KEY STAGE 3

HOW SCIENCE WORKS *INTERACTIVE*

CHEMISTRY V1.0

Getting Started

RISING STARS

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Contents

Introduction

This booklet provides the on-screen Getting Started instructions (in the 'investigation' section of each unit) from the *How Science Works Interactive Chemistry* CD-ROM in printed form. It should be used alongside the CD-ROM to facilitate discussion and planning of the investigations particularly if they are to be carried out by students with minimal teacher support.

How Science Works Interactive has been developed to support, complement and reinforce practical and investigational work at Key Stage 3. The programme consists of three CD-ROMs – Biology, Chemistry and Physics – and provides coverage of the *Framework for secondary science* 'How science works' strands as well as of the science content strands.

Each CD-ROM includes fully interactive investigations, each supported by information on science in a real-life context. Learning is reinforced and extended through follow-up questions, discussion points and extension work. These can be used for individual and group work in the classroom and as homework. More detailed information on structure and functionality is given in the 'How to use' document, accessible from the main menu screen on each CD-ROM.

Each investigation supports the teaching of the 'How science works' strand within the *Framework* generally although specific sub-strands have been identified as key to each investigation. The investigations have also been matched to the three most appropriate criteria within the Assessment Focuses (AFs) as described in *Assessing pupils' progress in science at Key Stage 3*. The investigations can provide evidence against these criteria to enable students to monitor their own learning and for teachers to make judgements about levels of attainment and progress. However, the follow-up discussion points and extension work develop the topic further to cover a much wider range of AFs. You will find the specific 'How science works' sub-strands and the three associated assessment criteria listed within each investigation's context screen.

3.1 Particle Models: *Hot chemistry*

Click on the ***e*** button to find the equipment you need to begin your investigation.

Choose one liquid to investigate and use the thermometer to measure its temperature at regular intervals. Click the 'minutes' button to make time pass. Investigate the other liquids in the same way. Record and plot your results. From the graphs, find the best value of temperature for each change of state.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

3.1 Particle Models:
Separating mixtures

Click on the ***e*** button and drag and drop a separation apparatus and a mixture to the workbench to begin your investigation. Drag and drop a mixture to the apparatus to begin the separation process. The results of the separation process will appear on screen after a short time. Record your results, working through the different apparatus and mixtures systematically.

Click the 'start again' button to reset the investigation.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

3.1 Particle Models:
Size of gas particles

Click on the ***e*** button to find the equipment you need to begin your investigation.

Drag and drop a balloon and a cylinder of gas to the gauge on the workbench. Click on the '+.5' button to release gas into the balloon until it is full. Be careful not to fill it with more than 10 litres of gas or it will burst! Measure and record the volume of gas released into the balloon.

Click on the 'day' button to begin the deflation process and record the diameter of the balloon at regular intervals. Use the ruler to measure its diameter. Record these results and the time it takes until the balloon deflates.

Repeat your investigation to explore how quickly the same balloon will deflate when inflated with other gases.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

3.2 Chemical Reactions: *Getting the right mix*

Click on the ***e*** button to find the equipment you need to begin your investigation.

This investigation helps you to explore the correct amounts of a chloride and a nitrate solution to mix together to achieve a complete reaction. The extent of the reaction is measured by the turbidity (cloudiness) of the mixture as the product is a precipitate. All the solutions used in this investigation are of the same concentration.

Start by choosing which nitrate solution to investigate and drag that test tube to the turbidity meter on the workbench. Then choose which chloride solution to mix with it and drag and drop that beaker to the workbench.

Add the chloride solution by dragging the pipette to the meter. When you drop it, 1 cm^3 of solution is mixed with the solution in the test tube and the meter automatically updates the turbidity level. Repeat this process until you are sure that maximum turbidity has been reached. The two solutions have now reacted together completely.

Repeat this investigation for all the mixtures and record and plot your results.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

3.2 Chemical Reactions: *Models of elements, compounds and mixtures*

Click on the ***e*** button to find an infinite supply of red atoms and blue atoms.

Drag and drop atoms into the circle to create a visual representation of the specified state of matter. Classify the representation as element, mixture or compound by clicking your choice to the right of the circle. Print the completed page.

Click the ‘next’ button to create different representations.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

3.2 Chemical Reactions: *Neutralisation*

The amount of acid that reacts with an alkali allows us work out the chemical equation for the reaction.

Click on the ***e*** button to find the equipment you need to begin your investigation.

Each burette is filled with a different acid and each flask with a different alkali. The alkali already has indicator added to it and is therefore already blue in colour.

Choose which acid to investigate and drag the burette to the workbench. Then drag your chosen alkali flask and drop it onto the workbench underneath the burette.

