PHYSICS

BOOKS - MTG GUIDE PHYSICS (HINGLISH)

BEHAVIOUR OF PERFECT GAS AND KINETIC THEORY

Illustration

1. An electric bulb of volume 300 cm^3 is sealed at temperature 300 K and pressure 10^{-4} mm of mercury. Find the number of air molecules in the

bulb.

(Given,

$\sigma = 13.6 \times 10^3 kgm^{-3}$ and $k_B = 1.38 \times 10^{-23} jK^{-1}$

)

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2. An enclosure of volume 3 litre contains $16g$ of oxygen, $7g$ of nitrogen and $11g$ of carbon - di-oxide at $27^\circ C$. The pressure exerted by the mixture is approximately

$\left[R = 0.0821 lit \text{atm mole}^{-1} K^{-1}\right]$

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3. A gas cylinder has walls that can bear a maximum pressure of $1.0 \times 10^6 Pa$. It contains a gas at $8.0 \times 10^5 Pa$ and $300K$. The cylinder is steadily heated. Neglecting any change in the volume calculate the temperature at which the cylinder will break.

A. 325 K

B. 350 K

C. 375 K

D. 400 K

Answer: C

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4. If masses of all molecules of a gas are halved and the speed doubled. Then the ratio of initial and final pressure is :

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5. Two perfect gases at absolute temperature T_1 and T_2 are mixed. There is no loss of energy. The masses of the molecules are m_1 and m_2. The

number of molecules in the gases are n_1 and n_2. The temperature of the mixture is

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6. Two vessels of the same volume and filled with the same gas at the same temperature. If the pressure of the gas in these vessel be in the ratio 1:2, then state : (i) the ratio of the rms speeds of the molecules, (ii) the ratio of the number of molecules.

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7. A vessel contains a mixture of one mole of oxygen and two moles of nitrogen at 300K. The ratio of the average rorational kinetic energy per O_2 molecules to that per N_2 molecules is

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8. The pressure of a gas kept in an isothermal container is $200Kpa$. If half the gas is removed from it, the pressure will be

A. 100 kPa

B. 200 kPa

C. 400 kPa

D. 800 kPa

Answer: A

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9. One mole of ideal monoatomic gas $(\gamma = 5/3)$ is mixed with one mole of diatomic gas $(\gamma = 7/5)$. What is γ for the mixture? γ Denotes the ratio of specific heat at constant pressure, to that at constant volume

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10. What amount of heat must be supplied to 2.0×10^{-2} kg of nitrogen (at room temperature) to raise the temperature by $45^{\circ}C$ at constant pressure. Molecular mass of $N_2 = 28, R = 8.3 J \text{mol}^{-1} K^{-1}$.

A. 614 J

B. 756 J

C. 892 J

D. 934 J

Answer: D

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11. Two cylinders A and B fitted with pistons contain equal amounts of an ideal diatomic gas at 300K. The piston of A is free to move, while that B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30K, then the rise in temperature of the gas in B is

A. 30 K

B. 18 K

C. 50 K

D. 42 K

Answer: D

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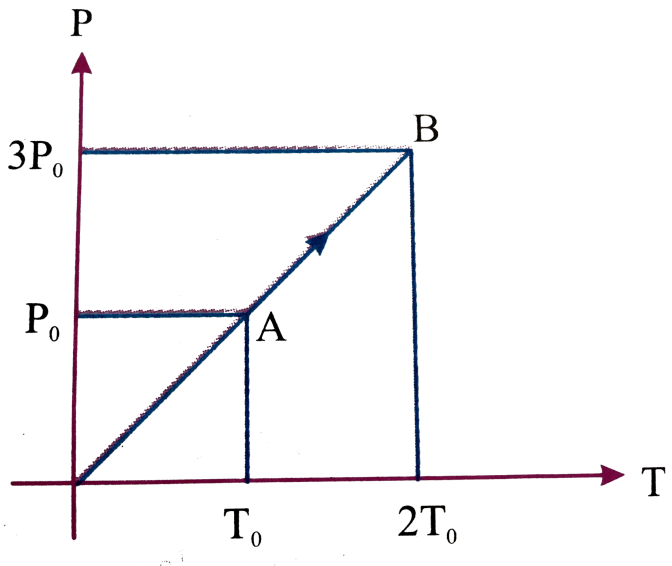
Topicwise Practice Questions Equation Of State Of A Perfect Gas

