

## Making Soluble Salts

Answer the questions about the equation below.



1. What does the state symbol (s) tell you?

**The substance is solid**

2. Name the reactants.

**Copper oxide and sulfuric acid**

3. Is this symbol equation balanced? If not, balance it.

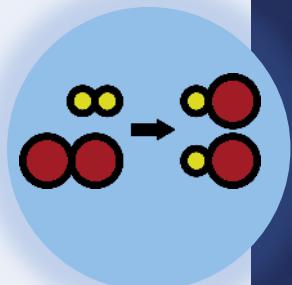
**Balanced, there are equal numbers of each type of atom in reactants and products**

4. Copper sulfate ( $\text{CuSO}_4$ ) is a blue colour. At the end of this reaction would you see a blue liquid or blue solid?

**Blue liquid – (aq) means aqueous, or dissolved in water**

5. Name the salt produced when hydrochloric acid reacts with copper oxide.

**Copper chloride**



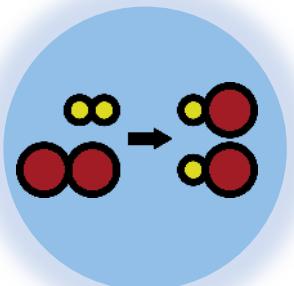
# Making Soluble Salts

C3.2.10

Science  
**Mastery**

- C3.2.1 Prior Knowledge Review
- C3.2.2 Relative Formula Mass
- C3.2.3 Percentage by Mass
- C3.2.4 Conservation of Mass
- C3.2.5 Balancing Equations
- C3.2.6 Uncertainty
- C3.2.7 Introducing Concentration

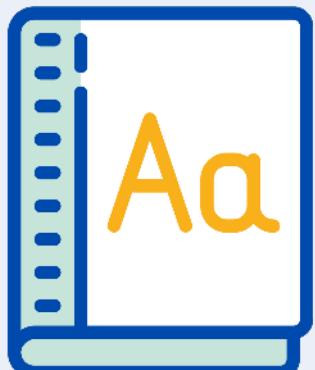
- C3.2.8 Concentration Calculations
- C3.2.9 Soluble Salts
- **C3.2.10 Making Soluble Salts**
- C3.2.11 Making Soluble Salts 2



## Following this lesson, students will be able to:

- Prepare a pure, dry sample of crystals of a soluble salt.
- Describe the key techniques required to prepare a sample of dry, soluble salt, including filtration, evaporation and crystallisation.
- Explain why each step of the procedure is necessary.

### Key Words:



evaporation

filtration

crystallisation

concentrated

solution

# This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

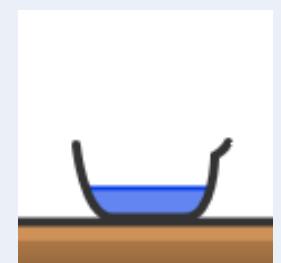
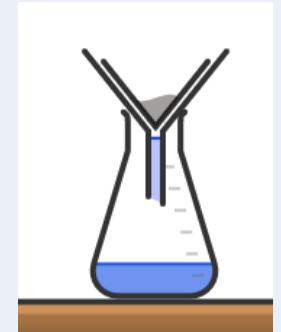
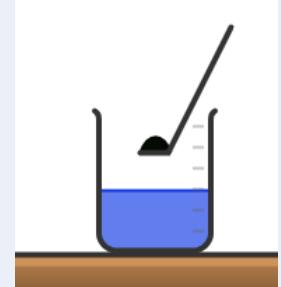
- The teacher should customise this slide as needed, to facilitate
  - **reteach, explanation, demonstration or modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.

## Answer the questions below.

1. An insoluble salt...  
 A. dissolves in water to form a solution.  
 B. cannot dissolve in water.  
 C. are alkalis.
2. Copper sulphate is a salt. Which of the following would **not** be involved in a reaction to make copper sulfate.  
 A. Hydrochloric acid  
 B. Copper oxide  
 C. Sulfuric acid
3. Which is true of an aqueous solution of copper sulfate?  
 A. It is molten (melted) copper sulphate salt  
 B. It is copper sulphate dissolved in water  
 C. Answers A and B are the same thing.

