BACHELOR OF MET ENGG EXAMINATION, 2010

(3rd Year, 2nd Semester)

HYDRO AND ELECTRO METALLURGICAL PROCESSES

Time : Three hours. Full Marks : 100

Answer any **five** questions. All questions carry equal marks.

1. The inner wall of an old sulphide roasting furnace contain a lot of valuable metals in the form of ZnS, CdS, CoS and some gold. Can you find a suitable hydrometallurgical technique to extract the metals economically, explain your process. Show that cyanide leaching of Au is an electrochemical process with anodic and cathodic areas and reactions. Derive the equation of rate of leaching involving lechant concentration. Is cyanide leaching activation or concentration polarization controlled? Explain and show how to enhance the rate.

   7+4+5+4

2. Draw a flowchart to produce pure Al_2O_3 from the bauxite ore. Explain the following on Bayer process.

   i) How will you decide temperature, pressure and concentration of leaching solution for the ore with different percentage of Boehmite and Gibbsite in the ore.

   ii) Why bauxite ore with high % of Silica is not considered as economically viable.

   iii) Why a critical temperature is required during precipitation stage.

   iv) The various factors which control the kinetics of precipitation and agglomeration and how to get very fine precipitate.

   5+4+2+4+5

3. a) Explain the following : 3+3+4

   i) Control of Potential and pH for precipitation of unwanted metal hydroxides from leached solution.

   ii) Utility of E-PH diagram in choosing proper leaching agent.

   iii) Leaching rate and Reaction mechanisms.

   b) Explain leaching of chalcopyrite ore in presence of oxidizing agent Fe^{+3}. What is the major advantage of the process? What is bio leaching and explain how some aerobic bacteria help in leaching of sulphide ore.

   3+3+4

4. a) What is the principle of ion exchange process? What are the factors on which selectivity of ion exchange resin depends.

   3+3

   b) What is the principle of Solvent extraction process. Explain with an example. Show that multistage counter current contacting is the most efficient in SE.

   3+4

   c) Explain the thermodynamics and kinetics conditions for cementation of a metal M_1 from its aqueous solution by another metal M_2. How these conditions are achieved?

   4+3

5. a) Explain the cementation process for metal production from leached solution by with help of electrochemical reactions, Nernst equations and polarization diagram. State the various factors control the finer metal powder production. 10

   b) Discuss the criteria of thermodynamics and kinetics factors that control the metal production from leached solution by H_2 gas. State also some salient points to increase the rate of production. 8+2

6. a) Elucidate a comparative discussion of Electrorefining and Electrowining of Cu in the light of

   i) Electrode reactions

   ii) Cell potential and overvoltage required

   iii) Current efficiency

   iv) Size and purity of cathode

   b) Draw a labeled diagram and explain the electrolytic production of Al from cryolite bath. What is the role of Cryolite here. How the various factors affect this process. What are the advantages of ALCOA process over this process.

   4+4+2

7. Write Short notes on following : 6+5+4+5

   a) Leaching Techniques and equipments.

   b) Mg production from sea water through Hydro and Electro metallurgical Route.

   c) Control of Potential and pH for precipitation of unwanted metal hydroxides from leached solution.

   d) Aqueous solution electrolysis vs. Fused salt electrolysis.

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