

1.1 It's a material world

Lesson outcomes

At the end of this activity students will be able to:

- identify some properties of materials
- describe how the properties of materials are related to their use
- describe the importance of working safely in the science laboratory.

What ideas might your students already have?

- Students have difficulty distinguishing between an object and the material or substances from which it is made.
- Students may not have considered everyday materials in terms of the properties that make them useful. They may focus mainly in easily observable properties such as colour and shape.

Key vocabulary:

Property

Equipment list

Each GROUP will require:

- access to **Student Digital**

Each STUDENT will require:

- **Notebook**

Things to consider and hints for success

- Students feel more confident presenting group ideas, as in **Think-Pair-Share (Step 2)** or via a show of hands (**Step 3**), than when they asked for their individual answers.
- Using thumbs up/thumbs down is even less threatening, as this can be done in front of the body, unseen by the class.
- Students may have already studied laboratory safety so this is an opportunity to revise before commencing laboratory work. Teachers can select appropriate **Notebook** questions to revise and reinforce safety in the laboratory.

Teacher content information:

In Rock, Paper, Scissors, students use their hands to represent each item (see images/photo in *Student Guide*). Each participant shakes a fist three times and on the third shake forms one of the three shapes with their hand. If both participants form the same shape it is a draw. If students form different shapes, the following rules apply:

1. rock beats scissors, because rock blunts scissors
2. scissors beat paper, because scissors cut paper
3. paper beats rock, because paper wraps up rock. The winner is the first person to win three times.

Lesson plan

Step 1: Ask students who have played Rock, Paper, Scissors to raise their hands.

Step 2: Students use a **Think-Pair-Share** strategy to discuss and complete **Steps 1** and **2**.
Use a show of hands to share pairs' ideas with the class.

Answer: (a) **rock** crushes scissors, (b) **paper** wraps around rock, (c) **scissors** cut paper

It is possible to come up with some alternative pairings based on other characteristics. For example, rock beats paper because it is stronger, but explain to students that the game is based on one particular set of agreed characteristics.

Step 3: Students play with their partner. Remind them the winner is the first person to win three times.

Step 4: Students answer the discussion question in their **Notebooks**, individually, in pairs or as a class.

Step 5: Students work individually to complete the second part of this activity. They consider how the properties of materials relate to their uses.

Step 6: Students share answers with their partner and/or the class.

Step 7: Students move to digital component to revise lab safety and complete **Notebook** questions.

1.2 What is the property?

Lesson outcomes

At the end of this activity students will be able to:

- use appropriate scientific terms to describe the properties of materials.

What ideas might your students already have?

Students have difficulty identifying that everything around them is a chemical substance with particular properties.

Key vocabulary:

Viscosity, elasticity, hardness, plasticity, malleability, ductility.

Equipment list

Each CLASS will require

- Six collections of substances (five or six items in each) demonstrating each of the following properties:
- viscosity (e.g. shampoo, honey, water, milk, pouring cream)
- elasticity (e.g. rubber band, spring, rubber tyres from a toy car, plastic ruler, rubber bike tube)
- hardness (e.g. glass bottle, scissors, drill bit, fork, a rock, a pair of pliers, metal hammer)
- plasticity (e.g. cane basket, play dough, clay, plasticine, bread dough, slime)
- malleability (e.g. lead sinker, copper pipe/saucepan, metal jewellery, aluminium foil or can)
- ductility (e.g. metal coat hangers, various wires, garden basket hooks, paper clips and electrical wires).
- Lustre (e.g. polished metal jewellery, cutlery, aluminium foil, coins, medallions)

Each STUDENT will require:

- **Notebook**

Things to consider and hints for success

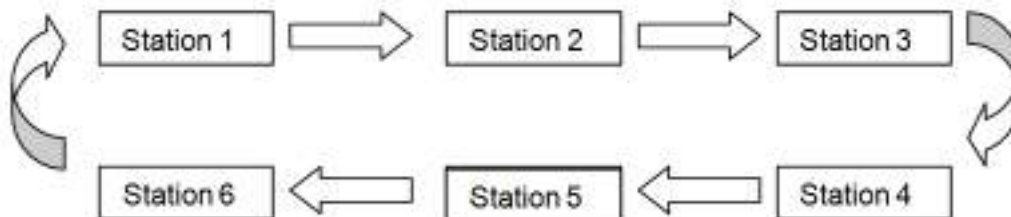
This activity is a caucus race. There are six stations, so the class is divided into six groups or into 12 groups which use two separate set-ups.

Caucus race

Each group rotates around the stations (collections) under the teacher's direction. It is important to first explain the rules to students.

1. Allocate groups to their starting stations.
2. Tell them they will have three minutes to record their observations.
3. Then direct groups move to the next station in the sequence.

e.g.



Lesson plan

Step 1: Form groups and explain how the race works. Students move around the stations, listing the common properties of all the materials in their **Notebooks**.

Step 2: The groups answer the discussion question in their **Notebooks**.

Step 3: Students share the properties for each set with the class. Reach a class consensus for each set and record the results on the board in a table (see below). Correct scientific terminology is not yet expected.

Table:

Set	Properties	Examples

Using a table means this information can be used to complete the next part. Only one column will need to be changed.

Step 4: Students complete the second part of the activity. This can be done individually, in groups or as a class, depending on the ability of the group or time available. Use the table on the board (from **Step 3**) to either work as a class or to discuss group responses.

Step 5: The discussion could be done individually as a **formative assessment** of students' ability to use the correct terminology to identify the properties of materials.

