KESTEVEN AND SLEAFORD HIGH SCHOOL

Chemistry Scheme of Learning

Year 10 – Term 3 Topic 5

Intent – Rationale

Pupils learn about energy changes in reactions, and that some reactions will take in energy and others release energy. They learn about everyday examples of endothermic and exothermic reactions. Students invesigtate how different variables affect energy changes in reactions I one of the required practicals and they learn how to calculate energy changes in reactions. Triple scientists go on to learn about chemical cells and fuel cells, including exploring hydrogen fuel cells as an alternative sustainable fuel source

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
• Year 7 – Topic 1 Chemistry and Physics (particles and energy transfer), Topic 3 Acids and Alkalis, Topic 4 Solutions, Topic 5 Simple Chemical Reactions • Year 8 – Topic 9 Reactions of Acids, Topic 10 Describing Chemical Reactions • Year 9 GCSE Topic 2 Bonding, Topic 3 Quantitative Chemistry, Topic 4 Chemical Changes	• GCSE Topic 6 Rates and Equilibria, Topic 7 Organic Chemistry, Topic 10 Using Resources, • A level Topic 2 Amount OF Substance, Topic 4 Energetics and Topic 17 Thermodynamics
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
• Base the content here on what you already know but there will be time in future to liaise further as part of our collaborative work	• SP – Pupil's enjoyment of learning about the world around them • GB4 c,d,e,f,g,i
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**
FROM THE LIBRARY *Energy And Chemical Change*-540 *Heat And Combustion*-540 *Hydrogen and The Noble Gas-540*	• Processing data, calculating means, plotting graphs • Calculating energy released in chemical reactions • Calculating energy changes from bond energies

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Chemistry Scheme of Learning

Year 10 – Term 3 Topic 5

Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?

Know

- I know that energy is conserved in chemical reactions
- I know that an exothermic reaction is one that transfers energy to the surroundings so the temperature of the surroundings increases
- I know that an endothermic reaction is one that takes in energy from the surroundings so the temperature of the surroundings decreases
- I know some everyday uses of exothermic reactions include self-heating cans and hand warmers
- I know that 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
- I know that 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
- I can identify variables in an investigation into temperature changes in chemical reactions
- I can come up with a simple hypothesis
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- I know that the energy needed to break bonds and the energy released when bonds are formed can be calculated from bond energies
- *I know that cells contain chemicals which react to produce electricity*
- *I know that a simple cell can be made by connecting two different metals in contact with an electrolyte*
- *I know that rechargeable cells and batteries can be recharged because the chemical reactions are reversed when an external electrical current is supplied*
- *I know that fuel cells are supplied by an external source of fuel (eg hydrogen) and oxygen or air. The fuel is oxidised electrochemically within the fuel cell to produce a potential difference.*
- *I know that hydrogen fuel cells offer a potential alternative to rechargeable cells and batteries*

Apply

- I know that exothermic reactions include combustion, many oxidation reactions and neutralisation
- I can distinguish between exothermic and endothermic reactions on the basis of the temperature change of the surroundings
- I know that endothermic reactions include thermal decompositions and the reaction of citric acid and sodium hydrogencarbonate. Some sports injury packs are based on endothermic reactions
- I can 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
- I can explain that the activation energy is the energy needed for a reaction to occur
- I can collect accurate data during a practical procedure
- I know 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.
- *I know that the voltage produced by a cell is dependent upon a number of factors including the type of electrode and electrolyte*
- *I know that batteries consist of two or more cells connected together in series to provide a greater voltage.*
- *I know that in non-rechargeable cells and batteries the chemical reactions stop when one of the reactants has been used up. Alkaline batteries are non-rechargeable.*
- *I know the overall reaction in a hydrogen fuel cell involves the oxidation of hydrogen to produce water.*

Extend

- I can evaluate uses and applications of exothermic and endothermic reactions given appropriate information
- I can use reaction profiles to identify reactions as exothermic or endothermic
- I can interpret data and draw valid conclusions
- I can analyse and evaluate data and suggest improvements to procedures
- I can calculate the energy transferred in chemical reactions using bond energies supplied
- I can calculate bond energies from energy transferred in chemical reactions

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- *I can interpret data for relative reactivity of different metals and evaluate the use of cells.*
- *I can evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries*
- *I can write the half equations for the electrode reactions in the hydrogen fuel cell.*

What subject specific language will be used and developed in this topic?

