**Substances 2: identifying mysterious substances**

**Levels:** 3-4  
**NoS achievement aims:** Understanding about science, Investigating in science   
**Contextual strands:** Material world   
**Topic:** Types of materials

**Rationale**

All substances have a unique set of properties.

Students working collaboratively to identify an unknown substance can build an appreciation of how scientists use diagnostic tests to confirm predictions.

**What you need**

This activity is the second in a sequence of two activities. The first activity is [Substances (1/2): carrying out common diagnostic tests](https://scienceonline.tki.org.nz/Nature-of-science/Nature-of-science-teaching-activities/Substances-1-2-carrying-out-common-diagnostic-tests) .

* Students will need access to sinks, and cleaning and drying cloths.
* Eight unlabelled containers of a substance. This substance is one of the six that students performed diagnostic tests on in the first substance activity.
* Test tubes (or equivalents, for example, small glass jars) per group.
* Glass jar lids (metal, for example, jam/chutney lids) suitable for heating.
* Tongs or forceps.
* A candle.
* Matches.
* White vinegar and water.
* Litmus paper (either neutral paper, or both red and blue paper).
* Diagnostic test record sheet

Note: Supporting activity resources are provided below.

**Focus**

Review the previous activity, ‘ [Substances (1/2): carrying out common diagnostic tests](https://scienceonline.tki.org.nz/Nature-of-science/Nature-of-science-teaching-activities/Substances-1-2-carrying-out-common-diagnostic-tests) ’, with the class. Recall the diagnostic tests you used. Show the class the mystery substance.

* What did you learn from your diagnostic tests that could help you to predict what the substance might be?
* What are some diagnostic questions you could investigate in class to determine what the substance is?

**Exploration**

1. Divide the class into the same eight teams of consultants as in the first activity.
2. Ask the students to imagine that they are a team of forensic scientists who have been asked to identify a mystery substance found at a crime scene.
3. Issue a sample of the unknown substance to each of the eight teams and ask them to conduct their specialist test on it.
4. Ask students to refer to the ‘Diagnostic test record sheet – student’s copy’. Students record their observations about the results of their diagnostic test on the ‘mysterious substance’ on the sheet.
5. Full class report back session: have each team report the results of their test on the ‘mystery substance’ and suggest what they now think the substance is, providing specialist, supporting evidence.

**Reflection**

* What do you think the mystery substance is? What prior knowledge did you use to make that prediction?
* How useful were your questions in guiding your diagnostic testing? Was it helpful to have predictions about the results?
* How did your confidence in your prediction change as more teams reported back their findings?
* How confident do you feel about your own team’s specialist test results? Do you think you would be as confident if you did one of the other tests without practising first?
* Was it more efficient when specialist teams shared their findings and arrived at a combined decision?
* Why do you think forensic scientists need to specialise in a narrow field?
* How much confidence should a court or jury have in just one piece of evidence?

**Activity resources**

* At the beginning of the activity, students should fill in the sheet with the results of the diagnostic tests undertaken in ‘ [Substances (1/2): carrying out common diagnostic tests](https://scienceonline.tki.org.nz/Nature-of-science/Nature-of-science-teaching-activities/Substances-1-2-carrying-out-common-diagnostic-tests) ’. During this activity, students use the record sheet to record the results of the tests on the ‘mystery substance’.