3055 BA SANGAM COLLEGE
PH: 6674003/9264117 E-mail: basangam@connect.com.fj

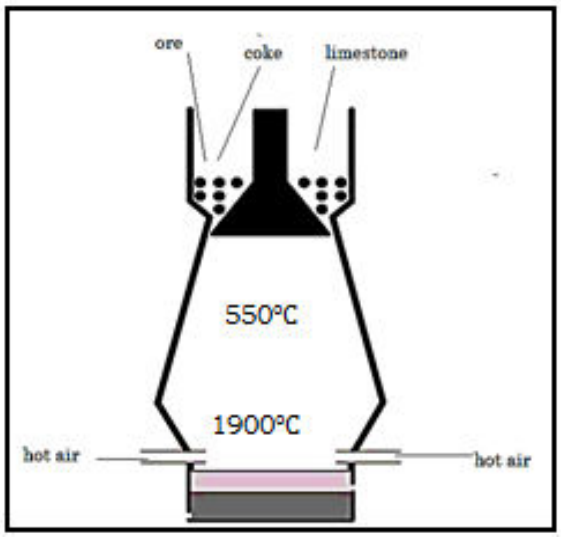
WORKSHEET 14

School: Ba Sangam College **Year:** 11
Subject: Chemistry **Name:**

Strand	**4 - Materials**
Sub strand	**4.1 – Metals and Non-metals**
Content Learning Outcome	**-Study and describe the production and uses of iron.**

Production of Iron

- ✓ Iron is the second most abundant metal in the earth's crust and the fourth most abundantelement.
- ✓ Iron is industriallyproduced using the Blast Furnace.



- ✓ The raw materials used are the iron ore, haematite (iron III oxide, Fe_2O_3 and the mainimpurity silica, SiO_2), limestone and coke (carbon).
- ✓ Hot air at a temperature of 1900°C is introduced at the bottom of the furnace heated coke toform carbon monoxide.

$2C_{(s)} + O_{2(g)} \rightarrow 2CO_{(g)}$

- ✓ As the hot air moves up the furnace, the temperature decreases to 550°C. At this temperature, iron III oxide is reduced by the carbon monoxide to molten iron.

$Fe_2O_{3(s)} + 3CO_{(g)} \rightarrow 2Fe_{(S)} + 3CO_{2(g)}$

- ✓ Limestone (calcium carbonate, CaCO3) decomposes to form calcium oxide.
- ✓ The oxide willreact with silica to form calcium silicate, $Ca_3(SiO_4)_2$, slag.
- ✓ Molten slag floats on the surfaceof molten iron; they are removed separately through separate taps.
- ✓ The molten iron is run into casts called Cast iron or Pig iron.

Pig Iron

- ✓ It is impure as it contains3 – 5% carbon and small amounts of silicon and phosphorus.
- ✓ It is brittle and cannotbe welded.
- ✓ It is used as fire grates, stoves and other uses.
- ✓ The impurities in Pig Iron are removed by heating it with an iron ore to molten form.

Wrought iron

- ✓ oxygen contained in the ore combines with the non-metal impurities to form such as carbonmonoxide. It is removed as gases or slag. The iron formed is called Wrought iron.
- ✓ It is softer and less brittle than pig iron, could be welded and rust resistant.
- ✓ Isused to make ornaments and farming implements and machinery.
- ✓ The use of mild steelcontaining 1% carbon had replaced wrought iron as it is cheaper.

Alloy

It is homogenous mixture of two or more metals.

The metals are mixed in definite proportions. The property of one of the metals is improved by the alloy.

The table below shows the common alloys, its components, properties and their uses.

Name	Composition	Properties	Use
Brass	Cu (60 - 80%), Zn (40 -20%)	More colourful, high resistant to corrosion, more malleable, low melting point	For making household utensils
Bronze	Cu (75-90%), Sn (25-10%)	Lightweight, high resistant to corrosion, stronger	For making coins, idols, utensils, decorative ornaments, springs, turbines, sculpture
Solder	Sn (50-75%), Pb (50-25%)	More tensile strength	Soldering of metals
Duralumin	Al (96%), Cu (3.5%), Mg (0.5%)	Strong, hard, light weight	In aircraft manufacturing
Steel	Fe (99%), C (1%)	High strength and hard	For making nails, screws, bridges
Stainless Steel	Fe (74%), Cr (18%), Ni (8%)	Highly resistant to corrosion, does not react with acid, shiny	For making cooking utensils, knives, surface for making food

- **READ THE CASE STUDIES ON COPPER – USES OF COPPER COMPOUNDS ON PG. NO. 90-93.**

Exercises

1. Which of the following metals is less dense that water?
A. Aluminium
B. Magnesium
C. Sodium
D. Lead

2. From the following list, choose a metal(s) that is appropriate for each use given below.
Give reasons for your choice.

Aluminium	Lead	Copper	Duralumin

i. Making a cooking pot- _____
ii. Making electrical wires - _____
iii. Building an aeroplane- _____
iv. Weights for a fishing net - _____

3. Out of the following four elements, which is the most reactive?
A. Zinc
B. Gold
C. Sodium
D. Magnesium

4. Write balanced chemical equations for the reactions of the following metals with dilute HCl, oxygen and water. *If a metal does not react with either dilute HCl, oxygen or water, write 'no reaction'*

i. Aluminium- _____
ii. Copper - _____
iii. Magnesium - _____
iv. Zinc - _____
v. Calcium - _____

5. What is the use of the following substances in the Blast Furnace?
a. Coke b. Limestone

6. State the composition of the following alloys:
a. Brass - _____
b. Bronze - _____
c. Solder - _____
d. Stainless steel - _____

7. Identify a use of each of the alloys in (6) above and explain how it is better than theconstituent element(s). _____
_____
_____

8. The chemical process by which iron is produced from iron ore is called
A. reduction.
B. combustion.
C. melting.
D. oxidation.

9. Inside a blast furnace, carbon monoxide reduces iron oxide to iron metal by
A. removing impurities.
B. melting the iron oxide.
C. adding oxygen to iron oxide.

D. removing oxygen from iron oxide.