What if I mix Cl\textsubscript{2} with H\textsubscript{2}? Will I “spontaneously” get HCl?

\[
\text{Cl}_2 + \text{H}_2 \rightarrow 2\text{HCl}
\]

\begin{align*}
\text{Cl}_2 \text{ bond} &= 242 \text{ kJ/mol} \\
\text{H}_2 \text{ bond} &= 436 \text{ kJ/mol} \\
\text{HCl} \text{ bond} &= 431 \text{ kJ/mol}
\end{align*}

\[
\Delta H = (436 + 242) \text{ kJ \cdot mol}^{-1} + 2(-431 \text{ kJ \cdot mol}^{-1})
\]

\[
\Delta H = -184 \text{ kJ \cdot mol}^{-1}
\]
Energy Release — Going Downhill

\[ \text{Cl}_2 + \text{H}_2 \rightarrow 2\text{HCl} \]

\[ \Delta \text{H} = -184 \text{ kJ} \cdot \text{mol}^{-1} \]

ENTHALPY

downhill 184 kJ/mol
Energy Release May Face A Barrier

$\text{Cl} \cdot + \text{Cl} \cdot + \text{H}_2$  

$\text{Cl}_2 + \text{H}_2$  

$\text{HCl}$

**ENTHALPY**

This energy out will get the *next* one over the hill.
Self assessment insert here

- Verification that 485 nm breaks Cl₂ bond
- multiple answers with color next to wavelength upon answering?
And Once The Reaction Is Started?

- The reaction releases 184 kJ/mol in heat.
- The temp will go up (assume an ideal diatomic gas at high temp)

\[ \Delta U = C_v \Delta T \quad \rightarrow \quad \Delta T = \frac{\Delta U}{C_v} = \frac{\Delta U}{7} \approx 6323 \text{ K} \]

- At constant volume, the pressure will go up (Amonton’s Law),

\[ \frac{P_2}{P_1} = \frac{T_2}{T_1} \quad \rightarrow \quad P_2 = (1 \text{ atm}) \left( \frac{300 \text{ K} + 6323 \text{ K}}{300 \text{ K}} \right) \approx 22 \text{ atm} \]
\[ dU = \delta q + \delta w \]

Next: Atomic Energy Levels