1. Pressure versus temperature graph of an ideal gas is shown in figure. Density of the gas at point A

is ρ_0. Density at B will be



A. $\frac{3}{4}\rho_0$

B. $\frac{3}{2}\rho_0$

C. $\frac{4}{3}\rho_0$

D. $2\rho_0$

Answer: B

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2. 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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3. A cylinder contains 12 litres of oxygen at $20^{\circ}C$ and 15 atm pressure. The temperature of the gas is raised to $35^{\circ}C$ and its volume increased to 17 litres. What is the final pressure of gas (in atm)?

A. 9

B. 11

C. 15

D. 17

Answer: B

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4. 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. becomes four times

Answer: B

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5. The temperature of a gas contained in a closed vessel increases by $1^{\circ}C$ when pressure of the gas is increased by 1%. The initial temperature of the gas is

A. 100 K

B. $100^{\circ}C$

C. 200 K

D. $250^{\circ}C$

Answer: A

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6. From the relation PV = RT, calculate the value of the constant R for one gram mole of an ideal gas (in cal / K)

A. $2Jmol^{-1}K^{-1}$

B. $8.3calmol^{-1}K^{-1}$

C. $4.2Jmol^{-1}K^{-1}$

D. $2calmol^{-1}K^{-1}$

Answer: D

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7. Two flasks R and S of volume V_1 and V_2 contain same gas at pressure P_1 and P_2 respectively at the same temperature. Pressure of the gas when the flasks R and S are connected by a tube of negligible volume is

A. $\frac{P_1V_1 + P_2V_2}{V_1 + V_2}$

B. $\frac{P_1V_1 + P_2V_2}{2(V_1 + V_2)}$

C. $\frac{P_1V_2 + P_2V_1}{V_1 + V_2}$

D. $\frac{(P_1 + P_2)(V_1 + V_2)}{(V_1 + 2V_2)}$

Answer: A

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8. 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. 100

B. 10^5

C. 10^8

D. 10^{11}

Answer: B

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9. Two containers of equal volume contain the same gas at pressure P_1 and P_2 and absolute temperature T_1 and T_2, respectively. On joining the vessels, the gas reaches a common pressure P and common temperature T. The ratio P/T is equal to

