

**Worksheet**  
**CHAPTER 6**  
**PURIFICATION OF METALS**

- **CONCEPTS COVERED :** i) Process of refining
  - ii) Reactions utilized in various processes
  - iii) Identification of reagents used in various processes

I. Match the column

Column A	Column B
1. Zone refining	(A) Zirconium , Titanium
2. Van Arkel method	(B) Aluminium
3. Electrolytic process	(C) gallium
4. liquation	(D) Zinc
5. Distillation	(E) Tin

II. Multiple choice questions:

- Which of the following reaction involves during Mond's process?
 

(a)  $\text{Ni} + 4\text{CO} \longrightarrow \text{Ni}(\text{CO})_4$   
 (b)  $\text{Ni}(\text{CO})_4 \longrightarrow \text{Ni} + 4\text{CO}$

(c) Both a & b  
 (d)  $\text{Zr} + 2\text{I}_2 \longrightarrow \text{ZrI}_4$
- Which of the expression is related with electrochemical principle?
 

(a)  $\Delta G^0 = -RT \ln K^0$   
 (b)  $\Delta G^0 = -nFE^0$

(c)  $\Delta G^0 = \Delta H^0 - T\Delta S$   
 (d) None of these
- During refining by electrolysis, impure copper is taken as
 

(a) Cathode  
 (b) Anode

(c) Both a and b  
 (d) None of these
- Chromatography purification is based on the principle of
 

(a) Chemical kinetics  
 (b) Electrochemistry

(c) Adsorption  
 (d) Absorption
- Pure metals get deposited at which electrode
 

(a) Cathode  
 (b) Anode  
 (c) Both a and b  
 (d) None of these

III. One word answer questions:

- Give one example of a metal purified by zone refining.
- Give one example of a metal purified by vapour phase refining.
- Give one example of a metal purified by electrolysis.
- Give one example of a metal purified by liquation.
- Give one example of a metal purified by distillation.

IV. Choose the correct word from the list and fill the blanks:

Words- **cresol, CaF<sub>2</sub>, NaCN, FeSiO<sub>3</sub>, pine oil.**

1. During froth floatation process, the froth is stabilized using \_\_\_\_\_.
2. For an ore containing PbS and ZnS, \_\_\_\_\_ is used as a depressant.
3. The sulphide ore is made more hydrophobic using collectors like \_\_\_\_\_.
4. During the extraction of copper having iron as impurity, the slag formed is \_\_\_\_\_.
5. Apart from cryolite, \_\_\_\_\_ can be used in the metallurgy of aluminium

IV. Identify the process:

1.  $2\text{Al}_2\text{O}_3 + 3\text{C} \longrightarrow 4\text{Al} + 3\text{CO}_2$
2.  $\text{ZrI}_4 \longrightarrow \text{Zr} + 2\text{I}_2$
3.  $\text{CaO} + \text{SiO}_2 \longrightarrow \text{CaSiO}_3$
4.  $\text{ZnCO}_3 \longrightarrow \text{ZnO} + \text{CO}_2$
5.  $\text{ZnS} + 3\text{O}_2 \longrightarrow 2\text{ZnO} + 2\text{SO}_2$

V. Match the ore with the processes involved during the extraction of the metal:

**Ore:** bauxite, zinc blende, haematite, copper pyrite, zinc carbonate.

**Process:** reduction with coke, leaching, reduction in a blast furnace, roasting of sulphide ore, electrochemical reduction, reduction in a reverberatory furnace.

VI. Analogy

1.  $\text{Al}_2\text{O}_3 : \text{NaOH} :: \text{Ag}_2\text{S} : \underline{\hspace{2cm}}$
2.  $\text{FeO} : \text{SiO}_2 :: \text{SiO}_2 : \underline{\hspace{2cm}}$ .
3. Aluminium : bauxite :: silver : \_\_\_\_\_
4. Ni :  $\text{Ni}(\text{CO})_4 :: \text{Zr} : \underline{\hspace{2cm}}$  -
5.  $\text{Na}[\text{Al}(\text{OH})_4] : \text{CO}_2 :: [\text{Au}(\text{CN})_2]^- : \underline{\hspace{2cm}}$ .

### KEY ANSWER

I. Match the column

Column A	Column B
Zone refining	Gallium
Van Arkel method	Zirconium , Titanium
Electrolytic process	Aluminium
Liquation	Tin
Distillation	Zinc

II. Multiple choice questions:

1. Which of the following reaction involves during Mond's process?

- (a)  $\text{Ni} + 4\text{CO} \longrightarrow \text{Ni}(\text{CO})_4$
- (b)  $\text{Ni}(\text{CO})_4 \longrightarrow \text{Ni} + 4\text{CO}$

Ans : Both a and b

2. Which of the expression is related with electrochemical principle?

$$\Delta G^0 = -nFE^0$$

3. During refining by electrolysis, impure copper is taken as

Anode

4. Chromatography purification is based on the principle of Adsorption
5. Pure metals get deposited at which electrode  
Cathode

## III

1. Give one example of a metal purified by vapour phase refining. [Titanium]
2. Give one example of a metal purified by electrolysis. {Silver}
3. Give one example of a metal purified by liquation. {Tin}
4. Give one example of a metal purified by distillation. {Zn}
5. Give one example of a metal purified by zone refining. [Ga]

(IV) Choose the correct word from the list and fill the blanks:

1. During froth floatation process, the froth is stabilized using **cresol**.
2. For an ore containing PbS and ZnS, **NaCN** is used as a depressant.
3. The sulphide ore is made more hydrophobic using collectors like **pine oil**.
4. During the extraction of copper having iron as impurity, the slag formed is **FeSiO<sub>3</sub>**.
5. Apart from cryolite, **CaF<sub>2</sub>** can be used in the metallurgy of aluminium.

(V) Identify the process:

- (a)  $2\text{Al}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Al} + 3\text{CO}_2$ , **Hall-heroult process**
- (b)  $\text{ZrI}_4 \rightarrow \text{Zr} + 2\text{I}_2$ , **Van Arkel method**
- (c)  $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$ , **Extraction of iron**
- (d)  $\text{ZnCO}_3 \rightarrow \text{ZnO} + \text{CO}_2$ , **Calcination**
- (e)  $\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$ , **Roasting**

(VI) Match the ore with the processes involved during the extraction of the metal:

**Ore:** bauxite, zinc blende, haematite, copper pyrite, zinc carbonate.

**Process:** reduction with coke, leaching, reduction in a blast furnace, roasting of sulphide ore, electrochemical reduction, reduction in a reverberatory furnace.

Answer - **1. Leaching and electrochemical reduction, 2. roasting of sulphide ore and reduction with coke, 3. reduction in blast furnace, 4. roasting of sulphide ore and reduction in a reverberatory furnace, 5. reduction with coke**

VII. Analogy

1.  $\text{Al}_2\text{O}_3 : \text{NaOH} :: \text{Ag}_2\text{S} : \text{NaCN}$
2.  $\text{FeO} : \text{SiO}_2 :: \text{SiO}_2 : \text{CaO}$
3. Aluminium : bauxite :: silver : (silver glance)
4. Ni :  $\text{Ni}(\text{CO})_4 :: \text{Zr} : \text{ZrI}_4$
5.  $\text{Na}[\text{Al}(\text{OH})_4] : \text{CO}_2 :: [\text{Au}(\text{CN})_2]^- : \text{Zn}$