# Preparing a soluble salt: supporting resources

## **This resource supports the practical video Preparing a soluble salt, available here:** [**rsc.li/3pmV9sw**](rsc.li/3pmV9sw)

**Using the follow-up worksheet**

Pause-and-think questions are supplied in two formats: a teacher version for ‘live’ questioning and a student version for independent study. The time stamps allow you to pause the video when presenting to a class, or learners to use for active revision.

The first set of questions focus on health and safety and provide an opportunity to discuss good laboratory practice during practical work, and risk assessment. Not all the answers will be found on the video, but they are things that learners should be familiar with, such as recalling the meaning of a particular hazard symbol. A student risk assessment worksheet is also included in the additional resources and could be used as a follow-up activity or in preparation for students preparing another soluble salt.

The rest of the questions, focus on both how to make a soluble salt and the underlying chemistry.

#### **Teacher version**

The questions are presented in a table and you can choose to use as many as appropriate for your class and the learning objectives.

Some questions have two timestamps to allow you to adapt the questions for different classes or scenarios. Pause the videos at the earlier timestamp to ask a question before the answer is given, useful for revision or to challenge learners. Pause at the later timestamp to ask a question reflectively and assess whether learners

have understood what they have just heard or seen. This would be useful when introducing a topic, in a flipped learning scenario or when additional support and encouragement is needed.

Think about how you will ask for responses. Variation may help to increase engagement – learners could write and hold up short answers; more complex questions could be discussed in groups.

Not all answers to questions are included in the video. Some of the questions will draw on prior learning or extend learners’ thinking beyond the video content.

#### **Student version**

The same questions are offered as a printable worksheet for learners. Use in situations where there is not a teacher present to guide discussion during the video, for example homework, revision or remote learning.

## **Pause-and-think questions**

### Teacher version

|  |  |  |  |
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| **Timestamp(s) Question Answer/discussion points** | | | |
| 01:06 | | What is the difference between hazard and risk? | A hazard is something that can harm people or property.  A risk is the likelihood that some harm will actually happen and how serious it might be. |
| 01:15 | | What do the symbols mean and what precautions should be taken? | Corrosive; irritant, dangerous to the environment.  Wear safety glasses, avoid contact with skin, do not swallow and only pour a very dilute solution down the waste disposal drain. Do not allow it to be put into naturally occurring fresh water supplies such as streams rivers or lakes. |
| 01:15 | | Identify any hazards associated with this experiment. | Heating; spilling hot reactants, boiling over; copper oxide has three hazard symbols. |
| 01:15 | 02:49 | What can we do to minimise any risks during this experiment? | Wear safety glasses; use a water bath to heat the acid rather than the Bunsen burner; use the smallest quantities of chemicals that we can. |
| **Making copper sulfate** | | | |
| 02:00 | 02:12 | To make copper sulfate, what will we need to react with the sulfuric acid? | Copper oxide or copper carbonate.  *Note: copper metal will not work as it is not reactive enough.* |
| 02:00 | 03:19 | Write the word / symbol equation for the reaction. | Copper oxide + sulfuric acid → copper sulfate  + water  CuO(s) + H2SO4(aq) → Cu SO4(aq) + H2O(l)  Copper carbonate + sulfuric acid → copper  sulfate + water + carbon dioxide  CuCO3(s) + H2SO4(aq) → CuSO4(aq) + H2O(l) + CO2(g) |
| 02:32 | 03:36 | What substances are now present in the boiling tube?  Identify any ions present. | Sulfuric acid: H+(aq) and SO42-(aq) Water: H2O(l)  Copper oxide: CuO(s)  Copper sulfate: Cu2+(aq) and SO 2(aq)  4  If the reaction has stopped then all the H+(aq) ions from the acid will have reacted with the copper oxide to produce water. |
| 02:49 | | Look at the boiling tube  Name the particle responsible for (a) the blue colour and (b) the black colour? | 1. Copper ion – Cu2+(aq) 2. Copper oxide – CuO(s) |
| 03:35 | | Explain what is meant by a limiting reactant. | A limiting reactant is the reactant in a chemical reaction that limits the amount of reactant formed. There is none of this reactant left over so the reaction stops. |
| 03:43 | 03:45 | How can we separate the product from the unreacted copper oxide? | By filtration. |

