



Fusion 1: C1.1 – Reversible and Irreversible Changes		
National Curriculum Link up • 2.1a, b, c. 2.2a, b. 2.3a. 3.2c.		
Electronic resources: Learning objectives, Practical worksheets, Starter / Plenary – Observation		
Learning Objectives Pupils should learn: What we mean by observation' in science. How to describe phenomena. How to describe a chemical change.	Teaching / Learning activities Lesson structure Starter - What can you see? Ask pupils to make a list of as many things as they can that can be seen in the room with a particular feature, e.g. all the red things. (5 mins) Main Allow students to complete the practical as detailed in the pupil book. Pupils who make more detailed observations when carrying out the activity, should receive more credit. Tease out from pupils that it is only by making careful observations that scientists can find out how the world works. – Adding baking powder to an acid (e.g. lemon juice) [hear fizzing, see bubbles] – Adding spirit vinegar to a chunk of beetroot [colour change] – Adding a solution of washing powder to a chunk of beetroot [colour change] – Adding a slice of celery to hydrogen peroxide solution (with a few drops of washing-up liquid) [see foaming] Plenary - It's a what? Put something into an opaque bag. Ask a volunteer to come to the front. They must put their hand in the bag and feel around and try to guess what is there. You could put science objects in, such as a disconnected Bunsen burner, or something really strange like cold cooked rice. (10–15 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Lower attaining pupils may only be able to make very simple observations during the practical and may need help in recording them correctly. • Extension. There is an opportunity for higher attaining pupils to lead the plenary 'It's a what?'. You could ask the volunteer who has their hand in the bag to describe what they feel, rather than trying to guess what the item is themselves. Other pupils could then try to guess based on the description. • Homework. To test pupils' observation skills further, ask them to describe how the appearance and taste of a squash drink changes as more water is added.
Learning Outcomes <i>All pupils should be able to observe safely.</i> <i>Most pupils should be able to record their observations.</i> <i>Some pupils should also be able to give examples of chemical changes.</i> How Science Works Describe and record observations and evidence systematically. (1.2d)	Additional teachers notes Equipment and materials required Per group: 3 test tubes, spatulas, test-tube rack, 100 cm ³ beaker, thermometer, sodium metabisulfite powder, 30 g crushed ice, 20 g salt, 10 cm ³ lemon juice, 4 g soap flakes, 5 g baking powder, 5 cm ³ spirit vinegar or 1 mol/dm ³ ethanoic acid, 5 cm ³ saturated washing-powder solution, 2 small pieces of raw beetroot (the beetroot must not have been kept in vinegar), 5 cm ³ 10 vol. hydrogen peroxide solution, 2–3 drops of washing-up liquid, 1 cm thick slice of celery, dropping pipette, sterilising powder and water. Safety Sodium metabisulphite powder: harmful, CLEAPSS Hazcard 92. Ethanoic acid: CLEAPSS Hazcard 38. Hydrogen peroxide: CLEAPSS Hazcard 50.	



<p>Fusion 1: C1.2 – What are Reversible and Irreversible Changes?</p> <p>National Curriculum Link up • 2.1a. 2.2b. 3.2c.</p> <p>Electronic resources: Learning objectives, Practical worksheets, Extension – Types of changes, Additional Support – Types of changes, PowerPoint – Reversible or irreversible, Interactive Drag and drop connector - Key words for reversible and irreversible changes</p>		
<p>Learning Objectives Pupils should learn: What a reversible change is. What an irreversible change is. How to decide whether a change is reversible or irreversible. One example of each type of change that happens in the home.</p>	<p>Teaching / Learning activities Lesson structure Starter - Match the word Present the pupils with the key words for the lesson and, jumbled up, the definitions for those words. Ask them to match the correct definition to each word. (5 mins) Main Set up various examples of physical/reversible and chemical/irreversible changes for pupils to try/observe: an ice cube melting [physical], burning a splint [chemical], dissolving copper sulfate in water [physical], boiling water holding a cold watch glass over it to see the steam condense [two physical changes] (Safety: steam burns), adding water to sherbet [chemical], melting chocolate (over a water bath) [physical], dropping a piece of magnesium into some acid [chemical]. Pupils should observe each event in turn and record what they observe happening. They should also decide whether they think a reversible, physical change has taken place or an irreversible, chemical one. Plenary - Match the word – Part 2 Revisit the definitions starter and ask pupils to sort them out again. This time they should get them all right. Ask them to give an example for each one. (10 mins)</p>	<p>Teaching suggestions</p> <ul style="list-style-type: none"> • Special needs. Give pupils cards stating some physical and chemical changes. These could be the changes they have seen during the lesson. Ask pupils to sort them into two groups and then stick them into their books. • Extension. Slowly pour a super-saturated solution of sodium ethanoate onto a sodium acetate seed crystal. A 'stalagmite' of sodium acetate will crystallise out. Challenge pupils to explain this physical change. (Safety: sodium ethanoate is harmful if large quantities are swallowed. Wear eye protection.) You could also get your pupils to try to change the colour of flowers by leaving them in water which has been dyed. • Learning styles. <i>Visual:</i> Observing physical and chemical changes. <i>Auditory:</i> Describing observations of changes. <i>Intrapersonal:</i> Reflecting on the differences between physical and chemical changes. • Functional skills link-up – ICT. Use appropriate search techniques to locate and select relevant information. (Research reversible and irreversible changes.)(Level 1) • Homework. Pupils to identify examples of reversible and irreversible changes around the home. Many examples of irreversible changes exist with respect to cooking food.
