GCSE

Edexcel GCSE in Additional Science
How fast? How furious?

(Concept approach)

April 2006

Support material

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Topic 8: How fast? How furious?

Introduction

1 This booklet contains a concept-driven scheme of work and some suggested activities for the Edexcel GCSE in Additional Science unit C2 topic 8: How Fast? How Furious?

2 Two schemes of work are available for each topic in separate booklets. One of these booklets contains a scheme of work that is concept-driven ie scientific ideas are presented before their applications are explored. The other booklet contains a scheme of work that is context-driven ie applications of science are presented before the scientific principles used in these applications are explored.

3 Booklets for each GCSE in Additional Science topic are provided free of charge to centres who are offering the Edexcel GCSE suite of Science qualifications via the secure area of the Edexcel website (www.edexcel.org.uk).

4 Although Edexcel owns the copyright for the booklets, they are provided in Word format so that Edexcel centres may customise the schemes if required.

5 Each lesson is designed to last for 50 minutes although the total teaching time is not stated in the specification; teachers may adjust the schemes of work to accommodate the time available in individual centres.

6 Centres are responsible for the overall risk assessment of experimental work undertaken by students.

7 Attention is drawn to the need for safe practice when students carry out laboratory experiments or observe demonstrations. Particular attention is drawn to the possible hazards associated with electrical equipment, the handling of micro-organisms and ionising radiation. Strict aseptic conditions should be used when undertaking practical work. Reference must be made to COSHH regulations and any specific local education authority restrictions.

Relevant advice can be obtained from the following publications:

- *CLEAPSS Laboratory Handbook* (available from CLEAPSS School Science Service, website www.cleapss.org.uk)
- *Control of Substances Hazardous to Health Regulations* (HSE, 2005) ISBN 0717629813
- *Hazcards* (2004 update available from CLEAPSS School Science Service)
- *Topics in Safety, Third Edition* (ASE January 2001) ISBN 0863573169

Scheme of work for Topic 8: How fast? How furious?

LESSON 1 – What are chemical reactions?							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
C2 8.4 C2 8.15 C2 8.16	7F: Simple Chemical reactions. 8E: Atoms and elements. 8F: Compounds and mixtures.	Chemical reactions produce new substances. Reactions occur when particles collide, and more collisions means a faster reaction. Represent chemical reactions by word equations and balanced equations.	**Starter:** Ask the students to answer the following question: 'Why do some chemicals explode when you mix them?' Demonstration 8.1: Dynamite soap (CLEAPSS – microscale) reacting hydrogen and oxygen to make water, through soap bubbles, or any other loud demonstration. **Main:** Discuss students' ideas of what is happening in the demonstration, using a mind map (on the board). Discuss the word equation for this reaction and also the balanced symbol equation. Discuss what is happening – the particles of hydrogen and oxygen are colliding and when ignited are reacting to release energy (sound) and produce a new substance (water). Introduce the idea of collisions for foundation students. **Plenary:** Use 'model' atoms of H and O and stick them on the board to show how the reaction between H_2 and O_2 makes H_2O. Show that the bonds break between the H atoms (and O atoms) and then new bonds form to produce a new substance (water).	Demonstration 8.1: Dynamite soap. Pre-made syringe of H_2 and O_2 mixture (2 parts H_2 to 1 part O_2). Bubble through soap solution (CLEAPPS). Light bubbles with lighted splint. Activity sheet 8.1.1: Chemical reactions. Activity sheet 8.1.2: Water collision theory	Explain that reactions can occur when particles collide and that increasing the frequency and energy of collisions increases the rate of reaction. Represent chemical reactions by word equations; write balanced equations; use state symbols (s), (l), (g) and (aq). Write balanced equations to describe and explain a wide range of reactions including ionic reactions.	C: □2.1 N: □2.1	Use HAZCARDS for all chemicals used. Demonstration is loud so warn students of this.

Scheme of work for Topic 8: How fast? How furious?

LESSON 1 – What are chemical reactions? (continued)
Homework: Complete word equations sheet, describing for each one what is happening to the particles in each reaction, and write the word equation. Extension work: write the balanced chemical equations for this worksheet also.

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LESSON 2 – Endothermic and Exothermic Reactions							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
C2 8.1 C2 8.2 C2 8.3	9H: Using chemistry.	Some reactions give out energy while others take in energy. Chemical reactions involve breaking bonds and forming bonds.	**Starter:** Ask the students the following question: 'How do the hot and cold packs that athletes use to treat injuries work?' Discuss the students' ideas about answers to this question and they should make a prediction. **Main:** Use the experiment to show how to make a hot and cold pack (Experiment 8.2: Chemical reactions that are hot and cold). Discuss the findings of this experiment and what the meanings of endothermic and exothermic are. Include temperature decrease/increase, heat energy taken in/given out, breaking bonds/making bonds. **Plenary:** Discuss whether the students' predictions were correct; ask some of them to share their predictions with the class. Recap what endothermic and exothermic reactions are. Ask the question: 'Which reaction is used to make the hot pack and which is used to make the cold pack?'	Experiment sheet 8.2: Chemical reactions that are hot and cold. A hot or cold pack to show the students (or a picture if no pack available).	Recall that exothermic reactions are accompanied by an increase in temperature and endothermic reactions by a decrease in temperature. Define an exothermic reaction as one in which heat energy is given out and an endothermic reaction as one which heat energy is taken in, and give examples. Recall that the breaking of bonds is endothermic and that the making of bonds is exothermic.	C: □2.1 N: □2.1 □2.2 □2.3	Safety glasses for experiment. Use HAZCARDS for chemicals.
Homework: Draw graphs for your results for both reactions (endothermic and exothermic) and calculate the temperature change. Extension: Explain some of the advantages and disadvantages of using a chemical reaction for hot and cold packs.							

Scheme of work for Topic 8: How fast? How furious?

LESSON 3 – Collision theory and rates of reaction							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
C2 8.4 C2 8.5	7G: Particle model of solids, liquids and gases.	Increasing the number of collisions between particles increases the rate of reaction. Temperature, concentration and surface area all affect the number of collisions (and therefore the rate of reaction).	**Starter:** Ask the students to answer the following question: 'Why do chips cook much faster than roast potatoes?' Recap that particles need to collide for reactions to happen. **Main:** Discuss and explain collision theory, recalling reactions from Lesson 2. Students should predict what factors could change how fast these reactions occur. Introduce the idea of rate of reaction, instead of speed of reaction. Students to investigate what affects the speed/rate of reactions using a suitable computer simulation programme. Students can analyse their results and state what factors actually affected the speed/rate of reactions. Explain why temperature, concentration and surface area affect the speed/rate of reaction, referring to collision theory. **Plenary:** Ask students this question: 'How could you increase the speed/rate at which jelly dissolves in water?'. Ask them to explain their idea (this relates the lesson to an everyday example).	Computer simulation of rates of reaction experiments eg Crocodile Chemistry 601.	Explain that reactions can occur when particles collide and that increasing the frequency and energy of collisions increases the rate of reaction. Describe and explain the effect of changes in temperature, concentration and surface area of a solid on a given rate of reaction.	C: □2.1 ICT: □2.1 □2.2 N: □2.1 □2.3	General safety issues involved when using computers.

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LESSON 3 – Collision theory and rates of reaction (continued)
Homework: Choose one factor to change in the dissolving jelly investigation. Plan how to carry out this investigation, and predict what will happen when the chosen factor is varied. Extension: Explain what will happen in terms of collision theory and include a diagram of the particles involved.

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LESSON 4 – How can temperature and concentration affect the rate of reaction?							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
C2 8.5 C2 8.6	7G: Particle model of solids, liquids and gases.	Reactions occur at different rates and these can be altered by temperature and concentration.	**Starter:** Recap that temperature and concentration affect the rate of reaction (from Lesson 3). Demonstration of the sodium thiosulphate and hydrochloric acid experiment that the students will carry out. Ask the students to predict what effect changing the temperature and concentration will have on the rate of reaction. **Main:** Experiment 8.4: Effect of temperature and concentration on reactions. Reacting sodium thiosulphate and hydrochloric acid.Do the reaction at three different temperatures and use three different concentrations. Collect all the results together, from the whole class, to make the average result more reliable. Students to write an analysis of the class results. **Plenary:** Discuss what the students found out, from the class results, of the effect of the temperature and concentration variations to the rate of reaction. Ask students why using the class results is better.	Experiment sheet 8.4: Effect of temperature and concentration on reactions.	Describe and explain the effect of changes in temperature, concentration and surface area of a solid on a given rate of reaction. Describe experiments to investigate the effect of temperature, concentration and surface area of a solid on the rate of reaction and interpret the results.	C: □2.1 N: □2.1 □2.3	Safety glasses need to be worn when students carry out the experiment. Use HAZCARDS. Heat the hydrochloric acid not the sodium thiosulphate. Take care when heating hydrochloric acid and when moving the hot beakers.

