We will use three principles to guide us in the development of the energy concept.

1. Energy can be viewed as a substance-like quantity that can be stored in a physical system.
2. Energy can "flow" or be "transferred" from one system to another and so cause changes.
3. Energy maintains its identity after being transferred.

Let's use a metaphor to further understand each of these principles. Consider how we describe *information*. We say that it can be *stored* in books, on computer hard drives, on flash drives, or on the internet. Information can be *transferred* from place to place via cables or by wireless transmission techniques - in fact I did this when I accessed this article on line, transferred it to my computer, and then printed it. But there is nothing substantial about the information itself; you can't touch it or measure its mass on a balance. And even though we move information from place to place or store it in different ways, *nothing* about the information itself has *changed*.

At this point, let us consider another metaphor to describe energy storage and transfer – that of money. We *store* money in accounts at the bank or credit union. We can have checking accounts, various savings accounts, certificates of deposit, etc. These accounts store money. There is nothing different about the money in checking and savings accounts. This money can be *transferred* back and forth in the bank without changing the *nature* of the money or the *total quantity* of money that resides in the collection of accounts that is attached to your name; let's call this the system for convenience.

The same is true of energy. It is stored in objects and in the arrangement of objects in a physical system. We use different "accounts" to help us keep track of energy as its transfer causes change in the objects or in their arrangement. As with money, nothing about the energy itself has changed. Let's consider the accounts we will use in this course.

1. Thermal energy, E_{th} – is the energy stored by moving particles. The quantity of thermal energy stored by a collection of particles is related to both their mass and velocity. You instinctively recognize this as you would rather catch barehanded baseballs thrown by Mrs. Lee than ones thrown by Justin Verlander. Similarly, you wouldn't be hurt if you were pelted by ping-pong balls, but would suffer if you were showered with golf balls.

2. Phase energy, E_{ph} – is the energy stored in the system due to the *arrangement* of particles that exert attractions on one another. Attractions result in a *decrease* in the energy of a system of particles. As particles become more tightly bound, their E_{ph} is lowered. Solids possess the lowest phase energy; liquids possess more, since the particles in a liquid are freer to move than those in a solid; and a gas possesses the greatest amount of E_{ph} since the particles in a gas have completely broken free from one another. E_{ph} is the energy account involved when phase changes occur.

3. Chemical energy, E_{ch}- is the energy due to attractions of atoms *within* molecules. These attractions are described as chemical bonds because they are directed between specific atoms in the molecule.