Clicking on one of the burette's buttons will discharge the given amount of acid into the flask. The alkali will change colour if there has been a reaction: blue indicates no reaction yet, purple indicates that the solution is neutral and red indicates that the solution is acidic.

Begin by doing a rough titration and add acid using the $10\,cm^3$ button. Gradually increase accuracy by repeating the investigation using the $1\,cm^3$ button and then the $0.1\,cm^3$ button.

Record your results. Repeat titrations as needed to ensure you have a reliable result for each reaction.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

3.2 Patterns in Chemical Reactions: *Forensics find an answer!*

Click on the ***e*** button to find the equipment you need to begin your investigation.

Choose a test tube to drag and drop into the clamp. Choose a container of reagent and drag and drop it to the workbench. Use the pipette to add the reagent to the sample. Test each sample in this way and find out what is in each test tube.

You are advised to investigate tubes A to F first before testing the two grit samples.

Testing steps

- Add universal indicator solution.
    - A red colour indicates acid.
    - A blue colour indicates alkali.
    - A green colour indicates no change.
- If no change after adding universal indicator solution, then add nitric acid.
    - Bubbles indicate carbonate.
- If no bubbles appear after adding nitric acid, take a fresh sample and add silver nitrate solution.
    - A white precipitate indicates chloride.
    - A cream precipitate indicates bromide.
    - A yellow precipitate indicates iodide.
- Take another fresh sample and add barium chloride solution.
    - A white precipitate indicates sulphate.

Record your results and summarise what you have found out about each of the six samples. Then undertake the forensic work on S1 and S2.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

3.2 Patterns in Chemical Reactions: *Carbon dioxide in cooking*

Click on the ***e*** button to find the equipment you need to begin your investigation.

Each test tube contains a different carbonate. Choose a test tube and drag it to the clamp on the workbench.

Testing steps

- Drag and drop the glass rod with a drop of limewater hanging from the bottom from the ***e*** panel to the test tube.
- Add acid to the test tube by dragging a beaker of acid from the ***e*** panel to the workbench and then dragging the pipette to the test tube.
- Use a fresh sample and apply heat to the test tube using the on/off controls on the Bunsen burner.

Observe and record any colour changes as well as any change to the limewater drop.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

3.2 Patterns in Chemical Reactions: *Temperature affects the speed of a reaction*

Investigate how quickly 4 cm^3 dilute hydrogen peroxide decomposes into water and oxygen when added to the ordinary catalyst solution in the flask.

hydrogen peroxide → oxygen + water

Set the temperature – either 7°C, 14°C or 21°C – of the water bath by clicking on the buttons on the box. Click on the tap of the dropping funnel to let the hydrogen peroxide into the flask. Click on the seconds counter to move time on in 10 second intervals.

Record the volume of gas in the syringe every 10 seconds for different temperatures.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

5.2 Changing Earth: *Geology rocks!*

Click on the ***e*** button to find the rock samples you will need to begin your investigation.

For each sample, you will need to look for clues to decide what type of rock it is and how it was formed.

- You can look for grains and bits stuck together in the samples. Sedimentary rock comes from sediments being glued together.
- You can look for crystals in the samples. Igneous rock is molten stuff from deep down in the Earth that has cooled and formed crystals.
- You can look for lines showing where the rock has been stretched or flattened or altered. Metamorphic rock has been changed by movements in the earth over time.

Choose a rock sample and drag it to the workbench. Look carefully at the way each rock is put together, its texture and its key features. Record this for each rock and, using this evidence, suggest what rock type each sample is and how it might have been formed.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

5.2 Changing Earth: *The metamorphic process*

Click on the 'start drilling' button to start your imaginary drilling down to 900 km.

When the drill stops, record the depth it has reached and what the temperature and pressure are. Describe what the mineral looks like.

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

5.2 Changing Earth: *Grain size in igneous rock*

Click on the ***e*** button to find the rock samples you will need to begin your investigation and a ruler. Clicking on the microscope gives polarised-light photomicrographs of the samples.

In the basalt sample, estimate and then measure and record the size of three of the tiniest crystals.

In the gabbro sample, you can see different coloured crystals. Estimate the size of at least five of the largest crystals and record two measurements for each.

In the granite sample, estimate and then measure and record the size of the five largest crystals.

In the obsidian sample, it cooled too quickly to crystallize. Describe its surface.

In the pumice sample, volcanic gas has mixed in with the magma and has left lots of pockets in the rock. Can you find any crystals to measure?

Go to the follow-up screen and work through the questions and challenges in each section to extend your thinking and learning.

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