

TRANSLATION

UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session of 2005/2006

April/May 2006

EBS 215/3 – Comminution and Sizing

Time : 3 hours

Please ensure that this paper consists of EIGHT printed pages and TWO pages APPENDIX before you proceed with the examination.

This paper contains 7 questions.

Answer any FIVE questions. If a candidate answer more than five questions, only the first five answered will be examined and awarded marks.

Answer to any question must start on a new page.

All questions must be answered in Bahasa Malaysia.

...2/-

1. [a] Draw a diagram of a jaw crusher and show the location of close side setting (CSS), open side setting (OSS), gape and maximum feed size.
(30 marks)
- [b] Why is liberation process important to mineral processing? Give related example in your answer.
(40 marks)
- [c] A 150 kW jaw crusher is used to crush rock at a rate of 1500 tons/hour. Calculate the Bond Work Index for the rock, if the feed size is 80% passing 320 mm and the product is 80% passing 100 mm.
(30 marks)
2. A hydrocyclone classifier accepts a feed of 30 t/h of solid (dry weight) from a ball mill. The hydrocyclone produces 22.0 tonnes of solids per hour and the fluid flow rate through the vortex finder and fluid flow rate through spigot are 25 liters/second and 7 liters/second respectively. Calculate:
- (i) Circulating load ratio.
 - (ii) Circulating load tonnage.

Due to some reasons it was suggested by your employer to use smaller size hydrocyclones in the circuit. As an engineer, what do you think will happen to the circuit and how you handle it?

(100 marks)

...3/-

3. [a] What is meant by circulating load ratio in a grinding circuit closed with a cyclone classifier? Illustrate two possible ball mill/cyclone circuit configurations.

(30 marks)

- [b] You are a mineral processing engineer working in a gold mine. You were instructed to analyse the performance of a set of hydrocyclone in a close circuit ball mill/hydrocyclone circuit. Size distribution of feed, under flow and over flow for the hydrocyclone is show in **Table Q3**.

Table Q3

Size range (μm)	% Retained		
	Feed	Under Flow	Over Flow
+500	9.6	14.7	-
-500 +360	14.2	21.8	-
-360 +250	18.4	25.0	5.9
-250 +180	7.9	7.4	9.0
-180 +130	8.2	6.3	11.7
-130 +90	7.0	4.8	11.2
-90 +63	4.6	2.9	7.9
-63	30.1	17.1	54.3

If 70% of the feed goes to under flow, using the graph paper provided, draw a partition curve for the cyclone and determine the d_{50} size.

(70 marks)

