**Gibbs free energy**

Definition

Gibbs [free energy](https://www.thoughtco.com/definition-of-free-energy-605148) is a measure of the potential for reversible or maximum work that may be done by a system at constant temperature and pressure. It is a [thermodynamic](https://www.thoughtco.com/thermodynamics-definition-602127) property that was defined in 1876 by Josiah Willard Gibbs to predict whether a process will occur spontaneously at constant temperature and pressure. Gibbs free energy *G* is defined as

G = H - TS

where *H*, *T*, and *S* are the [enthalpy](https://www.thoughtco.com/definition-of-enthalpy-605091), temperature, and entropy. The *SI* unit for Gibbs energy is the kilojoule.

Changes in the Gibbs free energy *G* correspond to changes in free energy for processes at constant temperature and pressure. The change in Gibbs free energy change is the maximum non-expansion work obtainable under these conditions in a closed system; *ΔG* is negative for [spontaneous processes](https://www.thoughtco.com/definition-of-spontaneous-process-604657), positive for [nonspontaneous processes](https://www.thoughtco.com/definition-of-nonspontaneous-reaction-604583), and zero for processes at equilibrium.

Gibbs free energyis also known as(G), Gibbs' free energy, Gibbs energy, or Gibbs function. Sometimes the term "free enthalpy" is used to distinguish it from Helmholtz free energy.

The terminology recommended by the [International Union of Pure and Applied Chemistry](https://iupac.org/) (IUPAC) is Gibbs energy or Gibbs function.

Positive and Negative Free Energy

The sign of a Gibbs energy value may be used to determine whether or not a chemical reaction proceeds spontaneously. If the sign for *ΔG* is positive, additional energy must be input for the reaction to occur. If the sign for *ΔG* is negative, the reaction is [thermodynamically](https://www.thoughtco.com/thermodynamics-overview-2699427) favourable and will occur spontaneously.

However, just because a reaction occurs spontaneously doesn't mean it occurs quickly. The formation of rust (iron oxide) from iron is spontaneous, yet occurs too slowly to observe. The reaction:

C(s)diamond → C(s)graphite

also has a negative *ΔG* at 25 C and 1 atmosphere, yet diamonds do not appear to spontaneously change into graphite.