

Paper 1

Chapter 5 — Energy Changes

(HT) Energy Changes

In a chemical reaction...

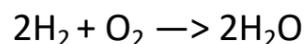
...energy needs to be supplied when bonds are _____ in the _____.

...energy is _____ when bonds are _____ in the _____.

The energy required to break a bond is (higher than/lower than/equal to) the energy released when the bond is formed.

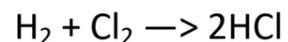
For each reaction use the bond energies to calculate the energy

- required to break the reactants,
- released when the products form,
- overall energy change,
- label endothermic/exothermic



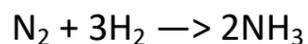
H—H = 440kJ O=O = 500kJ O—H = 460kJ

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H—H = 440kJ Cl—Cl = 240kJ H—Cl = 430kJ

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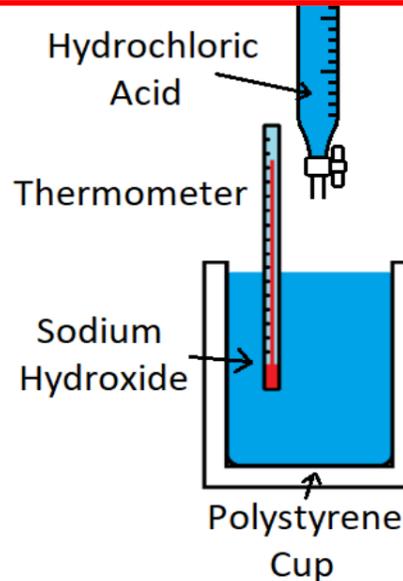
N≡N 940kJ H—H = 440kJ N—H = 390kJ

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Required Practical - Temperature Changes

25cm³ of Hydrochloric Acid of varying concentration was added to 25cm³ of Sodium Hydroxide (2.0mol/dm³) with the following results.

Concentration of Acid (mol/dm ³)	Maximum Temperature (°C)			
	Expt 1	Expt 2	Expt 3	Average
0.4	21.8	21.9	22.0	
0.8	24.1	24.1	21.7	
1.2	27.9	27.7	27.8	
1.6	30.0	31.0	30.5	
2.0	33.6	33.8	33.8	



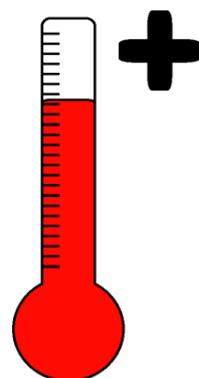
- Which was the anomalous result?
- Calculate the averages.
- What was the independent variable?
- What was the dependent variable?
- Name 2 control variables?
- What is the resolution of the thermometer used?
- What is the interval in the acid concentration?
- Why was the reaction completed in a polystyrene cup?
- Which acid concentration provided the least precise results?
- What is the range of temperatures for 0.4mol/dm³ acid?
- What is the uncertainty for 0.4mol/dm³ acid results?
- All three experiments show the same pattern so the results are?
- If another group get the same pattern the results are?

Exothermic Reactions

Exothermic reactions (transfer energy to/ take in energy from) the surroundings. The temperature of the surroundings (increases/ decreases).

Give 2 everyday uses of exothermic reactions

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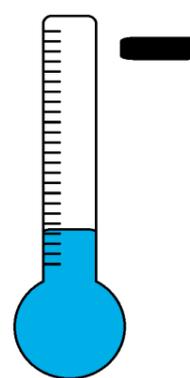


Endothermic Reactions

Endothermic reactions (transfer energy to/ take in energy from) the surroundings. The temperature of the surroundings (increases/ decreases).

Give an everyday use of an endothermic reaction

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Endothermic and Exothermic Reactions

Energy is always (created/destroyed/conserved) in chemical reactions. The amount of energy in the universe before a reaction is (higher than/lower than/the same as) the amount of energy in the universe after the reaction.

If the product molecules have less energy than the reacting molecules the reaction is (exothermic/ endothermic) and the difference in energy is _____ the surroundings.

If the product molecules have more energy than the reacting molecules the reaction is (exothermic/endothermic) and the difference in energy is _____ the surroundings.