...4/-

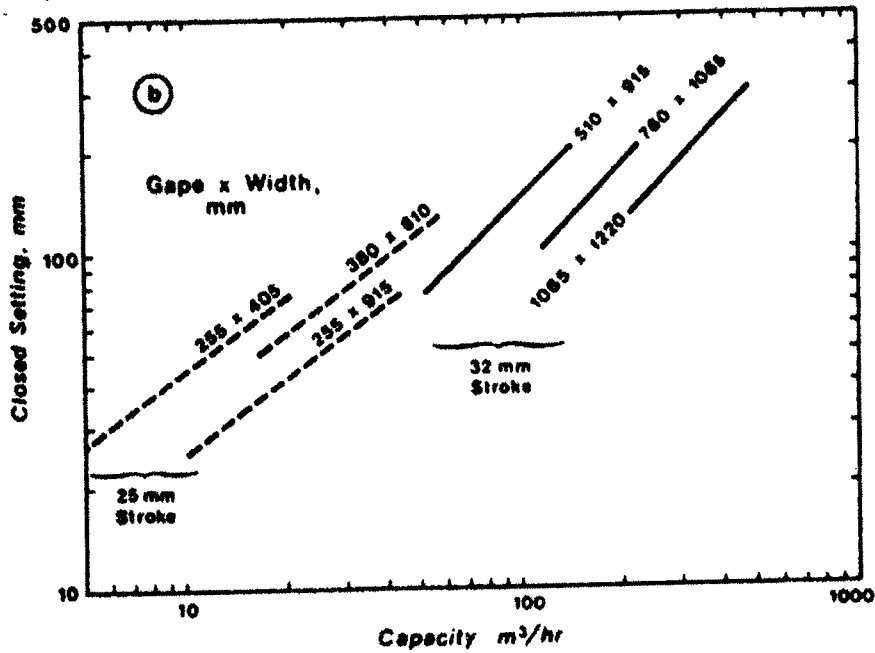
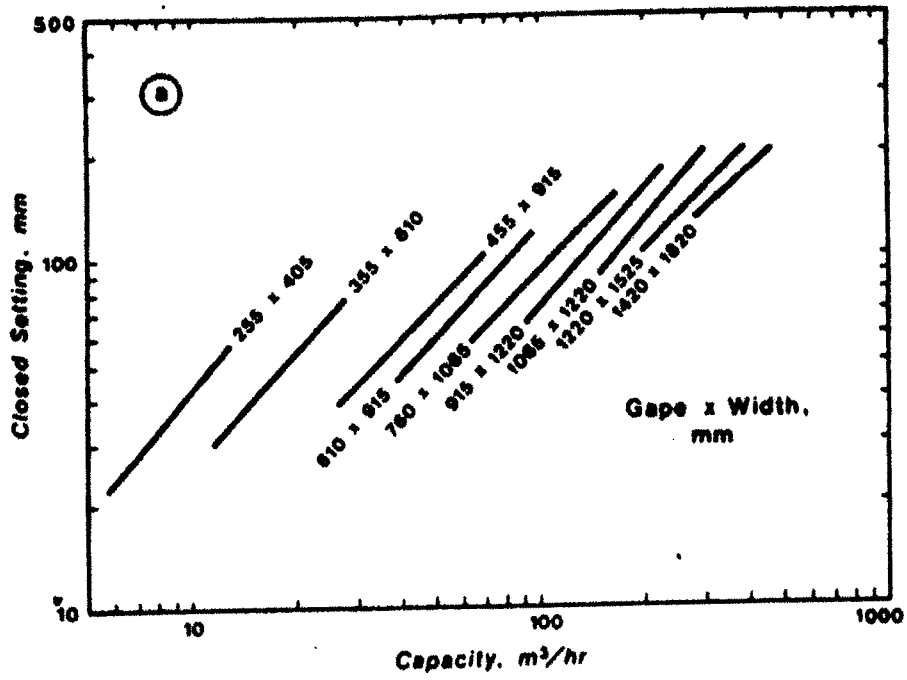
4. [a] Draw a crushing circuit in a quarrying industry showing close and open circuit operation.

(30 marks)

[b] 600 tonnes per hour of a -750 mm ore with a density of 2.0 tons/m³ is sent to a crushing plant. Based on the data given in **Figures 4.0 (a), (b) (c) and (d)**, construct the process flowsheet to reduce the ore size to -25 mm which is the appropriate size to be fed to the grinding mill. Determine the size and number of unit operations required at each stage of size reduction.

(70 marks)

