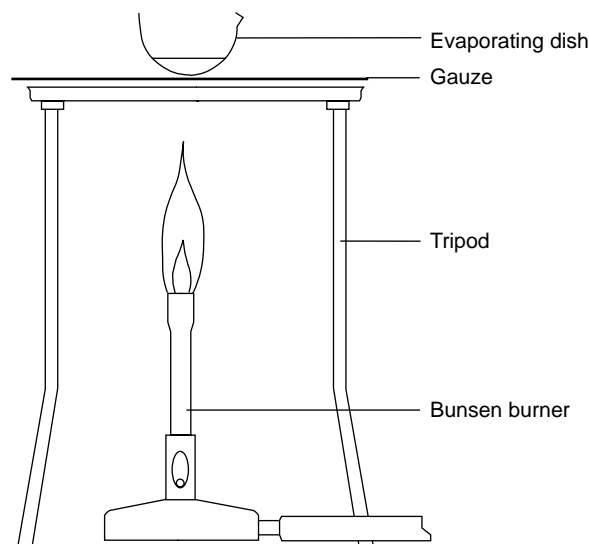


# Making a fertiliser

## Introduction

Producing fertilisers is very important. This experiment involves preparing ammonium sulfate. Ammonium sulfate is a popular and effective fertiliser.



## What to record

What was done and what was observed.

## What to do

1. Put 20 cm<sup>3</sup> sulfuric acid into an evaporating basin.
2. Add the ammonia solution a little at a time, with stirring, until a definite smell of ammonia is obtained.
3. Check the pH is 7 or above with indicator paper.
4. Evaporate the solution to about one-fifth of its original volume (**Care** – do not let the solution spit), and cool.
5. Filter off the crystals and dry.

## Safety

Wear eye protection.

The ammonia solution gives off ammonia which irritates eyes, lungs and respiratory system.

Sulfuric acid causes burns.

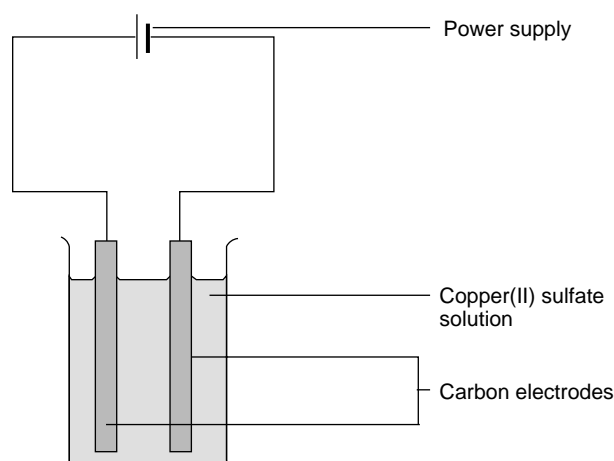
## Questions

1. Write a word equation for this preparation.
2. Write a balanced symbol equation for this preparation.
3. Calculate the percentage of nitrogen in this fertiliser.

# Electrolysing copper(II) sulfate solution

## Introduction

When a solution contains positive and negative ions, it conducts electricity. When electricity passes through a solution, chemical reactions may occur at the electrodes. This process is called electrolysis.



## What to record

Which electrode has a fresh deposit of copper?

## What to do

1. Set up the circuit shown in the diagram. Do not switch on the power supply until everything is ready.
2. Switch on and leave for about 5 min. Watch what happens and record your results.
3. Exchange the copper plated electrode for a key or key ring, or other article of your choice. Leave for 5 min.
4. Attempt to remove the copper plate by reversing the polarity.

## Safety

Wear eye protection.

Copper(II) sulfate is harmful.

