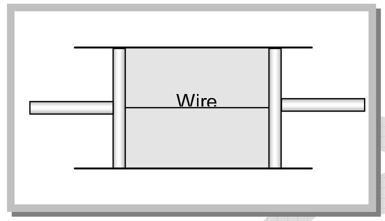
# Kinetic Theory of Gases

**1.** A cylindrical tube of uniform cross-sectional area *A* is fitted with two air tight frictionless pistons. The pistons are connected to each other by a metallic wire. Initially the pressure of the gas is $P_0$ and temperature is $T_0$. Atmospheric pressure is also $P_0$. Now the temperature of the gas is increased to $2T_0$, then tension in the wire will be




(a) $2P_0A$
(b) $P_0A$
(c) $\frac{P_0A}{2}$
(d) $4P_0A$

**2.** A container of volume 20 *litre* is filled with a mixture of $H_2$ and *He* at 20°*C*. The pressure is 2 *atm*. If the mass of mixture is 5 *gm*, then the ratio of masses of $H_2$ and *He* is
(a) 0.46 (b) 0.61 (c) 0.75 (d) 0.80

**3.** In kinetic theory of gases, a molecule of mass *m* of an ideal gas collides with a wall of vessel with velocity *V*. The change in the linear momentum of the molecule is
(a) 2 *mV* (b) *mV* (c) – *mV* (d) Zero

**4.** Consider a gas with density $\rho$ and $\bar{c}$ as the root mean square velocity of its molecules contained in a volume. If the system moves as whole with velocity *v*, then the pressure exerted by the gas is
(a) $\frac{1}{3}\rho\bar{c}^2$ (b) $\frac{1}{3}\rho(\bar{c}+v)^2$ (c) $\frac{1}{3}\rho(\bar{c}-v)^2$ (d) $\frac{1}{3}\rho(\bar{c}^2-v)^2$

**5.** 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 temperature 2*T* has a pressure of
(a) *P*/8 (b) *P* (c) 2*P* (d) 8*P*

**6.** The volume of gas at pressure $21\times10^4\ N/m^2$ and temperature 27°*C* is 83 *litres*. If *R* = 8.3 *J*/*mol*/*K*, then the quantity of gas in *gm-mole* will be
(a) 15 (b) 42 (c) 7 (d) 14

**7.** For a gas at temperature *T* the root-mean square velocity $v_{rms}$, the most probable speed $v_{rmp}$, and the average speed $v_{av}$ obey the relationship
(a) $v_{av} > v_{rms} > v_{mp}$ (b) $v_{rms} > v_{av} > v_{mp}$ (c) $v_{mp} > v_{av} > v_{rms}$ (d) $v_{mp} > v_{rms} > v_{av}$

**8.** The *rms* speed of gas molecules is given by
(a) $2.5\sqrt{\frac{RT}{M}}$ (b) $1.73\sqrt{\frac{RT}{M}}$ (c) $2.5\sqrt{\frac{M}{RT}}$ (d) $1.73\sqrt{\frac{M}{RT}}$

**9.** If the molecular weight of two gases are $M_1$ and $M_2$, then at a temperature the ratio of root mean square velocity $v_1$ and $v_2$ will be
(a) $\sqrt{\frac{M_1}{M_2}}$ (b) $\sqrt{\frac{M_2}{M_1}}$ (c) $\sqrt{\frac{M_1+M_2}{M_1-M_2}}$ (d) $\sqrt{\frac{M_1-M_2}{M_1+M_2}}$

**10.** According to the kinetic theory of gases, at absolute temperature
(a) Water freezes (b) Liquid helium freezes
(c) Molecular motion stops (d) Liquid hydrogen freezes

**11.** At 27°*C* temperature, the kinetic energy of an ideal gas is $E_1$. If the temperature is increased to 327°*C*, the kinetic energy would be
(a) $2E_1$ (b) $\frac{1}{2}E_1$ (c) $\sqrt{2}E_1$ (d) $\frac{1}{\sqrt{2}}E_1$

**12.** The kinetic energy per gm mol for a diatomic gas at room temperature is
(a) 3 *RT* (b) $\frac{5}{2}RT$ (c) $\frac{3}{2}RT$ (d) $\frac{1}{2}RT$

**13.** The pressure and temperature of two different gases is *P* and *T* having the volume *V* for each. They are mixed keeping the same volume and temperature, the pressure of the mixture will be
(a) *P*/2 (b) *P* (c) 2*P* (d) 4*P*

**14.** Two moles of a monoatomic gas are mixed with one mole of a diatomic gas. The $\gamma$ for mixture is
(a) $\frac{5}{3}$ (b) $\frac{7}{5}$ (c) $\frac{4}{3}$ (d) $\frac{17}{11}$

**15.** A mixture of $n_1$ moles of monoatomic gas and $n_2$ moles of diatomic gas has $\gamma = 1.5$, then

(a) $n_1 = 2n_2$ (b) $2n_1 = n_2$ (c) $n_1 = n_2$ (d) $2n_1 = 3n_2$