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LESSON 4 – How can temperature and concentration affect the rate of reaction? (continued)
Homework: Give some everyday examples of where temperature and concentration are used to increase the rate of reaction. Explain why this is important. Extension: Use collision theory in your explanations.

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LESSON 5 – How can surface area and a catalyst affect the rate of reaction?							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
C2 8.5 C2 8.6 C2 8.7	7G: Particle model of solids, liquids and gases.	Reactions occur at different rates and these can be altered by surface area and a catalyst.	**Starter:** Recap that surface area affects the rate of reaction (from Lesson 3). Introduce the terms catalyst and activation energy. Refer back to Lesson 2 on endothermic/exothermic reactions and the energy required to break and make bonds. **Main:** Experiment 8.5.1: Effect of surface area on rate of reaction. React magnesium ribbon with hydrochloric acid. Use three different sized pieces of magnesium ribbon to vary surface area. Experiment 8.5.2: Effect of catalyst on rate of reaction. Decomposition of hydrogen peroxide. Compare the rate of reaction with and without the catalyst manganese dioxide. Students to analyse their findings from these reactions. **Plenary:** Discuss with students what they found from the analysis of their results. Ask if the catalyst made a difference to the rate of reaction.	Experiment sheet 8.5.1: Effect of surface area on rate of reaction. Experiment sheet 8.5.2: Effect of catalyst on rate of reaction.	Describe and explain the effect of changes in temperature, concentration and surface area of a solid on a given rate of reaction. Describe experiments to investigate the effect of temperature, concentration and surface area of a solid on the rate of reaction and interpret the results. Describe the effect of a catalyst on the rate of reaction, interpreting results of experiments, given data.	C: □2.1 N: □2.1 □2.2 □2.3	Safety glasses need to be worn when students carry out the experiment. Use HAZCARDS. Use 10-volume hydrogen peroxide and pre-pour it into the containers for the students to use (do not allow students to pour it).
Homework: Research one industrial use of catalysts. Name the catalyst and give details on the reaction it is used in. Explain about the whole process and why it is useful. Extension: Explain why using a catalyst is desirable for industrial chemical processes (Hint: think about cost, time, etc).							

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LESSON 6 – Using data-logging with rates of reactions							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
C2 8.8	7G: Particle model of solids, liquids and gases.	How data-logging and ICT can be used for rates of reaction experiments, and analysis. The advantages and disadvantages of data-logging equipment.	**Starter:** Discuss any problems that the students had with any of the rates of reaction experiments that they carried out. Discuss how these experiments could be improved. **Main:** Use data-logging equipment to collect data on the rate of reaction of sodium thiosulphate and hydrochloric acid. Students should transfer the data collected to a spreadsheet. Produce a graph of the results, using the spreadsheet. Students should identify the advantages and disadvantages of using data-logging equipment to make measurements, rather than manual measurements. **Plenary:** Discuss the advantages and disadvantages that the students have identified, with the data-logging equipment. Discuss where data-logging allows data collection to take place where it normally would not be possible eg Robotic missions to Mars detecting soil composition.	Data-logging equipment, ICT resources, spreadsheet package. Experiment sheet 8.6: Using data logging with rates of reaction.	Demonstrate an understanding of how data from experiments about rates of reaction can be captured by data-logging, and how the data can be manipulated and displayed for analysis using spreadsheet software.	C: □2.1 ICT: □2.2 N: □2.1 □2.3	Safety glasses need to be worn when students carry out the experiment. Use HAZCARDS. Take care when using chemicals near computing equipment.
Homework: Explain how remote data-logging could be used in inaccessible locations eg deep underground, extreme environments, and why this is useful to us. Extension: Give specific detailed examples of the types of sensors that are used on such missions.							

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LESSON 7 – Enzymes – the biological catalysts							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
C2 8.9	8A: Food and digestion.	Enzymes are biological catalysts, and can increase the rate of reaction. Enzymes are needed for chemical reactions in the human body.	**Starter:** Ask students the question: 'Why are chemical reactions that happen inside our bodies important?' Discuss the need for chemical reactions inside our bodies, and why it is important that enzymes control these reactions. **Main:** Explain how enzymes work, and what factors can affect them. Carry out experiment 8.7 on enzymes to see how they work. Students write an analysis of their experiments. Extension: students could investigate which factors affect the effectiveness of the catalyst in this reaction. **Plenary:** Discuss the results from the experiment, what factors would affect the enzymes' performance.	Experiment sheet 8.7: Enzymes - the biological catalyst. Amylase and starch, varying the temperature and pH. This can be carried out manually or on a computer simulation programme eg Science Investigation 1 – Focus Education. The experiment sheet is for the manual process.	Recall that enzymes are biological catalysts, and the importance of speeding up chemical reactions to the maintenance of life.	C: □2.1 ICT: □2.1 □2.2 N: □2.1 □2.3	Safety glasses need to be worn when students carry out the experiment. Use HAZCARDS.
Homework: Research where enzymes are used in chemical applications that are not inside the human body. Explain the function of the enzymes and what reactions they are used in, eg biological washing powders, to remove certain stains. Extension: Explain the optimum conditions needed for these reactions, including reference to collision theory.							

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LESSON 8 – Reversible reactions and equilibrium							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
C2 8.10 C2 8.11	No direct link from KS3.	Some chemical reactions are reversible, and many reach equilibrium. Conditions of the reactions affect the equilibrium.	**Starter:** Ask students the question: 'Can chemical reactions be undone?' Demonstrations of heating copper sulphate, then adding water to show a reversible reaction. **Main:** Discuss with students what happened in the demonstration, giving a word and symbol equation.Introduce the reversible reaction symbol (⇌). Introduce the idea of equilibrium. Explain that one direction of the reaction will be endothermic and the other direction will be exothermic. Use a model of a 'see-saw' to introduce the idea of equilibrium and what happens when concentration of reactants or products, temperature or pressure are changed. (This will only be suitable for static-equilibrium, not dynamic equilibrium, but may be useful for foundation level students.)	Demonstration sheet 8.8: Reversible reactions. Copper sulphate and heat. BBC Bitesize website www.bbc.co.uk/ schools/gcsebitesize/chemistry/ chemicalreactions/	Understand that some chemical reactions are reversible and may reach equilibrium. Describe and explain how the position of equilibrium may be changed by changing the conditions of a reaction, limited to temperature, pressure (in a gaseous reaction) and concentration.	C: □2.1 ICT: □2.1 N: □2.2	Safety glasses need to be worn when carrying out the demonstration. Use HAZCARDS.

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LESSON 8 – Reversible reactions and equilibrium (continued)							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
			Plenary: Question and answers with the students to check that they have understood. A quiz would be a good way to do this eg tests on reversible reactions and equilibria on the BBC Bitesize website. Recap reversible reactions and equilibrium.				
Homework: Give three reactions that are carried out in the chemical industry, which are reversible reactions. Extension: Give the optimum industrial conditions of these reactions.							

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LESSON 9 – Ammonia production							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
C2 8.13 C2 8.14	9D: Plants for food.	Ammonia is produced by a reversible reaction. Mass production of ammonia is carried out using the Haber process.	**Starter:** Ask the students the question: 'How did the production of ammonia allow twice the world's population to be fed?' Discuss the use of ammonia, in the production of fertilizers, and the students' answers to the question. **Main:** Discuss the reaction for the production of ammonia giving word and balanced chemical equations. Explain that hydrogen and nitrogen to produce ammonia is exothermic, and the reverse of this is endothermic. Discuss the conditions used in the Haber process (temperature, pressure and catalyst) and link this to previous lesson's work on rates of reaction. Activity 8.9 – Students should investigate why the particular conditions for the Haber process are chosen. **Plenary:** Discuss with the students what they found out about why the particular conditions of the Haber process are chosen. Explain why these conditions are chosen. Discuss the usefulness of ammonia, in the production of fertilisers, linking this to the starter activity.	Activity sheet 8.9: Ammonia production. Information about the Haber process, either from textbooks or websites (www.google.co.uk to search for Haber process).	Explain that the production of ammonia is a reversible reaction and may reach a dynamic equilibrium. Explain the conditions under which ammonia is produced from nitrogen and hydrogen in the Haber process, given data on the effect of pressure and temperature.	C: □2.1 □2.2 ICT: □2.1 N: □2.1 □2.2	If using the internet ensure students are not able to access unsuitable websites.

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LESSON 9 – Ammonia production (continued)
Homework: Research the life of Fritz Haber and identify some of the applications of ammonia production, and the consequences that this had for him.