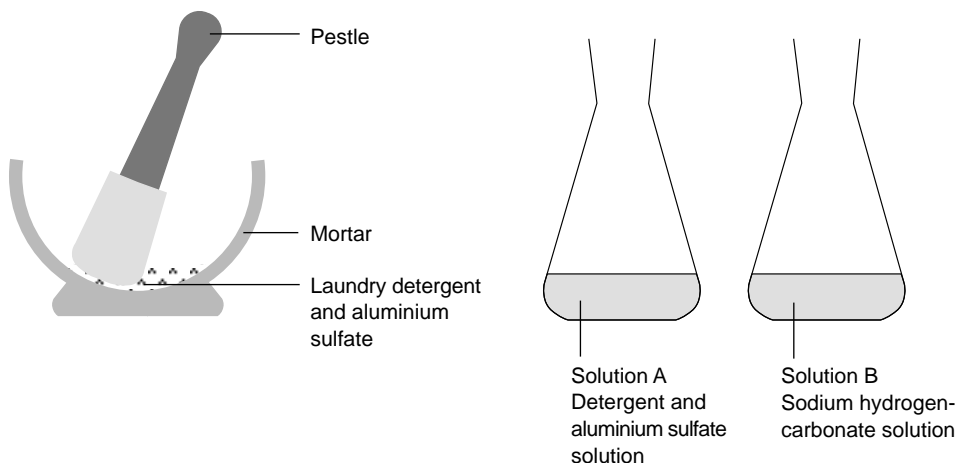
## Questions

1. To which electrode has the copper gone?
2. What does this indicate about the charge on the copper in solution?
3. Suggest a way to use this process to purify impure or scrap copper.

# Producing a Foam

## Introduction

This experiment examines how a stable foam is produced and what reactions are involved.



## What to record

What happened (observations).

## What to do

1. Put 1 g of laundry detergent and 7 g of aluminium sulfate in a mortar and grind into a fine powder with a pestle.
2. Dissolve this powder in approximately  $50 \text{ cm}^3$  of water in a conical flask (A).
3. Dissolve 5 g of sodium hydrogen carbonate in  $50 \text{ cm}^3$  water in another conical flask (B).
4. Pour the contents of flask A into flask B and mix quickly.

## Safety

Wear eye protection.

Detergent may irritate the skin.

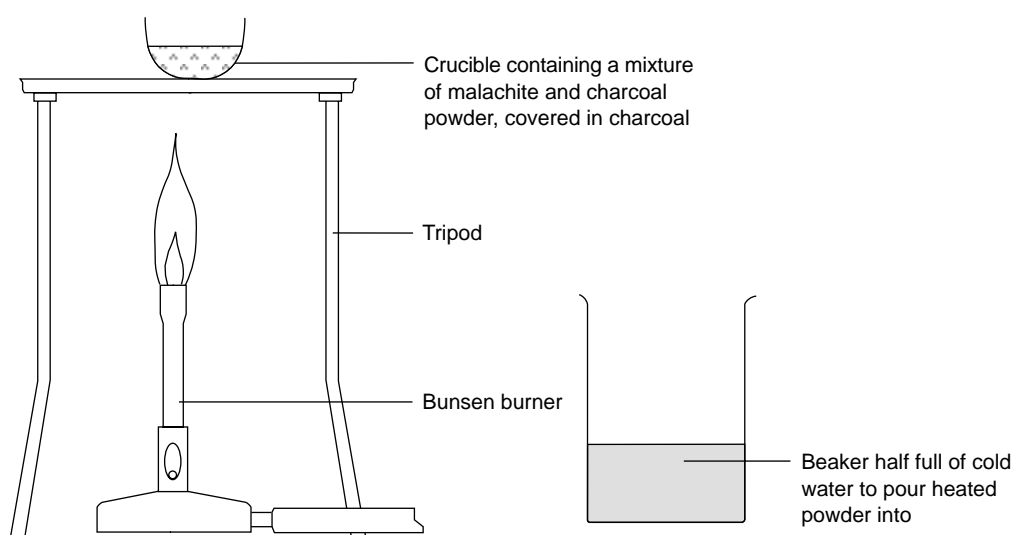
## Questions

1. What reactions lead to the production of the foam?
2. How is this reaction similar to that involving the production of carbon dioxide ( $\text{CO}_2$ ) during the baking process?
3. Name some other examples of foams.

