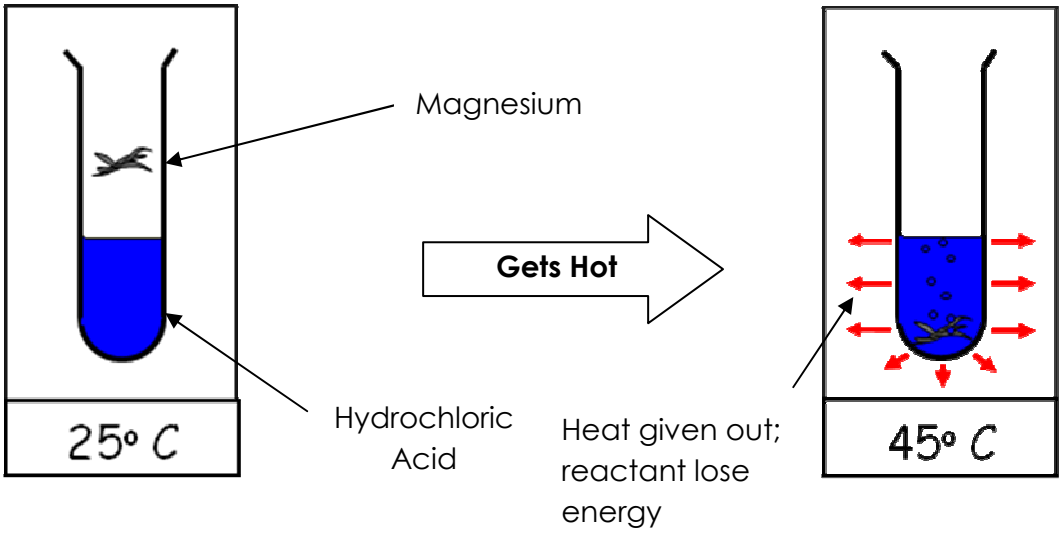
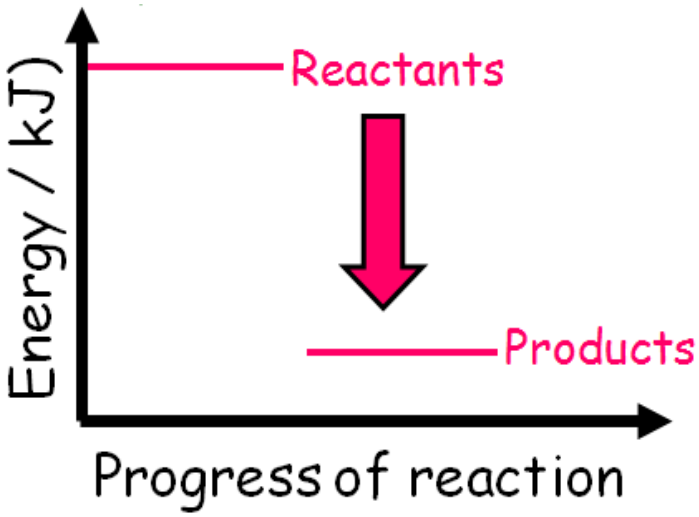
Exothermic Reactions:



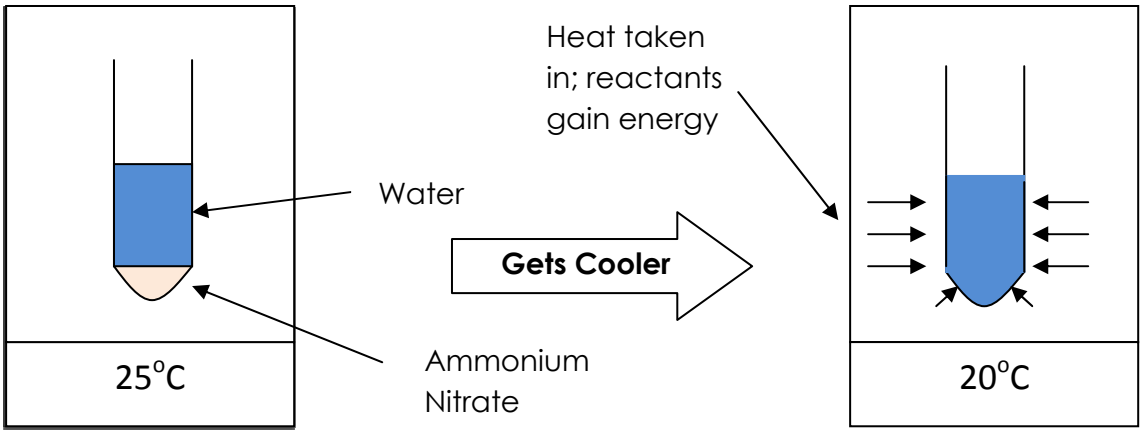
Energy Level Diagram for Exothermic Reactions:



