

Minerals Form Crystals – Teacher Notes

**Minerals are inorganic substances found naturally in the Earth's crust.
Minerals have a regular shape if they are able to crystallise properly.**

Firing X rays through thin sections of minerals has revealed their underlying atomic structure. The regular shapes are due to the geometrical arrangement of their atoms during crystallisation. As the liquid cools the atoms, ions or molecules take on a regular, orderly arrangement to bond together. The minerals cleave or break naturally along the planes of their least strong bonds.



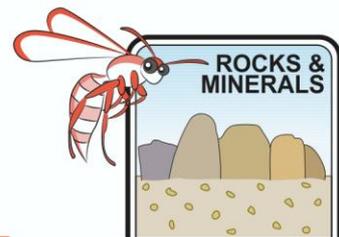
Large crystals of calcite

The mineral calcite (CaCO_3) has regular cleavage at 60° and 120° resulting in a beautiful rhombic crystal whereas iron pyrites (FeS_2) has 90° cleavage resulting in cubic crystals known by old time miners in WA as “Devil’s dice”.



Devil's dice of iron pyrite

Often the crystals do not have enough space or time to crystallise perfectly and twins and intergrowths occur.



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Vocabulary

Solute + Solvent = Solution

Solid + Liquid = Solution

Evaporation Liquid becomes gas

Fill in the blank spaces in the table below

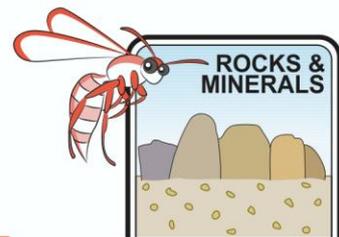
Solute	Solvent	Solution
Banana Ice cream	Milk	Banana milk shake
Coffee grounds Sugar	Water Milk	Coffee
Salt	Water	Seawater

Mineral crystals form when a mineral rich solution cools. Alum and salt are both naturally occurring minerals that have been used to preserve food for a very long time. The hotter the solvent the more solute will dissolve. Higher kinetic energy permits more movement between molecules. Stirring also increases solubility and permits the formation of a supersaturated solution. If the solution is stored away from breezes and movement it will evaporate to leave crystals. The surface area of the solutions and ambient heat and humidity controls the rate of crystal formation. Although both crystals are transparent and colourless, their forms are different. Salt is cubic and alum forms rhomboids.

Materials per person or group Salt crystals NaCl

- 250mL beaker (or jam jar)
- Stirring rod
- 50mL hot water
- Dry tea spoon
- Kitchen salt (sodium chloride)
- Half of a Petri dish or saucer

1. Carefully pour about 50mL of hot water into the beaker
2. Add salt to the water using the rod to keep the water moving. Wait until it has all dissolved before adding more.
3. When the solution will dissolve no more salt stop.
4. Pour the super-saturated solution into the Petri dish and place this on a shelf or on a windowsill where it will not be disturbed for a few days.
5. Observe and measure the crystals formed



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Materials per person or group Alum crystals $KAl(SO_4)_2 \cdot 12H_2O$

- Two 250mL beakers or jam jars
 - Stirring rod
 - 50mL hot water
 - A dry tablespoon
 - About two tablespoonsful of alum
 - One piece of paper towel
1. Add the alum to the hot water a little at a time stirring until no more will dissolve
 2. Remove the stirring rod and cover with paper to exclude dust
 3. When cool, pour into Petri dish and leave to cool

The alum crystals will form on any surface including those earlier crystals. The result is often an inter-grown mass of crystals.

EXTRA for EXPERTS

- Dissolve alum as before
- Leave to settle overnight. Crystals will have started to form at the bottom of the beaker
- Decant the clear liquid above into the clean beaker
- Select the largest of the alum crystals lying on the base of the old beaker. This will be your “seed” crystal
- Tie a piece of nylon thread to a pop stick or pencil. Tie your seed crystal and let it dangle within the clear liquid in the new beaker. Do not let it touch the bottom or sides of the beaker
- Leave for a week

If crystals do not grow the solution is too weak. Warm in the microwave and add more alum.

Alum is inexpensive and available from hardware shops.