# Demonstration Preparing a soluble salt

1. Heat the acid gently
2. The **solid** is added to the acid until **no more reacts**.
3. Excess **solid** is **filtered** off to produce a solution of the salt.
4. The solution is heated to evaporate the water to form a more **concentrated solution**.
5. This concentrated salt solution is **crystallised** to produce solid salt.
6. The salt is patted **dry** between two pieces of filter paper.



# Risk assessment

Apparatus/Chemical	Hazard	Precaution
Hydrochloric acid	Concentrated acid is corrosive and may cause chemical burns. Dilute acid is an irritant.	Use dilute acid. Ensure beaker is kept away from edge of bench
Bunsen burner and hot apparatus	Risk of burns or hair/clothing catching fire.	Do not touch apparatus until it cools down. Turn off Bunsen when not in use. Tie back hair and stand up.
Glassware	Cut skin from broken glass.	Hold one item at a time, with care. Keep away from edge of bench

# Key techniques

Match each step of the method below with the key processes involved.

crystallisation

filtration

evaporation

neutralisation

1. The solid is added to the acid until no more reacts.
2. Excess solid is filtered off to produce a solution of the salt.
3. The solution is heated to evaporate the water to form a more concentrated solution.
4. This concentrated salt solution is crystallised to produce solid salt.
5. The salt is patted dry between two pieces of filter paper.

neutralisation

filtration

evaporation

crystallisation

**These step are in the INCORRECT order**

**Discuss what the correct order should be.**

- A. Heat the solution to evaporate the water to form a more concentrated solution.
- B. The solid is added to the acid until no more reacts.
- C. Pat the salt dry between two pieces of filter paper.
- D. This concentrated salt solution is crystallised to produce solid salt.
- E. Filter the excess solid off to produce a solution of the salt.

## Practical activity: Preparation of a pure dry sample of a soluble salt from an insoluble oxide

Follow the practical method to prepare a pure dry sample of a salt. Once you have finished, answer the questions below.

1. Name the chemical processes and techniques involved in the preparation.

**Neutralisation, filtration, evaporation, crystallisation**

2. Name the two reactants required to make the salt.

**Sulfuric acid and copper oxide.**

3. Write a word equation for the reaction.

**Sulfuric acid + copper oxide → copper sulfate + water**

4. Write a balanced symbol equation for the reaction.

**$\text{H}_2\text{SO}_4 + \text{CuO} \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$**

## Drill

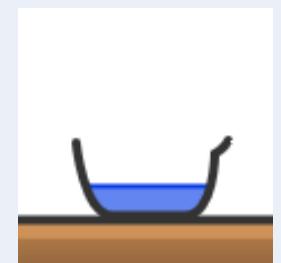
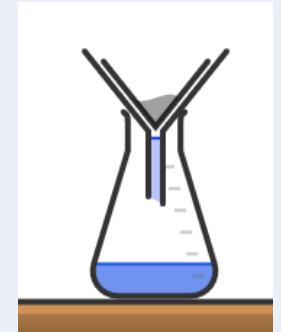
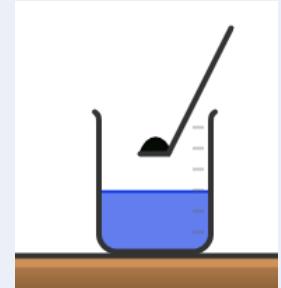
1. Acid is added to a metal oxide. What is the name of this reaction?
2. How are crystals made from this reaction?
3. Whilst preparing a soluble salt excess solid metal oxide is added. Why is this?
4. You have a mixture of insoluble copper oxide and dissolved copper sulfate. How will you separate them?
5. A soluble salt is heated, and it becomes a more concentrated solution. What is the name of this process?
6. What is the hazard for an acid?
7. What precaution must you take for an acid?
8. What precaution must you take for hot apparatus and Bunsen burners?

