Chemical energetics

Exothermic reaction:

Exothermic reaction transfers thermal energy to the surroundings leading to an increase in the temperature of the surroundings.

Note:

- **The energy released goes into warming up the surroundings.**

The surroundings include :
The air around the test tube, the test tube itself, thermometers , stirring rods etc.

Endothermic reactions:

An endothermic reaction takes in thermal energy from the surroundings leading to a decrease in the temperature of the surroundings
The heat absorbed is taken in by the reaction mixture and so lowers the temperature of the surroundings.

Examples of exothermic reactions	Examples of endothermic reactions
Burning of substances	Thermal decomposition
Nuclear fission	Photosynthesis
Mixing of water and acid	Action of light on Silver bromide
Rusting of iron	Electrolysis

ENTHALPHY CHANGE

Enthalpy change: The transfer of thermal energy during a reaction is called the enthalpy change, ΔH, of the reaction.
ΔH is negative for exothermic reactions and
ΔH ispositive for endothermic reactions

How to decide whether the reaction is endothermic or exothermic?

Remember that :

- Breaking the bonds of the reactants needs energy. So bond breaking is endothermic.
- New products are formed by the formation of new bonds. And energy is released when new bonds are formed.So bond making is exothermic.
- If more energy is released when new bonds are formed compared to the energy taken in when the bonds in the reactant are broken ; then the overall reaction is exothermic and vice-versa.

Example:

7 Hydrogen reacts with the halogens to form hydrogen halides.

(a) Bond energy is the amount of energy, in kJ, that must be supplied (endothermic) to break one mole of a bond.

bond	bond energy in kJ/mol
H–H	+436
Cl–Cl	+242
H–Cl	+431

Use the above data to show that the following reaction is exothermic.

H–H + Cl–Cl → 2H–Cl

Reactants side:
Bonds break. Energy is taken in hence its endothermic
1H-H bond=+436kJ/mol
1 Cl-Cl bond=+242kJ/mol
Total energy taken in while breaking the bonds= 436+242 = +678kJ/mol

Product side:
2H-Cl bonds are formed .Total energy taken given out when these bonds are formed= 2 X 431= -862kJ/mol
Adding the two +678kJ/mol-862kJ/mol=-184kJ/mol

Thus the overall reaction is exothermic as more heat is given out than that was taken in.
