# Unit 10 · Chemistry of Metals

WORKSHEET

Full marks 40

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 40

## 1 Key words [4]

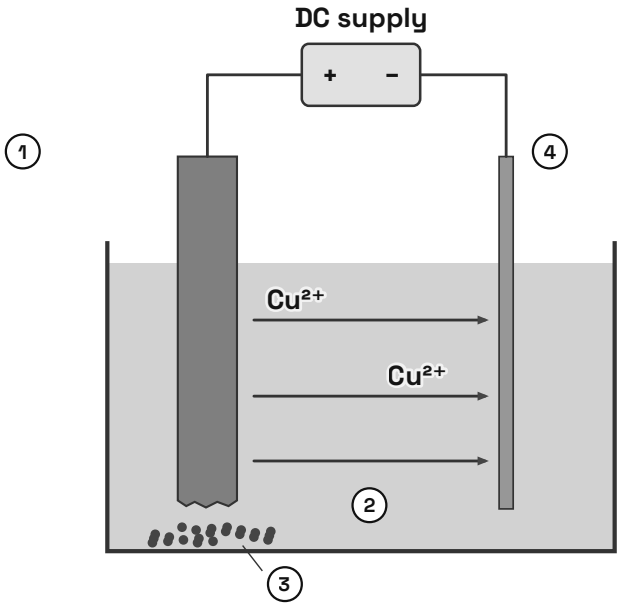
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **amalgam** | **calcination** | **flux** | **gangue** | **mineral** | **ore** | **poling** | **roasting** | **slag** | **smelting** |

A naturally occurring substance of definite composition found in the Earth's crust is a _____; one from which a metal can be extracted conveniently and profitably is an _____. The unwanted rock that comes up with it is the _____. A substance added to remove it is a _____, and the fusible substance they form is the _____. Heating a carbonate ore below its melting point in little or no air is _____; heating a sulphide ore in excess air is _____. Stirring molten impure copper with green wood to reduce its oxide is _____.

## 2 Label the diagram [2]

The diagram shows the electrolytic refining of copper. Write the part or substance that belongs in place of 1 to 4. Each carries 0.5 mark.




**1.** _____ **2.** _____

**3.** _____ **4.** _____

## 3 Multiple choice [5]

Choose the correct option for each of the following questions.

**i.** Zinc blende, ZnS, is concentrated by: [1]

**a.** gravity separation
**b.** magnetic separation
**c.** froth flotation
**d.** leaching with sodium hydroxide

**ii.** Iron ore with sand (silica) as its gangue is smelted in a blast furnace. The flux added is: [1]

**a.** silica
**b.** limestone
**c.** borax
**d.** $P_2O_5$

**iii.** The flame color of potassium and its salts is: [1]

**a.** crimson red
**b.** golden yellow
**c.** lilac (pale violet)
**d.** apple green

**iv.** The densities of the alkali metals, in increasing order, are: [1]

**a.** Li < Na < K < Rb < Cs
**b.** Li < K < Na < Rb < Cs
**c.** Cs < Rb < K < Na < Li
**d.** Li < Na < Rb < K < Cs

**v.** A solution gives a white precipitate with a little sodium hydroxide solution, and the precipitate does not dissolve in excess. The metal ion could be: [1]

**a.** $Zn^{2+}$
**b.** $Al^{3+}$
**c.** $Mg^{2+}$
**d.** $Cu^{2+}$

## 4 Very short answers [3]

Answer the following questions in a word or a sentence.

**a.** Write the formula of plaster of Paris. [1]

**b.** Name the process by which silver is dissolved out of its ore with dilute sodium cyanide solution. [1]

**c.** Why is a metal always set free at the cathode in electrometallurgy? [1]

## 5 Short answers [11]

Write short answers to the following questions.

**a.** Write two differences between calcination and roasting, with one balanced equation for each. [2]

**b.** Why can't sodium be obtained by electrolysis of a solution of sodium chloride in water, and why is calcium chloride added to the salt in the Downs cell? **[2]**

**c.** Write balanced equations for i. sodium burning in air (its main product), and ii. magnesium heated in nitrogen. **[2]**

**d.** Why does the solubility of the Group 2 sulphates decrease from $MgSO_4$ to $BaSO_4$? **[2]**

**e.** Explain, with equations, how electrolytic refining purifies copper. What happens to the silver and the zinc in the impure copper? **[3]**

## 6 Long answer **[4]**

Write a long answer to the following question.

Explain the thermal stability of the carbonates of the alkaline earth metals. Write the equation for the decomposition of calcium carbonate and arrange the carbonates from $BeCO_3$ to $BaCO_3$ in order of increasing stability.

## 7 Numerical problems [8]

Solve the following problems. Show your working. Take Cu = 63.5, Fe = 56, S = 32, Ca = 40, C = 12, O = 16, and the molar volume of a gas at STP as 22.4 L.

**a.** A copper ore contains 4.0% chalcopyrite, $CuFeS_2$, by mass; the rest is gangue. i. Find the percentage of copper in chalcopyrite. ii. Find the mass of copper in 1000 kg of the ore. iii. Froth flotation gives a concentrate that is 80% chalcopyrite. What mass of concentrate does 1000 kg of ore give, if all the chalcopyrite is recovered? [4]

**Answer:** _____

**b.** A lime kiln is loaded with 500 kg of limestone that is 90% calcium carbonate by mass. Write the equation for the reaction in the kiln, and find i. the mass of quicklime formed and ii. the volume of carbon dioxide given off, measured at STP. [4]

**Answer:** _____

## 8 Think [3]

Cesium has the lowest first ionization energy of the alkali metals, yet lithium, not cesium, has the most negative standard electrode potential. Explain why.

## 9 Activity: Metals and alloys at home

(not marked)

Look round your home and find six things made of a metal or an alloy (a karahi, a tap, a spoon, a bell, a heater coil, a wire…). Use the alloy tables of the unit to fill in the table.

| Object | Metal or alloy | Main elements in it | Why this material? |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
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Which of them are ferrous alloys, and which non-ferrous?