

Chemical Reaction (all at 298 K)	w	ΔH	ΔS	ΔG at 298 K	Spontaneous at what T?
$\text{CH}_4(\text{g}) + 2 \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{l})$	4.96 kJ	-890.5 kJ	-242 J/K	-818 kJ	< 3689 K
$2 \text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2 \text{H}_2\text{O}(\text{g})$	2.47 kJ	-484 kJ	-89 J/K	-457 kJ	< 5400 K
$\text{C}_2\text{H}_5\text{OH}(\text{l}) + 3 \text{O}_2(\text{g}) \rightarrow 2 \text{CO}_2(\text{g}) + 3 \text{H}_2\text{O}(\text{l})$	2.74 kJ	-1366 kJ	-138 J/K	-1324 kJ	< 9900 K
$\text{CCl}_4(\text{l}) \rightarrow \text{C}(\text{s}) + 2 \text{Cl}_2(\text{g})$ This is a non-spontaneous reaction <i>*using C(graphite) as C(s)</i>	-4.96 kJ	135 kJ	236 J/K	64 kJ	> 570 K
$\text{Ba}(\text{OH})_2 \cdot (\text{H}_2\text{O})_8(\text{s}) + 2\text{NH}_4\text{NO}_3(\text{s}) \rightarrow \text{Ba}(\text{NO}_3)_2(\text{s}) + 2\text{NH}_3(\text{g}) + 10 \text{H}_2\text{O}(\text{l})$ This is a spontaneous, endothermic reaction. <i>*couldn't find numbers for any of this, don't worry about it</i>	-4.95 kJ	+	+	+	high T
$2 \text{O}_3(\text{g}) \rightarrow 3 \text{O}_2(\text{g})$ This is a spontaneous, slightly exothermic reaction. <i>*O₃(g): H = 124 kJ; S = 239 J/K</i>	-2.74 kJ	-286 kJ	137 J/K	-326 kJ	always
$\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{l})$ <i>*ΔH I got by converting the H_{fus} (334 J/g) to J/mol</i>	0	6.01 kJ	22 J/K	-3.5 kJ	> 273 K
$\text{CO}_2(\text{g}) \rightarrow \text{CO}_2(\text{s})$ <i>*Don't worry about this one either</i>	2.74 kJ	-26 kJ	-	+	low T
$\text{NH}_3(\text{g}) + \text{HCl}(\text{g}) \rightarrow \text{NH}_4\text{Cl}(\text{s})$ This is a spontaneous reaction.	2.74 kJ	-176 kJ	-284 J/K	-91 kJ	< 620 K
$2\text{H}_2\text{O}_2(\text{l}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$ This is a spontaneous, exothermic reaction <i>*H₂O₂(l): H = -188 kJ; S = 110 J/K</i>	-2.74 kJ	-196 kJ	125 J/K	-233 kJ	always