ATOMIC MASS AND DENSITY

Background information and purpose

Isomorphous minerals are those having the same molecular structure and the same anions so the only variable is the cation. There should therefore be a linear relationship between the atomic mass of the cation and the density of the mineral. The purpose of this experiment is to test this hypothesis.

Instructions

1 Choose one of the sets of minerals.

Set A, DE 1 to DE 4, are all carbonates:

Witherite is soluble in stomach acid and is thus poisonous. Don't lick your fingers. Wash your hands after the experiment.

	Mineral	Formula	atomic weight of cation
DE1	Aragonite	$CaCO_3$	40.1
DE2	Strontianite	$SrCO_3$	87.6
DE3	Witherite	$BaCO_3$	137.3
DE4	Cerussite	$PbCO_3$	207.2

Set B, DE 5 to DE 7, are all sulphates:

DE5	Anhydrite	$CaSO_4$	40.4
DE6	Celestite	$SrSO_4$	87.6
DE7	Barite	$BaSO_4$	137.3
DE8	Anglesite	$PbSO_4$	207.2

2 Work out the density of each mineral by weighing first in air and then in water. Density = $\frac{\text{weight in air}}{\text{weight in air} - \text{weight in water}}$

3 Plot your data and draw your conclusions

4 Repeat for the other set of minerals.

5 Repeat for DE 9 and DE 10 which are also carbonates. Plot them on the same graph as the other carbonates.

DE9	Magnesite	$MgCO_3$	24.3
DE10	Calcite	$CaCO_3$	40.4

6 Repeat for DE 11 which is a sulphate and plot it on the same graph as the other sulphates.

DE11	Gypsum	$CaSO_4$ .2H20	40.4

7 What conclusions can you draw about DE9 to DE11.

Teacher's Section

Requirements

Samples of all the minerals listed in the instructions. The samples should be pure and at least 3cm long. All samples should have a nylon loop (made from fishing line) attached with a small drop of araldite. All samples should be numbered.

Beaker and balance.

Notes

This experiment does require quite careful measurements to get accurate densities. The densities of the samples should be checked beforehand to ensure that the samples have the correct density for that mineral. It is possible to do this activity just using data from books, e.g. Rutley's Mineralogy

Results

The densities obtained should be similar to those given in text books e.g. Rutley's Mineralogy.

The minerals in each set should lie in a straight line because there is a direct relationship between density and atomic weight of the cation. Samples De9, 10 and 11 do not fit on the lines because they are not isomorphous to either of the other groups.

Reference

Gribble C D 1988 Rutley's Elements of Mineralogy Unwin London

Time

About one hour for all the samples.

Cost

£22 for all the minerals needed except Anglesite which is £10.