Answer on Question #64978-Physics-Other

Calculate the ratio of change in mass of the molecules of a gas to the initial mass, if it's speed is speed is reduced to half and the ratio of initial and final pressure is 3:4

Answer is 13:3

Solution

From kinetic theory of gases:

$$pV \sim \frac{mv^2}{2}$$

$$\frac{p'V}{pV} = \frac{m'v'^2}{mv^2}.$$

Thus,

$$\frac{m'}{m} = \frac{p'}{p}\left(\frac{v}{v'}\right)^2 = \frac{4}{3}\left(\frac{1}{\frac{1}{2}}\right)^2 = \frac{16}{3}.$$

The ratio of change in mass of the molecules of a gas to the initial mass is

$$\frac{\Delta m}{m} = \frac{m' - m}{m} = \frac{m'}{m} - 1 = \frac{16}{3} - 1 = \frac{13}{3}.$$

Answer: $\frac{13}{3}$.