S’math Reference : Gibbs Free Energy

AP Biology

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| *The value of Gibbs Free Energy for a reaction – the energy available to do work - is based upon its enthalpy and entropy. Both factors affect whether or not a reaction will occur spontaneously.* |
| **Go = ΔHo - TΔSo** |
| Gibbs Free energy = change in enthalpy – T in Kelvin (change in entropy) |
| * A reaction is spontaneous (energy-releasing) if it is accompanied by a decrease in free energy. The result is that **G is negative**. |
| * *Exergonic* changes are accompanied by *an increase in entropy.* |
| ie.     H is negative, S is positive           G = (-) - T(+)  In such a change, G will be negative, and the change will be spontaneous |
| * On the other hand, an *endergonic* change is accompanied by a *decrease in entropy*. |
| i.e.  H is positive, S is negative         ΔG = (+) - T(-)  In this case, **G will be positive** and the change never spontaneous. |
| * When H and S have the same sign, temperature becomes critical in determining whether or not an event is spontaneous. |
| i.e. If H and S are both positive,        G = (+) - T(+)    Only at relatively high temperatures will the value of TS be larger than the  value of H so that their difference, G, is negative. |
| Ex: Melting ice is a change that is *endothermic* yet occurs with an *increase in entropy*. At temperatures above 0oC (at standard pressure), ice melts because  TS > H. At lower temperatures, ice doesn't melt because the smaller value for T gives a smaller value for TS, resulting in a positive G.  i.e. If H and S are both negative,  G = (-) – T (-)  Only at low temperatures will the value of TS be larger than the  value of H so that their difference, G, is negative. |
| *For a process to occur spontaneously, therefore, the system must either give up enthalpy (H must decrease), give up order (TS must increase), or both.* |

*Thank you Ms. Barkanic, whoever you are!*