Enthalpy and Entropy

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Introduction To Enthalpy and Entropy

Enthalpy is the sum of the internal energy E and the product of the pressure P and volume V of a thermodynamic system.

So, enthalpy H = E + PV.

Its value is determined by the temperature, pressure, and composition of the system at any given time. According to the law of conservation of energy, the change in internal energy is equal to the heat transferred to the system minus the work done by the system. If the only work done is a change of volume at constant pressure, the enthalpy change is exactly equal to the heat transferred to the system.

The internal energy of a system is the energy content of thesystem due to its thermodynamic properties such aspressure and temperature. A change of internal energy in a system depends only on the initial and final states of the system and not in any way on the path or manner of the change. This concept is used to definethe first law of thermodynamics.

Factors affecting Enthalpy

There are factors that affect the level of enthalpy in a system. The enthalpy will be directly proportional to the amount of substance you have. Chances are that if you have more of a substance, you have more energy. If you visualize this on a large scale, you can compare the enthalpy in a glass of water to the enthalpy in the ocean. The ocean has more total energy.

The second thing to remember is that the value for H (enthalpy) changes sign when the reactions or values are reversed. When a reaction moves in one direction, the sign is positive. When a reaction moves in the opposite direction, the value is negative. (Note: When you have numbers only, the idea of direction (as in vectors, for example) is difficult to convey. With numbers, we convey direction by using signs. One way is "positive" and the opposite way is "negative"). When a system is in equilibrium, the speed of forward reactions equals the speed of reverse reactions.

The third idea to remember is called Hess's Law. If a process happens in stages or steps, the enthalpy change for the overall (isolated) system can be figured out by adding the changes in enthalpy for each step. This recognizes that energy is conserved in an isolated system. Many reactions occur in steps. Only after looking at each step, and combining their effects, can you understand and measure the entire process.

Entropy

Entropy is a scientific measure of disorder, which is the opposite of order. Temperature involves uncontrolled random motion, so higher temperatures generally mean higher disorder. At T = 0, all random motion stops, so S = 0 at T = 0. This is called the third law of thermodynamics. Natural processes tend to move toward a state of greater disorder (i.e., higher entropy). Here “natural processes” means processes which can happen by themselves spontaneously, such as the breaking of a glass, or the spreading of a drop of ink inside a glass of water

Entropy is a measure of disorder, or more precisely of unpredictability. For example, a series of coin tosses with a fair coin has maximum entropy, since there is no way to predict what will come next.

Scientists use the formula ?S = ?Q /? T, where "S" is the entropy value, "Q" is the measure of heat, and "T" is the temperature of the system measured in Kelvin degrees. When we use the symbol ? (delta), it stands for change. Delta T would be the change in temperature (the original temperature subtracted from the final).

Factors effecting Entropy:

Several factors affect the amount of entropy in a system. Generally, if you increase temperature, you increase entropy.

(1) More energy put into a system excites the molecules and the amount of random activity.

(2) As a gas expands in a system, entropy increases. This one is also easy to visualize. If an atom has more space to bounce around, then it will bounce more. Gases and plasmas have large amounts of entropy when compared to liquids and solids.

(3) When a solid becomes a liquid, its entropy increases.

(4) When a liquid becomes a gas, its entropy increases. We just talked about this idea. If you give atoms more room to move around, they will move. You can also think about it in terms of energy put into a system. If you add energy to a solid, it can become a liquid. Liquids have more energy and entropy than solids.

(5) Any chemical reaction that increases the number of gas molecules also increases entropy. A chemical reaction that increases the number of gas molecules would be a reaction that pours energy into a system. More energy gives you greater entropy and increases the randomness of the atoms.

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Reference links:

- http://www.wisegeek.com/what-is-thermal-energy.htm
- http://www.en.wikipedia.org/wiki/temperature

- http://www.en.wikipedia.org/wiki/Molecule

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