Pressure

Applying the same force F on two very different areas can result in two very different behaviors.

This will probably cut the carrot

This probably won't cut the carrot

The main difference comes from the area of the knife's blade. The sharp side of the blade has a smaller area.

The physical quantity that encapsulates this behavior is the **Pressure**. We define it as follows:

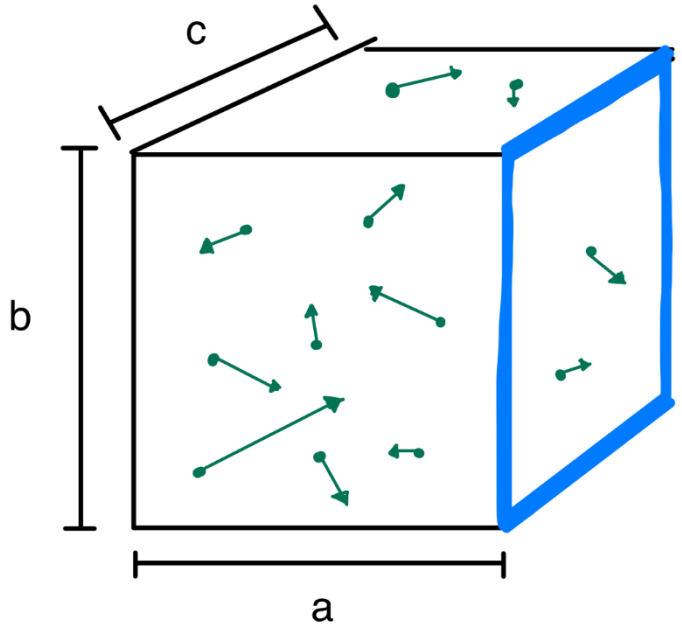
$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

The unit of pressure is the Pascal (Pa).

$$1\ \text{Pa} = 1\ \frac{\text{N}}{\text{m}^2}$$

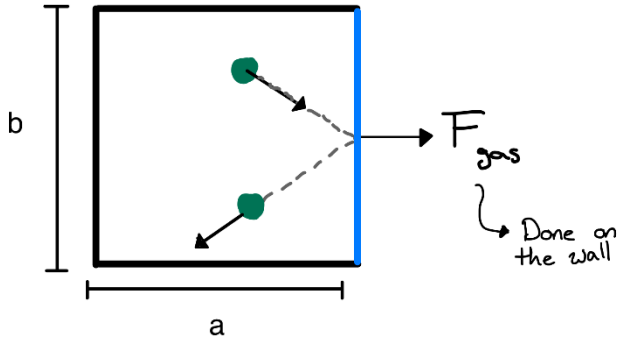
Ideal Gases

A very simple way of thinking of gases is to picture them as individual molecules floating around the empty space with a random velocity. The average speed of our gas molecules is directly proportional to the temperature at which the gas is. That is, if our gas is at a higher temperature its particles will move faster than a gas at a lower temperature.



Ideal Gases

The collisions of the gas molecules with the walls of the box, will produce a force on it. Since this force is distributed over the whole area of the different sides of the box, we can say that the gas has a definite pressure.



An increase in volume would be accompanied to a decrease in pressure (think about what happens to the collisions with the walls of the box). A decrease in the volume would be accompanied by an increase in the pressure of the gas. These observations lead us to claim that:

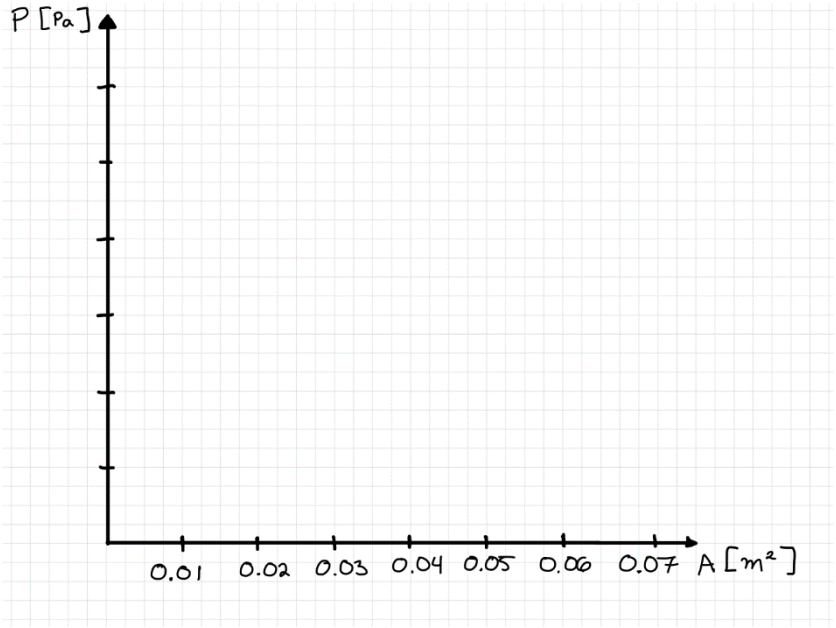
$$\text{Pressure} \times \text{Volume} = \text{Constant}$$

Later, we will see that this constant depends on the temperature of the gas

Homework

Suppose that you can apply a force of 10N with your knife. **(a)** Find the pressure applied for the following areas of the knife's blade. **(b)** Graph your results. Notice that you need to define a scale on the vertical axis that allows you to see the values you found in part (a).

Area (m^2)	Pressure (Pa)
0.01	
0.02	
0.03	
0.05	
0.06	
0.07	



(c) Using your graph, can you predict what would happen if you managed to apply your force on an area that is 0m^2?