**Substances 1: carrying out common diagnostic tests**

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

**Rationale**

All substances have distinctive properties.

Working in teams to identify unknown substances provides opportunities for students to find evidence and develop simple explanations. These are processes and practices that are important in the science community.

**What you need**

This activity is the first in a sequence of two activities. The second activity is [Substances (2/2): identifying mysterious substances](https://scienceonline.tki.org.nz/Nature-of-science/Nature-of-science-teaching-activities/Substances-2-2-identifying-mysterious-substances) .

* Students will need access to sinks, and cleaning and drying cloths.
* Eight sets of a range of common (non-toxic) white powders (one teaspoon of each in separate small containers with the name of the substance on the container):
  + castor sugar
  + salt (ground up)
  + white flour
  + baking powder
  + baking soda
  + citric (or tartaric) acid.
* 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).
* Copies of diagnostic test instruction sheets for each team of consultants: [Solubility](https://scienceonline.tki.org.nz/Nature-of-science/Nature-of-science-teaching-activities/Substances-1-2-carrying-out-common-diagnostic-tests#Solubility) , [Acid reaction](https://scienceonline.tki.org.nz/Nature-of-science/Nature-of-science-teaching-activities/Substances-1-2-carrying-out-common-diagnostic-tests#Acid) , [Melting](https://scienceonline.tki.org.nz/Nature-of-science/Nature-of-science-teaching-activities/Substances-1-2-carrying-out-common-diagnostic-tests#Melting) , [Acidity](https://scienceonline.tki.org.nz/Nature-of-science/Nature-of-science-teaching-activities/Substances-1-2-carrying-out-common-diagnostic-tests#Acidity) . plus Teacher Guide and record sheets

**Focus**

* How do you think someone could find out what **type** of substance something is?
* What do you think scientists mean when they say most substances have distinctive properties?
* What are some of the properties we know about? (If not already covered, suggest ‘solubility’, ‘acidity’, ‘reaction with acids’, ‘melting temperature’. For clarification of terms see Diagnostic tests – teacher’s copy in activity resources below).
* What questions do you think we could ask when trying to find out what an unknown powder is? (Write questions on white board.)
* What made you think of the questions?
* How can we decide which questions we might be able to investigate by ourselves in the classroom?
* Are there any skills/techniques we need to develop before the investigation?

**Exploration**

1. Explain to the students that they are going to practice some tests that can be used to explore the properties of substances.
2. Divide the class into eight teams of consultants:
   * two teams of solubility consultants
   * two teams of acid reaction consultants
   * two teams of melting consultants
   * two teams of acidity consultants.
3. Each team will have a different diagnostic test to perform (there are four different tests and eight teams). Hand out one diagnostic test instruction sheet to each team and explain that they will become specialists at using that diagnostic test. Explain the need for avoiding contamination by cleaning thoroughly in between substances.
4. Issue a set of powders to each team and give students about 15–20 minutes to complete the diagnostic tests to answer the investigation question on their team’s diagnostic test instruction sheet and record their observations for each substance.
5. Have the teams working on the same test meet and compare their process and their results. “Was your process the same?” “Did your tests answer your question for each substance?”
6. As a class, use the information from each team to fill in the table of the substances and their distinctive properties (see Diagnostic test record sheet – student’s copy in activity resources below).

**Reflection**

* Did your team get the same results for your diagnostic tests as the other team using the same tests? If there were any differences in your results, what could explain these differences?
* How important is a scientist’s experience when suggesting appropriate research questions?
* What is the advantage of practising your diagnostic test before using it on a mystery substance?
* How do the results of the test help you to describe the properties of the mystery substances?