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LESSON 10 – Fertilisers – artificial or organic?							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
C2 8.12	9D: Plants for food.	Artificial and organic fertilisers have advantages and disadvantages.	**Starter:** Discuss the use of ammonia to produce fertiliser (from Lesson 9). Introduce ideas of artificial and organic fertilisers. Discuss with students which fertiliser they think is best. Discuss the idea of organic food and organic farming. **Main:** Carry out role-play (Activity 8.10). Students take on different roles to investigate the advantages and disadvantages of using artificial and organic fertilisers, in these roles. Each group presents their findings and opinions to the rest of the class. **Plenary:** Discuss the arguments of the different groups. Summarise the main advantages and disadvantages of using artificial and organic fertilisers.	Activity sheet 8.10: Fertilisers – artificial or organic? Information about artificial and organic fertilisers, either from textbooks or websites (www.google.co.uk to search for artificial and organic fertilisers).	Discuss the arguments for and against using artificial fertilisers in farming compared to organic farming.	C: □2.1 □2.2 N: □2.1 ICT: □2.1 WO: □2.1 □2.2 □2.3	If using the internet ensure students are not able to access unsuitable websites.
Homework: Students to write a report on their own opinions (or their families' opinions) of artificial fertilisers in farming, and organic farming. Quiz on the whole topic to summarise what has been covered.							

Demonstration 8.1: Dynamite Soap

What you will learn from this demonstration

In this demonstration you will find out that some reactions are very violent and can cause explosions.

What you will know after you see this demonstration

When hydrogen and oxygen are mixed and ignited an explosion occurs.

What you do

Watch the demonstration that your teacher will show you.

You need to think about what the particles in the two chemicals (hydrogen gas and oxygen gas) are doing when they are reacted together.

Write any ideas in the notes section below.

Notes

Demonstration 8.1: Dynamite Soap

Notes for teachers and technicians

Aim

In this demonstration the students will find out that some reactions are very violent and can cause explosions. They will find out that when hydrogen and oxygen are mixed and ignited they explode.

Skills, knowledge and understanding

This demonstration will enable students to gain the following knowledge:

When hydrogen and oxygen are mixed and ignited an explosion occurs.

Previous skills, knowledge and understanding required

1 When chemicals are mixed together they can react.

2 When elements are combined they form a compound.

3 The test for hydrogen and oxygen gas.

Equipment and chemicals required

1 A syringe of hydrogen and oxygen in a ratio of two parts hydrogen to one part oxygen, with a short piece of plastic tube on the end.

2 A small weighing boat, or small shallow container, filled with soap solution (CLEAPSS soap solution, or a mixture of washing up liquid, water and glycerol).

3 Approximately three splints.

4 A lit Bunsen burner.

The mixture of hydrogen and oxygen gas should be a dry mixture. Use the in-syringe method of preparing gases described on the Microscale Gas Chemistry website (http://mattson.creighton.edu/BasicGasTechniques.html).

Health and safety issues

Students to sit a safe distance from the demonstration (approximately 5m). Safety glasses should be worn.

Delivery strategies

- Write the question ‘Why do some chemicals explode when you mix them?’ on the board and ask the students to think about it.
- Explain to the students which chemicals you are reacting together. Ask them to describe the test for hydrogen and oxygen, and ask them to suggest what will happen when they are reacted together and lit with a splint.
- Make sure that students write down a prediction of what will happen; choose students from across the ability range to read out their answer.
- Carry out the demonstration two or three times, then tell students that their observations will have to be explained during the rest of the lesson (link to the main part of the lesson).

Demonstration 8.1: Dynamite Soap

Links

Links with other GCSE Science topics

This demonstration is related to:

- C1a 5.15
- C1a 6.16

Links with Key Stage 3 (KS3)

This demonstration builds on the following skills, knowledge and understanding from KS3:

- 7F: Simple chemical reactions
- 8E: Atoms and elements
- 8F: Compounds and mixtures.

Resources

- CLEAPSS Hazcards.

Websites

http://mattson.creighton.edu/BasicGasTechniques.html – Microscale Gas Chemistry

Activity 8.1.1: Chemical reactions

Chemical reactions

For each reaction explain what is happening to the particles of the reactants and write a word equation.

1. **Copper oxide** is mixed with **sulphuric acid** to make **copper sulphate** and **water**.

2. A piece of **sulphur** is burnt in **oxygen** to produce **sulphur dioxide** gas.

3. When **hydrochloric acid** is mixed with **sodium hydroxide** they neutralise each other, making **sodium chloride** (salt) and **water**.

4. When **iron** is reacted with **sulphur** it produces **iron sulphide**.

5. **Magnesium** metal is put in a test tube of **hydrochloric acid** and they react together to form **magnesium chloride** and produce **hydrogen** gas.

Chemical reactions

For each reaction explain what is happening to the particles of the reactants and write a word equation.

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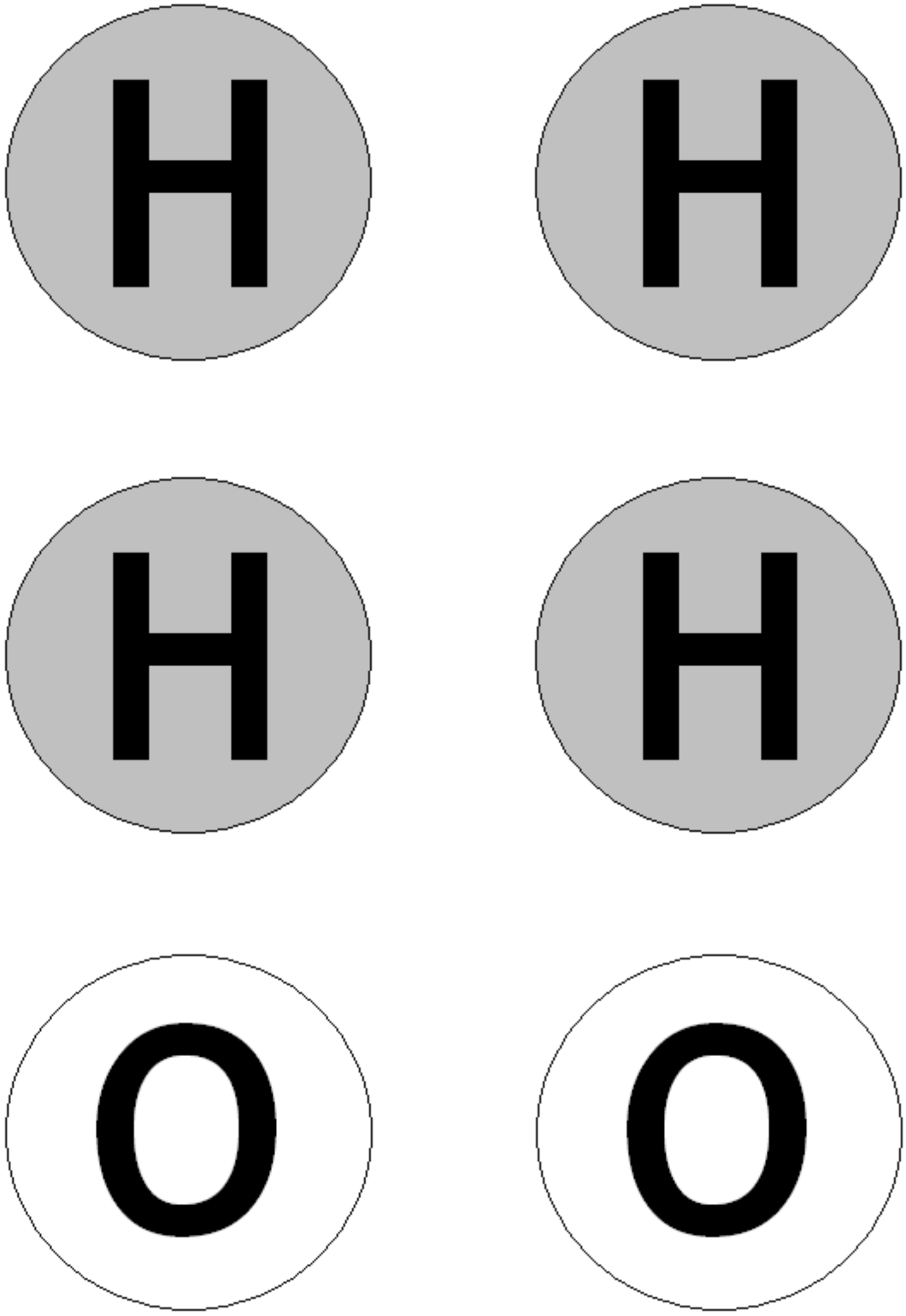
5. **Magnesium** metal is put in a test tube of **hydrochloric acid** and they react together to form **magnesium chloride** and produce **hydrogen** gas.

Activity 8.1.2: Water collision theory

Template for hydrogen and oxygen atoms



Experiment 8.2: Chemical reactions that are hot and cold

What you will learn from this experiment

How hot and cold packs that are used to treat athletes' injuries produce the required effect (hot or cold temperatures).