Label the reactions as exothermic or endothermic

Combustion -

Thermal Decompositions -

Oxidation Reactions -

Neutralisation -

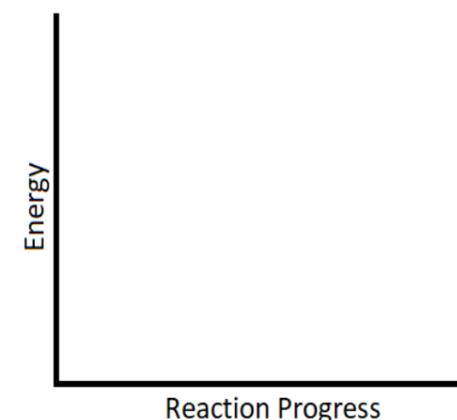
Citric Acid reacting with Sodium Hydrogen Carbonate -

Reaction Profiles

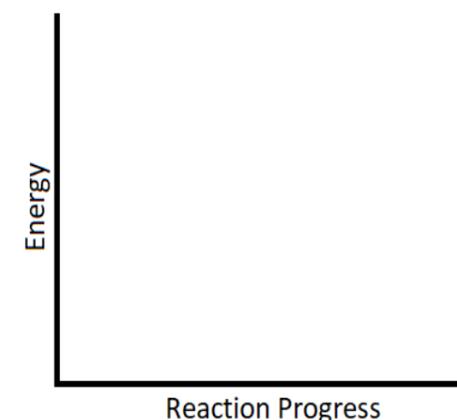
Chemical reactions can occur only when the particles that react _____ with each other and with enough _____. The minimum amount of energy the particles need to react is called the _____.

Draw reaction profiles (energy level diagrams) for an exothermic and an endothermic reaction. Label reactants, products, activation energy and overall energy change.

Exothermic Reaction



Endothermic Reaction

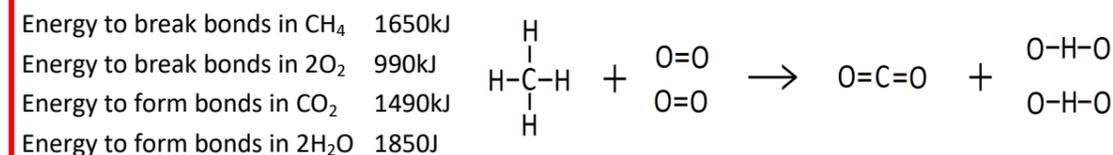


(HT) Bond Energy

If the energy released from the forming new bonds is _____ than the energy needed to break original bonds the reaction is _____.

If the energy needed to break original bonds is _____ than the energy released from forming new bonds the reaction is _____.

Is the following reaction endothermic or exothermic?



Paper 1

Chapter 5 — Energy Changes

(HT) Energy Changes

In a chemical reaction...

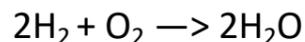
...energy needs to be supplied when bonds are **broken** in the **reactants**

...energy is **released** when bonds are **formed** in the **products**

The energy required to break a bond is (higher than/lower than/**equal to**) the energy released when the bond is formed.

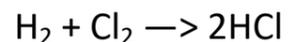
For each reaction use the bond energies to calculate the energy

- required to break the reactants,
- released when the products form,
- overall energy change,
- label endothermic/exothermic



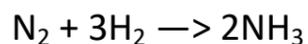
H—H = 440kJ O=O = 500kJ O—H = 460kJ

- $2 \times 440 + 500 = 1380 \text{ kJ}$
- $4 \times 460 = 1840 \text{ kJ}$
- Overall = -460 kJ
- Exothermic



H—H = 440kJ Cl—Cl = 240kJ H—Cl = 430kJ

- $440 + 240 = 680 \text{ kJ}$
- $2 \times 430 = 860 \text{ kJ}$
- Overall = -180 kJ
- Exothermic



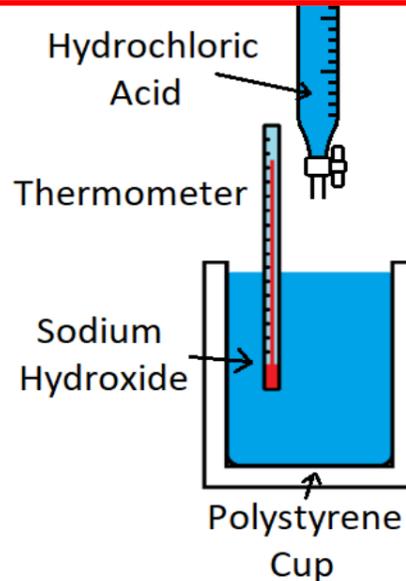
N≡N 940kJ H—H = 440kJ N—H = 390kJ

- $940 + 3 \times 440 = 2260 \text{ kJ}$
- $2 \times (3 \times 390) = 2340 \text{ kJ}$
- Overall = -80 kJ
- Exothermic

Required Practical - Temperature Changes

25cm³ of Hydrochloric Acid of varying concentration was added to 25cm³ of Sodium Hydroxide (2.0mol/dm³) with the following results.