## Drill answers

1. A neutralisation reaction
2. Heating a soluble salt until all the water has evaporated
3. To ensure that all the acid has reacted excess metal oxide is added
4. Copper oxide can be separated from solution using filtration
5. Evaporation is the process where a less concentrated solution becomes more concentrated
6. Hazard for an acid: If it is concentrated, then its corrosive, if it is dilute, then it can be irritating
7. The precaution for an acid is to use a more dilute acid where possible. Ensure containers are kept away from edge of bench
8. Precautions for hot substances and Bunsen burner: Do not touch apparatus until it cools down. Turn off Bunsen when not in use. Tie back hair and stand up

# I: Preparing a soluble salt

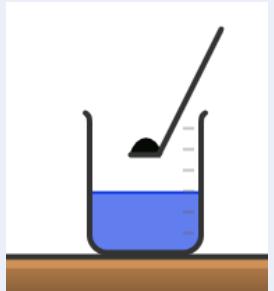
1. Heat the acid gently
2. The **solid** is added to the acid until **no more reacts**.
3. Excess **solid** is **filtered** off to produce a solution of the salt.
4. The solution is heated to evaporate the water to form a more **concentrated solution**.
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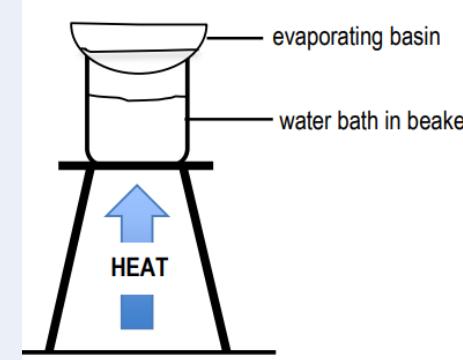
# We: Preparing a soluble salt

**Describe** how to prepare pure dry crystals of copper sulfate.

Describe what is happening in each stage.



Add a spatula full of copper oxide to warmed sulfuric acid. Once reacted add more until copper oxide is in excess



Set up a water bath and place the evaporating basin containing copper sulfate solution. Warm this gently until most of the water has evaporated



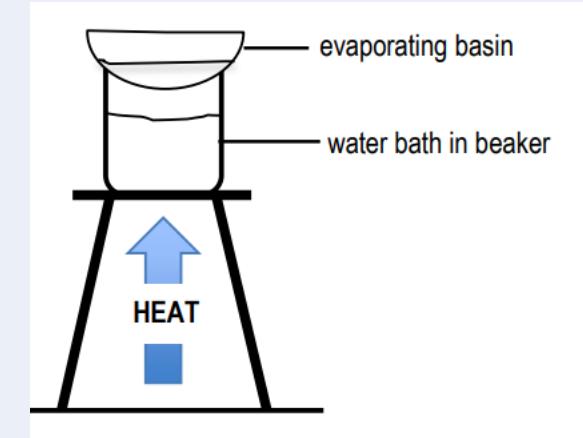
Separate the insoluble copper oxide from the copper sulfate solution

# You: Preparing a soluble salt

**Describe** how to prepare pure dry crystals of magnesium sulfate.

Model answer:

1. Measure out about  $25\text{ cm}^3$  of sulfuric acid using a measuring cylinder and place it in a  $100\text{ cm}^3$  beaker.
2. Gently warm the mixture using a Bunsen burner. Do not boil the acid.
3. Add a spatula magnesium oxide and stir. After a short time, the base will all react producing a colourless solution.
4. Keep adding Magnesium oxide one spatula at a time until it no longer reacts.
5. Filter and wash the mixture into a conical flask.
6. While the mixture is filtering, set up a water bath using a half full  $250\text{ cm}^3$  beaker of water on a gauze above a Bunsen. Start heating the water.
7. Once the filtration is complete, transfer some of the filtrate to an evaporating basin (do not more than half fill the basin).
8. Carefully place the basin on the water bath and heat to allow some of the water to evaporate from the magnesium sulfate solution. If time allows, keep heating until crystals start to appear and then stop heating.



**Answer the questions below.**

1. Which of the following is a precaution when preparing a soluble salt?  
 A. Concentrated acid is corrosive.  
 B. Allow hot glassware to cool before touching it.  
 C. Concentrated acid can cause chemical burns.
  
2. After which process/technique are you left with a copper oxide residue?  
 A. crystallisation  
 B. evaporation  
 C. filtration
  
3. Once the copper sulfate solution is prepared, why do we evaporate off some water using the Bunsen burner?  
 A. to make the solution stronger  
 B. to make the reaction happen faster  
 C. to make the solution more concentrated

## Lesson C3.2.10

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link](#)  
or by emailing [sciencemastery@arkonline.org](mailto:sciencemastery@arkonline.org)  
Thank you!