



# MINERALS

A Celebratory Re-Issue

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## Introduction

This issue is based on one of the first and very popular PESTs, which is now out of print. It seemed fitting in this 20<sup>th</sup> Anniversary year of writing these informative activity sheets to revisit and update some of the earlier issues which cover core Earth Science investigations and form a foundation on which pupils' knowledge of and enthusiasm for the subject can grow.

Understanding minerals and their properties is very important and a helpful step towards the study of rocks and their uses.

## What are minerals?

Minerals:

- occur naturally and are generally solid at room temperature
- are formed from unique arrangements of molecules or atoms giving each mineral a specific shape
- are the same all the way through
- each have their own characteristics (such as colour, lustre and hardness)
- grow in specific shapes called crystals
- make up rocks like ingredients make cakes
- can be formed in the oceans and seas (by precipitation) to build the shells of sea creatures

## What is the difference between a mineral and a rock?

Minerals are the same all the way through.

Minerals are the components (ingredients) from which rocks are formed.

Rocks are made of at least two, and usually more, different minerals. They are an accumulation of minerals.

## How do minerals occur?

### 1. In Rocks

- Many different minerals can be found in rocks. Igneous rocks (formed from solidified magma) contain minerals which grew together as the molten magma cooled, forming interlocking crystals. The slower the magma cooled the larger the crystals could grow. Granite is a good example and contains three main minerals: quartz, feldspar and mica.
- When igneous rocks weather and erode at the Earth's surface, most of their constituent minerals break down to form clays; only quartz is hard enough to survive and remains as grains of sand. These weathered minerals eventually make new, sedimentary rocks such as mudstone and sandstone.
- The mineral calcite can be formed by precipitation from sea water or removed from the sea water by creatures, especially microscopic plankton, to use in the making of their shells. Empty shells and the dead sea creatures can collect on shallow sea floors to eventually form limestone, which is a very common sedimentary rock.

## 2. By Evaporation

Minerals (salts) dissolved in sea water are precipitated (or left behind) as evaporation takes place. The minerals calcite, gypsum and halite can be formed in this way.

## 3. In Veins

The fluids leftover from granite formation are hot and watery and tend to rise through cracks in the Earth's crust. As the fluids cool the minerals they contain precipitate on the walls of the cracks to form mineral veins running through the rock. Common vein minerals are quartz, calcite, galena and pyrite.

## MINERAL INVESTIGATIONS

### Introductory Activity - Sorting Minerals

A good introduction to mineral investigating is to sort a mixed mineral and gem pack (see resource list) using simple criteria. This provides an introduction for KS2 pupils, if not done previously, and is an ideal activity for KS1 pupils. Working in small groups, pupils use their senses to explore the similarities and differences between the minerals.

#### Method:

- 1) Tip a selection of minerals onto a tray or plastic/paper plate for pupils to look at closely and try describing. They should write down the adjectives that best suit the different samples as these will help when deciding the criteria for the sorting.
- 2) Ask pupils to sort the minerals into groups or sets with similar characteristics (it is useful to place the sorted mineral groups onto a large sheet of paper). Drawing a Venn diagram on the paper can enhance this activity. Pupils may first choose the most obvious difference of colour as their criteria but should then be encouraged to use other criteria (referring to their initial list of descriptions) and could include shiny/dull; rough/smooth; metallic/non-metallic etc.
- 3) Allow groups to explain their sorting and give reasons for their choice of criteria to the rest of the class.
- 4) Pupils should resort the minerals using a different set of criteria.
- 5) Sorted minerals could be subdivided e.g. initial criteria of colour can be subdivided into glassy/dull; opaque/transparent etc

### Sorting Mineral Hand Specimens Using their Physical Properties – KS2 and above

**Equipment:** Set of mineral hand specimens (10 minerals are listed in the Mineral Reference Chart opposite), steel nail, copper coin, compass, white wall tile (use unglazed back), very dilute acid (diluted domestic lime descaler is adequate), recording sheet and mineral reference chart.

There are standard procedures for identifying minerals based on physical properties.