Concentration of Acid (mol/dm ³)	Maximum Temperature (°C)			
	Expt 1	Expt 2	Expt 3	Average
0.4	21.8	21.9	22.0	21.9
0.8	24.1	24.1	21.7	24.1
1.2	27.9	27.7	27.8	27.8
1.6	30.0	31.0	30.5	30.5
2.0	33.6	33.8	33.8	33.7



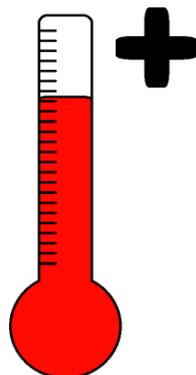
- Which was the anomalous result? **On table - 0.8mol/dm³ Expt 3 - 21.7**
- Calculate the averages. **On table**
- What was the independent variable? **Concentration of acid**
- What was the dependent variable? **Maximum temperature**
- Name 2 control variables? **Volume of acid, concentration of Sodium Hydroxide**
- What is the resolution of the thermometer used? **0.1°C**
- What is the interval in the acid concentration? **0.4mol/dm³**
- Why was the reaction completed in a polystyrene cup? **Reduce heat loss to surroundings**
- Which acid concentration provided the least precise results? **1.6mol/dm³**
- What is the range of temperatures for 0.4mol/dm³ acid? **21.8 to 22.0°C**
- What is the uncertainty for 0.4mol/dm³ acid results? **±0.1°C**
- All three experiments show the same pattern so the results are? **Repeatable**
- If another group get the same pattern the results are? **Reproducible**

Exothermic Reactions

Exothermic reactions (**transfer energy to**)/ (take in energy from) the surroundings. The temperature of the surroundings (**increases**)/(decreases).

Give 2 everyday uses of exothermic reactions

- self-heating cans**
- hand warmers**

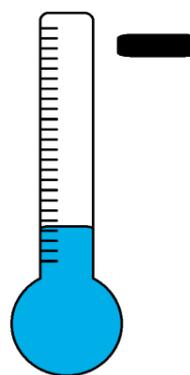


Endothermic Reactions

Endothermic reactions (transfer energy to)/ (**take in energy from**) the surroundings. The temperature of the surroundings (**increases**)/(decreases).

Give an everyday use of an endothermic reaction

- sports injury packs**



Endothermic and Exothermic Reactions

Energy is always created/destroyed/**conserved** in chemical reactions. The amount of energy in the universe before a reaction is higher than/lower than/**the same** as the amount of energy in the universe after the reaction.

If the product molecules have less energy than the reacting molecules the reaction is (**exothermic**/endothermic) and the difference in energy is **transferred to** the surroundings.

If the product molecules have more energy than the reacting molecules the reaction is (exothermic/**endothermic**) and the difference in energy is **absorbed from** the surroundings.

Label the reactions as exothermic or endothermic

Combustion - **exothermic** Thermal Decompositions - **endothermic**

Oxidation Reactions - **exothermic** Neutralisation - **exothermic**

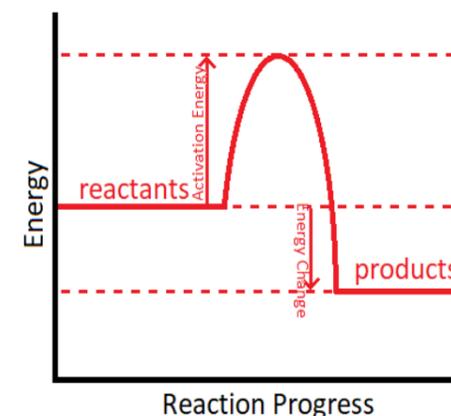
Citric Acid reacting with Sodium Hydrogen Carbonate - **endothermic**

Reaction Profiles

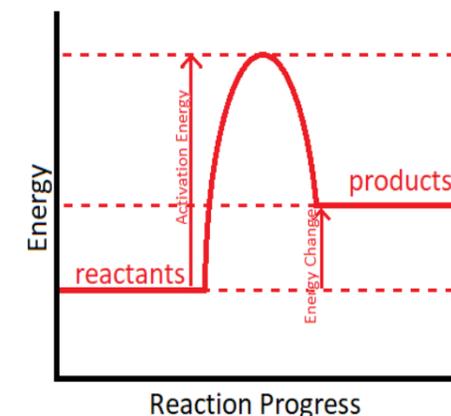
Chemical reactions can occur only when the particles that react **collide** with each other and with enough **energy**. The minimum amount of energy the particles need to react is called the **activation energy**.

Draw reaction profiles (energy level diagrams) for an exothermic and an endothermic reaction. Label reactants, products, activation energy and overall energy change.

Exothermic Reaction



Endothermic Reaction



(HT) Bond Energy

If the energy released from the forming new bonds is **greater** than the energy needed to break original bonds the reaction is **exothermic**.

If the energy needed to break original bonds is **greater** than the energy released from forming new bonds the reaction is **endothermic**.

Is the following reaction endothermic or exothermic? **Overall release of 1700kJ Exothermic**