<p>Learning Outcomes <i>All pupils should be able to recognise a change.</i> <i>Most pupils should be able to classify a change as reversible or irreversible.</i> <i>Some pupils should also be able to explain why a change is reversible or irreversible</i> How Science Works Describe and record observations and evidence systematically. (1.2d)</p>	<p>Additional teachers notes Equipment and materials required 2–3 ice cubes, splints (1 per pupil), copper sulphate powder (1–2 spatulas full per pupil group), a few watch glasses, bowl of iced water, paper towels, 1 packet of sherbet, tongs, 3–4 squares of chocolate, evaporating basin, 200 cm³ of 0.5 mol/dm³ hydrochloric acid, 1 cm long pieces of magnesium (1 per pupil group). Safety: Pupils should wear eye protection during the experiments. Copper sulfate is harmful: CLEAPSS Hazcard 27C. Sodium ethanoate is harmful if swallowed. (See 'Extension'.) Hydrochloric acid is harmful: CLEAPSS Hazcard 47A. Magnesium: CLEAPSS Hazcard 59A.</p>	



<p>Fusion 1: C1.3 – Are All Acids Dangerous?</p> <p>National Curriculum Link up</p> <ul style="list-style-type: none"> • 3.2c. <p>Electronic resources: Learning objectives, Practical worksheets, Plenary activity – Hazard symbols, PowerPoint – Are all acids dangerous, Interactive Drag and drop shuffle – Hazard symbols</p>		
<p>Learning Objectives Pupils should learn: How to tell if a chemical is dangerous. What acids are.</p>	<p>Teaching / Learning activities Lesson structure Starter - What's an acid? Ask pupils to describe what they think an acid is or what comes to mind when someone uses the word 'acid'. (5 mins) Main Ask pupils whether they think all acids are dangerous. Then show pupils a range of acidic substances including, lemon juice, vinegar, sherbet, hydrochloric acid, sulfuric acid and nitric acid. Ask them whether they still think all acids are dangerous (if they did before). Show them a bottle of acid with the 'Corrosive' warning symbol on it. Ask pupils to explain what it might mean. They are likely to come up with ideas about burning through things. Explain to them that some acids can damage materials and 'eat' away at them. Ask pupils why we need warning signs. Introduce them to the idea that lots of chemicals have warning signs on them. Give them a sorting activity to do where they must match the hazard symbol with its name and its meaning. Extend the activity by asking pupils to design their own warning symbol, e.g. for a label for a heavy object which may be difficult to carry, or the edge of a cliff. Plenary - Hazard Give pupils a recall test by holding up flashcards of hazard symbols and asking them to say what the hazard is and give an explanation. (10 mins)</p>	<p>Teaching suggestions</p> <ul style="list-style-type: none"> • Special needs. Play a game of hazard warning symbol snap. • Extension. Some pupils can be given the opportunity to design their own hazard symbols. They could provide a risk assessment for something they consider to be dangerous around the home – operating hair straighteners, boiling a kettle, making a cup of tea, mowing the lawn, etc. • Learning styles <i>Visual:</i> Studying hazard symbols. <i>Kinaesthetic:</i> Carrying out practical work. <i>Intrapersonal:</i> Understanding the idea that warning symbols are a fast way to convey information. • Functional skills link-up – ICT. Obtain, insert, size, crop and position images that are fit for purpose. (Level 2) See Extension work. • Homework. Pupils to find examples of warning symbols, e.g. road signs or those found in the home.