A. $\frac{P_1}{T_1} + \frac{P_2}{T_2}$

B. $\frac{1}{2}\left[\frac{P_1}{T_1} + \frac{P_2}{T_2}\right]$

C. $\frac{P_1T_2 + P_2T_1}{T_1 + T_2}$

D. $\frac{P_1T_2 - P_2T_1}{T_1 - T_2}$

Answer: B

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

A. $1500m^3$

B. $1700m^3$

C. $1900m^3$

D. $2700m^3$

Answer: D

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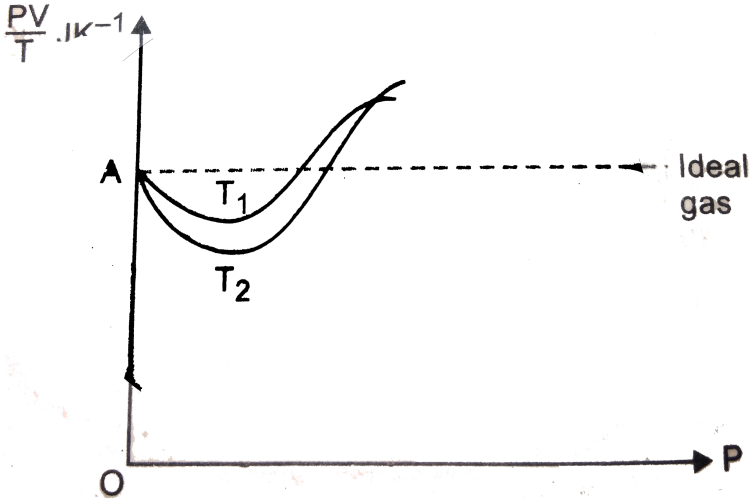
11. Given is the graph between $\frac{PV}{T}$ and P for 1 gm of oxygen gas at two different temperatures T_1 and T_2 Fig. Given, density of oxygen $= 1.427kgm^{-3}$. The value of $(PV)/(T)$ at the point A and the relation between T_1 and T_2 are

respectively :



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

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

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

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

Answer: C

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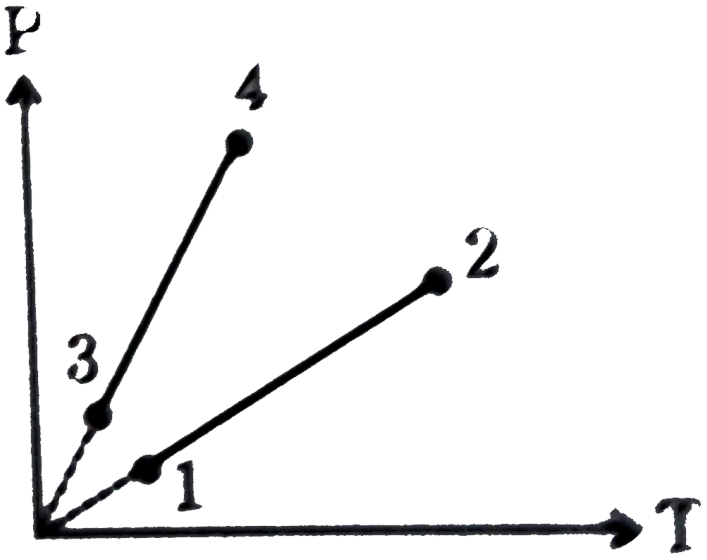
12. Pressure versus temperature graph of an ideal gas of equal number of moles of different volumes is plotted as shown in figure. Choose the correct alternatives.



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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13. Aperfect gas at $27^\circ C$ is heated at constant pressure soas to duuble its volume. The increase in temperature of the gas will be

A. $600^\circ C$

B. $327^\circ C$

C. $300^\circ C$

D. $54^\circ C$

Answer: C

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14. A gas enclosed in a vessel has pressure P, volume V and absolute temperature T, write the formula for number of molecule N of the gas.

A. $\frac{PV}{RT}$

B. $\frac{PV}{k_B T}$

C. $\frac{PR}{T}$

D. PV

Answer: B

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Topicwise Practice Questions Kinetic Theory Of Gases And Kinetic Interpretation Of Temperature

1. The mean translational kinetic energy of a perfect gas molecule at the temperature Tk is :

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

B. k_BT

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

D. $2k_BT$

Answer: C

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2. The average translational kinetic energy of O_2 (molar mass 32) molecules at a particular temperature is $0.048eV$. The translational kinetic energy of N_2 (molar mass 28) molecules in (eV) at

the same temperature is (JEE 1997)

(a) 0.0015 (b) 0.003 (c) 0.048 (d) 0.768

A. 0.0015

B. 0.003

C. 0.048

D. 0.768

Answer: C

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3. 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. 7.5 kg

B. 10.5 kg

C. 5.2 kg

D. 2.5 kg

Answer: A

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4. The average kinetic energy of gas molecule at $27^\circ C$ is 6.21×10^{-21} J. Its average kinetic energy at $127^\circ C$ will be

