

As a possible extension activity, students might extract copper from a sample by reduction and determine the percentage yield of copper.

### Analysis by colour matching

For convenience we use the term 'a solution of copper'. Students should understand that copper doesn't dissolve. Solutions contain copper ions, and it's these that cause the blue colour.

The question about modifying the procedure might be used to draw ideas about confidence in data and uncertainty. They might be shown a colorimeter and asked how this can give more accurate results than colour matching.

### Equipment and materials

Each student or pair will need:

- 100 cm<sup>3</sup> beaker
- 250 cm<sup>3</sup> beaker
- filter funnel and filter paper
- 100 cm<sup>3</sup> measuring cylinder
- test tubes (all the same size)
- test tube rack
- 2 mol dm<sup>-3</sup> sulfuric acid (HARMFUL)
- 23.6 g / 100 cm<sup>3</sup> copper sulfate solution (solubility of CuSO<sub>4</sub>·5H<sub>2</sub>O is 317 g dm<sup>-3</sup> at 20 °C) (HARMFUL)
- 'ore' containing malachite (suggest ore is a mixture of 6 g malachite and 4 g sand; this will contain 3.45 g copper) (HARMFUL)

### Other resources

- <http://www.mindat.org/min-2550.html>
- [http://www.derbycc.org.uk/alderley/mining\\_process\\_bronze.htm](http://www.derbycc.org.uk/alderley/mining_process_bronze.htm)

### Extracting copper from malachite

This may be used as an **extension activity**.

There is a photocopiable master at the end of this topic.

Sparks might fly off the reaction mixture when it is being heated, so students must be warned to take care.

### Equipment and materials

Each student or pair will need:

- balance that weighs to the nearest 0.01 g
- spatula
- crucible
- Bunsen burner, tripod and pipe-clay triangle
- 400 cm<sup>3</sup> beaker
- sample tube
- tongs
- oven at 110 °C
- safety goggles
- chemical suppliers' catalogue
- powdered malachite (basic copper carbonate) [HARMFUL]

# Raw materials

## 1: Quarrying, mining and drilling

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Working in pairs, students produce a list of substances used straight from the ground and how they are extracted. Combining with another pair, they compare lists. After discussion they modify their own lists if necessary.

In the group of four, they discuss the effect of quarrying, mining and drilling on the environment. Explain that scientists work on ways of minimising the environmental impact of extracting raw materials and processing them. Suitable images might act as a stimulus.

Ideas of sustainability together with social, economic and environmental issues are developed throughout the course.

Introduce the idea of sustainability. Students might try the questionnaire *Are you sustainable?* at <http://www.uyseg.org/sustain-ed/PAGES/AreYou/AreYouFrameset.htm>.

### Answers

Raw material	How it's extracted	Raw material	How it's extracted
gold	mined	gravel	quarried
rock salt	mined	coal	mined
sulfur	mined	crude oil	drilled
limestone	mined or quarried	iron ore	mined

### Other resources

<http://www.york.ac.uk/org/ciec/PVC/pages/what1-1.htm>

<http://www.uyseg.org/sustain-ed/PAGES/AreYou/AreYouFrameset.htm>

<http://www.rsc.org/chemistryworld/News/2005/November/01110502.asp>

## 2: Purifying rock salt

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Students may have separated a mixture in this way before. Here, the sample provided has a known mass of sodium chloride. As well as separating the sodium chloride, students determine the quantity of sodium chloride present. Different pairs may be given rock salt samples with differing quantities of sodium chloride.

Explain to students that the volumes of distilled water need only be approximate. Graduations on the side of the beaker will be a good enough guide.

Students work in pairs. The equipment and materials are laid out at their work stations.

As an extension, especially for those who might study chemistry at advanced level, some students might be asked to find out about the chloralkali industry. They could make a list of the chemicals it produces and their uses.

### Equipment and materials

Each students or pair will need:

- 2 x 250 cm<sup>3</sup> beakers
- balance (to weigh to the nearest 0.01 g)
- filter funnel and folded filter paper
- glass rod or polythene rod
- tripod, gauze and Bunsen burner
- evaporating basin