Energy Changes

What's the science story?

Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications. Some interactions between ions in an electrolyte result in the production of electricity. Cells and batteries use these chemical reactions to provide electricity. Electricity can also be used to decompose ionic substances and is a useful means of producing elements that are too expensive to extract any other way.

Previous knowledge:

Year 7,8,9 Reactions – bonding, electricity, elements, mixtures, compounds.

C2 and C4.

Next steps…

C6 – rate of chemical reaction.

Keywords

Bonds
Breaking
Making
Exothermic
Endothermic
Heat energy
Activation energy

Working scientifically skills: WS2 Draw/interpret diagrams WS14 Graphs WS15 Data WS16 Using equations WS18 Converting units	**Assessments:** • Exothermic and endothermic exit ticket

Lesson No. and Title	Learning objectives	AQA Specification	Practical equipment
1.Exothermic and endothermic reactions	5 – To explain exothermic and endothermic reactions 6 – To draw and label reaction profiles 7 – H - To use bond energies to calculate energy changes in reactions	**5.5.1.1 Energy transfer during exothermic and endothermic reactions** **5.5.1.3 The energy change of reactions (HT)** Energy is conserved in chemical reactions. The amount of energy in the universe at the end of a chemical reaction is the same as before the reaction takes place. If a reaction transfers energy to the surroundings the product molecules must have less energy than the reactants, by the amount transferred. An exothermic reaction is one that transfers energy to the surroundings so the temperature of the surroundings increases. Exothermic reactions include combustion, many oxidation reactions and neutralisation. Everyday uses of exothermic reactions include self-heating cans and hand warmers. An endothermic reaction is one that takes in energy from the surroundings so the temperature of the surroundings decreases. Endothermic reactions include thermal decompositions and the reaction of citric acid and sodium hydrogencarbonate. Some sports injury packs are based on endothermic reactions. Students should be able to: • distinguish between exothermic and endothermic reactions on the basis of the temperature change of the surroundings • evaluate uses and applications of exothermic and endothermic reactions given appropriate information. Limited to measurement of temperature change. Calculation of energy changes or ΔH is not required. During a chemical reaction: • energy must be supplied to break bonds in the reactants • energy is released when bonds in the products are formed. The energy needed to break bonds and the energy released when bonds are formed can be calculated from bond energies. The difference between the sum of the energy needed to break bonds in the reactants and the sum of the energy released when bonds in the products are formed is the overall energy change of the reaction. In an exothermic reaction, the energy released from forming new bonds is greater than the energy needed to break existing bonds. In an endothermic reaction, the energy needed to break existing	RP Magnesium powder, zinc powder, Iron powder, copper powder, copper sulfate.

		bonds is greater than the energy released from forming new bonds. Students should be able to calculate the energy transferred in chemical reactions using bond energies supplied.	
2.Exothermic and endothermic reactions.	5 – To explain exothermic and endothermic reactions 6 – To draw and label reaction profiles **7 – H - To use bond energies to calculate energy changes in reactions**	**5.5.1.2 Reaction profiles** Chemical reactions can occur only when reacting particles collide with each other and with sufficient energy. The minimum amount of energy that particles must have to react is called the activation energy. Reaction profiles can be used to show the relative energies of reactants and products, the activation energy and the overall energy change of a reaction. Students should be able to: • draw simple reaction profiles (energy level diagrams) for exothermic and endothermic reactions showing the relative energies of reactants and products, the activation energy and the overall energy change, with a curved line to show the energy as the reaction proceeds • use reaction profiles to identify reactions as exothermic or endothermic • explain that the activation energy is the energy needed for a reaction to occur.	
3.			

4.			
5.			
6.			

7.			