



force

$$\Delta p = \Delta m v = m v - (-m v) = 2 m v$$

$$v = d/t$$

$$t = \frac{d}{v} = \frac{2l}{v}$$

$$F t = \Delta m v$$

$$F = \frac{\Delta m v}{t}$$

$$F = \frac{2 m v}{2 l / v} = \frac{m v_x^2}{l}$$

one molecule

all molec.  $F = \frac{m v_x^2}{\rho}$

$$F = \frac{m}{\rho} (v_{x1}^2 + v_{x2}^2 + \dots + v_{xN}^2)$$

$$\bar{v}_x^2 = \frac{v_{x1}^2 + v_{x2}^2 + \dots + v_{xN}^2}{N}$$

$$\bar{v}_x^2 N = v_{x1}^2 + v_{x2}^2 + \dots + v_{xN}^2$$

$$F = \frac{m}{\rho} (\bar{v}_x^2 N)$$

$$\bar{v}^2 = \bar{v}_x^2 + \bar{v}_y^2 + \bar{v}_z^2$$

$$\bar{v}^2 = 3\bar{v}_x^2$$

$$\bar{v}_x^2 = \frac{\bar{v}^2}{3}$$

$$F = \frac{m}{\ell} (N \bar{v}_x^2)$$

$$\bar{v}_x^2 = \frac{\bar{v}^2}{3}$$

$$F = \frac{m}{\ell} N \left( \frac{\bar{v}^2}{3} \right) = \frac{N m \bar{v}^2}{3 \ell}$$

$$P = \frac{F}{A} = \frac{N m \bar{v}^2}{3 \ell} / A = \frac{N m \bar{v}^2}{3 A \ell}$$

$$P = \frac{N m \bar{v}^2}{3 V} = \frac{1}{3} N m \bar{v}^2 / V$$

$$P V = \frac{1}{3} N m \bar{v}^2$$

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express as  $k \bar{E}$

$$P V = \frac{2}{3} N \left( \frac{1}{2} m \bar{v}^2 \right)$$

$$P V = N K T$$

$$N K T = \frac{2}{3} N \left( \frac{1}{2} m \bar{v}^2 \right)$$

$$K T = \frac{2}{3} \left( \frac{1}{2} m \bar{v}^2 \right)$$

$$K \bar{E} = \frac{3}{2} K T$$

$$K E = \frac{1}{2} m v^2$$

$$P U = \frac{1}{3} N m \bar{v}^2$$

$$N k T = \frac{1}{3} N m \bar{v}^2$$

$$k T = \frac{1}{3} m \bar{v}^2$$

$$\bar{v}^2 = \frac{3kT}{m}$$

$$\bar{v} = \sqrt{\frac{3kT}{m}}$$

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air  $M = @ 29$

$$T = 20^\circ\text{C}$$

$$\bar{v} = ?$$

$$29 \text{ part } (1.67 \times 10^{-27} \text{ kg}) = 4.8 \times 10^{-26} \text{ kg}$$

$$\bar{v} = \sqrt{\frac{3(1.38 \times 10^{-23} \text{ J/K})(293 \text{ K})}{4.8 \times 10^{-26} \text{ kg}}}$$

$$\bar{v} = 503 \text{ m/s}$$

$$\bar{KE} = \frac{3}{2} kT$$

$$t = 20^\circ$$

$$\bar{KE} = \frac{3}{2} (1.38 \times 10^{-23} \text{ J/K}) 293 \text{ K}$$

$$KE = 6.07 \times 10^{-21} \text{ J}$$

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$$KE = \frac{1}{2} m v^2$$

$$KE = \frac{1}{2} (4.84 \times 10^{-26} \text{ kg}) (503 \text{ m/s})^2$$

$$KE = 6.07 \times 10^{-21} \text{ J}$$