#### Method:

- 1) Observe similarities /differences between minerals.
- 2) Discuss criteria for sorting. (Initial sorting can be done in the same way as in the activity above before testing other properties e.g. hardness and streak, in more advanced tests).
- 3) Plan the investigation.

**Streak** – the colour of a mineral when it is powdered or drawn across a streak plate (unglazed tile). Some minerals have a characteristic streak colour (see Mineral Reference Chart).

**Lustre** – the description of the way light is reflected from the surface of the mineral e.g. galena has a metallic lustre

**Hardness** – testing the relative hardness of minerals is one of the best ways of sorting and subdividing specimens. Minerals can be tested by scratching one mineral against another. If a mineral scratches another it must be harder, if it leaves a mark/streak it must be softer. Alternatively, the minerals can be scratched with everyday objects of increasing hardness – fingernail, copper coin and steel nail.

### Activity - Sorting According to Hardness





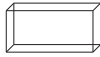

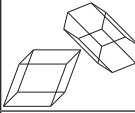


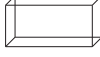
Pupils could devise a method to find the hardest mineral or use the following guide:

- 1) Draw up a results table similar that shown, with enough rows for each mineral being tested.
- 2) Using the Mineral Hand Specimens (preferably numbered) scratch each mineral with a fingernail and record each result in turn. If a fingernail can scratch it, record it as a tick or by writing 'yes' under the appropriate column, if not, record it as a cross or 'no'.
- 3) Repeat the above using a copper coin on any minerals with a cross against them and record the results as before.
- 4) Repeat the process using the steel nail.

Specimen	Fingernail	Copper Coin	Steel Nail	Mineral
1	✓			
2	x	✓		
3	x	x	✓	

- 5) Using lined paper, put the minerals in order of hardness. Line them up from softest-hardest or hardest-softest. If minerals appear to be similar in hardness put them on the same line.
- 6) See the Mineral Reference Chart to help name the mineral and complete the final column.

## MINERAL IDENTIFICATION REFERENCE CHART

Physical Properties and Characteristics						
Mineral	Colour	Streak Colour	Lustre	Hardness	Crystal Shape	Others
<b>Galena</b>	Grey to Silver	Grey	Bright Metallic	Soft	Cubic 	Very heavy
<b>Pyrite</b>	'Golden'	Greenish Black	Bright Metallic	Very Hard	Cubic 	Heavy
<b>Haematite</b>	Dark Red	Red	Dull to Metallic	Very Hard	Hexagonal 	Heavy
<b>Magnetite</b>	Black	Black	Metallic or Dull	Very Hard	Cubic 	Magnetic and heavy
<b>Mica</b>	Black or Colourless	White	Glassy to Pearly	Medium	Paper-thin Layered. 	Splits easily
<b>Quartz</b>	Colourless or White	None (too hard)	Glassy	Very Hard	Hexagonal or Poor 	Hardest common mineral
<b>Calcite</b>	White or Colourless	White	Dull to Glassy	Medium	Hexagonal or Rhombic 	Reacts with dilute acid (acid fizzes)
<b>Halite</b>	Stained Brown, White or Colourless	White	Glassy	Soft-Medium	Cubic 	Feels damp. Tastes salty
<b>Gypsum</b>	White or Colourless	White	Glassy or Silky or Dull	Soft	Poor 	Feels smooth. Softest common mineral
<b>Feldspar</b>	Cream, White or Pink	None (too hard)	Dull to Glassy	Very Hard	Tabular or Poor 	---