A. $52.2 \times 10^{-21} J$

B. $5.22 \times 10^{-21} J$

C. $10.35 \times 10^{-21} J$

D. $11.35 \times 10^{-21} J$

Answer: C

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5. Two perfect gases having masses m_1 and m_2 at temperatures T_1 and T_2 respectively are mixed without any loss of energy. If the molecular weights of the gas are M_1 and M_2 respectively, then the final temperature of the mixture is

A. $\frac{(m_1T_1 + m_2T_2)}{(m_1 + m_2)}$

B. $\frac{(M_1T_1 + M_2T_2)}{(M_1 + M_2)}$

C. $\frac{\left[\left(\frac{m_1T_1}{M_1}\right) + \left(\frac{m_2T_2}{M_2}\right)\right]}{\left[\left(\frac{m_1}{M_1}\right) + \left(\frac{m_2}{M_2}\right)\right]}$

D. $\frac{\left[\frac{M_1T_1}{m_1} + \frac{M_2T_2}{m_2}\right]}{\left[\left(\frac{M_1}{m_1}\right) + \left(\frac{M_2}{m_2}\right)\right]}$

Answer: C

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

A. the mass of a mole of the gas

B. the mass of the gas present in the volume V

C. the average mass of one molecule of the gas

D. the total number of molecules present in volume V

Answer: B

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7. 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

Answer: D

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8. Average kinetic energy of a gas molecule is

A. proportional to pressure of gas

B. inversely proportional to volume of gas

C. inversely proportional to absolute temperature of gas

D. proportional to absolute temperature of gas

Answer: D

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9. According to kinetic theory of gases, molecules of a gas behave like

A. inelastic spheres

B. perfectly elastic rigid spheres

C. perfectly elastic non-rigid spheres

D. inelastic non-rigid spheres

Answer: B

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10. The average kinetic energy of one molecule of an ideal gas at $27^\circ C$ and 1 atm pressure is [Avogadro number $N_A = 6.023 \times 10^{23}$]

A. $3.1 \times 10^{-20} J$

B. $3.5 \times 10^{-21} J$

C. $5.3 \times 10^{-18} J$

D. $6.21 \times 10^{-21} J$

Answer: D

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11. At $27^{\circ} C$ temperature, the kinetic energy of an ideal gas is E_1. If the temperature is increassed to $327^{\circ} C$, then the kinetic energy will be

A. $\frac{E_1}{2}$

B. $\frac{E_1}{\sqrt{2}}$

C. $\sqrt{2}E_1$

D. $2E_1$

Answer: D

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Topicwise Practice Questions Law Of Equipartition Of Energy And Application To Specific Heat Capacities

1. A gas is formed of molecules each molecules possessing f degrees of freedom, then the value of $\gamma = \frac{C_P}{C_V}$ is equal to

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

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

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

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

Answer: B

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2. For nitrogen $C_p - C_V = x$ and for argon $C_P - C_V$=Y.The relation between x and y is given by

A. $x = y$

B. $x = 7y$

C. $y = 7x$

D. $x = (1/2)y$

Answer: A

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3. A gaseous mixture consists of 16g of helium and 16 g of oxygen. The ratio $\frac{C_p}{C_v}$ of the mixture is

A. 1.4

B. 1.54

C. 1.59

D. 1.62

Answer: D

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4. The ratio $\frac{C_p}{C_v} = \gamma$ for a gas. Its molecular weight is M. Its specific heat capacity at constant pressure is

A. $\frac{R}{\gamma - 1}$

B. $\frac{\gamma R}{\gamma - 1}$

C. $\frac{\gamma R}{M(\gamma - 1)}$

D. $\frac{\gamma RM}{(\gamma - 1)}$

Answer: C

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5. One mole of a monatomic gas is mixed with 3 moles of a diatomic gas. What is the molar specific heat of the mixture at constant volume?

