

## Assignment Entropy II: Answers

Question	Answers
1.	-121.62 J / K
2.	-104.3 J/ K
3.a)	+0.737 kJ
3.b)	2.65 kJ/mol
3.c) d)	No because change of Gibbs free energy is not negative., (d) 195.5 K
4.	G = -394.4 kJ Yes because Gibbs free energy change is negative.
5.	H = - 98.93 kJ/ S = -93.975 J /K G = -70.91 kJ/ Therefore, spontaneous.
6.	G = -3 kJ Under these conditions diamonds should spontaneously change to graphite because change of Gibbs free energy is negative but at a very slow rate. Diamonds are more stable than graphite, this is why graphite has more ways in which energy can be distributed.  The reaction is product favoured, therefore diamond wants to be graphite, therefore not thermodynamically stable. But diamond is kinetically stable as a large AE is needed to break the bonds in diamond to create an activated complex, therefore the reaction progresses slowly
7.	G = - 1 378.1 kJ This reaction is thermodynamically favourable.
8.a)	H(f) = - 411.45 kJ S = -90.64 J/ K
8.b)	-384.4 kJ , therefore spontaneous
8.c)	T > 4 539 K
9.a)	$(\text{NH}_4)_2\text{Cr}_2\text{O}_7 (\text{s}) \rightarrow \text{N}_2 (\text{g}) + 4\text{H}_2\text{O} (\text{g}) + \text{Cr}_2\text{O}_3 (\text{s})$
9.b)	Because formation is the creation of a compound from its basic elements but N <sub>2</sub> is already a basic element in its most stable state.

<b>9.c)</b>	$H = -2\,085.5\text{kJ}$ $S = +0.6338\text{ J/ K}$ $G = -2\,274.4\text{kJ/}$
<b>9.d)</b>	<p>(Need to specify whether asking for useful energy - Gibbs free energy - or all theoretical energy - enthalpy. I know the end answer would have practically no difference but it would still help avoid confusion.)</p> $P = 1.49\text{ kPa}$
<b>10.a)</b>	-0.3018 kJ/mol
<b>10.b)</b>	- 0.7545 kJ
<b>10.c)</b>	Yes because Gibbs free energy change is negative.
<b>10.d)</b>	283.8 K
<b>11.</b>	+ 9.612 J/mol K
<b>12.a)</b>	<p>G is change of Gibbs Free Energy, which is the energy available to do useful work. Measured in kJ because it is a measurement of energy. It combines enthalpy and entropy change because reactions can be driven by either. H is enthalpy change and is measured by kJ/mol because it is the energy change per mole of substance. It is minus entropy because entropy induces spontaneity when positive but enthalpy when negative. With this negative G means spontaneity. Technically, the equations could just as easily be <math>G = T \cdot S - H</math> with G meaning spontaneity when positive instead. S is entropy change which is the number of ways energy is distributed. It is per Kelvin because a higher temperature means more entropy. It is in Joules because the energy is very miniscule when measured per Kelvin. But when put into equation its units have to be the same as enthalpies units. Entropy change is times T (temperature) because S is per Kelvin of temperature.</p>
<b>12.b)</b>	+ 33.56 J/mol K
<b>12.c)</b>	111 g