Reminders 1-30-08:
-3rd Homework due Feb 5.
-Read Ch. 19 and Chapters 1&2 of Understanding Thermodynamics
-Exam 1 February 13

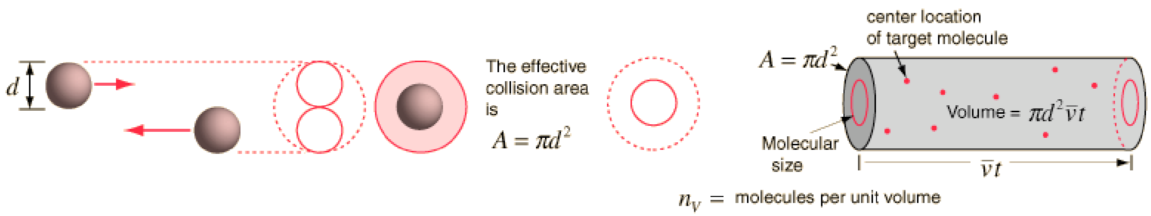
Outline:
-First Law of Thermodynamics
-Internal Energy
-Examples Thermodynamics Processes

18.61 Master physics Answer wrong

$m = 4.65 \times 10^{-26}$ kg

$28 \times 1.67 \times 10^{-27} = 4.67 \times 10^{-26}$ kg

$2m\left(\frac{\ell}{2}\right)^2$

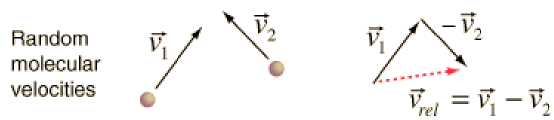


$$\#\ of\ collision\ in\ dt = n_V A v dt = \frac{N}{V} A v dt = \frac{N}{V} \pi d^2 v dt = \frac{N}{V} 4\pi r^2 v dt$$

$$\frac{dN}{dt} = \frac{N}{V} A v = \#\ of\ collisions / s$$

$$time\ between\ collisions = \frac{V}{N 4\pi r^2 v} = t$$

We need to know the average relative velocity for the molecules , not the average velocity of one molecule alone



$$|\vec{v}_2 - \vec{v}_1| = \sqrt{(\vec{v}_2 - \vec{v}_1) \bullet (\vec{v}_2 - \vec{v}_1)} = \sqrt{v_2^2 + v_1^2 - 2\vec{v}_2 \bullet \vec{v}_1}$$

$$= \sqrt{v_2^2 + v_1^2 - 2 v_2 v_1 \cos\theta}$$

$$|\vec{v}_2 - \vec{v}_1|_{AVG} = \sqrt{\bar{v}_2^2 + \bar{v}_1^2 - 2\bar{v}_2\bar{v}_1 \cos\theta_{AVG}} = \sqrt{\bar{v}_2^2 + \bar{v}_1^2}$$

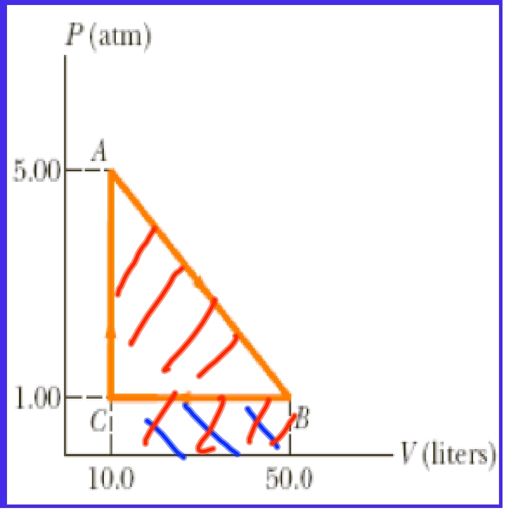
$$but\ \bar{v}_2^2 = \bar{v}_1^2 = \bar{v}^2$$

$$|\vec{v}_2 - \vec{v}_1|_{AVG} = \bar{v}\sqrt{2}$$

$$time\ between\ collisions = \frac{V}{N\pi d^2 \sqrt{2} v} = t$$

$$\ell = vt = \frac{V}{\sqrt{2} N A} = \frac{V}{\sqrt{2} N \pi d^2} = \frac{1}{\sqrt{2} n_V \pi d^2} = \frac{1}{\sqrt{2} n_V 4\pi r^2}$$

- **A gas undergoes the cyclic process shown.**
  - **What is W_{BC}?**
  - **What is W_{AB}?**
  - **What is W_{CYCLE}?**



Ans: -4050J, 12,500J, 8100J

$$W_{BC} = (1\,\text{atm})(10.0 - 50.0)\,\text{L} \cdot \left(101{,}300\,\frac{\text{Pa}}{\text{atm}}\right)\left(.001\,\frac{\text{m}^3}{\text{L}}\right)$$

$$= -4050\,\text{J}$$

$$W_{CA} = 0$$

$$W_{AB} = 4050\,\text{J} + \frac{1}{2}(4\,\text{atm})(40)\left(101.3\,\frac{\text{J}}{\text{L-atm}}\right)$$

$$= 12{,}200\,\text{J}$$

$$W_{cycle} = 12{,}200\,\text{J} - 4050\,\text{J}$$

$$= 8100\,\text{J}$$