University of Toronto
Faculty of Applied Science and Engineering

Final Examination, April 2001
2nd Year- Program 8
MMS 204S Raw Materials Characterisation. Usage and Treatment
Friday, April 20, 2001

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Attempt to answer Six (6) questions, any three from section 1 and question **6** from section 2 plus two more questions.
Use separate books for each section.

Section 1

Marks

1. A new copper sulphide deposit has been discovered. You are asked to develop a flowsheet for the production of copper cathodes from the deposit.

(5) A. Draw a flowsheet for the process you have selected

(9) B. Write a brief explanation on the function of each process step.

(5) C. Calculate the amount of energy required to electrowin 1000 kg of copper in kWh.

(5) D. What is more energy intensive electrowinning or electro-refining and why ?

DATA:
Cell Volts, V	2.1
Cu, atomic weight	63.5
Current efficiency, %	95.0

26.8 Ah will deposit one gram equivalent

2. A zinc concentrate containing 80 % ZnS is dead roasted with stoichiometric air according to the reaction :

$$ZnS + 3/2O_2 = ZnO + SO_2$$

(5) A. Calculate the amount of air required to roast 1000 kg/hr of the concentrate in Nm3/min

(5) B. Calculate the volume of the roaster off-gas at 900 °C in m^3/min.

(5) C. Calculate the roaster off-gas composition in volume percent

(9) D. What process would you use to produce zinc metal form ZnO ? Draw a flowsheet for the process you have selected and write a brief explanation on the function of each process step.

DATA: Atomic weights; Zn- 65.4, O_2-32, S-32
The volume of one gram mole is 22.4 litres
Air: O_2 21 %; N_2 79 %

3. Aluminium metal is produced from bauxite ore

(5) A. Draw a flowsheet describing the production of aluminium metal starting with the bauxite ore.

(9) B. Write a brief explanation on the function of each process step.

(10) C. Can you electrowin aluminium metal from an aqueous solution ? Give the reason for your answer.

4. A new nickel oxide ore deposit has been discovered which is suitable for the production of ferronickel. You have been charged to select a process suitable for the recovery of ferronickel from this ore.

(5) A. Draw a flowsheet for the process you have selected.

(9) B. Write a brief explanation on the function of each process step.

(10) C. What process would you use to remove sulphur and phosphorus from the metal ?

5. Approximately 36 percent of the steel produced in Canada is produced from scrap.

(5) A. Draw the flowsheet you would use to convert scrap into structural steel shapes.

(9) B. Write a brief description on the function of each unit operation.

(10) C. How would you convert iron oxide pellets into metallic pellets (DRI) units ?

Section 2.

Marks

6. **(16)** The following size analysis data was collected for a hydrocyclone.

Size (micrometers)	feed	underflow	overflow
212	7.7	16.8	0.1
212/150	5.1	11.8	0.6
150/105	5.5	10.4	2.8
105/75	10.0	11.7	7.2
75/53	11.7	12.5	12.0
53/37	12.0	9.5	13.0
-37	48.0	28.0	64.0

Use this data to calculate the mass distribution between the overflow and the underflow. (Graph paper provided).

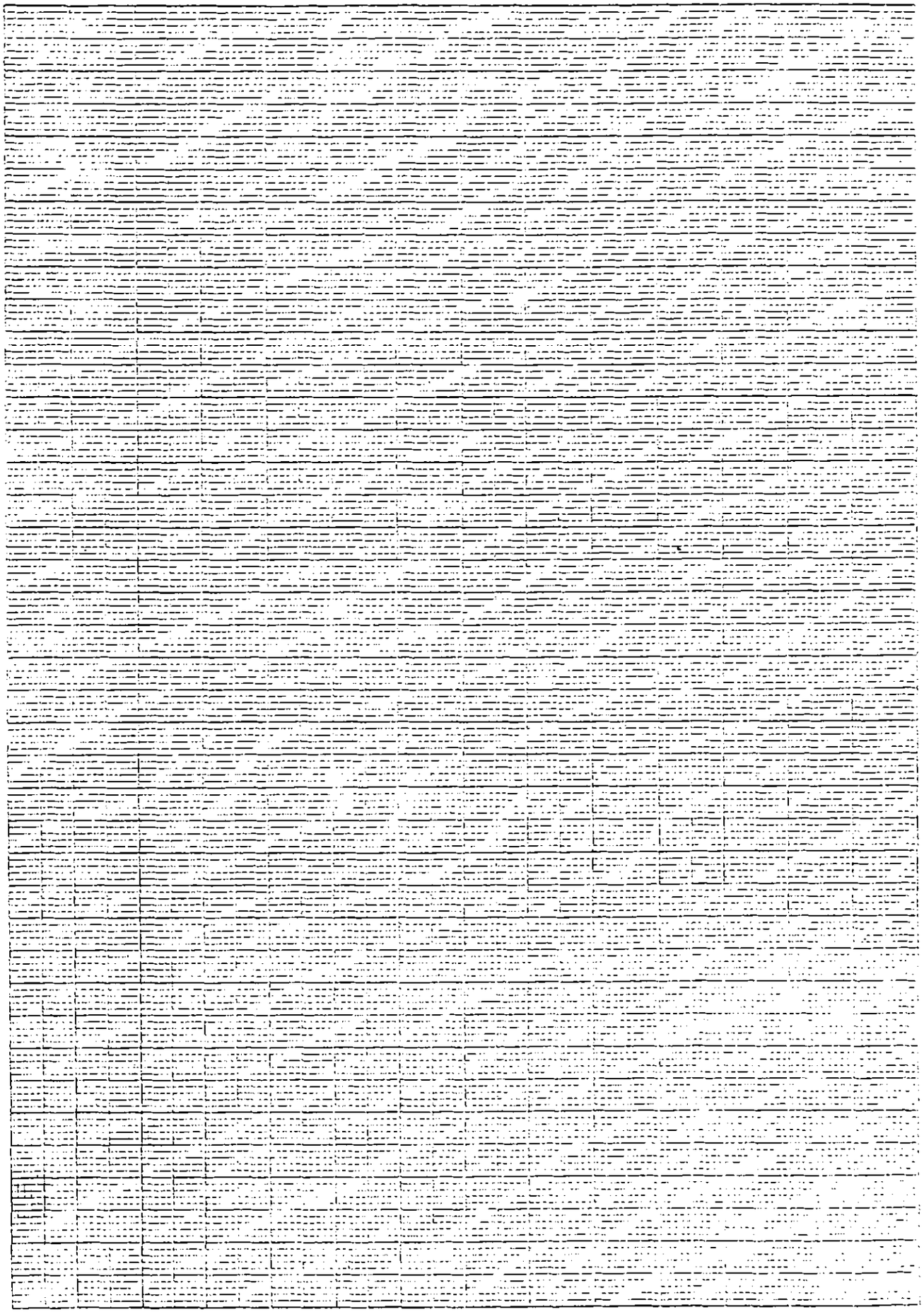
7. **(6)** There are several groups of chemicals used to induce selective hydrophobicity enabling us to separate minerals. Name these groups of chemicals and give examples of each.

8. **(6)** The following data were collected from an operating concentrator. Calculate the distribution of the elements into the concentrate..

		Assays (%)		
	Wt (%)	Pb	Zn	Fe
Feed	100	2.9	12.3	1.4
Lead Conc.	3.4	77.3	2.6	0.9
Zinc Conc	18.9	0.94	63.0	1.1
Tails	77.7	0.10	0.46	1.5

9. **(6)** If you were working in Sudbury for a nickel producer what minerals would you be dealing with and how would you make concentrates from the ore mined?

-End of Questions-



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