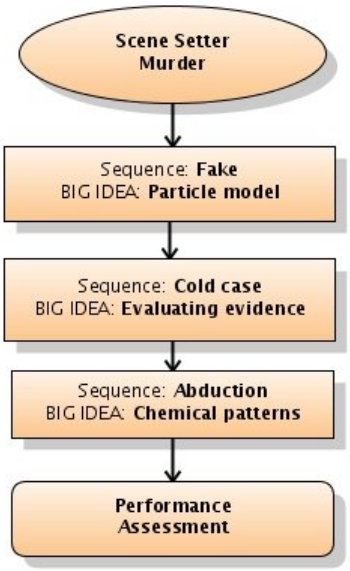
Extract from Planning pack (in trialling)

Forensics unit: 'Fake' teaching sequence

"Creating mystery with a crime story context, to make teaching about particles more engaging."



Forensics unit overview: A crime always leaves some trace. What chemical techniques and reactions can scientists use to identify these clues? How do they work? As a forensic scientist, you have to build up a case to tie the suspect to the crime scene. What kind of evidence and how much do you need? In this unit, students play the role of the trainee, eager to prove their worth, opening up old cases and using science to bring criminals to justice.

Fake Sequence overview: Students learn about the particle model, to solve a crime that has been committed in an art gallery. They investigate how a change in state can be used to discover fingerprints, use the ideas of solubility to analyse an unknown white powder, chromatography to identify dyes and distillation to separate liquids with different boiling points. All the time, they are encouraged not just to try the technique but to understand what's going on – in terms of particles.

Learning objectives

The Big Idea for this sequence:

The particle model provides explanations for the different physical properties and behaviour of matter (Strategy Framework 3.1)

The conceptual knowledge we want students to understand ...

-- If we imagine substances are made up of tiny particles, then we can explains what happens in physical changes, including dissolving and changes of state.
- Pure substances can be identified by their physical properties, including melting and boiling points and solubility.
- Particles in liquids and gases can move because their particles are not joined together
- We can separate a mixture of different substances because their particles are not joined together.

(by building on previous understanding that)
- solids and liquids can be separated, and can be changed physically

By considering the essential questions ...

- Why do particles matter to forensic scientists?
- What tests help forensic scientists solve crimes?
- Is forensic evidence enough to prove guilt? (whole unit)
- Do all substances have different properties?

The important factual knowledge we want students to remember ...

- Pure substances change state at known temperatures.
- The amount of a pure substance that dissolves in a certain amount of water is its solubility.
- Impurities affect the physical properties of a substance, including the temperatures at which they change state.
- Solids, liquids and gases are made up of tiny particles.
- When a substance changes state, the arrangement and movement of its particles change.
- The particles of the substances in a mixture are not joined together.
- Terminology: change of state, solvent, solute, soluble, insoluble, solubility, mixture, dissolving, crystallisation, melting point, boiling point, distillation.

Procedural knowledge

The procedural knowledge (skills) we want students to apply

- knowledge of how to use boiling point and melting point data to identify pure substances.
- knowledge of how to compare solubility using a semi-quantitative scale.
- knowledge of the criteria for doing a fair test
- knowledge of how to make and record observations of physical properties.
- knowledge of how to use the separation techniques of chromatography, distillation and filtration.

Extract from teachers Guide for Activity: What was the crime? (in trialling)

As the valuable painting is still hanging on the wall, Billie and Dragon wonder what the crime actually was. They decide to check the painting for fingerprints. Students see that the traditional way of brushing on charcoal is not very good as it smudges the prints. Can they come up with a better method? Under the guidance of Dr Sherl they come up with a method using the sublimation of iodine. Students learn about particles and changes in state in order to explain how this technique works.

N.B. This is one of 6 activities that form the Fake sequence

(there is a crime scene setter before this extract)

Engage

Present slide 2 to the class – invite responses.

Elicit

Show class slide 3. Have they come across any ways of showing up hidden fingerprints? Then show slide 4.

Explore

N.B. Remember this is a practical activity and should only be undertaken with a risk assessment. Students work in pairs. They are given a small piece of laminated white card which they must make a fingerprint onto. They then use brushes and charcoal powder to gently brush on the powder to show up the prints. Discuss with students how good this technique is. Show them slide 5.

Students work in pairs. Boiling tubes will be prepared which has a strip of filter paper inside along with a substance at the bottom. Some pairs have coloured wax, some iodine and some charcoal. Discuss with the students how to get the substances to move up to the oil. They may come up with the idea of heating. They should try holding the tube for 2 minutes first to see if this gives the substances enough energy to move. (should be enough for iodine) If there is no change, they should put the tubes in a beaker of hot water from the kettle and leave for 2 minutes (enough for wax). If still no change, they can heat by holding tube in test tube holders over a Bunsen burner (only for those with charcoal).
Discuss with students if their substances fulfilled the criteria on slide 5.

Explain
Slide 6 is shown which shows how the iodine can be used to show up the fingerprints on the frame.
Slide 7 introduces the essential question.

(after this extract)

... introduce the idea of particles

Slide 9 – has diagrams that show the 3 states of matter. If preferred, animations can also be used instead here. See http://www.bbc.co.uk/schools/ks3bitesize/science/chemistry/particle_model_intro.shtml for links to pages on solids, liquids and gases. Each of these pages contains animations that you can download. (See the page on the wiki http://www.wikiedscience.com/display/users/Animation+tutorials for information on how to download animations and embed them into PowerPoint)
Slide 10 – changes in state. See http://www.harcourtschool.com/activity/states_of_matter/ for a suitable animation.

(continues beyond extract)

... Demonstrate making fingerprints with iodine. Use a piece of filter paper and ask members of the class to put fingerprints all over it. Put this in a large beaker which contains iodine. Cover the beaker. Heat gently on a hot plate until the fingerprints are clear.

... explain sublimation as a change of state.

Evaluate
Slide 11 and 12 shown. Students write their response to Dr Sherl. They should use the particle diagrams in their answer.