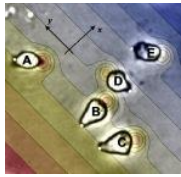
Physics 131-Physics for Biologists I



Professor: Wolfgang Losert
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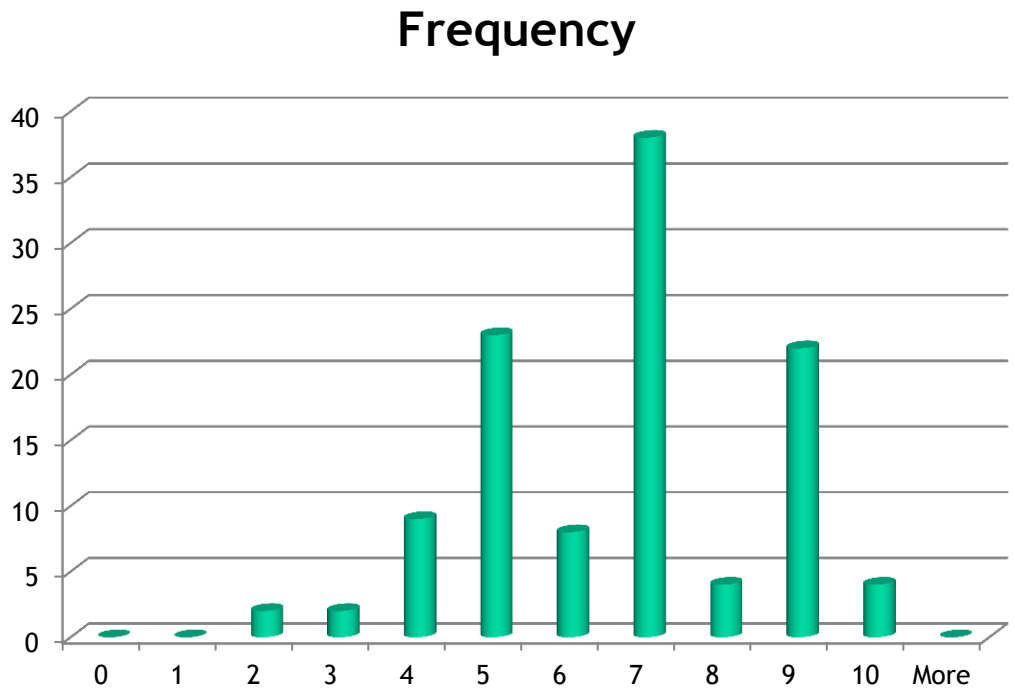
Midterm 2: November 8

Office Hours before Midterm 2:
Course Center: Monday Nov 4, 11am-12.30pm
3341 AV Williams: Wednesday Nov 6, 11.30am-1pm

For Homework: Assemble images into a pdf: Use Adobe Acrobat which can be downloaded for FREE from the Terpware store!