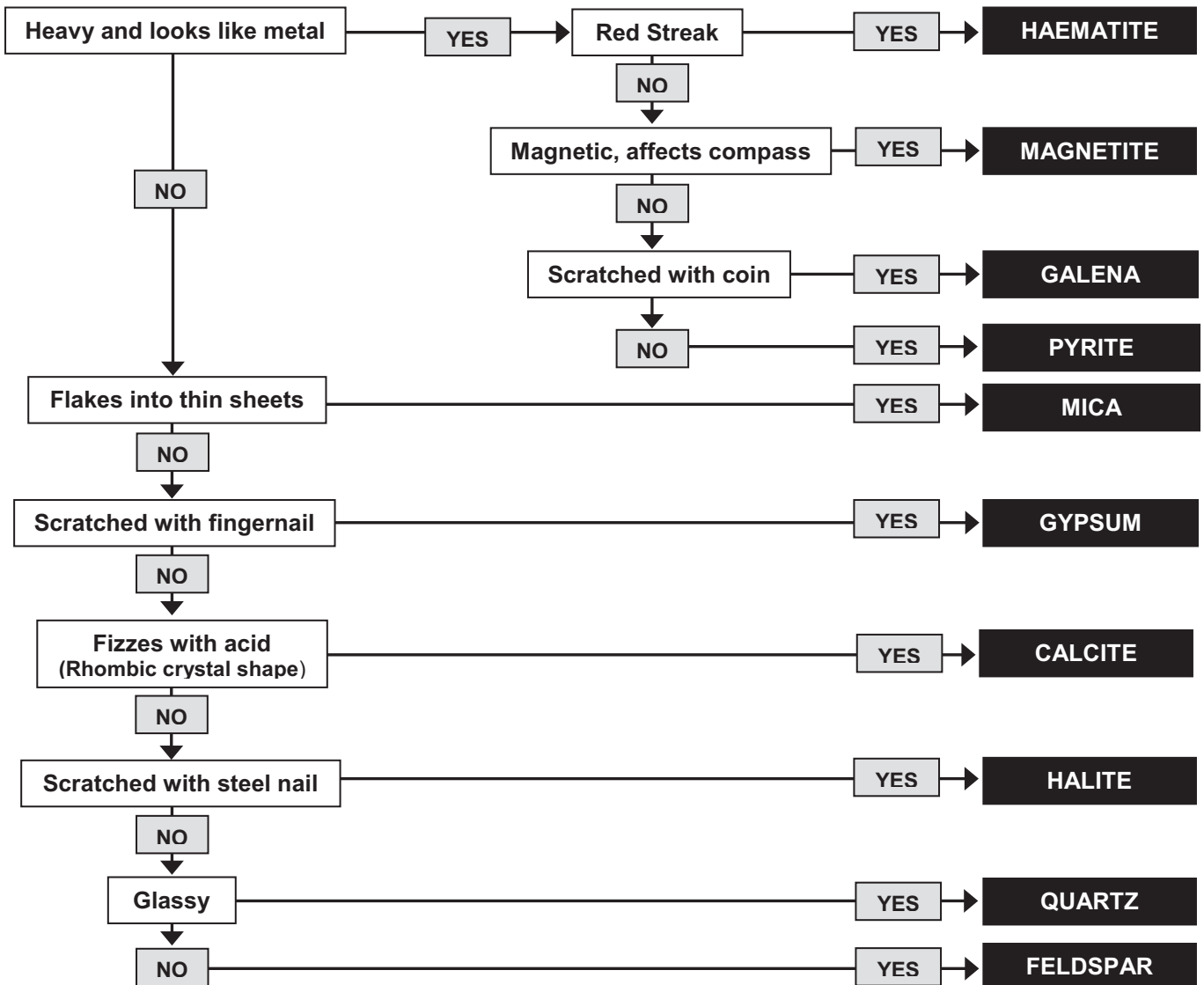
## Other Tests

Calcite reacts (fizzes) with dilute acid from a dropper bottle (under supervision).

Magnetite is magnetic and affects a compass.

Halite (rock salt) feels damp and tastes salty (tasting minerals is not recommended)

It is possible to construct a mineral sort chart using the tests above. This is an example:



**Precautions:** Hands should always be washed after handling any minerals. Care must be taken with the use of steel nails. The use of dilute acid must be supervised.

## Resources

Mixed mineral and gem packs (polished or rough) can be bought via the internet, from rock and fossil shops or some craft stores.

Mineral Hand Specimen sets are available at the National Stone Centre, Wirksworth, Derbyshire, [www.nationalstonecentre.org.uk](http://www.nationalstonecentre.org.uk)

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