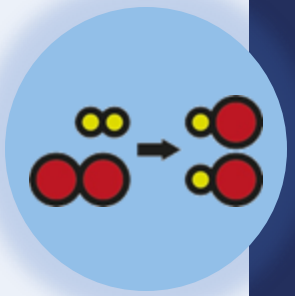
# Obtaining Raw Materials

**Answer the questions below.**

1. Define 'potable' water.
   **Water that is safe/clean enough to drink.**
2. Soda-lime glass is made by heating a mixture of which 3 substances?
   **sand, sodium carbonate and limestone**
3. A copper ore with a mass of 70 g contains 20% copper. What is the mass of copper in the ore?
   **14 g**
4. What is meant by 'sustainable development'?
   **Sustainable development is development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.**
5. State one non-renewable source of energy.
   **Coal, oil or natural gas**

Do Now



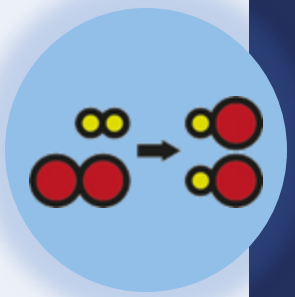
# Obtaining Raw Materials

## Do Now:

1. Define ‘potable’ water.
2. Soda-lime glass is made by heating a mixture of which 3 substances?
3. A copper ore with a mass of 70 g contains 20% copper. What is the mass of copper in the ore?
4. What is meant by ‘sustainable development’
5. State one non-renewable source of energy.

## Drill:

1. Write a word equation for the reaction of copper with oxygen to form copper oxide.
2. Write a balanced chemical equation for the reaction of copper with oxygen to form copper oxide.



Do Now

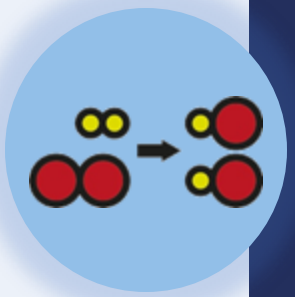
# Obtaining Raw Materials

## Read Now:

Small sea creatures called bloodworms can **burrow** several metres down through the ocean floor. Scientists have learned that this is partly due to their remarkable jaws, which are made from a high proportion of copper! The jaws act like a composite material, like fibreglass or rubber filled reinforced tyres. A single protein is responsible for forming this jaw material, using copper from the environment. Researchers hope that by studying this material, they can improve other composite materials like concrete.

1. Why can bloodworms burrow several metres down through the seabed?
2. What metal is contained in the jaws of a bloodworm?
3. State an example of a composite material.
4. What do researchers hope to gain by studying the jaws of a bloodworm?
5. Define the word in **bold**.

Do Now



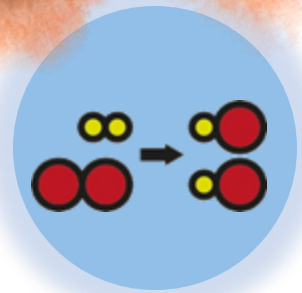
31/01/2025

# (HT) Obtaining Raw Materials

## C4.2.14

Science Mastery

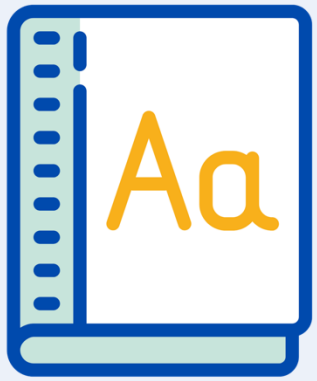




**Following this lesson, students will be able to:**

- List some disadvantages of mining and quarrying
- Define bioleaching and phytomining
- Explain how bioleaching and phytomining are carried out

**Key Words:**




**bioleaching** | **leachate**

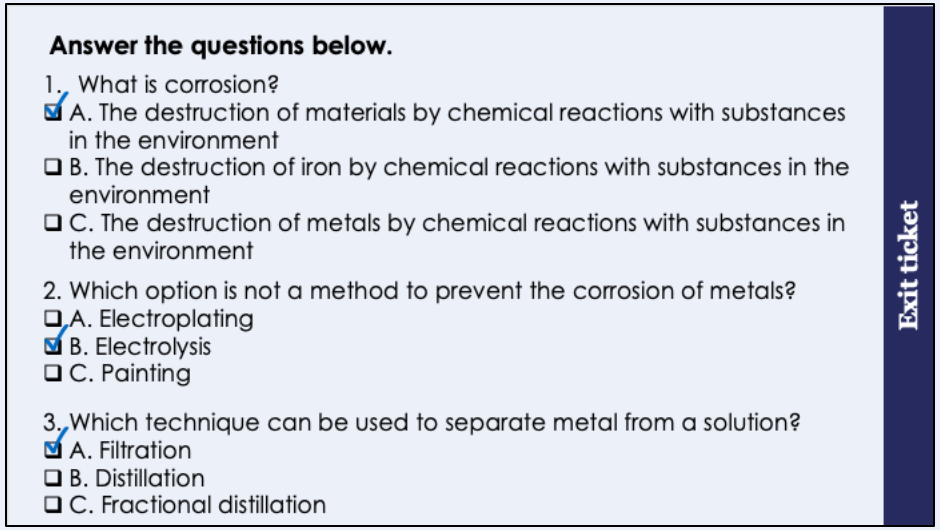
**phytomining** | **low-grade ore**

Lesson Objectives

# 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. What is corrosion?
- ☑ A. The destruction of materials by chemical reactions with substances in the environment
- ☐ B. The destruction of iron by chemical reactions with substances in the environment
- ☐ C. The destruction of metals by chemical reactions with substances in the environment