# Getting metals from rocks

## Introduction

This experiment involves producing copper from copper ore (malachite). The composition of malachite is mainly copper carbonate ( $\text{CuCO}_3$ ). This experiment involves heating the copper carbonate with carbon.



## What to do

1. Mix a spatula of crushed malachite with two spatulas of charcoal powder. (This can be done in a dry test-tube or on a piece of paper).
2. Make a pile of the mixture in a crucible and then cover the pile with a layer of charcoal in small pieces.
3. Put the crucible on a tripod and pipe clay triangle and heat very strongly. **(Beware sparks)**
4. Half fill the beaker with water and then use tongs to tip the powder from the crucible into the water.
5. Swirl the beaker round so any copper falls to the bottom and then pour off the water and charcoal.
6. Add more water and keep on pouring and swirling so only the heavy material is left at the bottom of the beaker.

## Safety

Wear eye protection.

Copper compounds are harmful.

Beware sparks.

## RS•C

### Questions

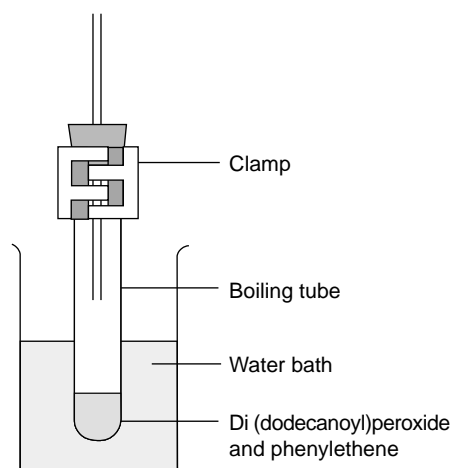
1. Malachite ore is mainly copper carbonate ( $\text{CuCO}_3$ ). When heated it produces carbon dioxide.  
Write word and symbol equations for the decomposition of copper carbonate.
2. Carbon reduces copper oxide to copper and carbon dioxide.  
Write word and symbol equations for this reaction.
3. An alternative method of extracting copper from malachite is by reaction with sulfuric acid, followed by electrolysis.  
Write formula equations for this reaction scheme.

## RS•C

# Addition polymerisation

## Introduction

Alkenes (carbon compounds containing double bonds) undergo addition reactions. In this experiment molecules of phenylethene (styrene) – the monomer – add on to each other to form polyphenylethene (polystyrene) – the polymer.



## What to record

What was done. Compare the appearance of your product with the starting material.

## What to do

1. Prepare a beaker of boiling water to act as a water bath. Keep your Bunsen burner away from all other chemicals.
2. Add 0.1 g of di(dodecanoyl) peroxide (**Irritant**) to 5 cm<sup>3</sup> of phenylethene (**Flammable**) in a boiling tube.
3. Put a bung containing a 20 cm length of glass tubing in the top and clamp the tube in the boiling water bath.
4. Heat for about 30 min and leave to cool. Extinguish all flames.
5. Pour the contents of the tube into 50 cm<sup>3</sup> of ethanol (**Highly flammable**). Use a glass rod to push the polyphenylethene into a lump and pour off the ethanol.
6. Dry the solid on a filter paper.

## Safety

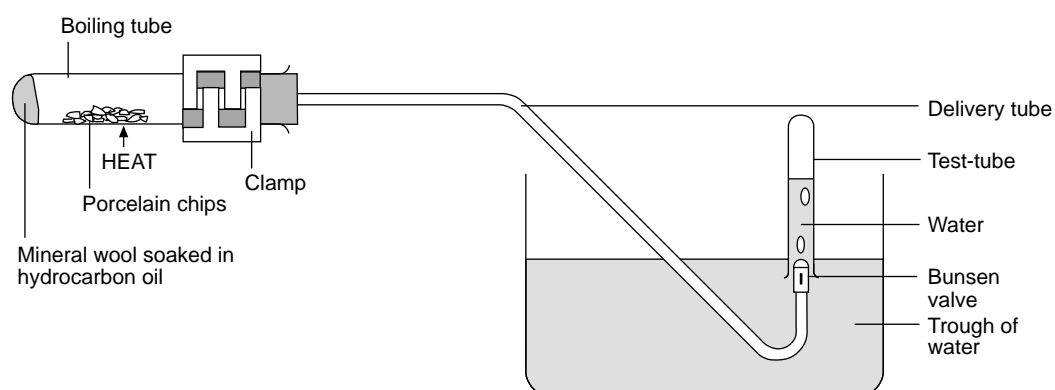
Wear eye protection. Work in a fume cupboard or ensure good ventilation.

