UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, NOV/DEC 2017

COURSE NO: MR 371
COURSE NAME: PRINCIPLES OF HYDROMETALLURGY
CLASS: MR III **TIME**: 3 HOURS

Name**:** _____Index Number: _____

Answer all Questions

Question 1

a. Define leaching and state five factors that influences the leaching of ores. ***(7 marks)***

b. An ore after mineralogical studies was found to contain manganese dioxide (MnO_2) and Lead Oxide (PbO_2). A company wishes to selectively leach PbO_2 using a reductive acid dissolution process. Assuming the reductant to be used is Fe^{2+}, determine the feasible region to achieve good selectivity between the two minerals. (Take $[Fe^{2+}] = [F^{3+}] = [Mn^{2+}] = [Pb^{2+}] = 1M$).

$MnO_{2\,(S)} + 4H^+ + 2\bar{e} \leftrightarrow Mn^{2+} + 2H_2O \quad Eh^O = 1.28\ V$

$PbO_{2\,(S)} + 4H^+ + 2\bar{e} \leftrightarrow Pb^{2+} + 2H_2O \quad Eh^O = 1.45\ V$

$Fe^{3+} + \bar{e} \leftrightarrow Fe^{2+} \quad Eh^O = 0.771\ V$ ***(12 marks)***

c. Determine if ferric sulfate ($Fe_2(SO_4)_3$) is precipitating at 298.15 K if the ferric ion (Fe^{3+}) activity is 0.7 and the sulfate ion (SO^{2-}_4) activity is 0.3. (ΔG_r° = - 6465 J/mol)

$Fe^{3+} + 3SO_4^{2-} \leftrightarrow Fe_2(SO_4)_3$ ***(7 marks)***

Question 2

a. Explain the following chemical extraction theories

(i) ion-pair transfer (ii) ion exchange theory **(6 marks)**

b. State 3 differences between chemisorption and physisorption **(3 marks)**

(i) A mining company wishes to purchase activated carbon for gold adsorption. Two brands of activated carbon is available in the market and you have been consulted to assist in selecting the best one. As a metallurgist what will inform your decision? **(5 marks)**

c. Using the reaction below, draw an ion distribution diagrams for sulphate water system

(i) What deductions can you make from the ion distribution diagram?

$H^+ + SO_4^{2-} \leftrightarrow HSO_4^- \quad K = 94.9$ **(15 marks)**

Question 3

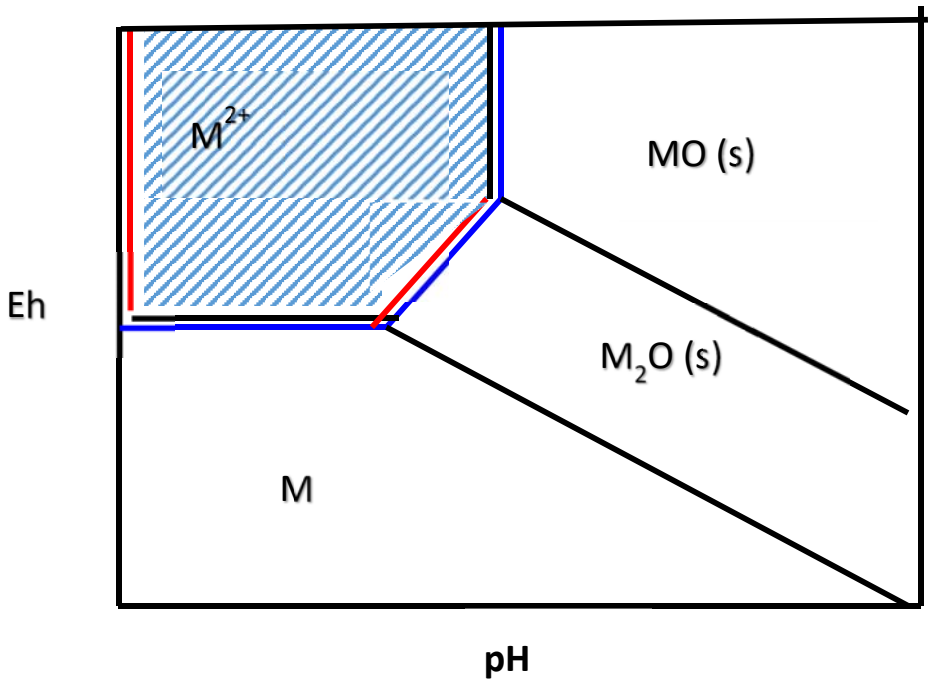
The Eh-Ph diagram for the dissolution of metal M from it oxide (MO) is as shown in Figure 1. Use it to answer the following questions

a. Identify all possible reaction paths for the dissolution of metal M (including combined thermo-hydro processing) **(4 marks)**

b. Provide balanced chemical equation for each reaction path. **(5 marks)**

c. Indicate whether dissolution scheme is non-oxidative, oxidative, or reductive **(6 marks)**

d. Provide conceptual flow-diagram for each reaction path **(10 marks)**



Good luck!

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