A. $\frac{5}{4}R$

B. $\frac{9}{4}R$

C. $\frac{3}{4}R$

D. R

Answer: B

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6. One kg of a diatomic gas is at a pressure of $8 \times 10^4 Nm^{-2}$ the density of the gas if $4kg/m^g$ .What is the energy of the gas due to its thermal mole

A. $3 \times 10^4 J$

B. $5 \times 10^4 J$

C. $6 \times 10^4 J$

D. $7 \times 10^4 J$

Answer: B

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7. The internal energy of one geam 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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8. If one mole of a monatomic gas $\left(\gamma = \frac{5}{3}\right)$ is mixed with one mole of a diatomic gas $\left(\gamma = \frac{7}{5}\right)$, the value of gamma for mixture is

A. 1.40

B. 1.50

C. 1.53

D. 3.07

Answer: B

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9. The total internal energy of one mole of rigid diatomic gas is

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

B. $\frac{7}{2}RT$

C. $\frac{5}{2}RT$

D. $\frac{9}{2}RT$

Answer: C

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10. 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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11. 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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12. For a gas molecule with 6 degrees of freedom the law of equipartition of energy gives the following relation between the molar specific heat (C_V) and gas constant (R)

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

B. $C_V = R$

C. $C_V = 2R$

D. $C_V = 3R$

Answer: D

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13. If for a gas $\frac{R}{C_v} = 0.67$, this gas is made up of molecules, which are :

A. monatomic

B. diatomic

C. polyatomic

D. mixture of diatomic and polyatomic molecules

Answer: A

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14. If γ be the ratio of specific heats $(C_p \& C_v)$ for a perfect gas. Find the number of degrees of freedom of a molecules of the gas?

A. $\frac{25}{2}(\gamma - 1)$

B. $\frac{3\gamma - 1}{2\gamma - 1}$

C. $\frac{2}{\gamma - 1}$

D. $\frac{9}{2}(\gamma - 1)$

Answer: C

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Topicwise Practice Questions Mean Free Path

1. Mean free path of a gas molecule is

A. inversely proportional to number of molecules per unit volume

B. inversely proportional to diameter of the molecule

C. directly proportional to the square root of the absolute temperature

D. directly proportional to the pressure

Answer: A

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Check Your Neet Vitals

1. About 0.014 kg nitrogen is enclosed in a vessel at temperature of $27^{\circ}C$ How much heat has to be transferred to the gas to double the rms speed of its molecules ? $(R = 2cal/molK)$

A. 1200 K

B. 600 K

C. 300 K

D. 150 K

Answer: A

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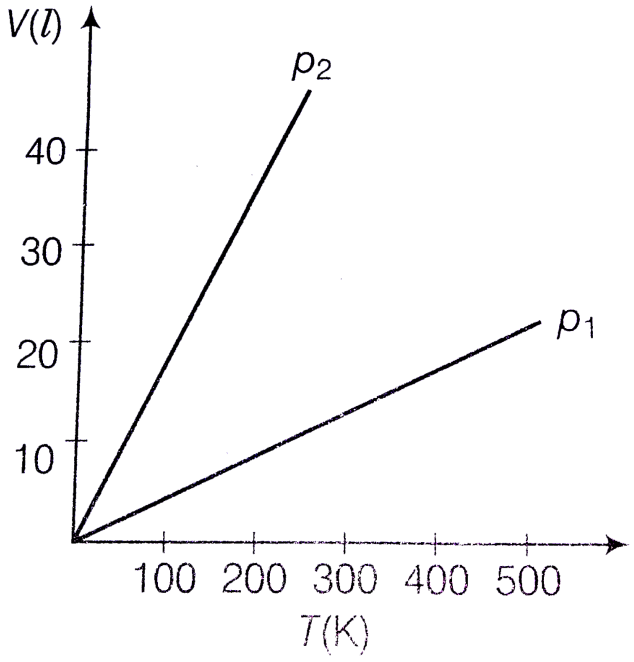
2. Volume versus temperature graphs for a given mass of an ideal gas are shown in figure. At two different values of constant pressure. What can be inferred about relation between P_1 and P_2 ?



