1. Laws of Thermodynamics
   1. [Summary (Laws of Thermodynamics)](https://en.wikipedia.org/wiki/Laws_of_thermodynamics)

In some cases, thermodynamics can be summarized through laws that have been widely agreed upon as experimentally determined facts of nature or as axioms from which other thermodynamic relationships can derive from. The four *laws of thermodynamics* **describe fundamental physical quantities such as temperature, entropy, and energy which characterize the thermodynamic systems at thermal equilibrium.** In all, these laws describe how these quantities would behave under various circumstances and forbid certain phenomena from occurring such as perpetual motion.

* 1. [Zeroth Law (0th)](https://en.wikipedia.org/wiki/Laws_of_thermodynamics#Zeroth_law)

The *zeroth law of thermodynamics* states that, **“If two systems are in thermal equilibrium with a third system, they are in thermal equilibrium with each other”** (Laws of Thermodynamics, n.d.). Simply put, if system A is in thermal equilibrium with system B and system B is in thermal equilibrium with system C, then system A must be in thermal equilibrium with system C. The 0th law of thermodynamics introduces the important intensive thermodynamic variable of temperature (*T*) as a measure of the thermal intensity of a material and allows the determination of thermal equilibrium. Out of all the four laws, it is the third to be discovered and more information on this law will be in the following chapter (chapter 3).

* 1. [First Law (1st)](https://en.wikipedia.org/wiki/Laws_of_thermodynamics#First_law)

The *first law of thermodynamics* states that, **“When energy passes, as work, as heat, or with matter, into or out from a system, the system's internal energy changes in accord with the law of conservation of energy”** (Laws of Thermodynamics, n.d.). In a general sense, the 1st law states that energy in the universe is conserved but it also argues that the various forms energy can be converted into other different forms. The first law of thermodynamics can be written as the change in internal energy of a closed system is equal to the work done by the system on its surroundings subtracted from the heat supplied by the system. In short, it can be written as the equation:

Of the four laws, this law is the second to be discovered and will be looked at in further detail in chapter 4.

* 1. [Second Law (2nd)](https://en.wikipedia.org/wiki/Laws_of_thermodynamics#Second_law)

The *second law of thermodynamics* states that, **“In a natural thermodynamic process, the sum of the entropies of the interacting thermodynamic systems increases”** (Laws of Thermodynamics, n.d.). This law is useful for allowing us to make important predictions in the direction in which a system will evolve towards with time during spontaneous processes. More importantly, once other caveats are taken into consideration the 2nd law allows for us to use an, “important extensive thermodynamic state function called entropy (*S*)” (Gaskell & Laughlin, 2017, p.17). This law can be summarized in the equation:

This law is the first to be discovered and will be looked at in further detail in the upcoming chapters.

* 1. [Third Law (3rd)](https://en.wikipedia.org/wiki/Laws_of_thermodynamics#Third_law)

The *third law of thermodynamics* states that, **“The entropy of a system approaches a constant value as the temperature approaches absolute zero”** (Laws of Thermodynamics, n.d.). Succinctly, the 3rd law states that once a system at internal equilibrium approaches 0 kelvin (K), entropy (*S*) also approaches zero. This leads to something known as the *unattainability principle* as the 3rd law also states that a system can never reach absolute zero (0 K). This law was the last to be discovered and will be discussed further in the following chapters.

1. Relevant Examples