# Scheme of work

## Combined Science: Trilogy - Foundation

## Chemistry – Energy changes

This resource provides guidance for teaching the Energy changes topic from our new GCSE Combined Science: Trilogy specification (8464). It has been updated from the draft version to reflect the changes made in the accredited specification. These changes are also reflected in the learning outcomes and opportunities to develop skills columns.

The scheme of work is designed to be a flexible medium term plan for teaching content and development of the skills that will be assessed. It is provided in Word format to help you create your own teaching plan – you can edit and customise it according to your needs. This scheme of work is not exhaustive; it only suggests activities and resources you could find useful in your teaching.

### 5.5 Energy changes

#### 5.5.1 Exothermic and endothermic reactions

| **Spec ref.** | **Summary of the specification content** | **Learning outcomes**  *What most candidates should be able to do* | **Suggested timing (hours)** | **Opportunities to develop scientific communication skills** | **Opportunities to develop and apply practical and enquiry skills** | **Self/peer assessment**  **Opportunities and resources**  *Reference to past questions that indicate success* |
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| 5.5.1.1 | 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. | 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.  WS 2.1, 2.2, 2.3, 2.4, 2.6, 2.7  MS 1a, 2a, 2b, 4a, 4c. | 2 | Recap KS3 work by defining the terms exothermic and endothermic.  Describe examples of the different types of exothermic reactions, including combustion, oxidation reactions and neutralisation.  Describe the everyday uses of exothermic reactions, include self-heating cans and hand warmers.  Describe examples of the different types of endothermic reactions, including thermal decomposition.  Describe the everyday uses of endothermic reactions, include sports injury packs. | **Required practical 10:**  Investigate the variables that affect temperature changes in reacting solutions such as, eg acid plus metals, acid plus carbonates, neutralisations, displacement of metals.  AT skills covered by this practical activity: 1, 3, 5 and 6. | [Exampro user guide PowerPoint](http://filestore.aqa.org.uk/resources/science/AQA-GCSE-SCIENCE-EXAMPRO-UG.PPTX)  Video clips:  [BBC Bitesize Endothermic and exothermic reactions](http://www.bbc.co.uk/education/clips/zy886sg)  YouTube: [Exothermic and Endothermic Reactions](https://www.youtube.com/watch?v=yvyHVA1Ww_M) |
| 5.5.1.2 | Chemical reactions can occur only when reacting particles collide with each other 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. | 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 arrow 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.  WS 4.1 | 1 | Define the activation energy is the energy needed for a reaction to occur.  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 arrow to show the energy as the reaction proceeds.  An energy diagram for an exothermic reaction is shown below:  Provide students with various reaction profiles and ask them to interpret them as exothermic or endothermic, giving their reasons.  Provide students with various descriptions and ask them to draw the relevant profiles. | Demonstrate the exothermic alcohol gun:  [The alcohol gun – Nuffield Foundation](http://www.nuffieldfoundation.org/print/3068)  Students can investigate endothermic super-cooled sodium thiosulfate:  [Supercooling, the energetics of freezing – Nuffield Foundation](http://www.nuffieldfoundation.org/print/2899) |  |