RS•C

# Cracking hydrocarbons

## Introduction

The demand for petrol is greater than the amount produced by distilling crude oil. The cracking of hydrocarbons also produces molecules which can be converted into petrol. This experiment models the industrial cracking process.



## What to record

Record:

1. The appearance of the original oil and the gas.
2. Whether the oil and gas burn.
3. Whether the oil and gas smell.
4. The effect of the oil and the gas on aqueous bromine water.
5. A table may be helpful.

## What to do

1. Set up the apparatus as shown in the diagram. Fill four test-tubes with water and invert them in the trough.
2. Strongly heat the catalyst (porcelain chips) for a few minutes.
3. Now flick the flame onto the end of the tube containing the mineral wool and the oil. Try to produce a steady stream of bubbles.
4. Collect tubes of the gas. Discard the first one, which will be mainly air.
5. Stopper the three tubes of gas and test them as follows
  - (a) What do they look like?
  - (b) What do they smell like (care)?
  - (c) Use a lighted splint to see if they burn.
  - (d) Add two drops of aqueous bromine and shake.

## Safety

Wear eye protection.

Be careful to avoid the water in the trough sucking back. When heating stops lift the apparatus out of the water using the stand.

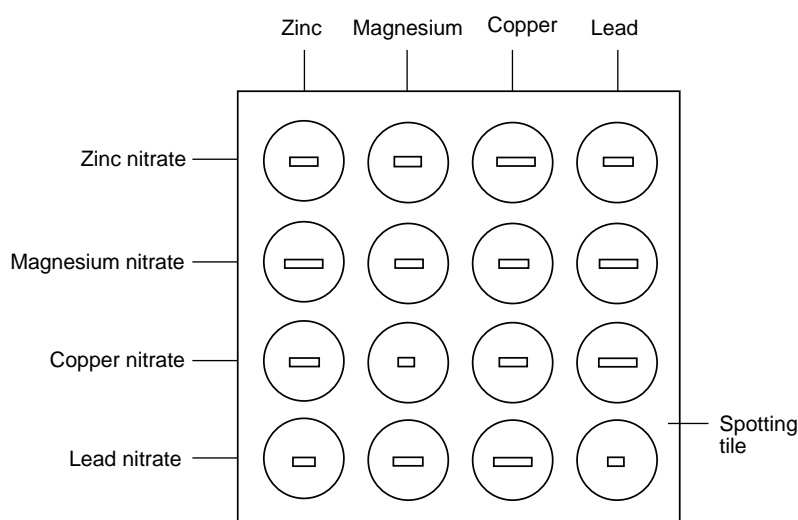
Make sure the apparatus is not blocked. If no gas appears check the bung has not melted and that the catalyst has not blocked the delivery tube.

Aqueous bromine water is harmful and irritant.

# Displacement reactions between metals and their salts

## Introduction

Some metals are more reactive than others. In this experiment, a strip of metal is added to a solution of another. If the metal is more reactive than the metal in solution, this metal displaces (pushes out) the less reactive metal from the solution.



## What to record

Record which metals react with the solutions.

A table may be useful. Use a ✓ to show reactivity and an ✗ to show no reaction.

Solution / Metal	Zinc nitrate solution	Magnesium nitrate solution	Copper nitrate solution	Lead nitrate solution
Zinc				
Magnesium				
Copper				
Lead				

## What to do

1. Clean each of the metal strips with emery paper.
2. Using a teat pipette put some of the solution of a metal compound in four of the holes in the spotting tile. (Label this row with the name of the solution).
3. Do this for each solution of a metal compound.
4. Put a piece of each metal in each of the solutions.
5. Put a tick or a cross in your table to show if they have reacted.