What you will know when you finish this experiment

1 That reactions that take in heat energy are called Endothermic.

2 That reactions that give out heat energy are called Exothermic.

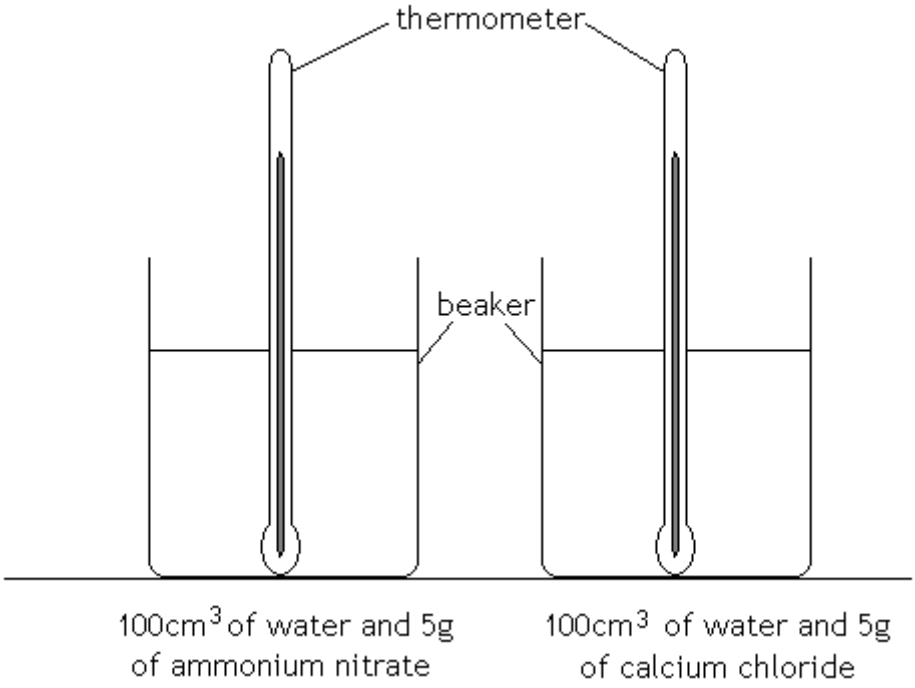
How you may be assessed

1 Your ability to carry out the experiment safely and accurately.

2 What you find out from your experiment.

3 Your analysis of the results from your experiment.

What you do



1 Put on your safety glasses.

2 Collect two 250 cm^3 beakers, and fill each one with 100 cm^3 of water.

3 Measure the temperature in each beaker, and record it.

4 Add 5 g of ammonium nitrate to one beaker, stir, and start the stopwatch.

5 Measure and record the temperature in the beaker every minute for five minutes.

6 Reset the stopwatch.

7 Add 5 g of calcium chloride to the other beaker, stir, and start the stopwatch.

8 Measure and record the temperature in the beaker every minute for five minutes.

9 Tidy away all your equipment.

Experiment 8.2: Chemical reactions that are hot and cold

Suggestions for further work/homework

1 Draw a graph for each of the reactions.

2 Calculate the temperature change during the reactions.

Experiment 8.2: Chemical reactions that are hot and cold

Note for teachers and technicians

Aim

How hot and cold packs that are used to treat athletes' injuries produce the required effect (hot or cold temperatures).

Previous skills, knowledge and understanding required

9H: Using chemistry.

Skills, knowledge and understanding

This experiment will enable students to gain the following skills, and/or knowledge and understanding:

1 measuring, observation and analysis skills

2 some reactions take in heat energy and are called endothermic

3 some reactions give out heat energy and are called exothermic.

Equipment and chemicals required

Per group.

1 Two 250 cm^3 beakers.

2 5 g of ammonium nitrate.

3 5 g of anhydrous calcium chloride (or anhydrous magnesium sulphate).

4 Thermometer.

5 Stopwatch.

6 Safety glasses.

7 Stirring rod.

Health and safety issues

Safety glasses must be worn by all students. HAZCARDS must be consulted.

Delivery strategies

- Introduce the experiment as a way to find out how hot and cold packs work, and which reactions produce the 'hot' and the 'cold' temperatures.
- Students should work in pairs to encourage teamwork and also they can check each others results are accurately taken.
- Students of low ability should be given help, check by asking how they are getting on, or by providing a help sheet (adapted version of the experiment sheet).
- Tell the students to pack away when finished and to draw conclusions from their result.
- At the end of the experiment, students could be asked about their results, and also which reaction produced the 'hot' and the 'cold' temperature for the heat packs, therefore answering which reaction could be used in which type of pack.

Experiment 8.2: Chemical reactions that are hot and cold

Assessment strategies

Students may be assessed on:

- their ability to carry out the experiment safely and accurately
- what they found out from the experiment
- their analysis of the results of the experiment. The analysis of the experiment will be carried out individually so this enables assessment of an individual student's work.

Links

Links with Key Stage 3 (KS3)

This experiment builds on the following skills, knowledge and understanding from KS3:

- 9H: Using chemistry.

Links with other GCSE Science topics

This experiment is related to:

- C1a 5.17.

Resources

- Crocodile Clips Chemistry could be used instead of physically carrying out the experiment.

Experiment 8.4: Effect of temperature and concentration on reactions

What you will learn from this experiment

In this experiment you will find out what effect temperature and concentration have on the rate of reaction.

What you will know when you finish this experiment

1 The effect that varying the temperature has on the rate of reaction.

2 The effect that varying the concentration has on the rate of reaction.

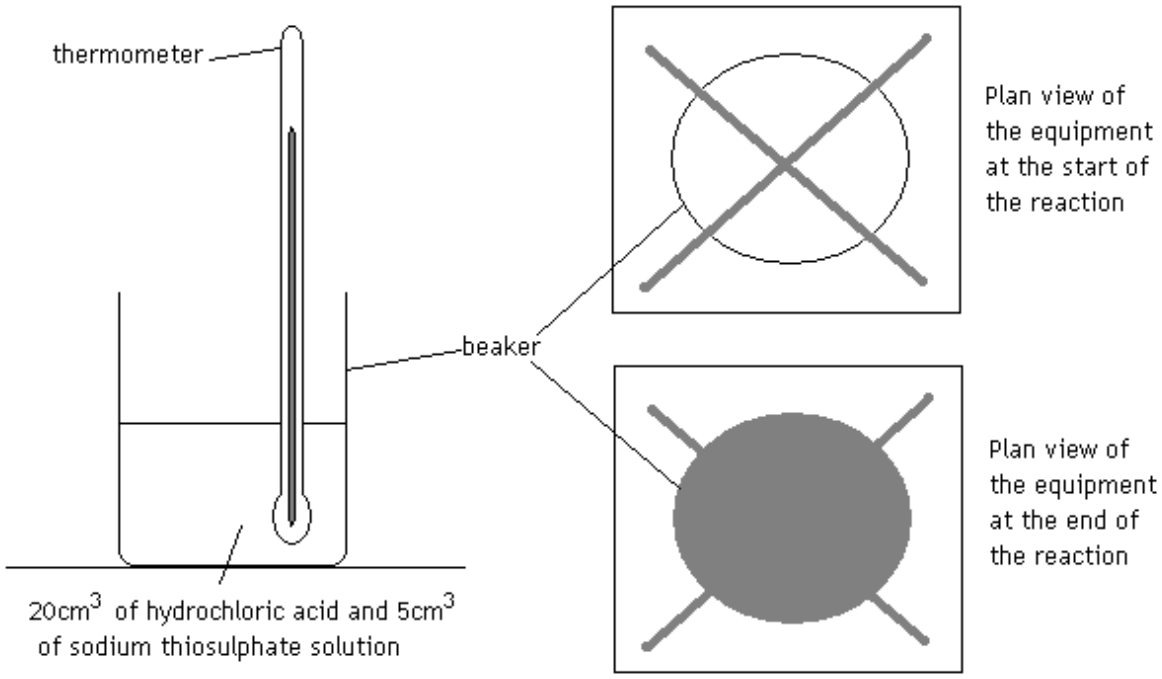
How you may be assessed

1 Your ability to carry out the experiment safely and accurately.

2 What you find out from your experiment.

3 Your analysis of the class results from the experiment.

What you do



A Effect of temperature on rate of reaction

1 Measure 20 cm^3 of 0.5M hydrochloric acid into one of the 100 cm^3 beakers.

2 Measure the temperature of one of the beakers (room temperature) and record it.

3 Stand the acid on top of the card with the big X drawn on it.

4 Measure 5 cm^3 of sodium thiosulphate solution into a 10 cm^3 measuring cylinder.

5 Add the sodium thiosulphate to the hydrochloric acid and start the stopwatch.

6 Watch the mixture by looking down onto the top of the beaker.

7 Stop the stopwatch when you can no longer see the big X and record the time taken.

Experiment 8.4: Effect of temperature and concentration on reactions

8 Thoroughly clean the beakers with water.

9 Repeat this again using hydrochloric acid at approximately 35°C and 50°C (either use a water bath or a Bunsen burner to heat the water).