A. $P_1 > P_2$

B. $P_1 = P_2$

C. $P_1 < P_2$

D. data is insufficient

Answer: A

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3. 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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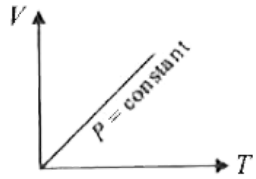
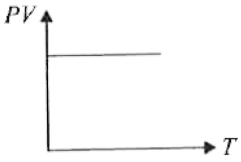
4. Which of the following graphs represent the behaviour of an ideal gas ?

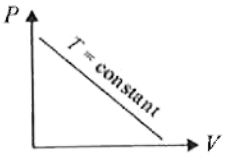
A.

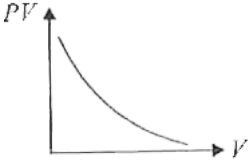


B.



C.



D. 

Answer: A

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5. 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

Answer: A

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6. 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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7. 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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8. 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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9. 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 of mercury

D. 114 cm of mercury

Answer: D

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10. 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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11. When the temperature of a gas filled in a closed vessel is increased by $1^\circ C$, its pressure increases by 0.4 percent. The initial temperature of gas was

A. $250^\circ C$

B. $25^\circ C$

C. 250 K

D. 25 K

Answer: C

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12. $(1/2)$ 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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13. One mole of an ideal monoatomic gas at temperature T_0 expands slowely according to the law P/V=constant. If the final temperature is $2T_0$ heat supplied to the gas is -

A. $2RT_0$

B. RT_0

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

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

Answer: A

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14. 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. 0.003

C. 0.048

D. 0.768

Answer: D

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15. If a gas has 5 degrees of freedom ratio of specific heats of gas 5

A. 5

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

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

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

Answer: D

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16. The volume of water molecule is

Take, density of wter is $10^3 kgm^{-3}$ and avogadros' number $= 610^{23} \text{mole}^{-1}\Big)$

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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17. When an ideal gas is compressed adiabatically, is temperature rises the molecule have more kinetic energy than before. The kinetic energy increases,

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

B. because of collisions 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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18. The molecules of a given mass of gas have root mean square speeds of $100ms^{-1}at27^{\circ}C$ 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. $\frac{200}{\sqrt{3}}$

B. $\frac{100}{\sqrt{3}}$

C. $\frac{400}{3}$

D. $\frac{200}{3}$

Answer: A

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19. Which one of the following is/are assumptions of 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 of these

Answer: D

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20. The kinetic theory of gases gives the formula $PV = \frac{1}{3}Nmv^{\bar{2}}$ 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 gas present in the volume V

C. the average mass of one molecule of the gas

D. the total number of molecules present in volume V

Answer: B

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21. For a gas $\frac{R}{C_V}$ = 0.4, where R is the universal gas constant and C, is molar specific heat at constant volume. The gas is made up of molecules which are

A. monoatomic

B. diatomic

C. polyatomic

D. mixture of diatomic and polyatomic molecules

Answer: B

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22. A vesel has 6 of oxygen at pressure 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. 5 g

B. 4 g

C. 2 g

D. 3 g

Answer: C

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23. Molecular motion shows itself as

A. temperature

B. internal energy

C. friction

D. viscosity

Answer: A

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

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

Answer: B

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25. 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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26. 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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27. A vessel contains 1 mole of O_2 gas (molar mass 32) at a temperature T. The pressure of the gas is P . An identical vessel containing one mole of He gas (molar mass 4) at a temperature $2T$ has a pressure of xP. Find the value of x.

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

B. P

C. 2P

D. 8P

Answer: C

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28. 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 $35^\circ C$?

