Unit 7 · Study of Heavy Metals

WORKSHEET

Full marks 33

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 33

1 Key words [4]

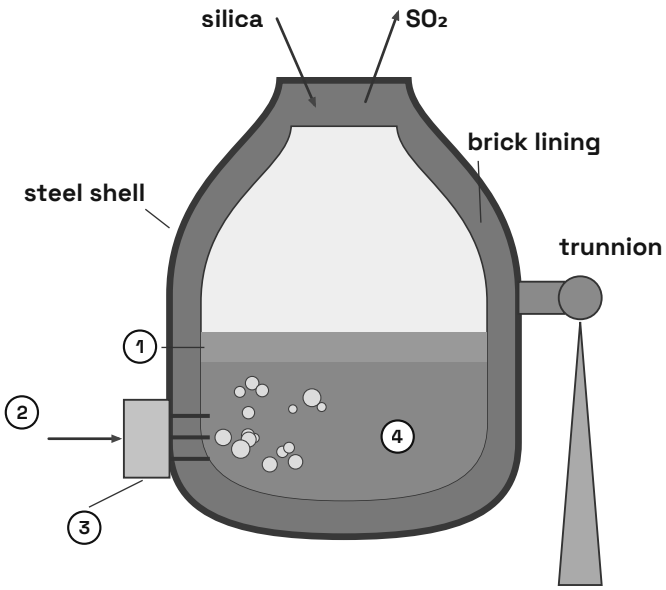
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

amalgam	**blister copper**	**calomel**	**froth flotation**	**horn silver**	**lunar caustic**	**matte**
slag	**spelter**	**spiegeleisen**				

A sulphide ore is concentrated by _____, in which the ore particles rise with the bubbles. In the extraction of copper, the molten mixture of Cu_2S and FeS from the blast furnace is _____, and the iron goes off as _____, $FeSiO_3$. Copper from the converter, its surface pitted by escaping SO_2, is _____. The impure zinc collected from the retort is _____. An alloy of mercury with another metal is an _____. Mercury(I) chloride, Hg_2Cl_2, is called _____, and silver nitrate is called _____.

2 Label the diagram [2]

The diagram shows the Bessemer converter used in the extraction of copper. Write the names of the parts 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. The chief ore from which zinc is extracted is: [1]

a. cinnabar
b. zinc blende
c. argentite
d. chalcopyrite

ii. In the converter, copper(I) oxide reacts with copper(I) sulphide to give copper, with no other reducing agent: $2\,Cu_2O + Cu_2S \rightarrow 6\,Cu + SO_2$. This is called: [1]

a. smelting
b. roasting
c. self-reduction
d. poling

iii. Which of these has the least carbon in it? [1]

a. pig iron
b. cast iron
c. steel
d. wrought iron

iv. In the cyanide process, silver is got back from the solution of $Na[Ag(CN)_2]$ by adding: [1]

a. iron filings
b. zinc dust
c. copper turnings
d. mercury

v. Mercury is stored and traded in iron (steel) flasks because: [1]

a. iron is lighter than mercury
b. iron forms no amalgam with mercury
c. mercury oxidizes iron
d. iron absorbs mercury vapor

4 Short answers [7]

Write short answers to the following questions.

a. Zinc is amphoteric. Write balanced equations for its reactions with dilute hydrochloric acid and with hot, concentrated sodium hydroxide solution. [2]

b. What is galvanizing? Why does a galvanized iron sheet not rust even where its zinc coat is scratched? [2]

c. Write balanced equations for the reactions in these zones of the blast furnace used for iron: a. the zone of combustion; b. the zone of fusion, where carbon monoxide is made; c. the zone of reduction. Name the reducing agent in c. **[3]**

5 Long answer **[4]**

Write a long answer to the following question.

How is silver extracted from argentite by the cyanide process? Describe the steps, with balanced equations, and say how the silver is refined by electrolysis.

6 Numerical problems **[8]**

Solve the following problems. Show your working. Take Cu = 63.5, Fe = 56, S = 32, O = 16, C = 12; one mole of a gas at STP fills 22.4 L.

a. 500 kg of copper ore contains 25% chalcopyrite, $CuFeS_2$, the rest being rock with no copper or sulphur. **[4]**

i. Find the percentage of copper in chalcopyrite.
ii. What mass of copper can be extracted from the ore, if none is lost?
iii. What mass of blister copper (98% copper) does it give?
iv. If all the sulphur leaves the plant as sulphur dioxide, what mass of SO_2 is formed?

Answer:

Science Playground, Katunje, Bhaktapur
https://science-playground.com/learn/grade-12-chemistry/study-of-heavy-metals

b. One tonne (1000 kg) of hematite ore containing 80% Fe_2O_3 is reduced in a blast furnace: **[4]**

$Fe_2O_3 + 3\,CO \rightarrow 2\,Fe + 3\,CO_2$

i. Find the moles of Fe_2O_3 in the ore.

ii. Find the mass of iron formed.

iii. Find the mass of carbon monoxide needed, and the volume of carbon dioxide formed at STP.

iv. Pig iron from the furnace is 95% iron. What mass of pig iron is obtained?

Answer: _____

7 Think **[3]**

When cinnabar, HgS, is roasted in air, mercury itself comes off, and no reducing agent is needed. When zinc blende, ZnS, is roasted, zinc oxide is left, which must then be heated strongly with coke. Write the equations for the two roastings, and explain the difference.

8 Activity: Copper and zinc in salt solutions (not marked)

In the laboratory, put a clean strip of zinc into copper sulphate solution, and a clean strip of copper into zinc sulphate solution, in two test tubes. Watch them for 15 minutes.

Test tube	What you see on the metal	What happens to the solution's color
Zinc in copper sulphate		
Copper in zinc sulphate		

Write the equation for any reaction. Which metal is more reactive?