<p>Learning Outcomes <i>All pupils should be able to name household examples of acids.</i> <i>Most pupils should be able to recall the hazard symbols.</i> <i>Some pupils should also be able to explain why hazard symbols are important.</i> How Science Works Explain how action has been taken to control obvious risk ... (1.2c)</p>	<p>Additional teachers notes CLEAPSS CD-ROM has printable hazard labels and fonts. Equipment and materials required A variety of acidic substances in bottles are needed, including one bottle of laboratory acid which has the corrosive hazard warning symbol on it. Acids chosen could include: lemon juice, vinegar, sherbet, hydrochloric acid (1 mol/dm³), sulfuric acid (0.5 mol/dm³) and nitric acid (0.4 mol/dm³).</p>	



<p>Fusion 1: C1.4 – Are All Alkalis Dangerous?</p> <p>National Curriculum Link up</p> <p>• 2.1c. 3.2c.</p> <p>Electronic resources: Learning objectives, Practical worksheets, Interactive – Odd one out</p>		
<p>Learning Objectives Pupils should learn: Which substances are alkalis. The difference between an alkali and an acid.</p>	<p>Teaching / Learning activities Lesson structure Starter - Mix it up? Challenge pupils to come up with as many words as they can using the letters in the word 'alkali' or 'sodium hydroxide'. To make it harder, only allow words of more than three or four letters. (10 mins) Main Show pupils a bar of soap. Wet it and ask one of them to touch the soap and then describe how it feels. Explain that soap is made from an alkali which is the chemical opposite of an acid. Most alkalis feel soapy. [Alkalis feel soapy as they react with fats in the skin, turning to a form of soap. Traditionally soap is made by reacting animal fat with 'lye', the traditional name for sodium hydroxide.] Set pupils the challenge of identifying the alkalis from a range of substances. They can make their own indicator from red cabbage to do this. Use the indicator to test the substances. The indicator will turn green in alkalis and red in acid. You may wish to demonstrate this by dripping some indicator onto the soap shown earlier. Plenary - Alkalis at home Having seen that soap is an alkali, ask pupils to compile a list of all the alkalis they have at home. Most cleaning products, from shower gel to oven cleaner are alkalis. (10 mins)</p>	<p>Teaching suggestions</p> <ul style="list-style-type: none"> • Special needs. Allow short words if you are using the starter 'Mix it up'. • Extension. Ask pupils to research the difference between alkalis and bases. Although 'alkali' is the more commonly used term, 'base' is the correct name. Alkalis are bases which are soluble in water. Ask pupils what might happen if a base and an acid were to react together. This will be covered in C1.6, but they could start to think about it now. • Learning styles <i>Kinaesthetic:</i> Testing substances to see if they are alkalis. <i>Intrapersonal:</i> Understanding that not all alkalis are dangerous. • Homework. Give pupils some pieces of litmus paper and ask them to identify some alkaline substances they find at home.
<p>Learning Outcomes <i>All pupils should be able to name household examples of alkalis.</i> <i>Most pupils should be able to state the difference between an acid and an alkali.</i> <i>Some pupils should also be able to explain the difference between alkalis and bases.</i> How Science Works Explain how action has been taken to control obvious risks and how methods are adequate for the task. (1.2c)</p>	<p>Additional teachers notes No explanation of indicators is necessary at this point, as these will be discussed in detail in C1.5.</p> <p>Equipment and materials required Per group: pestle and mortar, a few pieces of chopped red cabbage, 10 cm³ 95% ethanol, disposable pipette, 5 test tubes, test-tube rack, 2 cm³ each of: 0.5 mol/dm³ hydrochloric acid, distilled water, 0.4 mol/dm³ sodium hydroxide, 0.5 mol/dm³ sodium carbonate and limewater.</p> <p>Safety Eye protection must be worn. Ethanol is highly flammable and harmful: CLEAPSS Hazcard 40A. No naked flames when using ethanol. Sodium hydroxide is an irritant (at 0.4 mol/dm³): CLEAPSS Hazcard 91. Limewater is an irritant: CLEAPSS Hazcard 18</p>	



Fusion 1: C1.5 – Indicators National Curriculum Link up • 2.1a, c. 3.2c.		
Electronic resources: Learning objectives, Practical worksheets, Extension – Indicators, PowerPoint – Testing acids and alkalis, Interactive Drag and drop – pH scale		
Learning Objectives Pupils should learn: What an indicator is. What the pH scale shows us. How we test the pH of a chemical.	Teaching / Learning activities Lesson structure Starter - What's the danger? Ask pupils to match the hazard symbols to the correct chemical, e.g. concentrated acid = corrosive, concentrated alkali = corrosive, ethanol = flammable. (5 mins) Main Discuss the need for a simple way to tell acids from alkalis and how dangerous they are. Introduce universal indicator as a means of testing how acidic or alkaline a solution is. Ask pupils to test a range of substances to find their pH. A suitable table for their results is suggested in the pupil book. [The pH scale is so called as it tells you about the concentration of hydrogen ions (H ⁺) in a solution. It must be written 'pH', and not PH or Ph, as the letters have a meaning.] Discuss the results of the experiment and allow pupils to share their results. There is often a difference of opinion, which is a good opportunity to discuss the limitations of universal indicator and, perhaps, to get the pupils to consider why it is important that scientists share their research. Plenary - What's the pH? Give pupils a range of substances and ask them to place them at the correct point on the pH scale. Choose some of the substances seen this lesson and some met in previous lessons. (5 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Give pupils an outline of the pH scale for them to colour in with the colours which universal indicator turns at each pH. • Extension. Ask pupils to explain why universal indicator is a much better indicator than they made in C1.4. [That is, to explain that universal indicator is more useful because it gives more detailed information about a substance.] Ask pupils to find out how the pH scale was developed. Some higher attaining pupils may wish to research the meaning of 'pH', but this is very advanced (see 'Main lesson' notes). Learning styles <i>Visual:</i> Observing colour changes in indicators. <i>Auditory:</i> Justifying the decision about pH. <i>Kinaesthetic:</i> Testing the indicators. <i>Intrapersonal:</i> Understanding the need for scientists to collaborate.
