. (The temperature of the system is kept at $30^\circ C$).

A. $75.4$

B. $45.8$

C. $67.5$

D. $89.3$

**Answer: A**

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**5.** An insulated container containing monoatomic gas of molar mass m is moving with a velocity $V_0$. If the container is suddenly stopped , find the change in temperature .

A. $\frac{mv_0^2}{2R}$

B. $\frac{mv_0^2}{3R}$

C. $\frac{3mv_0^2}{2R}$

D. $\frac{1}{2}\frac{mv_0^2}{R}$

**Answer: B**

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**6.** A gas has molar heat capacity $C = 37.55 J \text{mole}^{-1} K^{-1}$, in the process PT =

constant, find the number of degree of freedom of the molecules of the gas.

A. 6

B. 3

C. 1

D. 5

**Answer: D**

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**7.** Calculate the mean free path of nitogen at $27^{\circ}C$ when pressure is 1.0 atm. Given, diameter of nitogen molecule = $1.5\text{Å}$, $k = 1.38 \times 10^{-23} JK^{-1}$. If the average speed of nitrogen molecules is $675 ms^{-1}$, find the time taken by the molecule between two successive collsions and the frequency of collisions.

A. 0.6 ns

B. 0.4 ns

C. 0.8 ns

D. 0.3 ns

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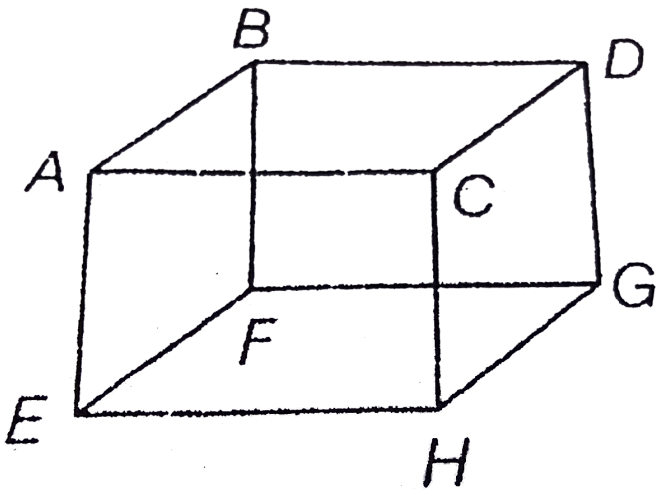


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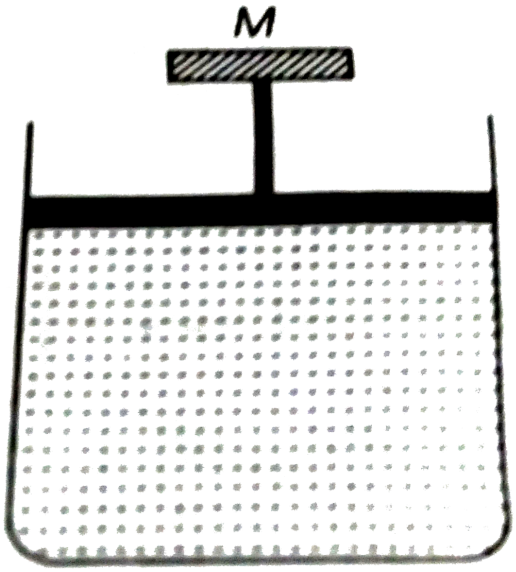


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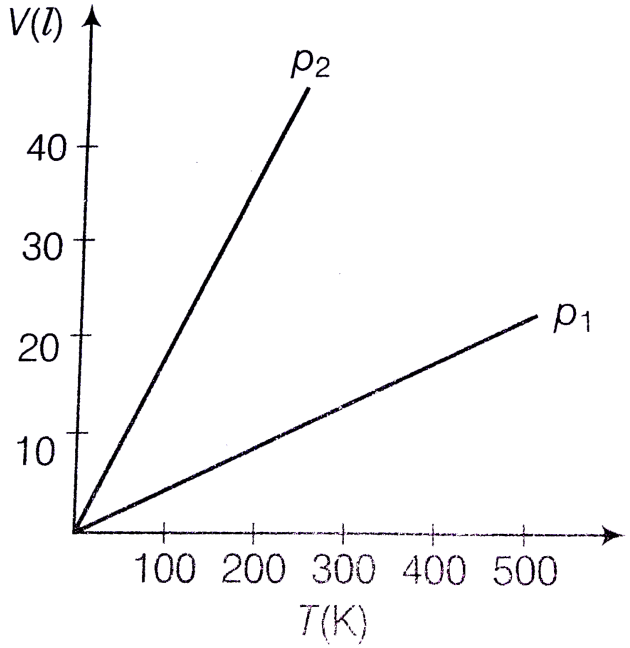


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**Answer: B**

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**7.** Assertion: For a mixture of non reactive ideal gases, the total pressure gets contribution from each gas in the mixture.

Reason: In equilibrium, the average kinetic energy of the molecules of different gases will be equal.

A. If both assertion and reason are true and reason is the correct explanation os assertion.

B. If both assertion and reason are true but reason is not be correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: B**

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**8.** Assertion: Each vibrational mode gives two degrees of freedom.

Reason: By law of equipartition of energy, the energy for each degree of freedom in thermal equlibrium is $2k_BT$.

A. If both assertion and reason are true and reason is the correct explanation os assertion.

B. If both assertion and reason are true but reason is not be correct explanation of

assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: C**

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**9.** Assetion : Specific heat of a gas at constant pressure is greater than its specific heat at constant volume.

This is because at constant pressure, some heat is spent in expansion of the gas.

A. If both assertion and reason are true and reason is the correct explanation os assertion.

B. If both assertion and reason are true but reason is not be correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: A**

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**10.** Assertion : The ratio $C_P / C_v$ for a diatomic gas is more than that for a monoatomic gas.

Reason : The moleculess of a monoatomic gas have more degrees of freedom than those of a diatomic gas.

A. If both assertion and reason are true and reason is the correct explanation os

assertion.

B. If both assertion and reason are true but reason is not be correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: D**

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