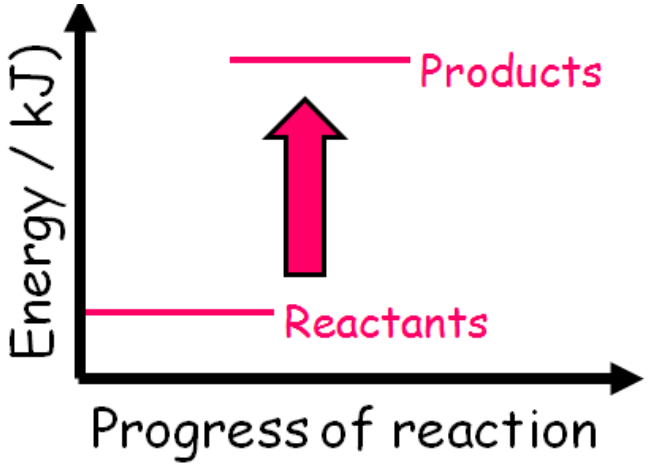
In an exothermic reaction, the reactants start with a lot of energy but lose this during the reaction as heat to the surroundings.

The products have a lot less energy than the reactants.

Endothermic Reactions:



Energy Level Diagram for Exothermic Reactions:



The reactants start with a low amount of energy but then gain a lot of energy from the surroundings.

The products have more energy than the reactants.

POINTS TO NOTE:

- In exothermic reactions atom bonds are made
- In endothermic reactions atom bonds are broken
- For a reaction to be overall exothermic more bonds have to be formed than broken.
- For a reaction to be endothermic more bonds have to broken than formed.

In an exam **NEVER** state that more/less bonds are made/broken!!!!

USE the following:

In an exothermic reaction, more energy is needed to make the bonds than to break the bonds (or vice-versa).

PPQ(1):

11 Nitrogen molecules react with oxygen molecules.

Nitrogen monoxide molecules are made.

$$N_2 + O_2 \rightarrow 2NO$$

The reaction is endothermic.

(a) Explain, in terms of bond breaking and bond making, why this reaction is endothermic.

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..... **[3]**

OCR Gateway January 2013 C1 C2 C3

PPQ(2):

12 This question is about energy changes during chemical reactions.

(a) Cold packs are used to treat sports injuries.

The cold pack **reduces** the temperature of the injured part of the body.

An endothermic reaction happens when the chemicals in the cold pack react.

Energy is absorbed when bonds break.

Explain, in terms of bonds between atoms, why this reaction is **endothermic**.

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..... **[2]**

OCR Gateway May 2013 C1 C2 C3

PPQ(3):

(b) During any chemical reaction bonds are broken and bonds are made.

Burning fuels is an **exothermic** reaction.

Explain why.

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..... **[3]**

OCR Gateway May 2012 B3 C3 P3

PPQ(4)

(b) Burning fuels is an **exothermic** reaction.

Explain, in terms of bonds between atoms, why burning fuels is an exothermic reaction.

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..... **[3]**

OCR Gateway June 2013 B3 C3 P3

Mark Schemes:

PPQ(1):

Question			Answer	Marks	Guidance
11	(a)		bond breaking is endothermic / bond breaking takes in energy / bond breaking absorbs energy (1) bond making is exothermic / bond making gives out energy / bond making releases energy (1) more energy taken in than is released / more energy absorbed than given out (1)	3	**allow** heat instead of energy **ignore** more bonds are broken than are made

PPQ(2):

Question			Answer	Marks	Guidance
12	(a)		bond making is exothermic / bond making gives out energy / bond making releases energy (1) more energy taken in than is released / more energy absorbed than given out (1) **but** it takes more energy to break the bonds than the energy released in making new bonds scores (2)	2	**allow** heat instead of energy **ignore** more bonds are broken than are made

PPQ(3):

	(b)		bond making is exothermic / energy given out (1) bond breaking is endothermic / energy taken in (1) more energy is given out than is taken in (1)	3	the energy required to break the bonds is less than the energy released in making the bonds (3) / aw **ignore** references to number of bonds

PPQ(4):

	(b)		idea that bond breaking is endothermic (1) idea that bond making is exothermic (1) more energy is given out (in bond making) than is taken in (in bond breaking) (1)	3	**allow** bond breaking absorbs energy (1) **allow** bond making releases energy (1) **allow** more energy released than absorbed (1) **ignore** references to different numbers of bonds, eg more bonds made than broken **not** references to intermolecular bonds **allow** exothermic reactions give out energy or heat (1) if no other mark awarded