B Effect of concentration on rate of reaction

1 Measure 20 cm^3 of 0.1M hydrochloric acid into one of the 100 cm^3 beakers.

2 Stand the acid on top of the card with the big X drawn on it.

3 Measure 5 cm^3 of sodium thiosulphate solution into a 10 cm^3 measuring cylinder.

4 Add the sodium thiosulphate to the hydrochloric acid and start the stopwatch.

5 Watch the mixture by looking down onto the top of the beaker.

6 Stop the stopwatch when you can no longer see the big X and record the time taken.

7 Thoroughly clean the beakers with water.

8 Repeat this again using 0.5M and 1.0M hydrochloric acid.

Suggestions for further work/homework

1 Add your results to the chart of the class results.

2 Write an analysis of the class results stating the effect that temperature and concentration had on the rate of reaction.

3 Explain your analysis using the collision theory.

4 Explain why using the class results were better than using only your own results.

Experiment 8.4: Effect of temperature and concentration on reactions

Note for teachers and technicians

Aim

In this experiment the students will find out what effect temperature and concentration have on the rate of reaction.

Previous skills, knowledge and understanding required

7G: Particle model of solids, liquids and gases.

Skills, knowledge and understanding

This experiment will enable students to gain the following skills, and/or knowledge and understanding:

1 measuring, observation and analysis skills

2 the effect that varying the temperature has on the rate of reaction

3 the effect that varying the concentration has on the rate of reaction.

Equipment and chemicals required

Per group

1 100 cm^3 beakers.

2 Hydrochloric acid (0.1M, 0.5M, 1M).

3 Sodium thiosulphate solution (0.1M).

4 Measuring cylinders (25 cm^3 for hydrochloric acid, 10 cm^3 for sodium thiosulphate).

5 Stop watches.

6 Thermometers.

7 Water baths (or Bunsen burners, tripods and gauzes).

8 Heatproof mats.

9 Pieces of card with a big 'X' drawn on it (template supplied).

10 Safety glasses.

Health and safety issues

Safety glasses should be worn. Take care when handling acid (especially acid from the water baths). The hydrochloric acid should be heated not the sodium thiosulphate solution. Read HAZCARDS regarding sodium thiosulphate solution and hydrochloric acid.

Experiment 8.4: Effect of temperature and concentration on reactions

Delivery strategies

- Introduce the experiment by explaining to the students that they are going to see what effect temperature and concentration have on the rate of reaction.
- Demonstrate how to carry out the experiment.
- The experiment is fairly easy to carry out, but the students will have a lot to do, so working in pairs may be best.
- Low-ability students could be provided with a help sheet, or partnered with higher-ability students.
- At the end of the experiment collect the results from all of the individual experiments. Then calculate the average times for all temperatures and concentrations used. This could be done on an OHT sheet, on the white/blackboard or on a suitable spreadsheet on an interactive white board (using a prepared table).
- End the experiment by asking the students to write an analysis of the class results. Higher-ability students could include information about collision theory.

Assessment strategies

Students may be assessed on:

- their ability to carry out the experiment safely and accurately
- what they find out from the experiment
- their analysis of the class results from the experiment (analysis will be individual work).

Links

Links with Key Stage 3 (KS3)

This experiment builds on the following skills, knowledge and understanding from KS3:

- 7G: Particle model of solids, liquids and gases.

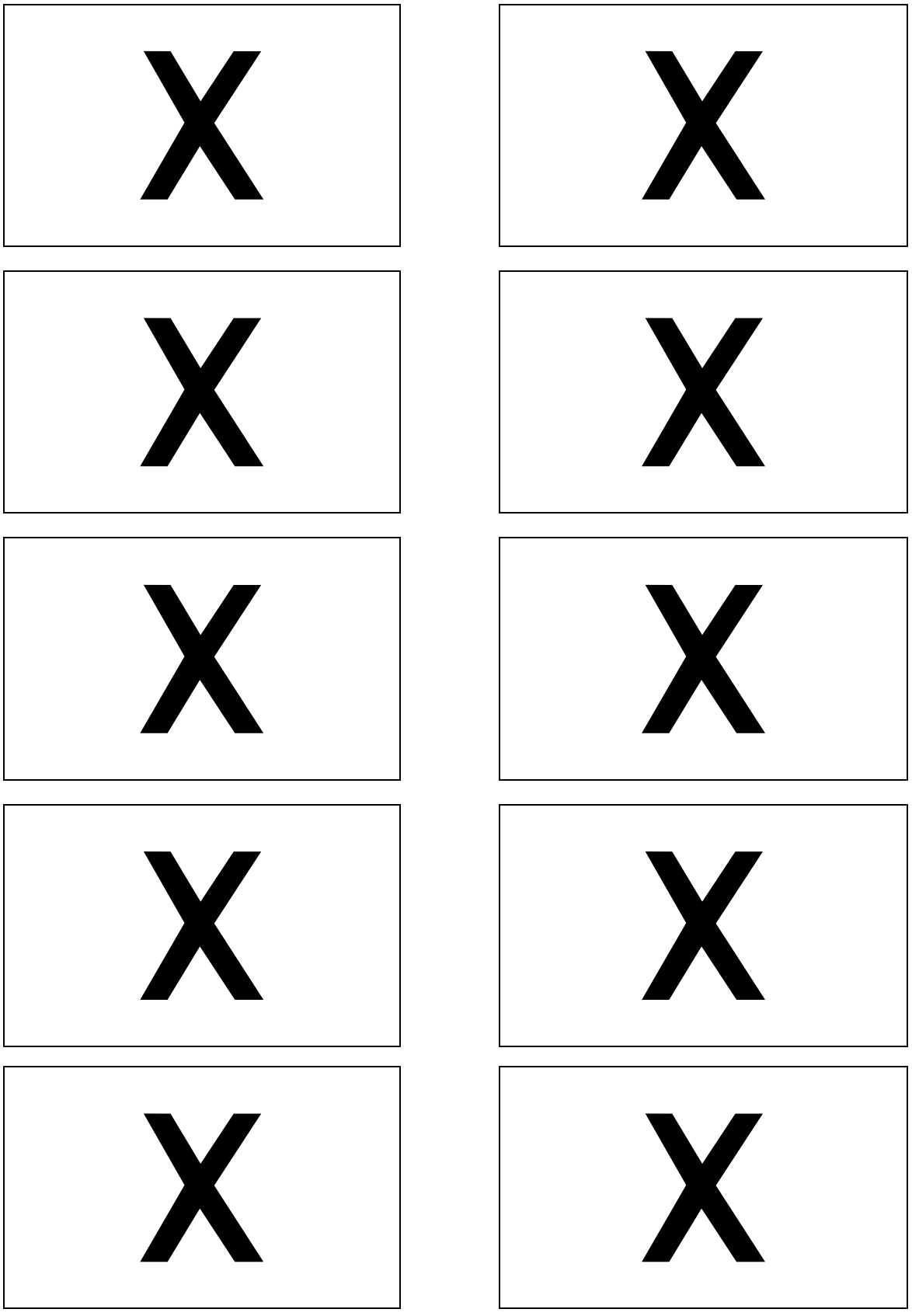
Links with other GCSE Science topics

This experiment is related to:

- C1a 5.16

Experiment 8.4: Effect of temperature and concentration on reactions

Template for cards with a big X on them.



Experiment 8.5.1: Effect of surface area on rate of reaction

What you will learn from this experiment

In this experiment you will find out what effect surface area has on the rate of reaction.

What you will know when you finish this experiment

The effect that varying the surface area has on the rate of reaction.

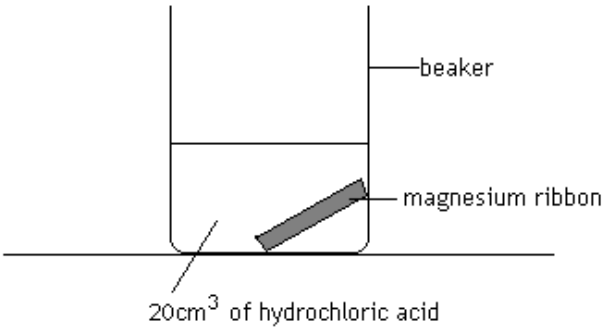
How you may be assessed

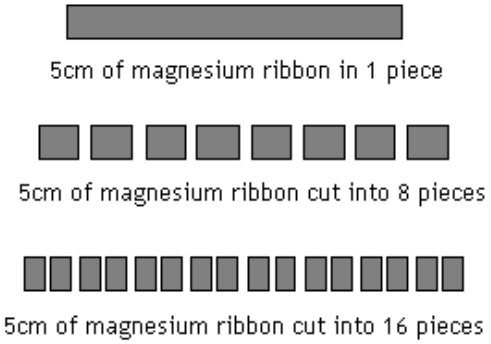
1 Your ability to carry out the experiment safely and accurately.

