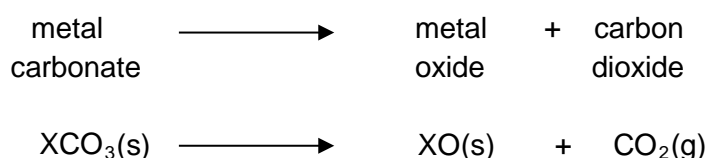


Investigation of thermal stabilities of calcium carbonate, copper(II) carbonate and sodium carbonate

Introduction

Metal carbonates can be made to break down (decompose) when they are heated. The harder it is to break them down, the more stable they are. In this experiment, three carbonates are heated strongly to see how easily they decompose. By carrying out this experiment you will be able to place the carbonates in order of their thermal stability.



Apparatus

3 × boiling tubes
 test tube holder
 Bunsen burner
 heat proof mat
 rack for boiling tubes
 calcium carbonate
 copper(II) carbonate
 sodium carbonate
 spatula

Access to:

electronic balance ± 0.01 g

Method

1. Record the mass of an empty boiling tube.
2. Add approximately 2g of calcium carbonate.
3. Record the mass of the boiling tube and the calcium carbonate.
4. Heat in a roaring (blue) Bunsen burner flame for approximately 5 minutes.
5. Allow the boiling tube to cool.
6. Record the mass of the boiling tube and the calcium carbonate.
7. Repeat steps 1-6 with copper(II) carbonate and sodium carbonate.

Analysis

1. Calculate the loss of mass for each carbonate. Use this to place the carbonates in order of thermal stability.

Risk Assessment

Hazard	Risk	Control measure
Copper(II) carbonate is harmful	Powder may spit when heated and be breathed in	Watch the tube carefully when heating Point the tube away from anyone when heating
Sodium carbonate is an irritant	Powder may spit when heated and be breathed in	Watch the tube carefully when heating Point the tube away from anyone when heating
Hot apparatus can burn	Burning skin when moving hot apparatus	Do not move apparatus until cool

Teacher / Technician notes

Copper(II) carbonate - Refer to CLEAPSS hazard card 26B.

Sodium carbonate - Refer to CLEAPSS hazard card 95A.

Powders can be roughly pre-weighed (2 g) into weighing bottles or similar to save time. Alternatively, teacher can show that 2 g is roughly half a spatula.

Knowledge of the science behind thermal stability of carbonates is not required. Cement production can be used as a link to an everyday application of this.

No repeats are given in the method, but can be done if time allows. Alternatively, students can compare results to discuss reproducibility.

Students should design their own table, but a suggested table format is shown below.

	Calcium carbonate	Copper(II) carbonate	Sodium carbonate
Mass of boiling tube (g)			
Mass of boiling tube + carbonate (g)			
Mass of carbonate (g)			
Mass of tube + contents after heating (g)			
Mass of boiling tube (g)			
Mass of contents after heating (g)			
Loss of mass (g)			

Working scientifically skills covered

1. Development of scientific thinking

Explain every day and technological applications of science; evaluate associated personal, social, economic and environmental implications and make decisions based on the evaluation of evidence and arguments.

2. Experimental skills and strategies

Carry out experiments appropriately having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations.

3. Analysis and Evaluation

Carry out and representing mathematical analysis.