Learning Outcomes <i>All pupils should be able to</i> test chemicals to classify them as acids or alkalis. <i>Most pupils should be able to</i> identify the pH of a chemical. <i>Some pupils should also be able to</i> explain why universal indicator is more useful than others such as litmus. How Science Works Describe and record observations and evidence systematically. (1.2d) Recognise that the presentation of experimental results through the routine use of tables ... makes it easier to see patterns and trends. (1.2d)	Additional teachers notes Equipment and materials required Per group: test-tube rack, 1 test tube per substance to be tested, universal indicator with dropping pipettes, pH scale keys (available from universal indicator suppliers), 2–3 cm ³ of each substance to be tested, such as: 0.5 mol/dm ³ sulfuric acid, lemon juice, vinegar, distilled water, ethanol, 0.5 mol/dm ³ sodium bicarbonate solution, 0.4 mol/dm ³ sodium hydroxide, 0.5 mol/dm ³ ammonia solution, commercial oven cleaner. Safety Eye protection must be worn. Sulfuric acid: CLEAPSS Hazcard 98A. Sodium hydroxide: CLEAPSS Hazcard 91. Ethanol is flammable, so there must be no naked flames: CLEAPSS Hazcard 40A. Universal indicator usually contains ethanol and is flammable. Many of the substances suggested are corrosive.	



Fusion 1: C1.6 – Acid Reactions: Neutralisation		
National Curriculum Link up • 2.1b. 3.2c.		
Electronic resources: Learning objectives, Practical worksheets, Homework activity – Neutralisation with a datalogger, Extension – Neutralisation word equations, Webquest – What is neutralisation and what are its uses?, Animation – How is neutralisation useful		
Learning Objectives Pupils should learn: What a neutral chemical is. What happens when an acid and alkali are mixed. How to measure the volume of a liquid.	Teaching / Learning activities Lesson structure Starter - Chemical clash Ask pupils to consider what would happen if a chemical of pH 1 were to meet a chemical of pH 14. (5 mins) Main Remind pupils that a neutral substance is neither acid nor alkaline. Introduce the idea of neutralisation of an acid and ask pupils how they could make an acid less acidic. [Hopefully they will suggest adding an alkali.] Ask pupils to carry out the neutralisation reaction between dilute hydrochloric acid and sodium hydroxide solution. It is quite tricky to get the solution to be completely neutral, so challenge them to be the first to successfully complete the task. There is also an excellent opportunity here to get pupils to measure out liquids in a measuring cylinder accurately and the chance to introduce some data-logging. Get the class to feedback on any problems they had with the practical and how they tried to solve them. Plenary - See-saw Challenge pupils to explain how neutralisation is like a see-saw. If you add too much acid it will tip one way. Too much alkali and it will tip the other. (5 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Pupils with poor motor skills may struggle to obtain a neutral solution, as only tiny drops of acid or alkali will be needed at the end point. • Extension. Ask pupils to write a word equation for the reaction. Support for this is available in the pupil book. • Learning styles. <i>Visual:</i> Observing the changes in indicator colour as pH changes. <i>Auditory:</i> Describing and discussing the difficulties in obtaining a neutral solution. <i>Kinaesthetic:</i> Manipulating the apparatus during neutralisation, this requires good motor control. <i>Interpersonal:</i> Taking part in discussions about the practical. • Functional skills link-up – ICT. Select and use software applications to meet needs and solve given problems (monitoring neutralisation). (Level 1) • Homework. Pupils could find out what the acid-neutralising ingredient in an antacid tablet is. [It is usually a carbonate of some sort.]
Learning Outcomes All pupils should be able to measure the volume of a liquid in a measuring cylinder. Most pupils should be able to recall that acids and alkali react. Some pupils should also be able to explain observations of a neutralisation reaction. How Science Works Recognise that the presentation of experimental results through the routine use of tables ... and simple graphs makes it easier to see patterns and trends. (1.2d) Describe patterns and trends in results ... (1.2e)	Additional teachers notes Equipment and materials required Per group: two 10 cm ³ measuring cylinders, 50 cm ³ of 0.1 mol/dm ³ hydrochloric acid, 50 cm ³ of 0.1 mol/dm ³ sodium hydroxide, a few drops of universal indicator, two dropping pipettes (one for acid and one for alkali), glass stirring rod, 100 cm ³ beaker; optional: data-logger with pH probe and access to a PC to review data. Safety Universal indicator usually contains ethanol and is flammable. Eye protection should be worn to protect from possible acid and alkali splashes. Watch for pupils squirting pipettes at each other.	