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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29. 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. $7.8 \times 10^{5} Nm^{-2}$

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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Aipmt Neet Mcqs

1. If C_p and C_v denote the specific heats (per unit mass of an ideal gas of molecular weight M), then where R is the molar gas constant.

A. $c_P - c_V = R/M^2$

B. $c_P - c_V = R$

C. $c_P - c_V = R/M$

D. $c_P - c_V = MR$

Answer: C

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2. The molar specific heats of an ideal gas at constant pressure and volume are denotes by C_P and C_v respectively. If $\gamma = \frac{C_P}{C_v}$ and R is the universal gas constant, then C_v is equal to

A. $\frac{(\gamma - 1)}{R}$

B. γR

C. $\frac{1+\gamma}{1-\gamma}$

D. $\frac{R}{(\gamma-1)}$

Answer: D

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3. The amount of heat energy required to raise the temperature of 1 g of Helium at NTP, from T_1 K to T_2 K is :

A. $\frac{3}{4}N_a k_B(T_2-T_1)$

B. $\frac{3}{4}N_a k_B\left(\frac{T_2}{T_1}\right)$

C. $\frac{3}{8}N_a k_B(T_2 - T_1)$

D. $\frac{3}{2}N_a k_B(T_2 - T_1)$

Answer: C

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4. The mean free path of molecules of a gas (radius r) is inversely proportional to

A. r^3

B. r^2

C. r

D. $\sqrt{r}$

Answer: B

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5. The ratio of the specific heats $\frac{C_p}{C_v} = \gamma$ in terms of degrees of freedom (n) is given by

A. $\left(1 + \frac{2}{n}\right)$

B. $\left(1 + \frac{n}{2}\right)$

C. $\left(1 + \frac{1}{n}\right)$

D. $\left(1 + \frac{n}{3}\right)$

Answer: A

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6. Two vessel separately contains two ideal gases A and B at the same temperature, the pressure of A being twice that of B. under such conditions, the density of A is found to be 1.5 times the density of B. the ratio of molecular weight of A and B is

A. 2

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

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

D. $\frac{3}{4}$

Answer: B

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7. The molecules of a given mass of a gas have rms velocity of $200m/sat27^\circ C$ and $1.0 \times 10^5 N/m_2$ pressure. When the temperature and pressure of the gas are respectively $127^\circ C$ and $0.05 \times 10^5 Nm^{-2}$, the rms velocity of its molecules in ms^{-1} is

A. $\frac{100\sqrt{2}}{3}$

B. $\frac{100}{3}$

C. $100\sqrt{2}$

D. $\frac{400}{\sqrt{3}}$

Answer: D

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8. A fiven sample of an ideal gas occupise a volume V at a pressure p and sbsoulte temperature T.The mass of each molecule of the gas is m. Which of the following fives the dinsity of the gas ?

A. $P/(kT)$

B. $Pm/(kT)$

C. $P/(kTV)$

D. mkT

Answer: B

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9. A gas mixture consists of 2 moles of O_2 and 3 moles of Ar at temperature T. Neglecting all vibrational modes, the total internal energy of the system is

A. 15 RT

B. 9 RT

C. 11 RT

D. 4 RT

Answer: C

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10. At what temperature will the rms speed of oxygen molecules become just sufficient for escaping from the Earth's atmsphere? [Given, mass of oxygen molecule (m) = 2.76×10^{-26} kg,

Boltzmann's constant $k_B = 1.38 \times 10^{-23} J \cdot K^{-1}$

]

A. $2.508 \times 10^4 K$

B. $8.360 \times 10^4 K$

C. $5.016 \times 10^4 K$

D. $1.254 \times x 10^4 K$

Answer: B

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11. Increase in temperature of a gas filled in a container would lead to :

A. decrease in intermolecular distance

B. increase in its mass

C. increase in its kinetic energy

D. decrease in its pressure

Answer: C

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