1.3 Metals and their properties

Lesson outcomes

At the end of this activity students will be able to:

- describe a range of properties common to metals
- recognise the importance of metals to their daily lives.

Key vocabulary:

Conductivity, lustre

Equipment list

Each GROUP will require:

- several samples of different metals and non-metals
- a simple electrical circuit with globe to test conductivity
- hand lens or dissecting microscope
- emery paper
- hammer

Each STUDENT will require:

- **Notebook**

Things to consider and hints for success

Students may need to be reminded about the basic operation of an electrical circuit, depending on their previous experiences.

The digital activity *Down to Earth: metals matter* (L927) in the **Notebook** is housed in *Scootle*. You (as educator) will need to register on *Scootle* (<https://www.scootle.edu.au/ec/p/home>) in order to access this resource for your students. Once registered you can search for the resource using its ID code L927 and add the resource to your own learning path. Click on the 'Add to' button, and choose 'Create new learning path'. Once you have curated the required resources you need in a learning path, click on 'Learning paths' at the top of the page, open your learning path and copy the six letter PIN number that you can share with your students. Your students need to go to the *Scootle* home page (<https://www.scootle.edu.au/ec/p/home>), click on 'Student login' at the top of the page and enter the PIN number.

Teacher content information:

This activity introduces students to the properties of metals before dealing with elements and compounds. Strictly speaking the distinction between metals and non-metals is restricted to the elements. However, many alloys, such as brass and steel, are regarded as metals in common usage since they share all the essential properties with metallic elements. The focus in this activity is on the properties associated with metals and how these make metals one of the most useful types of materials in the modern world. The mining of metallic ores in Australia accounts for more than 100 billion dollars of Australia's annual GDP (and around a quarter of our export earnings). Metals really are important to Australia.

An additional property of metals that is not specifically explored in this activity is conductivity of heat. In fact the conductivity of electricity and heat are both mediated by the de-localised electrons so that these two properties tend to match.

Lesson plan

Step 1: Students observe each sample. If the sample is not shiny they try polishing it with the emery paper.

Step 2: Students test each sample using some of the tests you learnt about in **Activity 1.2**. This includes a test of whether the sample is able to conduct electricity. They test for malleability using a hammer. Explain how the test for electrical conductivity works, depending on the past experience of the class.

Step 3: Observations are recorded in a table in their **Notebook**.

Discussion:

At the end spend some time discussing what life would have been like before the discovery of how to produce pure metals.

1. Which group (metals or non-metals) had properties that were most similar?
2. Describe some of the properties that you think make metals very useful to us.

1.4 Rock to scissors

Lesson outcomes

At the end of this activity students will be able to:

- name some minerals mined near them
- describe some properties and uses of iron.
- identify the manufacturing process used to produce a pair of scissors from a rock.

What ideas might your students already have?

Depending on the region where your students live, some students will have advanced knowledge of mining activities while others will have limited knowledge

Key vocabulary:

Ore, metal, shiny, mixture, alloy, liquid, solid, melting point, mining, hard, malleable, manufacture, mould.

Equipment list

Each **GROUP** will require:

- access to **Student Digital**

Each **STUDENT** will require:

- **Notebook**

Things to consider and hints for success

- You may need to demonstrate how to draw a flow chart to summarise ideas. (If required, students may be given some terms to use in their flow chart).
- Students use *Find out more* to research the properties and uses of iron. This can then be followed by a more general discussion on mining activities in their local area or state to promote interest and understanding of the benefits and issues associated with mining. Has anyone visited a mining site?
- When using the *Australian Mines Atlas* to find out what is mined nearby, first check the steps below, as the site may have been updated.
- Each time you make a selection, use 'Refresh Map'.

Finding your location

- select your state or territory on the bottom tool bar
- select Map Layers tab
- select Geographic layers folder
- select Population centers
- use zoom tool to find where you live.

Finding mines near you

- select Mineral Deposits and Occurrences folder
- select Operating Mines – All commodities
- Find the name of the mine(s) nearest you.

Finding the mineral(s) mined near you

- select Resources Search tab
- type in name
- search.

To view the interactive history in *Find out more*, Google Earth must be installed.

Teacher content information:

Iron (Fe) is the fourth-most abundant element in the Earth's crust and exists in nature as iron ore. Australia is the world's second-largest producer of iron ore after China, with 98 per cent from the Pilbara region of Western Australia. The remainder of Australia's production comes from mines in Tasmania, New South Wales, Queensland and South Australia.

Rock containing ore (solid) → mined → iron extracted from ore → iron metal (solid, malleable and shiny) → heated until it reaches melting point (liquid) → mixed with other metals and non-metals to form alloy (mixture) → poured into mould to manufacture scissors → cooled → scissors (solid and hard).

Lesson plan

Step 1: Ask students to look at the images of the rock and scissors and roll over images to see how the rock became scissors. This leads students to explore minerals mined in Australia.

Step 2: Students use the *Australian Mines Atlas* to find minerals mined nearby. Instructions on using this resource are found in **Things To Consider And Hints For Success**.

Step 3: Students use the links to digital resources to find five interesting facts about iron. (These facts will be useful in the *Information report* assessment task).

Step 4: Students answer six questions.

Step 5: Students prepare a flow chart to summarise the manufacturing process: rock → iron → scissors.

Find out more:

Students explore the history and importance of mining in Australia, and can view more information about iron ore mining. This information could be used as part of their research into the properties and uses of iron.