Fusion 1: C1.7 – Acid Reactions: Metals		
National Curriculum Link up • 2.1a, b, c. 3.2c.		
Electronic resources: Learning objectives, Practical worksheets, Interactive – Metals and acids, Video – The Hindenburg disaster		
Learning Objectives Pupils should learn: What we observe when a metal reacts with an acid. How to test for hydrogen gas.	Teaching / Learning activities Lesson structure Starter - Metal everywhere Ask pupils to list as many metals as they can. To make it more difficult, they must give a use for each metal. (5–10 mins) Main Explain that in this lesson they are going to study what happens when an acid reacts with a metal. Show the pupils how to set up the experiment. They are unlikely to have collected a gas before and will need to be shown how to do this. Get the pupils to carry out the experiment according to the instructions in the pupil book. Explain to pupils that the gas is hydrogen and demonstrate the test for hydrogen once more. Emphasise that a lighted splint makes a squeaky pop in hydrogen gas. Ask pupils if they observed a difference in how well the acids reacted. They should have noticed that magnesium was the most reactive, followed by zinc, then copper. Plenary - Diminishing words Ask pupils to write down five sentences which summarise the lesson. They must then reduce this to five words and, finally, to just one word. (10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Some pupils may need extra guidance with the ‘Diminishing words’ plenary. They could use five sentences provided to them and try summarising into one sentence. Some may not successfully catch enough hydrogen in order for the test to work. However, the demonstration at the end should cover this aspect. • Extension. Ask pupils to write word equations for the reactions. Support for this is available in the pupil book. • Learning styles <i>Auditory:</i> Listening to the ‘pop’ when hydrogen burns. <i>Kinaesthetic:</i> Collecting hydrogen gas. <i>Interpersonal:</i> Working with others to collect the gas. <i>Intrapersonal:</i> Understanding that all acids react with metals in a similar way. • Functional skills link-up – English Present information in a logical sequence. (Level 1) See Plenary ‘Diminishing words’. • Homework. Find out what the ‘Hindenburg Disaster’ was. [The Hindenburg was an early airship, filled with hydrogen, which exploded. Later airships were filled with the inert gas helium.]
Learning Outcomes <i>All pupils should be able to</i> record observations. <i>Most pupils should be able to</i> recall the test for hydrogen. <i>Some pupils should be able to</i> also complete word equations. How Science Works Describe and record observations and evidence systematically. (1.2d) Describe patterns and trends in results ... (1.2e)	Additional teachers notes Metals and acids Equipment and materials required Per group: three test tubes, 2 cm long piece of magnesium ribbon, 2–3 g of granulated zinc (1 or 2 pieces), one piece of copper, 9 cm ³ of 1 mol/dm ³ hydrochloric acid, boiling tube, test-tube rack, splints, access to a lit Bunsen Burner nearby. Safety Wear eye protection and keep the metals away from flames. Magnesium ribbon: CLEAPSS Hazcard 59A. Demonstration of hydrogen test The teacher will need: 2 boiling tubes of hydrogen gas. These could be pre-filled from a cylinder or obtained by the method given in the pupil experiment. Safety Hydrogen is extremely flammable: CLEAPSS Hazcard 48.	



Fusion 1: C1.8 – Acid Reactions: Metal Carbonates National Curriculum Link up • 2.1a, b, c. 3.2c.		
Electronic resources: Learning objectives, Practical worksheets, Plenary – Metal carbonates and acids		
Learning Objectives Pupils should learn: What is observed when a carbonate reacts with acid. How to test for carbon dioxide.	Teaching / Learning activities Lesson structure Starter - All of a muddle Give pupils the steps of the practical suggested for this lesson, but in the wrong order. They must put the steps into the correct order. (5 mins) Main Introduce metal carbonates as the main mineral in many rocks: calcium carbonate in limestone, copper carbonate in malachite. Introduce the practical and explain how to carry it out. You may wish to get pupils to collect some of the gas, rather than bubbling it through limewater. They could then test it in the same way as in C1.7 and prove that the gas collected was not hydrogen. Discuss with the group the fact that the limewater turning milky is a test for the presence of carbon dioxide gas and that when acids react with carbonates, carbon dioxide is always produced. Carbonates are the basis for many antacid remedies. That's why they can taste chalky; they are often made from chalk. The carbonate reacts with excess stomach acid. Carbon dioxide is released, which is why taking an indigestion remedy can give you wind. Plenary - Sort it out! Give pupils the key words (carbonate, carbon dioxide and limewater) as anagrams. Ask them to sort the words out and then write a sentence which includes each word. (10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Some pupils may struggle to understand that the limewater 'bubbles' because of the carbon dioxide passing through it and not because it is reacting. • Extension. Ask pupils to write word equations for the reactions. Support for this is available in the pupil book. • Learning styles <i>Visual:</i> Observing the reaction between acids and carbonates. <i>Auditory:</i> Describing observations of the reactions. <i>Kinaesthetic:</i> Reacting acids with carbonates. <i>Interpersonal:</i> Working with others during the practical and discussing ideas with other pupils. <i>Intrapersonal:</i> Understanding that all acids react with carbonates in a similar way. • Homework. Pupils to find out what carbon dioxide is used for. [Certain fire extinguishers, the fizz in 'fizzy' drinks, a packaging gas for some foods which slows oxidation, the gas given off by yeast which makes bread rise.]
