

(One personal A4-size cheat-sheet allowed for consultation)

1.1 A mineral sample from a concentrate in a potentially new mining site contains three main phases: chalcopyrite ( $\text{CuFeS}_2$ ), pyrite ( $\text{FeS}_2$ ), and non-sulfides (containing no Cu or Fe). If the Cu concentration is 22,5% and the Fe concentration is 25,6%, what is the concentration of chalcopyrite, pyrite and non-sulfides? (5 points each)  
 (Molar masses (g/mol) are: Cu = 63,5; Fe = 56; S = 32)

1.2. The results of elemental analysis of the mineral extracted from this potential new mining site are shown below. What is its mineralogical composition? (10 points)

Element	Composition (%)
Cu	12,15
Fe	14,2
Cr	2,32
Si	28,00
O	43,33

2. After grinding the chalcopyrite-containing mineral from problem 1, it is mixed with water to produce a slurry containing 12% of solids in a stirred tank. The mineral slurry needs to be transported from the stirred tank to a preparation tank right before the concentrator. If the flowrate of slurry is 120 ton/h determine the pumping power required (in KW) (35 points).
- The total pipe length between the stirred suspension tank and the preparation tank is 500 m and the concentrator is 20 m higher than the stirred tank (the presence of instruments and corners in the pipeline is negligible)
  - The pipe is made of steel and has an inner diameter of 5 in
  - The solid density of the mineral is 2,8 ton/m<sup>3</sup>
  - The slurry's viscosity is 1 cp and it can be assumed to behave as a Newtonian fluid

3. The following data of specific gravity was obtained for the chalcopyrite-containing mineral. Produce separability curves for chalcopyrite and gangue (10 points). Assuming all Cu is found in the form of chalcopyrite:

- With which property set-point could we recover 90% of Cu? (15 points)
- What is the best Cu grade achievable with this recovery? (15 points)

Specific gravity	Total Mass Distribution (%)	Mineralogical Analysis (CuFeS <sub>2</sub> %)
<2,55	1,57	0,01
2,55-2,60	9,22	0,12
2,60-2,65	26,11	0,12
2,65-2,70	19,67	0,12
2,70-2,75	11,91	0,49
2,75-2,80	10,92	0,98
2,80-2,85	7,87	1,07
2,85-2,90	2,55	3,76
>2,90	10,18	27,74