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| --- | --- | --- | --- |
| 04:01 | 04:24 | What is the benefit of using fluted filter paper over a conical filter? | The fluted filter paper has a larger surface area and allows air into the funnel so that a seal is not formed. Both of these lead to a much faster rate of filtration. |
| 05:02 | 05:13 | Describe what you see happening during the separation process.  Explain your observations. | A clear blue liquid is collecting in the conical flask.  A black solid is remaining in the filter paper.  **Explanations**  The clear blue liquid is called the filtrate and it is copper sulfate solution. The water  molecules, copper ions and sulfate ions have passed through the small holes in the filter paper.  The black solid is called the residue and it is unreacted copper oxide. These particles are too big to pass through the small holes in the filter paper and so collect on the paper. |
| 05:14 | 05:20 | How and why do we need to remove excess water from the filtrate? | By evaporation.  To make a very concentrated solution of copper sulfate, which will then crystallise on cooling. |
| 05:24 | 05:40 | Why do we add anti-bumping crystals to the solution before heating? | To prevent the hot solution ‘jumping’ out of the conical flask. The anti-bumping crystals help to remove ‘hot spots’ in the solution and so smooth out the boiling. |
| 06:12 | | What health and safety problems do you think may result if the solution is allowed to boil dry? | The conical flask could get too hot and crack – so the hot solution would run out the bottom and burn someone. It could also put out the Bunsen burner flame and so gas would be filling the room.  The copper sulfate will start to decompose producing toxic and corrosive fumes. If these fumes are inhaled they could also trigger an asthma attack. |
| 06:27 | | If there are no heat proof gloves available what other safety precautions could  be taken? | Allow the flask to cool before transferring the solution to the evaporating basin. |
| 06:58 | | What conditions are needed to produce larger crystals?  What conditions are needed to produce smaller crystals? | The crystals need to grow slowly. Leave the crystals in a cool place with no draughts, for example a fume cupboard.  The crystals need to form quickly. Leave the crystals in a warm or draughty place such as on top of a radiator or on a sunny window sill. |
| 07:24 | | Now try this long-written answer question using the structure strips:  *Zinc is an essential dietary mineral required for growth and a healthy immune system.*  *Patients suffering from a zinc deficiency may be required to take a zinc supplement containing zinc sulfate.*  *Write a method for preparing a sample of pure dry zinc sulfate crystals from a metal oxide and acid. You must include details of the chemicals and equipment you will use, and any safety considerations.* | |

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## **Pause-and-think questions**

### Student version

*Pause the video at the time stated to test or revise your knowledge of these practical experiments.*

**Time Question Health and safety**

01:15 What is the difference between hazard and risk?

01:15 What do the symbols shown mean and what precautions should be taken?

01:15 Identify any hazards associated with this experiment.

01:15 What can we do to minimise any risks during this experiment?

**Making copper sulfate**

02:00 To make copper sulfate, what will we need to react with the sulfuric acid?

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02:32 What substances are now present in the boiling tube? Identify any ions present.

02:49 Look at the boiling tube. Name the particle responsible for:

1. the blue colour
2. the black colour

03:35 Explain what is meant by a limiting reactant.

03:43 How can we separate the product from the unreacted copper oxide?

04:01 What is the benefit of using fluted filter paper over a conical filter?

05:02 Describe what you see happening during the separation process.

Explain your observations.

05:14 How and why do we need to remove excess water from the filtrate?

05:24 Why do we add anti-bumping crystals to the solution before heating?

06:12 What health and safety problems do you think may result if the solution is allowed to boil dry?

06:27 If there are no heat proof gloves available what other safety precautions could be taken?

06:58 What conditions are needed to produce larger crystals?

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07:24 Now try writing a longer answer to this question using the structure strips:

*Zinc is an essential dietary mineral required for growth and a healthy immune system.*

*Patients suffering from a zinc deficiency may be required to take a zinc supplement containing zinc sulfate. Write a method for preparing a sample of pure dry zinc sulfate crystals from a metal oxide and acid.*

*You must include details of the chemicals and equipment you will use, and any safety considerations.*

This question has a structure strip. Find more resources to support you here <rsc.li/3pmV9sw>.