Learning Outcomes <i>All pupils should be able to</i> record observations. <i>Most pupils should be able to</i> recall the test for carbon dioxide. <i>Some pupils should be able to</i> complete word equations. How Science Works Explain how action has been taken to control obvious risk and how methods are adequate for the task. (1.2c)	Additional teachers notes Equipment and materials required Per group: 2 test tubes, 1–2 spatulas of copper carbonate powder, 10 cm ³ measuring cylinder, 3 cm ³ of 0.4 mol/dm ³ hydrochloric acid, 5 cm ³ of limewater (calcium hydroxide solution), test tube rack, bung attached to delivery tube to fit test tubes used. Safety Wear eye protection to protect from acid spills and from copper carbonate which is harmful. Copper carbonate powder is harmful: CLEAPSS Hazcard 26. Limewater is an irritant: CLEAPSS Hazcard 18.	



Fusion 1: C1.9 – Is It a Metal? National Curriculum Link up • 2.1a. 2.2b. 3.2 c.		
Electronic resources: Learning objectives, Practical worksheets, Animation – Metals and non-metals, Interactive Drag and drop – Metals and non-metals, Starter – Memory game, Homework – Is it a metal?		
Learning Objectives Pupils should learn: What a metal is. What a non-metal is. How to decide if a substance is a metal or non-metal.	Teaching / Learning activities Lesson structure Starter - Is it a metal? Give pupils a list of materials and ask them to divide them up into ‘metallic’ and ‘non-metallic’. Ask them to give a reason why for each. (5 mins) Main Show the class a Periodic Table and ask them to pick out the names of elements which they know to be metals. Explain that there are lots of metals on the Periodic Table and that they must come up with a set of ‘rules’ which describe what a metal is, while carrying out the main activity. Ask pupils to carry out the practical ‘Classifying metals and non-metals’, as a circus of activities. Many of the materials pupils meet in the practical may not pure metals and non-metals in the elemental sense; they do not appear on the Periodic Table. However, the aim of this lesson is to convey typical metallic and non-metallic properties. Plenary - That can’t be right? Show that a piece of graphite will conduct electricity even though it is a form of the non-metal carbon. Challenge pupils to say why it is probably still a non-metal. [Dull appearance, not sonorous, brittle, other forms of carbon, such as diamond, do not conduct electricity.] (5 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. There are many new key words and terms used in this lesson which pupils with poor literacy skills may need support with. • Extension. Challenge pupils to explain what a ‘semi-metal’ is. A good element for them to research here is silicon. • Learning styles <i>Visual:</i> Observing the behaviour of metals. <i>Kinaesthetic:</i> Testing the properties of metals. <i>Interpersonal:</i> Working with others during practical. <i>Intrapersonal:</i> Understanding that some substances, such as graphite, are not easily classed as metals or non-metals.
Learning Outcomes <i>All pupils should be able to</i> group some metals and non metals. <i>Most pupils should be able to</i> recall the physical properties of metals and non-metals. <i>Some pupils should also be able to</i> explain why a material is a metal or non-metal. How Science Works Describe and record observations and evidence systematically. (1.2d)	Additional teachers notes Classifying metals and non-metals Equipment and materials required Per station: a selection of metallic and non-metallic materials; 2–3 magnifying glasses, bowl half filled with water, paper towels to dry materials; lamps (up to 6 V), 3 wires, power supply (low voltage) to match lamps, 2 crocodile clips; board to protect bench, small hammer. Safety Keep electrical conductivity test away from floating test. Pupils should wear eye protection when testing malleability. Plenary: That can’t be right Equipment and materials required As per pupil practical for testing electrical conductivity except: 1 graphite electrode stick.	



