

# Extraction of copper

Conducting a scientific investigation

Calculators may be used and all questions must be answered in the space provided.

Red Sky Copper Pty Ltd has been operating a copper mine for thirty years in a lush forest in Asia. Villagers living in a small village downstream of the mine complain of copper in the soil poisoning their crops. Any level of copper above 3.4% is considered toxic. The Chief Scientist of Red Sky Mining is assigned the task by the Boss to investigate the problem and report if Red Sky Mining is responsible for the copper contamination of the soil. The chief scientist suggests that if Red Sky Mining is responsible there should be a trend of high levels of copper in the soil near the mine (site A) and less copper in the soil furthest from the mine (Site D) with no or little copper at site E. One sample of soil was taken from each site labeled A – E on the map shown above where the arrow indicates the direction of the river flow. The results are shown below.



## **Results**

**Mass of soil sample at A was 10.7g and produced 0.45g of copper.**

**Mass of soil sample at B was 5.8g and produced 0.22g of copper.**

**Mass of soil sample at C was 11.8g and produced 0.35g of copper.**

**Mass of soil sample at D was 9.7g and produced 0.21g of copper.**

**Mass of soil sample at E was 8.7g and produced 0.61g of copper.**

i. What problem is Red Sky Mining trying to solve?

**(Descriptor i)**

- 7-8 **describe** a problem or question to be tested by a scientific investigation
- 5-6 **outline** a problem or question to be tested by a scientific investigation
- 3-4 **state** a problem or question to be tested by a scientific investigation
- 1-2 **state** a problem or question to be tested by a scientific investigation, with **limited success**

ii. Describe a hypothesis for this investigation using scientific reasoning.

**(Descriptor ii)**

- 7-8 **outline and explain** a testable hypothesis **using correct scientific reasoning**
- 5-6 **outline and explain** a testable hypothesis **using scientific reasoning**
- 3-4 **outline** a testable hypothesis that includes some scientific reasoning
- 1-2 **outline** a testable hypothesis

iii. Give the dependent and independent variables as well as all the controlled variables in this investigation. Describe how the appropriate variables will be manipulated and how sufficient, relevant data will be collected.

**(Descriptor III)**

- 7-8 **describe** how to manipulate the variables, and **describe** how **sufficient, relevant** data will be collected
- 5-6 **outline** how to manipulate the variables, and **outline** how **sufficient, relevant data** will be collected
- 3-4 **outline** how to manipulate the variables, and **state** how **relevant data** will be collected
- 1-2 **state** the variables

- iv. Outline a set of comprehensive steps, in dot point, that can be followed to conduct this investigation when testing each soil sample. Include safety procedures that ensure safe handling of the chemicals provided and disposal of products and a detailed list of chemicals and equipment necessary for this investigation.

*For example – Hydrochloric acid is used. Since acids are corrosive, suggest appropriate precautions when handling acids in the lab. Gases are also produced, discuss some precautions taken when gas is produced.*

**(Descriptor iv)**

- 7-8 design a **logical, complete and safe method** in which he or she **selects appropriate materials and equipment**  
5-6 design a **complete and safe method** in which he or she **selects appropriate materials and equipment.**  
3-4 design a **safe method** in which he or she **selects materials and equipment.**  
1-2 design a **method, with limited success.**

**Command terms**

**State** - Give a specific name, value or other brief answer without explanation or calculation.

**Discuss** - Offer a considered and balanced review that includes a range of arguments, factors or hypotheses. Opinions or conclusions should be presented clearly and supported by appropriate evidence.

**Describe** - Give a detailed account or picture of a situation, event, pattern or process.

**Outline** – Give a brief account

**Explain** - Give a detailed account including reasons or causes