Average: 6.7



Foothold ideas: Pressure

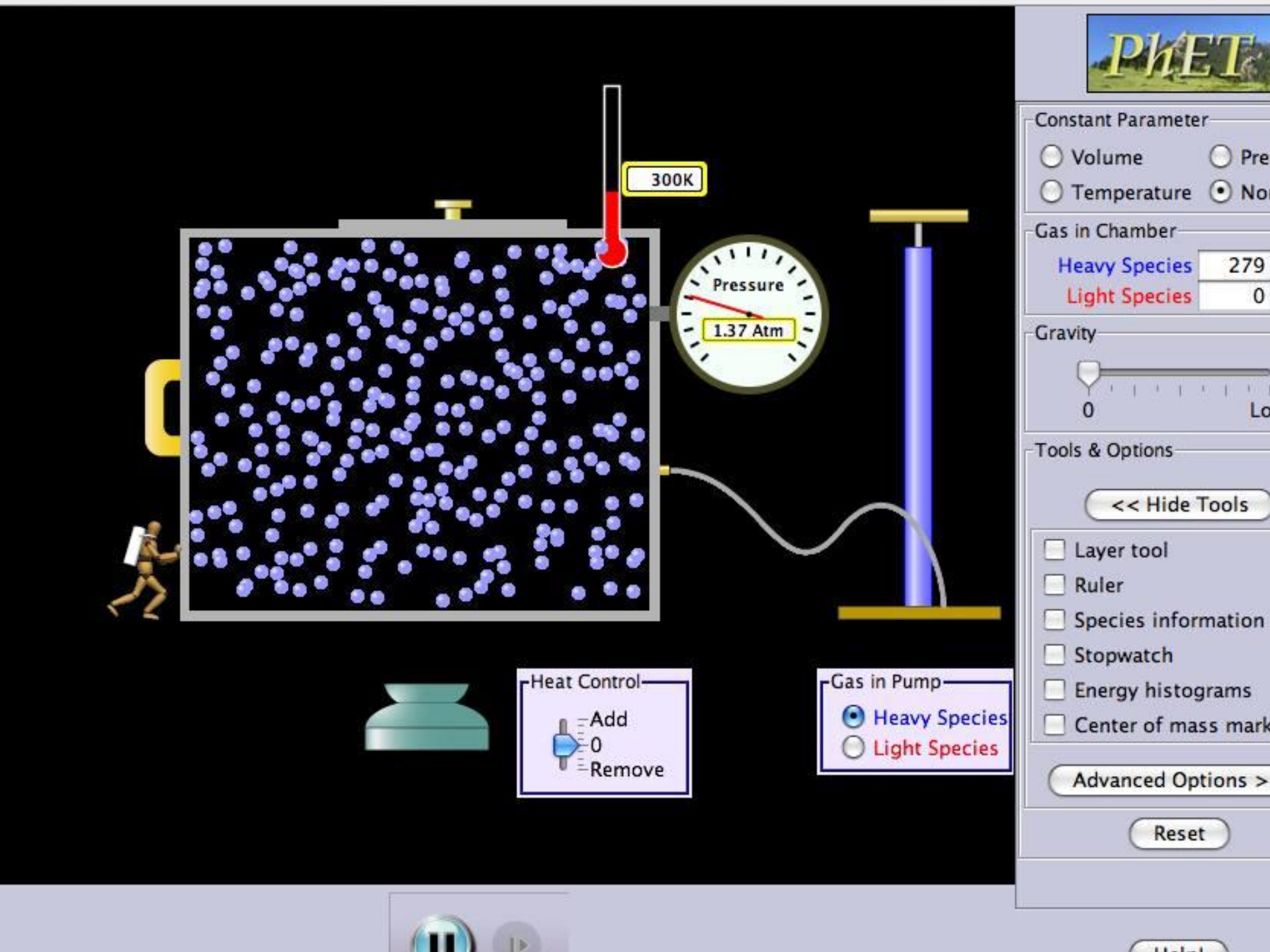
- At a boundary or wall, the pressure in a constrained fluid creates a force perpendicular to the surface.