<p>Fusion 1: C1.10 – Burning</p> <p>National Curriculum Link up</p> <p>• 2.1b. 2.3a. 3.2c.</p> <p>Electronic resources: Learning objectives, Practical worksheets, Interactive Drag and drop – Labelling a Bunsen burner, PowerPoint – How to light a Bunsen burner, Additional Support – Using light a Bunsen burner</p>		
<p>Learning Objectives</p> <p>Pupils should learn:</p> <p>How to use a Bunsen burner safely.</p> <p>What is needed for burning.</p> <p>What happens when something burns.</p>	<p>Teaching / Learning activities</p> <p>Lesson structure</p> <p>Starter - Who was he?</p> <p>If Internet connection is available, ask pupils to find out who Robert Wilhelm Bunsen, who is credited with the invention of the Bunsen burner, was. Pupils who complete this quickly could try to think how a Bunsen burner might work. (10–15 mins)</p> <p>Main</p> <p>Remind pupils about the general laboratory safety rules, especially those relating to experiments. They may have had access to or seen a Bunsen burner in earlier lessons, but the focus here is on getting the pupils to use one correctly.</p> <p>Ask them if they have heard of the fire triangle. If anyone knows, ask them to explain what it means. A lit candle as a visual prompt may be useful.</p> <p>There are instructions for setting up a Bunsen burner for the pupils to follow in the practical support section. It may be best to demonstrate all of this before allowing the pupils access to the apparatus. Explain to pupils that opening the air hole allows air to mix with the fuel (gas) and makes the flame hotter. The role of oxygen will be dealt with next lesson. Ask pupils to share their observations.</p> <p>Plenary - Bunsen's rule!</p> <p>Ask pupils to write a set of instructions to allow other Year 7 pupils to use a Bunsen burner safely. Their instructions should cover setting up and lighting the burner, and how and when to use the safety flame. (5–10 mins)</p>	<p>Teaching suggestions</p> <ul style="list-style-type: none"> • Special needs. Ask pupils to match the safety rules in a laboratory with the reasons for the rule. • Extension. Ask pupils to write word equations for the reactions. Support for this is available in the pupil book. • Learning styles <p><i>Auditory:</i> Observing differences between Bunsen flames.</p> <p><i>Kinaesthetic:</i> Operating a Bunsen burner safely.</p> <p><i>Interpersonal:</i> Working in a way which keeps others safe.</p> <p><i>Intrapersonal:</i> Understanding the need to work safely.</p> <ul style="list-style-type: none"> • Functional skills link-up – ICT <p>Access, navigate and search internet sources of information purposefully and effectively. (Level 1) See Starter 'Who was he?'</p> <p>English</p> <p>Present information in a logical sequence. (Level 1) See Plenary 'Bunsen's rule!'</p> <ul style="list-style-type: none"> • Homework. Pupils to find out what rules are in place at petrol stations to try to prevent fires.
<p>Learning Outcomes</p> <p><i>All pupils should be able to</i> set up a Bunsen burner safely.</p> <p><i>Most pupils should be able to</i> explain the laboratory safety rules.</p> <p><i>Some pupils should be able to</i> write word equations for the reactions they have seen.</p> <p>How Science Works</p> <p>Explain how action has been taken to control obvious risk and how methods are adequate for the task. (1.2c)</p>	<p>Additional teachers notes</p> <p>The local Fire Service may be willing to visit the school for a talk.</p> <p>Equipment and materials required</p> <p>Heat mat, Bunsen burner, splints or matches, half a spatula of carbon (charcoal) powder, half a spatula of fine iron filings, half a spatula of magnesium powder.</p> <p>Safety</p> <p>Make sure anything that can burn is moved away from the Bunsen burner. Tie long hair and clothes back so that they do not go into the flame. Wear eye protection.</p> <p>Iron filings are highly flammable: CLEAPSS Hazcard 55A. Magnesium powder is highly flammable: CLEAPSS Hazcard 59A.</p>	



Fusion 1: C1.11 – Fuels and Oxygen National Curriculum Link up • 2.1a. 2.2a, b. 2.3a. 3.2c.		
