Chapter 4

As usual, read the chapter. It is about temperature and the effects of changing temperature.

Temperature is a measure of the random energies of the atoms and molecules making up matter.

Think of kids in a special kindergarten room with rubber walls. Imagine the kids to be atoms. When they are napping, they move very slightly as they breath and wiggle. The walls of the room are still. This is the case near the lowest temperature attainable called **absolute zero** temperature. Atoms are moving at absolute zero, but they cannot move any less. There is something called zero-point motion, a quantum-mechanical effect.

After a while, nap-time ends and the kids start to move around gently bumping into each other and against the walls. When a kid recoils off of the rubber walls, the rubber wall bulges outward momentarily. When a kid bumps into another kid, they both recoil and go off in different directions. The billowing of the walls is an indication of pressure in the room. The more kids in a given volume of room, the more pressure.

Now, it becomes time for a birthday party and the kids get some chocolate (containing sugar) and cake that is quickly converted to sugar by their saliva and digestive system. Sugar provides excess energy and the kids start to run around with great vigor, bouncing into each other and into the walls with greater speed. The temperature of the atoms in the room has been increased. The walls billow out more, and so the pressure has also increased.

Next a door is opened to another equally large room that has no kids. Half of the kids flow through the door and bounce around in the adjacent room. The volume has now doubled, but the pressure has been reduced to half because there are now half as many kids bouncing against the walls of each room.

So, we are led to the following proportion equation for the pressure p: $p \propto \frac{(\text{number of kids})\cdot(\text{sugar per kid})}{(\text{size of space})}$

In terms of number of atoms N, temperature T, and volume V, this is: $p \propto \frac{N \cdot T}{V}$.

Adding a constant of proportionality k_B called Boltzmann's constant, this becomes: $p = \frac{N k_B T}{V}$.

This called the **Ideal Gas Law**.

Specific heat measures how hard it is to raise the temperature of a substance. Older, larger kids require more chocolate; they have a higher specific heat.

Entropy is a strange concept to understand. I will show an animation in lab to try an help understand the difference between entropy and energy.

We will also discuss heat conduction mechanisms in the lab.