2. Which option is not a method to prevent the corrosion of metals?
- ☐ A. Electroplating
- ☑ B. Electrolysis
- ☐ C. Painting

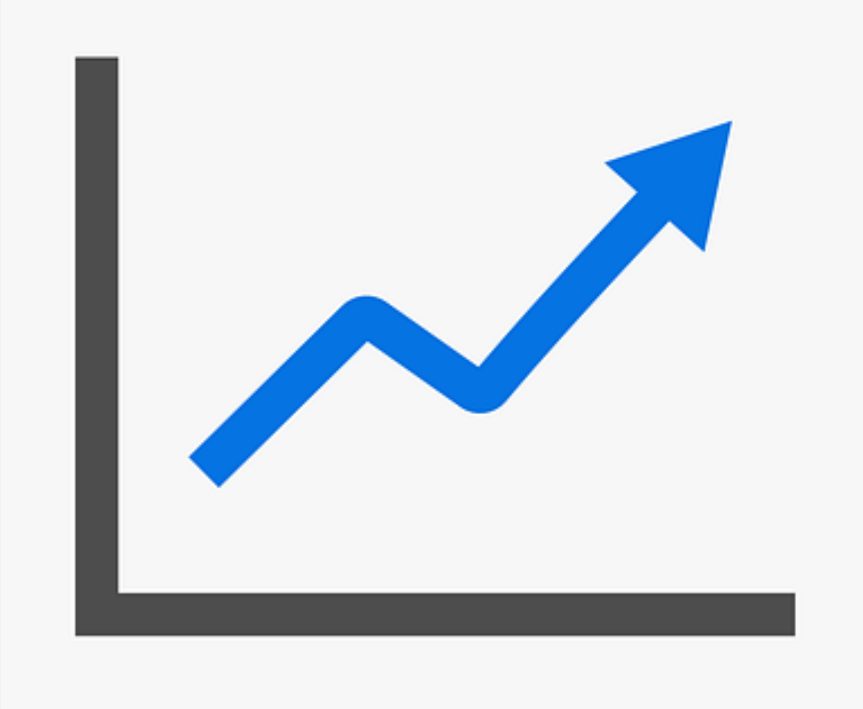
3. Which technique can be used to separate metal from a solution?
- ☑ A. Filtration
- ☐ B. Distillation
- ☐ C. Fractional distillation

Exit ticket

Fix-it

# Extracting Copper

Copper prices have increased rapidly since 2003.
Why might this be? **Copper-rich ores are becoming more scarce.**



## Extracting Copper

Copper ores vary in the percentage of copper they contain.

If they contain very little copper, extracting it might be more costly than it is worth!

As the availability of high-grade copper ores dwindles, scientists are looking for more effective ways to use **low-grade copper ores** to obtain copper.

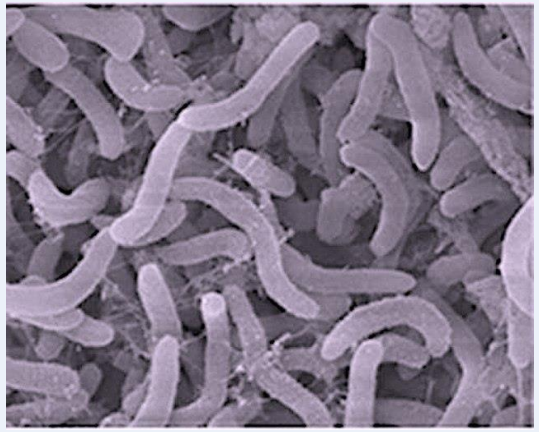
There are two main methods currently being used:

1. **Bioleaching**
2. **Phytomining**

# Bioleaching

**Bioleaching** is a method to extract metals from their ore using living organisms such as **bacteria**.

1. Bacteria are added to low-grade ores.



2. They 'feed' on the ore, creating a solution of ions called **leachate**.

3. The copper solutions are then **purified** using displacement reactions or electrolysis.

- This method produces around 20-25% of all copper extracted from ores.
- However, there is a long way to go with bioleaching… Scientists are looking for ways to **speed up** this process which can take years!