Electronic resources: Learning objectives, Practical worksheets, Animation – The fire triangle, Homework – Fighting fires		
Learning Objectives Pupils should learn: What a fuel is. The products of combustion. What effect oxygen has on a fire. How to record the results of an investigation.	Teaching / Learning activities Lesson structure Starter - Fire of London Show pupils a picture depicting the Fire of London or a forest fire. Ask them to think about why fire caused so much damage. (5–10 mins) Main Establish that, as oxides are formed, oxygen is required for burning. [It is a common misconception that oxygen burns. Burning is generally an oxidation reaction; that is a substance may burn when it reacts with oxygen. Oxygen cannot react with oxygen and so does not burn. For burning to take place, a fuel (such as petrol) must react with oxygen. The reaction is fast enough for us to feel heat and see light being given off.] Explain that they are going to investigate whether the amount of air available affects how long a candle will burn. Get pupils to carry out ‘Investigating combustion’ described in the pupil book. You could, at this point, ask pupils to plan the investigation themselves, including a table for their results, if you have the time available. Ask pupils to plot a graph of their results, plotting jar size against candle burn time. If you want pupils to plot a line graph, they will need to know the volumes of the jars used. Establish the pattern that the greater the volume of the jar, the longer the candle burns. Ask pupils to say why they think this is the case [more oxygen in the larger jars than the smaller jars]. Relate the experiment back to the fire triangle and explain that removing any part of the triangle puts the fire out. Plenary - Put it out! Give pupils different ways of putting out a fire and ask them to explain why it works. (5–10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. If plotting line graphs many pupils in Year 7 will need support in preparing the axes. It may be better just to ask them to identify the pattern that ‘the larger the jar, the longer the candle burns for’ and then to explain why this is. • Learning styles <i>Visual:</i> Observing the burning candles. <i>Auditory:</i> Describing how to carry out the investigation. <i>Kinaesthetic:</i> Carrying out the investigation into burning. <i>Interpersonal:</i> Working with others during practical work. <i>Intrapersonal:</i> Deciding how to plot a graph of results. • Functional skills link-up – Mathematics Find mean and range. (Level 1) Collect and represent discrete and continuous data, using ICT where appropriate. (Level 2) • Homework. Pupils to find out how long the world’s oil reserves are predicted to last. [Answers will vary wildly, as oil company optimism changes regularly, but the important point to establish is that oil is a finite resource.]
Learning Outcomes All pupils will recall that oxygen is needed for burning and the fire triangle. Most pupils will recall that length of burning is related to amount of oxygen available. Some pupils will also draw a graph of their results. How Science Works Describe patterns and trends in results and link this evidence to any prediction made. (1.2e)	Additional teachers notes Equipment and materials required 2–4 different-sized glass containers: glass beakers will be fine, measuring cylinder, tray of sand, candle (about 2 cm tall), splints, stopwatch. Safety Wear eye protection. Remove things that catch light easily from the bench. Tie back hair and loose clothing. Avoid skin contact with cobalt chloride paper.	



Fusion 1: C1.12 – Making Oxygen National Curriculum Link up • 2.1a, b, c. 3.2c.		
Electronic resources: Learning objectives, Practical worksheets, Plenary – Testing gases		
Learning Objectives Pupils should learn: What we observe when hydrogen peroxide reacts with manganese dioxide. How we test for oxygen.	Teaching / Learning activities Lesson structure Starter - Fire, fire! Ask pupils to draw the fire triangle from recall, which they should remember from C1.10 and C1.11. (5 mins) Main Remind pupils how important oxygen is to many processes on Earth, including respiration. Demonstrate to pupils how to collect a gas by displacement, as they are unlikely to have done this before. It is quite tricky, so be sure to emphasise to make sure that the boiling tube is completely full of water before they start collecting the gas. Place a bung in while the tube is still submerged under the water. Ask them to carry out the decomposition of hydrogen peroxide, collect the gas produced and test for oxygen. At this level, most pupils do not need to know that the hydrogen peroxide decomposes in the presence of the manganese (IV) oxide catalyst. They can simply observe it as a chemical change. Once they have collected two or three test tubes of oxygen, show them how to test for oxygen. Plenary - Ask the expert Invite a panel of three pupils to the front. Choosing at least one high attaining pupil might be a good idea. The rest of the class must then think of questions about this topic. The person who asks the question has to decide if they were given the correct answer or not. (10–15 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Some pupils may struggle to collect enough gas to test. You may wish to have a few tubes of oxygen from a cylinder to cover for this eventuality. • Extension. Ask pupils to find out where they might come across hydrogen peroxide in everyday life. (It is used by hairdressers to bleach hair, hence the term ‘peroxide blonde’). • Learning styles <i>Auditory:</i> Asking or answering questions in the ‘Ask the expert’ plenary. <i>Kinaesthetic:</i> Collecting oxygen. <i>Interpersonal:</i> Taking part in class discussion in the ‘Ask the expert’ plenary. <i>Intrapersonal:</i> Understanding that oxygen had to be discovered and that all the gases in our atmosphere are not the same. • Functional skills link-up - English Make relevant contributions to discussions, responding appropriately to others. (Level 1) See Plenary ‘Ask the expert’.
Learning Outcomes <i>All pupils should be able to</i> record observations and be able to collect gas by displacement. <i>Most pupils should be able to</i> recall the test for oxygen. <i>Some pupils should be able to</i> write word equations. How Science Works Explain how action has been taken to control obvious risk and how methods are adequate for the task. (1.2c)	Additional teachers notes Equipment and materials required Per group: conical flask, 25 cm ³ of 10 vol. hydrogen peroxide solution, bung with single hole attached to rubber delivery tube, 2–3 boiling tubes for gas collection with bungs, test tube rack, bowl, half-filled with water, spatula, manganese (IV) oxide powder, splints and access to a lit Bunsen burner. Safety Wear eye protection. Hydrogen peroxide solution: CLEAPSS Hazcard 50. Manganese(IV) oxide powder is harmful: CLEAPSS Hazcard 60.	