2 What you find out from your experiment.

3 Your analysis of your observations of the experiment.

What you do





1 Measure 20 cm^3 of 0.5M hydrochloric acid into a 100 cm^3 beaker.

2 Add a 5 cm strip of magnesium ribbon and start the stopwatch.

3 Stop the stopwatch when you can no longer see any bubbles coming from the magnesium ribbon and record the time taken.

4 Repeat this again using the 5 cm strip of magnesium ribbon that has been cut into eight pieces, then the one that has been cut into 16 pieces.

Suggestions for further work/homework

1 Add your results to the chart of the class results.

2 Write an analysis of the class results stating the effect that temperature and concentration had on the rate of reaction.

3 Explain your analysis using the collision theory.

4 Explain why using the class result was better than using only your own results.

Experiment 8.5.1: Effect of surface area on rate of reaction

Note for teachers and technicians

Aim

In this experiment the students will find out what effect surface area has on the rate of reaction.

Previous skills, knowledge and understanding required

7G: Particle model of solids, liquids and gases.

Skills, knowledge and understanding

This experiment will enable students to gain the following skills and/or knowledge and understanding:

1 measuring, observation and analysis skills

2 the effect that varying the surface area has on the rate of reaction.

Equipment and chemicals required

Each group of students will need the following materials.

1 Three 100 cm^3 beakers.

2 Hydrochloric acid (0.5M).

3 Measuring cylinders.

4 Three pieces of magnesium ribbon (each 5 cm long).

5 Stopwatch.

6 Safety glasses.

Health and safety issues

Safety glasses should be worn. Care should be taken when handling acid and HAZCARDS should be read carefully. Students should be warned not to get too close to the top of the beaker of hydrochloric acid when it is reacting with the magnesium ribbon, as the fumes given off are acidic.

Delivery strategies

- Introduce the experiment by explaining to the students that you are going to see what effect surface area has on the rate of reaction.
- Demonstrate how to carry out the experiment.
- Low-ability students could be provided with a help sheet, or partnered with higher-ability students.
- At the end of the experiment ask the students what they found out from their observations.
- End the experiment by asking the students to write an analysis of their observations. Higher-ability students could calculate the actual surface area and could include in their analysis information about collision theory.

Experiment 8.5.1: Effect of surface area on rate of reaction

Assessment strategies

Students may be assessed on:

- their ability to carry out the experiment safely and accurately
- what they find out from the experiment
- their analysis of their observations of the experiment (analysis will be individual work).

Links

Links with Key Stage 3 (KS3)

This experiment builds on the following skills, knowledge and understanding from KS3:

- 7G: Particle model of solids, liquids and gases.

Links with other GCSE Science topics

This experiment is related to:

- C1a 5.16

Experiment 8.5.2: Effect of catalyst on rate of reaction

What you will learn from this experiment

In this experiment you will find out what effect a catalyst has on the rate of reaction.

What you will know when you finish this experiment

The effect that a catalyst has on the rate of reaction.

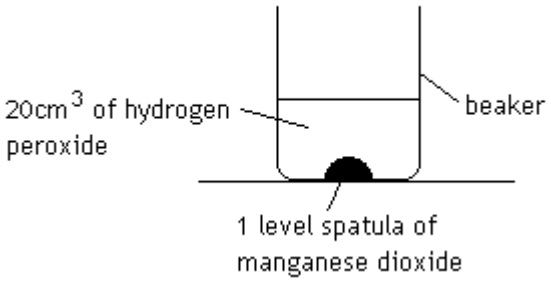
How you may be assessed

1 Your ability to carry out the experiment safely and accurately.

2 What you find out from your experiment.

3 Your analysis of your observations of the reaction.

What you do



1 Examine the hydrogen peroxide in the beaker to see if there are any bubbles of oxygen produced.

2 Add a level spatula of manganese dioxide powder to the hydrogen peroxide and record what happens.

Suggestions for further work/homework

1 Repeat the experiment with a small lump of manganese dioxide, predicting what would happen first.

2 Write an analysis of your observation stating the effect that the catalyst had on the rate of reaction.

3 Extension: Include in your analysis an explanation of how the surface area of the catalyst affected the rate of reaction.

Experiment 8.5.2: Effect of catalyst on rate of reaction

Note for teachers and technicians

Aim

In this experiment students will find out what effect a catalyst has on the rate of reaction.

Previous skills, knowledge and understanding required

7G: Particle model of solids, liquids and gases.

Skills, knowledge and understanding

This experiment will enable students to gain the following skills and/or knowledge and understanding:

1 measuring, observation and analysis skills

2 the effect a catalyst has on the rate of reaction.

Equipment and chemicals required

Each group of students will need the following materials.

1 One 100 cm^3 beaker containing 20 cm^3 hydrogen peroxide.

2 Manganese dioxide (catalyst).

3 Spatula.

4 Safety glasses.

Health and safety issues

Safety glasses should be worn. Use 10-volume concentration hydrogen peroxide; care should be taken when handling it. Students should not handle the hydrogen peroxide. It should be placed into the beakers before the experiment. Warn students not to get too close to the beakers when the manganese dioxide is added.

Delivery strategies

- Introduce the experiment by explaining to the students that you are going to see what effect a catalyst will have on the rate of reaction.
- Demonstrate how to carry out the experiment.
- Heat the hydrogen peroxide (only) to show that there is a very slow reaction without a catalyst.
- Low-ability students could be provided with a help sheet, or partnered with higher-ability students.
- At the end of the experiment discuss what the students observed, and what their analysis of the reaction is.
- Higher-ability students could explain what effect the catalyst had on the activation energy.

Experiment 8.5.2: Effect of catalyst on rate of reaction

Assessment strategies

Students may be assessed on:

- their ability to carry out the experiment safely and accurately
- what they find out from the experiment
- their analysis of their observations of the reaction.

Links

Links with Key Stage 3 (KS3)

This experiment builds on the following skills, knowledge and understanding from KS3:

- 7G: Particle model of solids, liquids and gases.

Links with other GCSE Science topics

This experiment is related to:

- C1a 5.16.

Experiment 8.6: Using data-logging with rates of reaction

What you will learn from this experiment

In this experiment you will find out how data-logging equipment can be used.

What you will know when you finish this experiment

1 How data-logging equipment can be used to collect data on the rate of reactions.

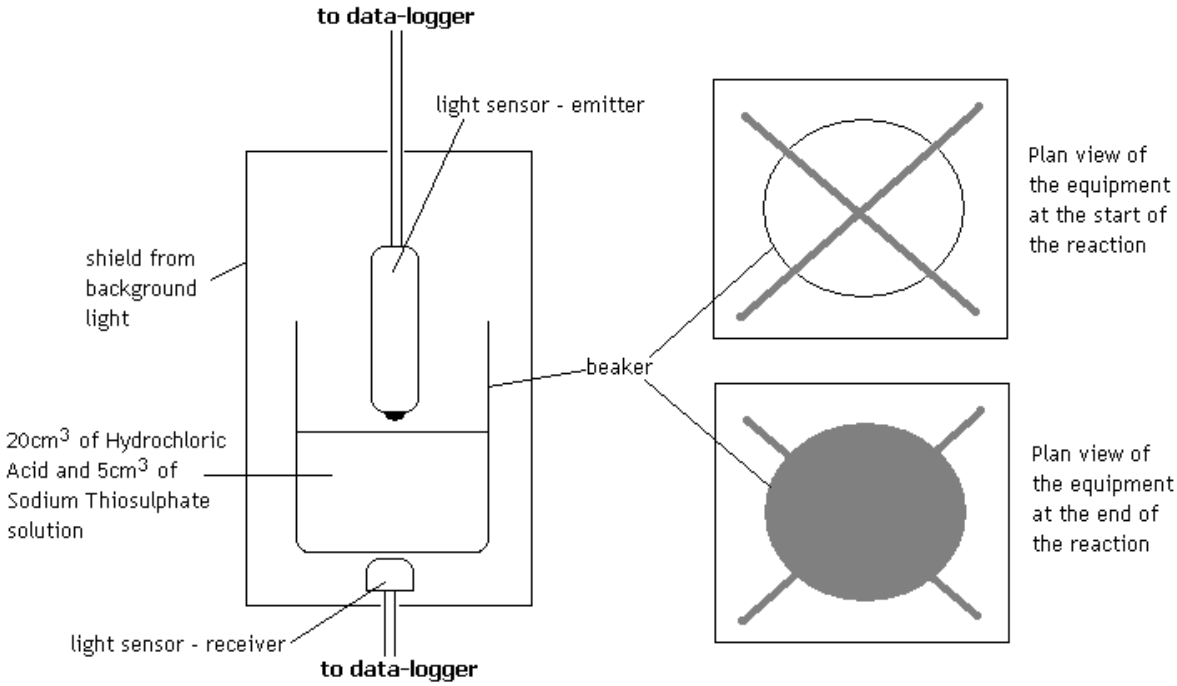
2 How the data can be analysed using a spreadsheet package.

