

I have used the term quasistatic several times now in defining the entropy. I will here try to define several terms that you will come across.

Fast: A fast process is one in which the system does not have time to equilibrate. How fast this is will depend on your system, and what processes you are interested in observing. A diamond will spontaneously turn into graphite, but this takes a while. From one perspective, your lifetime is short (i.e. every change you observe is fast) because diamond will never reach equilibrium. However, we typically ignore this sort of slow change, and say that diamond is in equilibrium.

Slow: A slow process is one which allows "things" to reach equilibrium while it is going on. As with fast, slowness will depend on which "things" you wish to consider. In practice, there are often many orders of magnitude between the border of "fast" and "slow".

Quasistatic: This describes a process that is slow. Slow enough that at every instant, the system is essentially in equilibrium. We most often discuss quasistatic processes, since non-quasistatic processes involve thermodynamic quantities being ill-defined until after the process is over.

Reversible: Reversible processes are those that can happen in reverse. Every reversible process is quasistatic, but not vice versa. Often the term reversible is used interchangeably with quasistatic.

Irreversible: A process that cannot be reversed. Usually an irreversible process is not quasistatic, but not always. But the easy to imagine irreversible processes are very non-quasistatic (e.g. lighting off fire crackers, or popping a balloon). Many irreversible processes are fast.

Spontaneous: Something that happens without us forcing it to happen. Spontaneous processes are irreversible, but the two words are not synonymous.

Isentropic: A process in which the entropy does not change. An isentropic process is reversible (according to the Second Law) and also quasistatic.

Adiabatic: A process in which there is no energy exchanged by heating. An adiabatic quasistatic process is isentropic (by the definition of entropy), and we often use the two words interchangeably (because we usually consider quasistatic processes). Chemists may tell you that an adiabatic process is fast. Physicists will usually describe it as slow. It all depends on what system you wish to consider.