Exothermic	A reaction that releases energy to the surroundings
Endothermic	A reaction that takes in energy from the surroundings
Activation Energy	The minimum energy required for a reaction to take place
Bond Energy	The energy required to break a specific chemical bond
Fuel Cell	*Sources of electricity that are supplied by an external source of fuel e.g. hydrogen*
Reaction Profile	A diagram that shows the relative amounts of energy in the reactants and products. A curved line is drawn from the reactants and products shows the course of the reaction. The difference in energy between the top of the peak of the curve and the reactants is the activation energy
Anhydrous	Describes a substance that does not contain water
Hydrated	Describes a substance that has water in its crystals
Water of crystallisation	The water contained in a hydrated salt
Non-rechargeable Battery	*A battery which cannot be recharged. The chemical reaction in the cell is not reversible*
Rechargeable Battery	*A battery which can be recharged because it uses a reversible reaction. An external voltage is supplied which forces the electrons in the opposite direction*

What opportunities are available for assessing the progress of students?

- **Required Practical 4**
- **Long answer questions after lesson 5 and 7 – self and teacher assessed**
- **Tests after lesson 5 or 7**

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Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
Lesson 1 Exothermic and Endothermic Reactions	• I know that energy is conserved in chemical reactions • I know that an exothermic reaction is one that transfers energy to the surroundings so the temperature of the surroundings increases • I know that an endothermic reaction is one that takes in energy from the surroundings so the temperature of the surroundings decreases • I know some everyday uses of exothermic reactions include self-heating cans and hand warmers • I know that exothermic reactions include combustion, many oxidation reactions and neutralisation	• I can distinguish between exothermic and endothermic reactions on the basis of the temperature change of the surroundings • I know that endothermic reactions include thermal decompositions and the reaction of citric acid and sodium hydrogencarbonate. Some sports injury packs are based on endothermic reactions • I can evaluate uses and applications of exothermic and endothermic reactions given appropriate information	
Lesson 2 Required Practical 4	• I can identify variables in an investigation into temperature changes in chemical reactions • I can come up with a simple hypothesis • I can collect accurate data during a practical procedure	• I can interpret data and draw valid conclusions • I can analyse and evaluate data and suggest improvements to procedures	
Lesson 3 Energy Profile Diagrams	• I know that 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 • I know that 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	• I can 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 • I can explain that the activation energy is the energy needed for a reaction to occur • I can use reaction profiles to identify reactions as exothermic or endothermic	
Lesson 4 Measuring Energy Changes	• I know that the energy needed to break bonds and the energy released when bonds are formed can be calculated from bond energies • I can carry out an investigation to calculate the energy transferred when different alcohols are burned	• I can explain why larger molecules release more energy when burned, in terms of bond breaking and bond making	
Lesson 5 Bond Energies	• I know that the energy needed to break bonds and the energy released when bonds are formed can be calculated from bond energies	• I know 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.	

		• I can calculate the energy transferred in chemical reactions using bond energies supplied • I can calculate bond energies from energy transferred in chemical reactions	
Lesson 6 Simple Cells	• *I know that cells contain chemicals which react to produce electricity* • *I know that a simple cell can be made by connecting two different metals in contact with an electrolyte* • *I know that rechargeable cells and batteries can be recharged because the chemical reactions are reversed when an external electrical current is supplied*	• *I know that the voltage produced by a cell is dependent upon a number of factors including the type of electrode and electrolyte* • *I know that batteries consist of two or more cells connected together in series to provide a greater voltage.* • *I know that in non-rechargeable cells and batteries the chemical reactions stop when one of the reactants has been used up. Alkaline batteries are non-rechargeable.*	
Lesson 7 Fuel Cells	• *I know that fuel cells are supplied by an external source of fuel (eg hydrogen) and oxygen or air. The fuel is oxidised electrochemically within the fuel cell to produce a potential difference.* • *I know that hydrogen fuel cells offer a potential alternative to rechargeable cells and batteries*	• *I can interpret data for relative reactivity of different metals and evaluate the use of cells.* • *I can evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries* • *I can write the half equations for the electrode reactions in the hydrogen fuel cells*	
Test and long answer question after lesson 5 (combined)			
Test after Lesson 7 and long answer question(Triple)			