## **Safety**

Wear eye protection. Some solutions are toxic.

## **Questions**

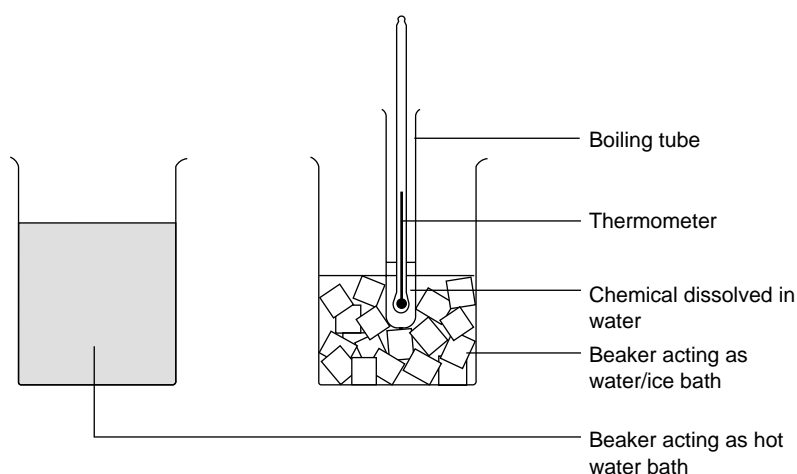
1. What is the order of reactivity of these metals (from most to least reactive)?

## RS•C

# The effect of temperature on solubility

## Introduction

Most solid substances that are soluble in water are more soluble in hot water than in cold water. This experiment examines solubility at various temperatures.



## What to record

Fill in the temperatures.

Volume of water/cm <sup>3</sup>	Solubility/g dm <sup>3</sup>	Crystallisation temperature /° C
4	650	
5	520	
6	433	
7	371	
8	325	
9	289	
10	260	

(The crystallisation temperature is the temperature at which crystals appear).

## What to do

1. Set up a hot water bath and an ice bath. Put 2.6 g of ammonium chloride (**Harmful**) into the boiling tube. Add 4 cm<sup>3</sup> water.
2. Warm the boiling tube in the hot water bath until the solid dissolves.
3. Put the boiling tube in the ice bath and stir with the thermometer. Use wooden tongs to hold it if necessary.
4. Note the temperature at which crystals first appear and record it in the table
5. Add 1 cm<sup>3</sup> water. Warm the solution again, stirring until all the crystals dissolve.

6. Then repeat the cooling and note the new temperature at which crystals appear.
7. Repeat steps 5, 6 and 7 until 10 cm<sup>3</sup> water has been used.

## Safety

Wear eye protection.

