A Warm Word About "Cold"

UW-Madison Japanese Speech Contest 2004

English Version

To everyone who has braved the winter cold to be here today, I would like to speak about a very familiar subject. That is, "cold." I'm sure everyone here has experienced cold (perhaps some of you are experiencing it now), but I imagine that there are many who aren't sure exactly what cold is or how it occurs. So that we can face winter in a more enlightened fashion, I will explain the physics of cold.

First of all, when one thinks of the cause of cold, the words "low temperature" come to mind. But what is "temperature?" Simply put, it is a measure of the kinetic energy of the molecules that make up air. In other words, if the movement of the molecules is fast and vigorous, the temperature is high. If the movement is slow and sluggish, the temperature is low. In order to understand how the movement of molecules affects ones skin, one can imagine, for example, pool balls. The molecules of ones skin, which is at about 99°F, are moving fairly fast, so they can be represented by a ball hit with the cue. Molecules in near-freezing point air may be moving in bulk with the wind, but they are not oscillating much, so they are a ball sitting on the table. What happens when they collide? One can expect that the stationary ball starts moving, and the moving ball stops or slows down. Just like this, ones skin loses energy to the air and becomes cold. This is called "energy loss."

When waiting for a bus that just won't come, ones fingers become very cold. When that happens one becomes unable to move his fingers as usual. This is also because of

energy loss. When energy is low, the reaction rate of the chemical processes that govern the movement of ones hand slows down. This is a bit too complicated for pool balls, so please use your imagination. The muscles of ones fingers extend and contract because of chemical reactions, in other words various molecules combining, breaking apart and forming new molecules, and so on. The faster the molecules are moving, the faster these reactions take place. Therefore, if ones fingers are cold, which is equivalent to saying that the molecules' energy is low, then the reactions become slow and ones finger becomes hard to move. When I first noticed this, I thought that if I really concentrated I could move my finger like normal, but now I realize that the laws of nature are not so easily broken.

The fact that ones breath is visible on cold days is also due to energy loss. There is lots of water in exhaled breath; what happens when those water molecules lose energy? First, water molecules attract one another, so it takes energy to pull them apart. This is easy to understand if one imagines a spring. When one puts energy in, it stretches; when one takes energy out, it contracts. Just like this, when water molecules lose energy they come closer and stick together. Individual molecules are too small to reflect light, but when they form a big enough clump they become able to reflect light, and are therefore visible with the naked eye. Clouds are also formed in this way.

I hope you enjoyed my explanations of the physics of cold. The next time you are cold, if you just realize that it's not "cold," it's just that "the kinetic energy of the air molecules is low," you should be able to make it through the toughest winters.