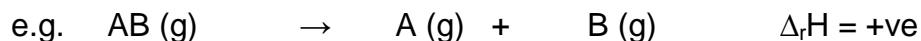


Calculating Enthalpy from Bond Energies

$$\Delta_r H = \Delta_r H (\text{bonds broken}) - \Delta_r H (\text{bonds made})$$

Bond energies are a measure of the energy needed to break an intramolecular covalent bond in a molecule.

“Bond energy is the average energy required to break 1 mole of covalent bonds between 2 atoms in the gaseous state”



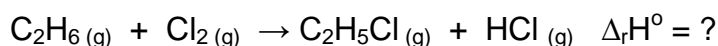
A chemical reaction is a series of bond breaking processes ($\Delta H = +ve$) and bond making processes ($\Delta H = -ve$).

We can estimate the enthalpy of a chemical reaction by adding the bond energies for bonds that break and subtracting energies for those bonds which are made.

Example

Bond energies (kJ mol^{-1})	
C - H	413
C - Cl	339
Cl - Cl	242
H - Cl	431

Calculate the heat of reaction for the following reaction given the bond energies above



Answer

Bonds Broken ($\Delta H = +ve$)		Bonds Made ($\Delta H = -ve$)	
Cl - Cl	413	C - Cl	339
C - H	242	H - Cl	431
655		770	

$$\begin{aligned} \Delta_r H &= \Delta_r H (\text{bonds broken}) - \Delta_r H (\text{bonds made}) \\ &= 655 - 770 \\ &= \underline{-115 \text{ kJ mol}^{-1}} \end{aligned}$$

Hint: Draw structural formula to really see how many bonds break / form