How you may be assessed

1 Your ability to set up and use the data-logging equipment.

2 Your ability to carry out the experiment safely and accurately.

What you do



A Effect of concentration on rate of reaction

1 Measure 20 cm^3 of 0.1M hydrochloric acid into one of the 100 cm^3 beakers.

2 Set up the data-logging equipment, including the light sensor.

3 Measure 5 cm^3 of sodium thiosulphate solution into a measuring cylinder.

4 Add the sodium thiosulphate to the hydrochloric acid and start the data-logging equipment.

5 The data-logging equipment will automatically measure the rate of reaction, until the liquid in the beaker is completely opaque (cloudy).

6 Thoroughly clean all of the beakers with water.

7 Repeat this again using 0.5M and 1.0M hydrochloric acid.

Experiment 8.6: Using data-logging with rates of reaction

Suggestions for further work/homework

1 Transfer the results to a spreadsheet to analyse.

2 Draw a graph (on the spreadsheet package) of your results.

3 Identify some of the advantages and disadvantages of using data-logging equipment rather than a manual practical (as in Lesson 4).

Experiment 8.6: Using data-logging with rates of reaction

Note for teachers and technicians

Aim

In this experiment the students will find out how data-logging equipment can be used.

Previous skills, knowledge and understanding required

7G: Particle model of solids, liquids and gases.

Skills, knowledge and understanding

This experiment will enable students to gain the following skills, and/or knowledge and understanding:

1 how data-logging equipment can be used to collect data on the rate of reactions

2 how the data can be analysed using a spreadsheet package

3 some advantages and disadvantages of using data-logging equipment.

Equipment and chemicals required

Each group of students will need the following materials.

1 Three 100 cm3 beakers.

2 Hydrochloric acid (0.1M, 0.5M, 1M).

3 Sodium thiosulphate solution (0.1M).

4 Two measuring cylinders (one for hydrochloric acid, one for sodium thiosulphate).

5 Data-logging equipment (including light sensors).

6 Safety glasses.

Health and safety issues

Safety glasses should be worn. Care must be taken when handling acid. Read HAZCARDS carefully regarding sodium thiosulphate solution and hydrochloric acid.

Delivery strategies

- If you are unfamiliar with the data-logging equipment in your department please try this experiment in advance.
- Review the experiment from Lesson 4.
- Demonstrate how to set up and carry out the experiment.
- Students may find the equipment difficult to set up, so it may be best to do this before the lesson with the science technician.
- Low-ability students could be provided with a help sheet, or partnered with higher-ability students.
- At the end of the experiment the students should transfer their data to a spreadsheet and analyse it, and draw a graph (on the spreadsheet).
- Students should identify some of the advantages and disadvantages of using data-logging equipment.

Experiment 8.6: Using data-logging with rates of reaction

Assessment strategies

Students may be assessed on:

- their ability to set up and use the data-logging equipment
- their ability to carry out the experiment safely and accurately.

Links

Links with Key Stage 3 (KS3)

This experiment builds on the following skills, knowledge and understanding from KS3:

- 7G: Particle model of solids, liquids and gases.

Links with other GCSE Science topics

This experiment is related to:

- C1a 5.16.

Experiment 8.7: Enzymes — the biological catalyst

What you will learn from this experiment

In this experiment you will find out how enzymes are used in chemical reactions inside our bodies.

You will find out what effect temperature and pH have on enzymes.

What you will know when you finish this experiment

1 How enzymes are used in chemical reactions in our bodies.

2 The effect that temperature has on the enzymes.

3 The affect that pH has on the enzymes.

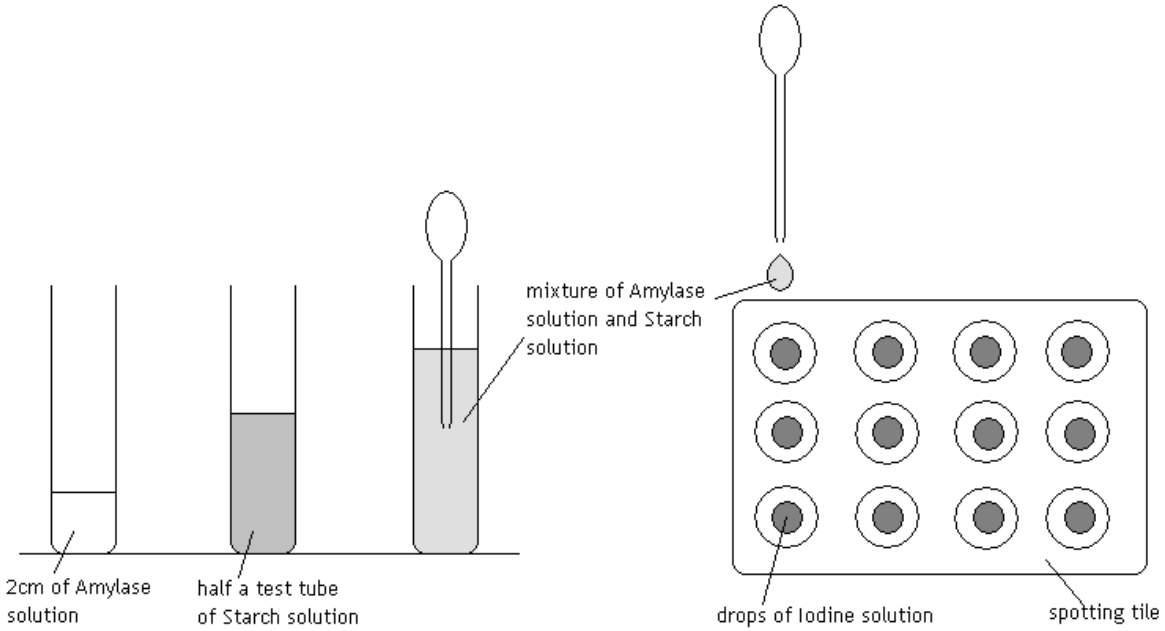
How you may be assessed

1 Your ability to carry out the experiment safely and accurately.

2 The findings of your experiments.

3 Your analysis of your findings.

What you do



A Effect of temperature on enzymes

1 Pour amylase solution into a test tube to a depth of approximately 2 cm.

2 Half fill another test tube with starch solution.

3 Measure the temperature of the amylase solution and record it.

4 Add one drop of iodine solution to each dimple in the spotting tile.

5 Using the pipette add one drop of the starch solution (from the test tube) to the first dimple in the spotting tile (add it to the iodine solution that is there). This should turn blue/black and is the control.

6 Rinse the pipette.

7 Pour the test tube of amylase solution into the test tube of starch solution and shake quickly.

8 Repeat steps 4 and 5 every 30 seconds until a blue/black colour no longer appears.

9 Record all observations.

10 Repeat the experiment at 35°C and 50°C, heating the amylase and starch solutions in a water bath, and keeping all solutions at these temperatures throughout the experiment.

B Effect of pH on enzymes

1 Pour amylase solution into a test tube to a depth of approximately 2 cm.

2 Half fill another test tube with starch solution.

3 Add one drop of iodine solution to each dimple in the spotting tile.

4 Using the pipette add one drop of the starch solution (from the test tube) to the first dimple in the spotting tile (add it to the iodine solution that is there). This should turn blue/black and is the control.

5 Rinse the pipette.

6 Add 2 cm^3 of pH buffer solution (pH 7) to the starch solution and shake.

7 Pour the test tube of amylase solution into the test tube of starch solution and shake quickly.

8 Repeat steps 4 and 5, every 30 seconds, until a blue/black colour no longer appears.

9 Record all observations.

10 Repeat the experiment using pH buffer solutions of pH 3 and 11.

Suggestions for further work/homework

1 Try to find out the exact temperature and pH that give the fastest rate of reaction.

2 Try to find out at which temperature the amylase denatures.

3 Record your observations in a suitable table.

4 Write an analysis of your observations.

Experiment 8.7: Enzymes — the biological catalyst

Note for teachers and technicians

Aim

In this experiment students will find out how enzymes are used in chemical reactions inside our bodies. They will find out what effect temperature and pH have on enzymes.

Previous skills, knowledge and understanding required

8A: Food and digestion.

Skills, knowledge and understanding

This experiment will enable students to gain the following skills and/or knowledge and understanding:

1 how enzymes are used in chemical reactions in our bodies

2 the effect that temperature has on the enzymes

3 the effect that pH has on the enzymes.

Equipment and chemicals required

Each group of students will need the following materials.

1 Water bath (or 250 cm^3 beaker of water, Bunsen burner, tripod and gauze) – a water bath could be shared between a few groups.