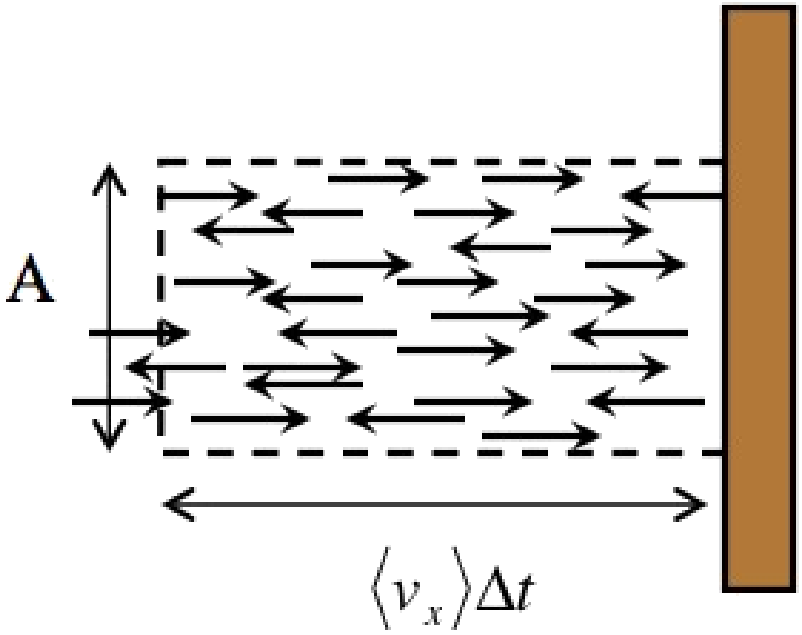
$$\vec{F} = p\vec{A}$$

- The constrained gas or liquid has an internal pressure, meaning that it would create a force against any surface placed anywhere inside the gas or liquid in any orientation.
- You know an equation for pressure from Chemistry – the ideal gas law:

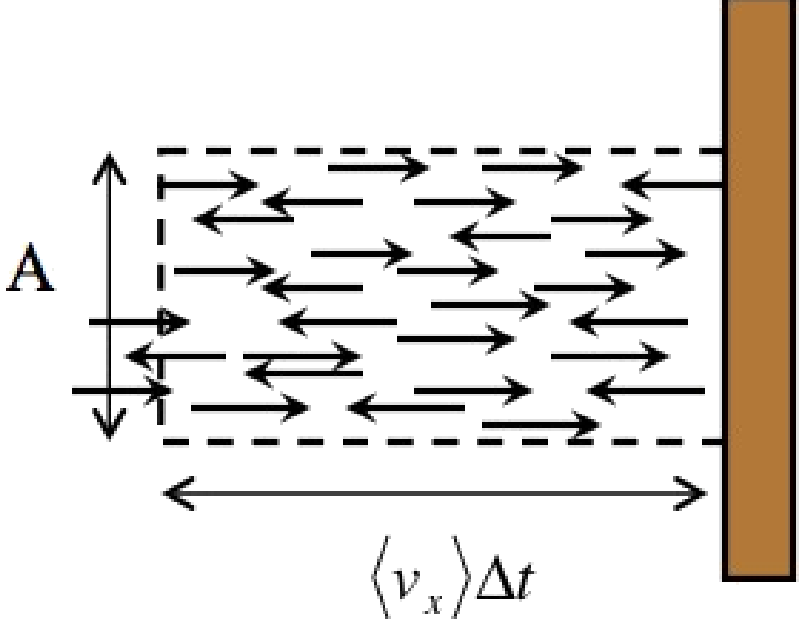
$$pV = n_{moles}RT$$

- **Can we connect this equation to what we know about the random motion of molecules?**


PhET
Constant Parameter
Volume
Temperature
Gas in Chamber
Heavy Species
279
Light Species
0
Gravity
0
Tools & Options
<< Hide Tools
Layer tool
Ruler
Species information
Stopwatch
Energy histograms
Center of mass mark
Advanced Options >
Reset
300K
Pressure
1.37 Atm
Heat Control
Add
0
Remove
Gas in Pump
Heavy Species
Light Species



$$F = \left(\frac{2mv_x}{\Delta t} \right) \left(\tfrac{1}{2} nAv_x \Delta t \right) = nmv_x^2 A$$



$$F = \left(\frac{2mv_x}{\Delta t} \right) \left(\tfrac{1}{2} nAv_x \Delta t \right) = nmv_x^2 A$$

$$p = \frac{F}{A} = nmv_x^2$$

$mv_x^2 = ?$

Whiteboard, TA & LA

$k_B T = mv_x^2$

$mv^2 = ?$

$$pV = Nk_B T$$

$$v^2 = v_x^2 + v_y^2 + v_z^2 = 3v_x^2$$

The Ideal Gas Law

Chemist's form

$$pV = n_{moles}RT$$

$$n_{moles} = \frac{N}{N_A}$$

$$R = k_B N_A$$

Physicist's form

$$pV = Nk_BT$$

Kinetic Theory

$$p = nmv_x^2$$

$$\frac{3}{2}k_BT = \frac{1}{2}mv^2$$