

## QUESTION 1:

### a) *MASS BALANCE*

The flow-rate of ore from your mine is  $1000 \text{ t hr}^{-1}$ . This ore is crushed, and then milled. There is a single stage of milling, followed by a hydrocyclone. The hydrocyclone underflow is returned to the mill.

15% of the solids that leave the mill (and enter the hydrocyclone) go to the underflow and is recycled.

Draw the flow diagram.

What is the total flow-rate of solids through the mill?

(4 Marks)

### b) *PARTITION CURVE*

i) Given the following data, calculate and draw the partition number of each size range from a size separator.

CLEARLY SHOW YOUR METHODOLOGY.

USE THE GRAPH PAPER SUPPLIED.

(4 Marks)

Particle size class: top size [ $\mu\text{m}$ ]	Particle size class: bottom size [ $\mu\text{m}$ ]	Feed: % in size class	Coarse product: % in size class	Partition number
300	212	38	60	
212	150	15	22	
150	106	4	5	
106	75	5	4	
75	53	8	4	
53	10	20	1	
<b>SOLIDS FLOWRATE Tonne/hr</b>		<b>1000</b>	<b>600</b>	

ii)

Estimate how many tonnes/hr of solids finer than 90 microns go to the fine product stream?

What fraction is that of the total solids flowrate to the fine product stream?

(2 marks)

## QUESTION 2: *PROCESS MANAGEMENT*

A mineral processing plant treats 2000 tons per hour of ore containing 0.8% copper as a sulphide mineral in a SiO<sub>2</sub> gangue. There are no other minerals in the ore.

The plant can be operated at two conditions:

Condition 1: A copper recovery of 75% and a concentrate grade of 26.8% (high grade, low recovery)

Condition 2: A copper recovery of 95% and a concentrate grade of 21.4% (low grade, high recovery)

The smelter pays 85% of the market price for the copper in the concentrate, and charges \$950 per ton of concentrate as a treatment charge. The current copper price is \$6650/tonne.

Calculate:

- How many tons of copper enter the plant every hour?  
(1 mark)
- How many tonnes of copper and total concentrate are produced every hour for each of the two conditions?  
(2 marks)
- What is the concentrate value per hour for each of the two conditions?  
(2 marks)
- If the copper price increases (say to \$10000 per ton), should the plant operate at a higher or lower recovery condition? Explain and justify your answer.  
(2 marks)
- In terms of sustainability, is a higher copper price favourable or unfavourable? Explain.  
(3 marks)

## QUESTION 3: *GRADE-RECOVERY CURVE*

Calculate and draw the cumulative grade-recovery curve from the following data.

CLEARLY SHOW YOUR CALCULATION METHODOLOGY.  
USE THE GRAPH PAPER SUPPLIED.

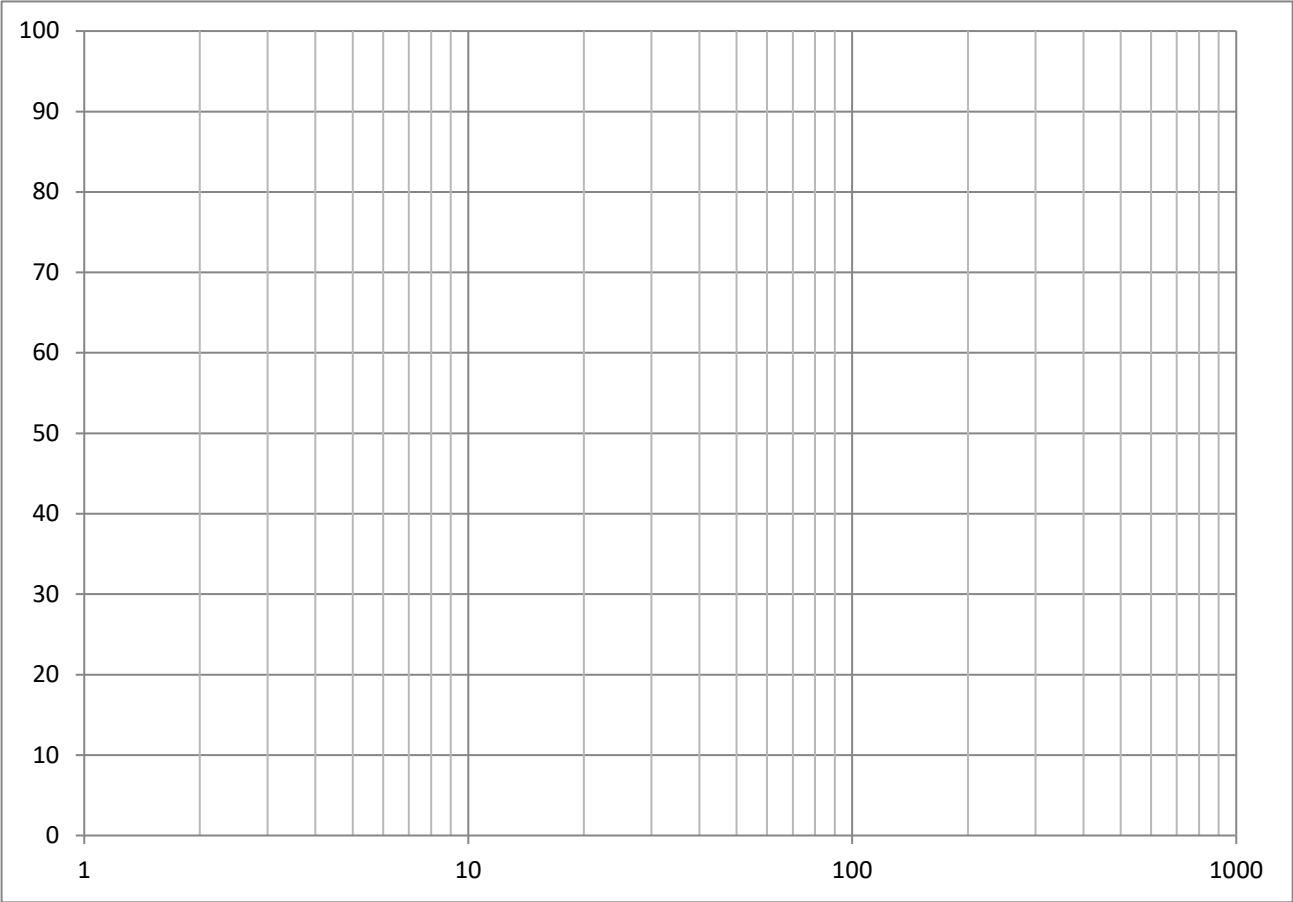
The flotation feed rate is 500 tph solids, with a grade of 5% mineral.

	Cell 1	Cell 2	Cell 3
Concentrate flowrate t/h	22.5	19.2	26.1
Concentrate grade %	20	16	9

(10 Marks)

**QUESTION 1: GRAPH PAPER FOR SOLUTION**

NAME: \_\_\_\_\_ CID \_\_\_\_\_



**QUESTION 3: GRAPH PAPER FOR SOLUTION**

NAME: \_\_\_\_\_ CID \_\_\_\_\_