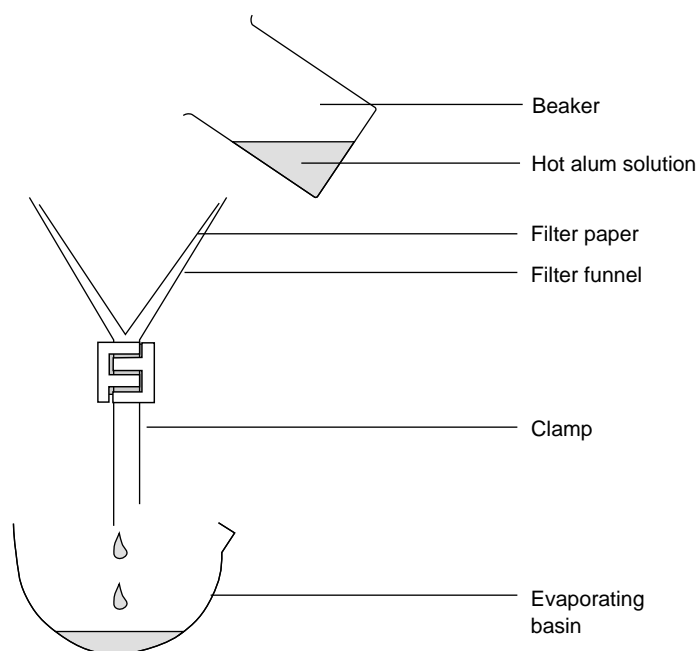
## Questions

1. Plot a graph showing solubility on the vertical axis and temperature on the horizontal axis.

# Purifying an impure solid

## Introduction

It is often necessary to obtain a pure chemical from an impure sample. This experiment involves the purification of a chemical called alum.



## What to record

What was done.

## What to do

1. Cover the bottom of the beaker with alum.
2. Add enough water to cover it.
3. Heat and stir the mixture with a glass rod.
4. Wait until the mixture boils. If the alum has not dissolved, (ignore the dirt) add some more water and boil.
5. Filter the hot solution into the evaporating basin.
6. Leave the solution to cool.
7. Pour off the liquid and dry the crystals on filter paper.

## Safety

Wear eye protection. Take care with hot apparatus.

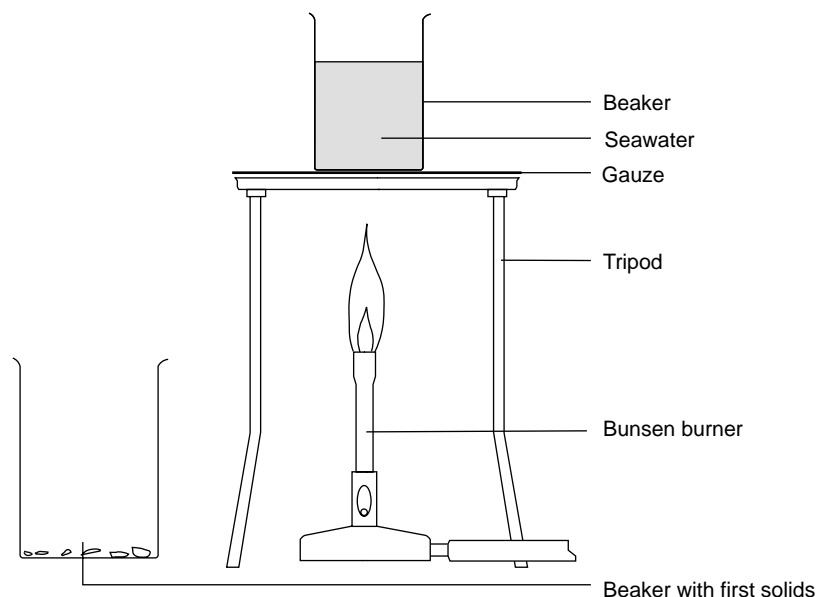
## Questions

1. Write a couple of sentences to describe this experiment. Make sure all of the following words are used:  
dissolve, solvent, filter, filtrate, evaporate, solute, crystallise, crystal.

# Chemicals from seawater

## Introduction

Seawater is often called salt water. Seawater contains various different salts. This experiment involves separating some of these salts from the mixture.



## What to record

What was done and what was seen.

## What to do

1. Put  $200\text{ cm}^3$  of seawater into a  $250\text{ cm}^3$  beaker.
2. Heat the seawater to boiling point and boil the liquid until  $60\text{--}70\text{ cm}^3$  remains. Stop heating when solid is observed and let the solid settle.
3. Pour (decant) the clear liquid into a  $100\text{ cm}^3$  beaker.
4. Add a few drops of hydrochloric acid to the solid left behind. What happens?
5. Put the beaker back on the heat and boil it again until another solid appears (probably when the liquid level is between  $20\text{ cm}^3$  and  $40\text{ cm}^3$ .)
6. Filter the liquid off, wash out the beaker, and boil the liquid again until there is almost none left. Let it cool. What is observed?

## Safety

Wear eye protection. Take care with hot apparatus and solutions.

## Questions

1. Is seawater a single substance?
2. What is the difference between these separated salts?