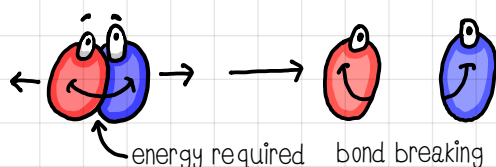


Bond energy calculations

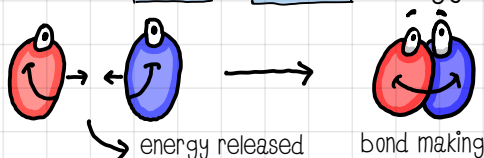
- In exothermic reactions, energy is transferred from the chemicals to the surroundings.
- Exothermic energy changes are shown as negative because energy has been transferred from the chemicals (energy lost).
- In endothermic reactions, energy is transferred into the chemicals from the surroundings.
- Endothermic energy changes are shown as positive because energy has been transferred into the chemicals (energy gained).

Bond energy

- When a chemical bond is broken, energy is required (endothermic)



- When a chemical bond is made, energy is released (exothermic)

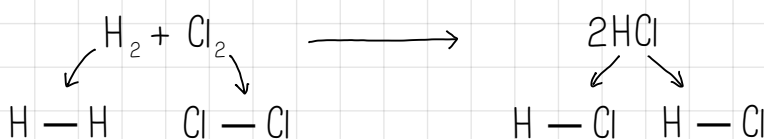


- Every chemical bond has an energy value. This is the energy required to make or break the bond.

Example question #1

- Calculate the energy change for the following reaction

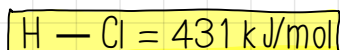
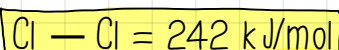
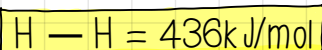
hydrogen + chlorine \longrightarrow hydrogen chloride



These bonds will be broken

These bonds will be made

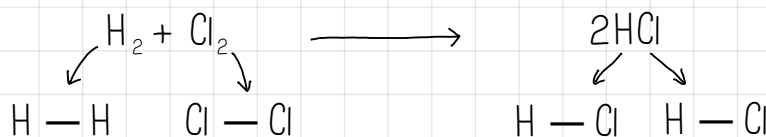
Bond values



Bond energy calculations...

Example question #1

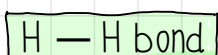
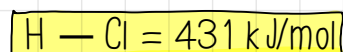
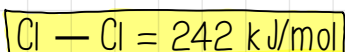
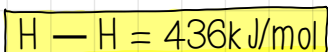
hydrogen + chlorine \longrightarrow hydrogen chloride



These bonds will be broken

These bonds will be made

Bond values

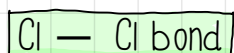


reactant



The energy required to make or break a $\text{H} - \text{H}$ bond is 436 kJ/mol. In this reaction the hydrogen bonds are broken which is endothermic. Endothermic reactions are positive as they gain energy.

Therefore the energy value for $\text{H} - \text{H} = +436 \text{ kJ/mol}$

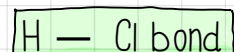


reactant



The energy required to make or break a $\text{Cl} - \text{Cl}$ bond is 242 kJ/mol. In this reaction the chlorine bonds are broken which is endothermic. Endothermic reactions are positive as they gain energy.

Therefore the energy value for $\text{Cl} - \text{Cl} = +242 \text{ kJ/mol}$



product



The energy required to make or break a $\text{H} - \text{Cl}$ bond is 431 kJ/mol. In this reaction the bonds are made which is exothermic. Exothermic reactions are negative as they lose energy.

Therefore the energy value for $\text{H} - \text{Cl} = -431 \text{ kJ/mol}$

The balanced equations shows two molecules of HCl so the total energy change $= -431 \times 2 = -862 \text{ kJ/mol}$



To calculate the energy change place the sum of the products next to the sum of the reactants and do the calculation.



$$(+436) + (+242) - 862 = +678 - 862 = -184 \text{ kJ/mol}$$

The change is negative, the overall reaction is exothermic.

watch video