

Basic Definitions

Skills to Develop

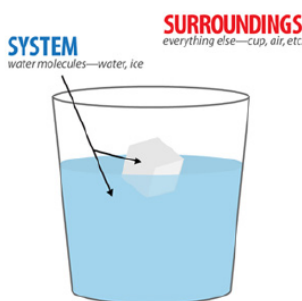
- Understand the fundamental concepts of thermodynamics

Thermodynamics

Thermodynamics is the study of heat, energy, and work and how they move. This is important because we have to move or generate heat to stay comfortable in winter and summer; we need to do work by moving things for many different purposes; we need to generate chemical energy to live and grow our bodies, etc.

System and Surroundings

In thermodynamics, we often separate the universe (that is, everything that exists) into 2 parts: the **system**, which is the small part we are interested in, and the **surroundings** which is everything outside the system. This will help us think about how heat, energy and work move between parts of the universe.



Open, Closed, and Isolated Systems

Open systems allow energy and matter (stuff) to enter and leave the system. A pan on the stove is an open system because water can evaporate or be poured in, and heat can enter the pan if the stove is turned on, and leave the pan also. A **closed system** does not allow matter to enter or leave, but does allow energy to enter or leave. A covered pot on the stove is approximately a closed system. An **isolated system** does not allow either matter or energy to enter or leave. A thermos or cooler is approximately an isolated system. There are no truly isolated systems.



State Functions

State functions are quantities that don't depend on path. Your bank balance is a good example. It doesn't matter how the money entered your bank account, the total amount there at any given time is what it is and you can measure it easily. It doesn't matter if you put it in all at once, or a little bit every month, or put a lot in then spent it slowly... any time you want to know how much is there, you just check. Most of the quantities you know are state functions, like pressure, volume, temperature, location, etc. But some quantities that are important in thermodynamics, like heat and work, are only defined by a process, so they aren't state functions.

Extensive vs. Intensive

Extensive refers to properties that depend on how much stuff there is. For instance, the volume or pressure created by a sample of gas depend on how much gas is in the sample, so they are extensive. **Intensive** quantities don't depend on how much there is. For instance, temperature, density, etc. If you divide a sample in 2, it does not change temperature. Density is a ratio of 2 extensive properties, so it is intensive.

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