Speed of cooling

Speed of cooling ***D***

Identical teapots but of different sizes are filled with boiling water. Students are asked to predict which one will cool first and what factors will affect the speed of cooling. This is good for engendering discussion.

Cooling and crystal size ***A P F 30 min***

Use salol to show the relationship between speed of cooling and crystal size.

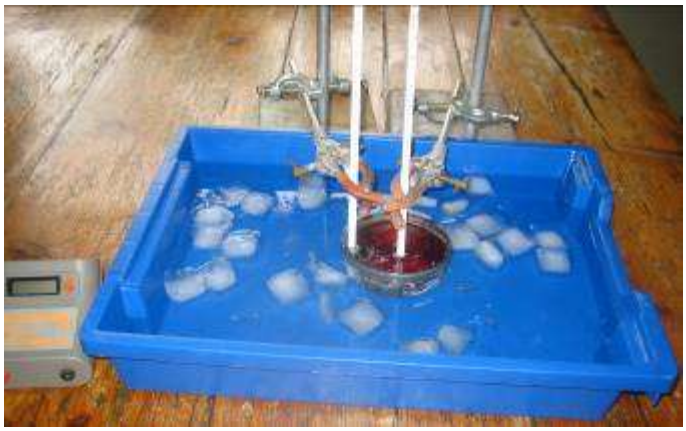
Use a glass rod to put a drop of melted salol at 60°C onto a glass slide at room temperature and put another slide on top and squeeze it down. Repeat with the other pairs of slides at different temperatures. The coolest slides give the finest grain size.

Cooling and crystal size ***A G 5 min***

The class is divided into 4 groups, A, B, C and D and each student is given 16 loose plastic blocks which can be connected to each other. Each block represents a molecule and 2 blocks joined together are a small crystal. More blocks joined together represent a larger crystal. Students make as many pairs as possible, and then join those to make fours and then eights. The teacher calls out "group A stop" almost as soon as they have started so they have only molecules (=volcanic glass). Group B is stopped after most blocks are in twos (=fine grained rock). Those allowed longer produce medium and course grained rock. I used pieces of "Multilink", which is a construction kit for children . "Leggo "bricks could be used, or even squares of card which are placed beside each other on the desk.

Cooling in a liquid ***E P F 60 min***

Two thermometers are placed in a small tin of molten salol, one at the edge and on in the centre. Both thermometers cool rapidly to start with. The rate of cooling slows down and may even reverse as crystallisation takes place because the latent heat of fusion is released. Once the salol is solid the outer one cools much faster than the central one.



Cooling of different sizes using aluminium cans ***E P 30 min***

To show how the speed of cooling varies with size, use aluminium cans of different sizes. Pour the boiling water into the cans and record the temperature every minute for 20 min.

Cooling of aluminium shapes ***E P F 30 min***

Aluminium blocks of various shapes and sizes are heated to 110°C and their temperature measured as they cool. The resulting data can be used to show the effect of size, shape, surface area and surrounding temperature on speed of cooling.

Effect of composition and grain size on speed of cooling ***E P F 30 min***
Cubes of granite, basalt, dolerite and gabbro 5cm on each side are heated to 100°C and the speed of cooling recorded. There is no significant difference in speed of cooling of these.

Wet and dry granites ***Pa I F 15 min***
Granite magmas which contain water crystallise at depth producing batholiths whereas those granite magmas which contain less water rise up to the surface and give rise to volcanic activity. Students are given two graphs, showing how the melting temperature of wet granite and of dry granite varies with pressure and therefore depth. Students must work out which magma will crystallise below the surface and which will reach the surface.