2 Amylase solution.

3 Starch solution (4%).

4 Iodine solution.

5 Three test tubes.

6 Thermometer.

7 Spotting tile (dimple tray).

8 Stopwatch.

9 Pipette (plastic).

10 Measuring cylinder.

11 pH buffer solutions of pH3, 7 and 11.

Health and safety issues

Safety glasses should be worn. Read HAZCARDS carefully.

Experiment 8.7: Enzymes — the biological catalyst

Delivery strategies

- This experiment could be carried out using a computer simulation if preferred.
- Demonstrate how to set up and carry out the experiment.
- Timing is very important in this experiment, therefore students may be better organised in pairs.
- Low-ability students could be provided with a help sheet, or partnered with higher-ability students.
- At the end of the experiment the students can proceed to the extension experiment activities, or analyse their observations.

Assessment strategies

Students may be assessed on:

- their ability to carry out the experiment safely and accurately
- the findings from their experiments
- their analysis of their findings.

Links

Links with Key Stage 3 (KS3)

This experiment builds on the following skills, knowledge and understanding from KS3:

- 8A: Food and digestion.

Links with other GCSE Science topics

'Enzymes' is not covered by any other GCSE Science topic, except B3 Topic 1 – Biotechnology, in much more depth.

Demonstration 8.8: Reversible reactions

What you will learn from this demonstration

In this demonstration you will find out that some chemical reactions are reversible.

What you will know after you see this demonstration

Some chemical reactions are reversible.

What you do

Watch the demonstration that your teacher will show you.

You need to think about what is happening in the reaction, and why the reaction is reversible.

Write any ideas in the notes section below.

Notes

Demonstration 8.8: Reversible reactions

Notes for teachers and technicians

Aim

In this demonstration the students will find out that some chemical reactions are reversible.

Skills, knowledge and understanding

This demonstration will enable students to gain the following knowledge:

- Some chemical reactions are reversible.

Previous skills, knowledge and understanding required

1 When chemicals are mixed together they can react.

2 Some reactions are endothermic and some are exothermic.

Equipment and chemicals required

1 A small amount of copper sulphate crystals ($CuSO_4.5H_20$) in an evaporating basin.

2 A pipette (plastic).

3 A beaker of water.

4 A lit Bunsen burner.

Health and safety issues

Students to sit a safe distance from the demonstration. Safety glasses should be worn.

Delivery strategies

- Write the question 'Can chemical reactions be undone?' on the board and ask the students to think about it.
- Explain to the students what chemicals you are reacting together. Ask them what they think will happen.
- Make sure that students write down a prediction of what will happen; choose students to answer from across the ability range.
- Carry out the demonstration then tell students that their observations will be explained during the rest of the lesson (link to the main part of the lesson).

Demonstration 8.8: Reversible reactions

Links

Links with other GCSE Science topics

This demonstration is related to:

- C2 8.1
- C2 8.2
- C2 8.3
- C1a 5.17.

Resources

- CLEAPSS Hazcards.

Websites

- BBC GCSE Bitesize revision website – for revision and tests (www.bbc.co.uk/schools/gcsebitesize/chemistry/chemicalreactions/).

Activity 8.9: Ammonia production

What you will learn from this activity

In this activity you will find out the particular conditions of the Haber process, to produce ammonia, and why these conditions are used.

What you will know when you finish this activity

1 The conditions of the Haber process – temperature, pressure and catalyst used.

2 The effect of these conditions on the rate of reaction.

3 Why these conditions are used.

How you may be assessed

1 Your explanation of the effect of these condition on the rate of reaction.

2 Your understanding of the need for these conditions.

What you do

1 Use textbooks or the internet to find out what conditions are used in the chemical industry in the Haber process, to produce ammonia.

2 Explain what effect these conditions have on the rate of the forward (hydrogen and nitrogen to ammonia) and backwards (ammonia to hydrogen and nitrogen) reactions.

3 Explain why these conditions are chosen for the reaction, stating the yield of ammonia that these conditions give.

Suggestions for further work/homework

1 Extension: Find out about the bond energies involved in this reaction.

2 Research the life of Fritz Haber.

3 Identify some of the applications of ammonia production.

4 Identify some of the consequences that this had for Fritz Haber.

5 Give your opinion whether you think that Fritz Haber's work on the production of ammonia was a good idea.

6 Explain what you would have done if you were Fritz Haber.

Activity 8.9: Ammonia production

Notes for teachers and technicians

Aim

In this activity students will find out the particular conditions of the Haber process, to produce ammonia, and why these conditions are used.

Skills, knowledge and understanding

This activity will enable students to gain the following skills and/or knowledge and understanding:

1 the conditions of the Haber process – temperature, pressure and catalyst used

2 the effect of these conditions on the rate of reaction

3 why these conditions are used.

Previous skills, knowledge and understanding required

1 An understanding of rates of reaction.

2 An understanding of endothermic, exothermic and reversible reactions.

Materials required

Access to textbooks about the Haber process, or the internet.

Health and safety issues

If using the internet ensure that students are not able to access unsuitable websites.

Delivery strategies

- This activity is part of the lesson, so other work will already have been covered.
- Explain to students that they are to research this on their own, and to form their own opinions.
- Students of low abilities could be given a help sheet, or guided towards suitable pages in a textbook or a suitable websites.
- Higher-ability students could look in more detail at the bond energies of the reactions.
- The plenary part of the lesson is asking the students what they have found out, and summarising the information.
- The work should be carried out individually.

Assessment strategies

Students may be assessed on:

- their explanation of the effect of these conditions on the rate of reaction
- their understanding of the need for these conditions.

Activity 8.9: Ammonia production

Links

Links with other GCSE Science topics

This activity is related to:

- C1a 5.16
- C1a 5.17.

Links with Key Stage 3 (KS3)

This activity builds on the following skills, knowledge and understanding from KS3

- 9D: Plants for food.

Resources

- Any textbooks containing information on the Haber process.
- Internet to search for websites containing information on the Haber process.
- www.google.co.uk

Activity 8.10: Fertilisers — artificial or organic?

What you will learn from this activity

In this activity you will take on the role of either a farmer, a gardener, an environmental officer or a buyer for a supermarket. You will have to decide whether you think artificial or organic fertilisers should be used and explain your reasons. You will work in groups and present your opinions to the rest of the class.

What you will know when you finish this activity

1 Some of the advantages and disadvantages of using artificial and organic fertilisers.

2 That different people in different situations will have different needs, and may choose artificial or organic fertilisers based on their needs.

How you may be assessed

1 Your explanation of the questions put to your role (on the role-play cards).

2 Your presentation to the class on your questions.

3 Your contribution to your group.

What you do

1 Use textbooks or the internet to find out the answers to the questions on your role-play card.

2 Write an explanation of which fertiliser you think is best and your reasons for choosing it.

3 In your group present your opinions to the rest of the class (you may wish to use the whiteboard, a computer, a flipchart/poster or handouts to help your presentation).

Suggestions for further work/homework

1 Extension: Find out the opinions of people who are actually in these different roles.

2 What makes organic fruit and vegetables organic?

Activity 8.10: Fertilisers — artificial or organic?

Notes for teachers and technicians

Aim

In this activity the students will take on the role of either a farmer, a gardener, an environmental officer or a buyer for a supermarket. They will have to decide whether they think artificial or organic fertilisers should be used, and explain their reasons. The students will work in groups and present their opinions to the rest of the class.

Skills, knowledge and understanding

This activity will enable students to gain the following skills and/or knowledge and understanding:

1 some of the advantages and disadvantages of using artificial and organic fertilisers

2 that different people in different situations will have different needs, and may choose artificial or organic fertilisers based on their needs.

Previous skills, knowledge and understanding required

The difference between an artificial and an organic fertiliser.

Materials required

Access to textbooks about artificial and organic fertilisers, or the internet.

Health and safety issues

If using the internet ensure students are not able to access unsuitable websites.

Delivery strategies

- Introduce the activity by dividing the students into groups. There are four roles so try to have four, eight or twelve groups.
- Students in the groups should work together, so a good group size is three to four students.
- Explain to students that they are to research this on their own and to form their own opinions.
- The groups should be of mixed abilities so that students of low abilities can be encouraged and helped.
- The activity will finish with all the groups of students giving their presentations on their roles.
- The plenary part of the lesson will summarise some of the advantages and disadvantages of artificial and organic fertilisers.

Activity 8.10: Fertilisers — artificial or organic?

Assessment strategies

Students may be assessed on:

- their explanation of the questions put to their role (on the role-play cards)
- their presentation to the class on their questions
- their contribution to the group.

Links

Links with other GCSE Science topics

This activity is related to:

- B2 3.9.

Links with Key Stage 3 (KS3)

This activity builds on the following skills, knowledge and understanding from KS3:

- 9D: Plants for food.

Resources

- Any textbooks containing information on artificial or organic fertilisers.
- Internet to search for websites containing information on artificial or organic fertilisers.
- www.google.co.uk

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