# Phytomining

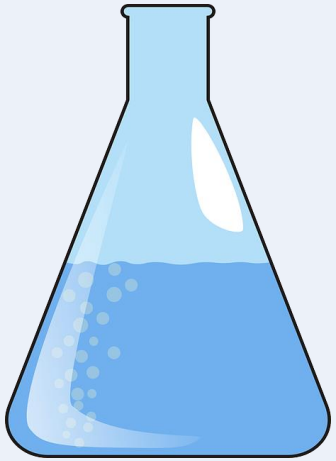
**Phytomining** is a method to extract copper metal from low-grade copper ore in soil, using **plants**

1.

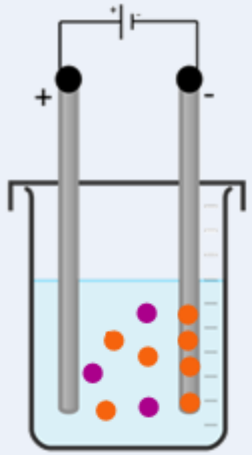
2.

3.

4.



5.




**Did you know?**
The prefix '***phyto-***' means 'derived from plants'

**Is this statement correct?**

Bioleaching is a method to extract copper metal from low-grade copper ore in soil, using plants

Talk Task

# Drill

1. State a use of copper metal.
2. Are copper ores renewable or non-renewable?
3. What word is given to a copper ore containing a low percentage of copper?
4. State one disadvantage of mining copper ores.
5. List two methods that can be used to effectively extract copper from low-grade copper ores.
6. Define bioleaching.
7. Define phytomining.
8. When bacteria feed on are ore, what do we call the solution of metal ions that they produce?
9. What process is used to extract pure copper metal from a copper sulphate solution?
10. At which electrode will copper metal form in electrolysis?

Check for understanding

# Drill answers

1. Copper metal is used for electrical wiring.
2. Copper ores are non-renewable.
3. Low-grade copper ores contain a low percentage of copper
4. One disadvantage of mining copper ores is that it can result in habitat destruction.
5. Phytomining and bioleaching can extract copper from low-grade ores.
6. Bioleaching is a method to extract metals from their ore using living organisms such as bacteria.
7. Phytomining is a method to extract copper metal from low-grade copper ore in soil, using plants
8. When bacteria feed on an ore, they produce a leachate
9. Electrolysis is used to extract copper from a copper sulphate solution
10. Copper metal will form at the cathode (negative electrode)

Check for understanding

# I: Describe: *to recall facts, events or processes in an accurate way*

Example question:

Phytomining is used to obtain copper from land that contains very low percentages of copper compounds.

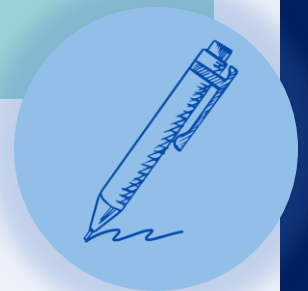
**Describe** how copper compounds are obtained by phytomining.

Model answer:

- grow **plants** on land containing copper ores
- **burn** the plants to form ash (copper oxide)
- dissolve the copper oxide in (sulfuric) acid to form copper sulfate (leachate) **solution**
- carry out the **electrolysis** of this solution to form pure copper

To 'describe', your answer should:

- Use **bullet points** to keep your answer clear
- Cover enough points to **fully answer** the question
- Use scientific **keywords** in your answer
- '**Say what you see**' if there is a diagram, graph or table.



Writing like a scientist

# We: Describe: *to recall facts, events or processes in an accurate way*

Example question:

Soil near copper mines is often contaminated with low percentages of copper compounds.

Phytomining is a new way to extract copper compounds from soil.

**Describe** how copper compounds are extracted by phytomining.

Model answer:

- grow **plants** on land containing copper ores
- **burn** the plants to form ash (copper oxide)
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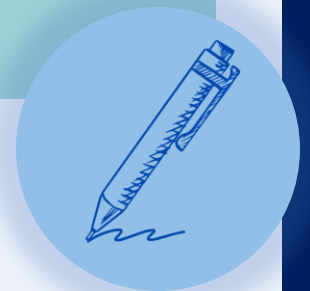

Writing like a scientist

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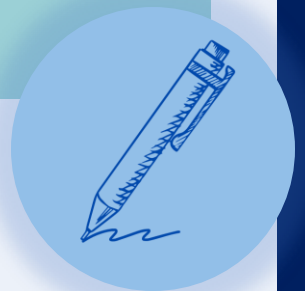

Writing like a scientist

**Answer the questions below.**

1. State the name of the process where plants are used to extract metals from compounds.

☑ A. Phytomining
❑ B. Bioleaching
❑ C. Mining

2. Copper is now extracted from ores containing a low percentage of copper compounds. Why is this?

❑ A. Other methods are too expensive
☑ B. Copper ores are becoming scarce
❑ C. So that electrolysis can be carried out

3. Why is phytomining preferable to traditional mining of copper ores?

☑ A. It results in less destruction of habitats
❑ B. It is faster
❑ C. It is more expensive

Exit ticket

# Feedback

| Lesson C4.2.14 | |
|---|---|
| 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
Thank you!