...5/-



...6/-

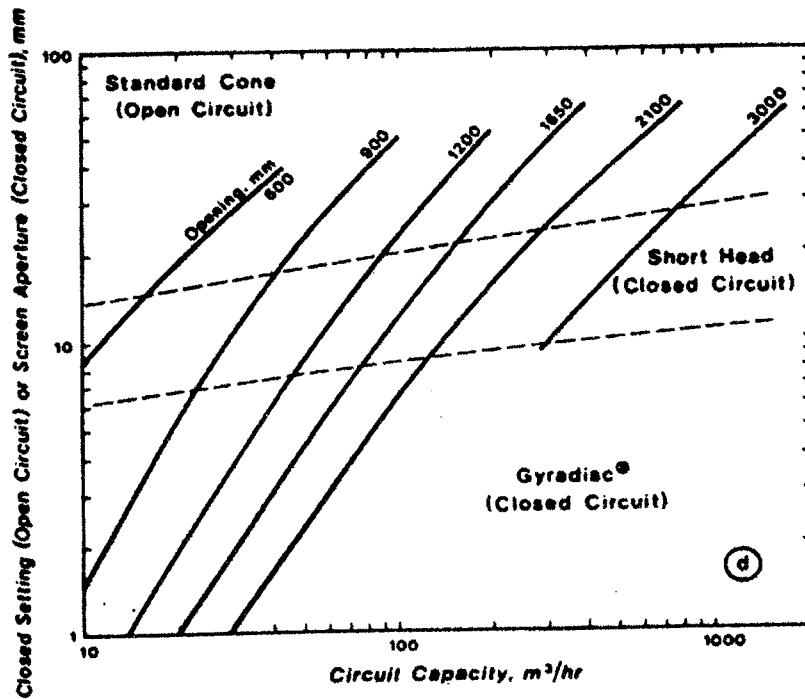
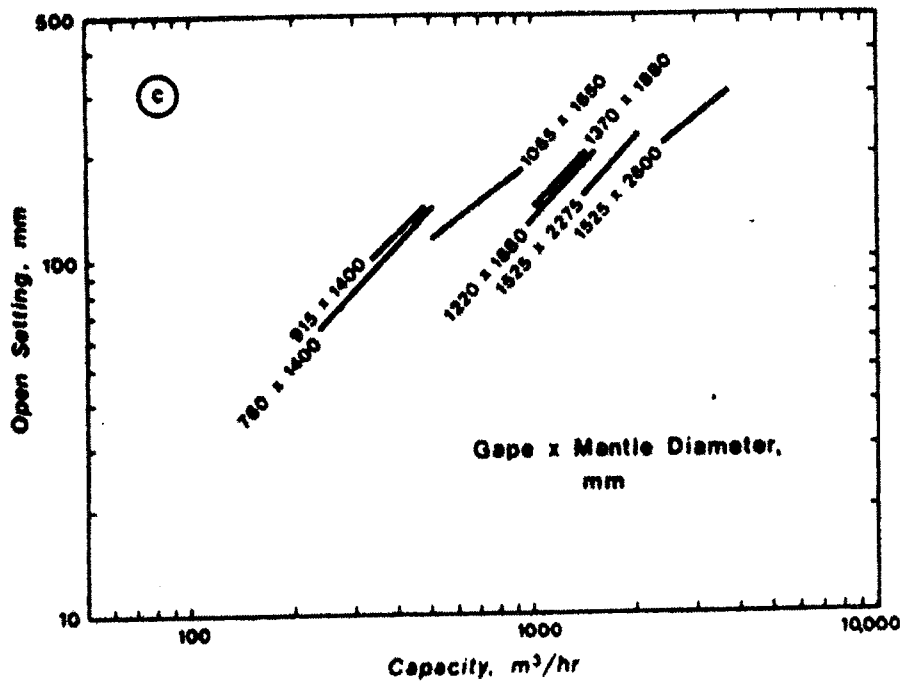


Figure Q4.0 (a), (b), (c) and (d)

...71-

5. A representative ground copper sulphide sample was taken from the grinding circuit of a processing plant for evaluation. The size and assay analyses of the sample yield the following results as shown in **Table Q5**.

Table Q5

Size Range (μm)	Wt. %	Assay (%Cu)
+500	2.0	0.05
-500 +355	5.5	0.08
-355 +250	10.5	0.35
-250 +180	12.0	0.80
-180 +125	15.5	1.20
-125 +90	20.5	1.55
-90 +63	22.0	1.80
-63	12.0	2.89

- (i) Determine the head grade of the sample (% Cu in feed sample).
- (ii) Show the distribution of Cu in each size range.
- (iii) Determine the d_{50} size of the sample.
- (iv) If the feed to the grinding mill contains 80% passing 9 mm size particles, suggest briefly the flowsheet of the grinding circuit for the plant.

(100 marks)

...8/-

6. [a] Describe with the aid of a diagram the zones of separation in the hydrocyclone during classification process. What is the effect of changing the diameter of the hydrocyclone on the classification process?
(30 marks)
- [b] Discuss the mechanisms of breakage in rod mill, ball mills, autogenous (AG) mills and semi autogeneous (SAG) mills.
(40 marks)
- [c] What is the difference between primary and secondary crusher of the same type?
(30 marks)
7. Rahman Hydraulic Tin Bhd. is a tin mine which processes weathered and hard rock ores. Blasting and heavy duty excavators are used to mine the ore. Describe how you can prepare the ore from mine face until it is suitable to be fed to the concentrators that process particles below 1.0 mm. Draw a flow sheet to show the process circuit. (Your answer is limited to comminution and sizing only and concentration processes are not required). The mineral characterization is shown in **Table Q7**.

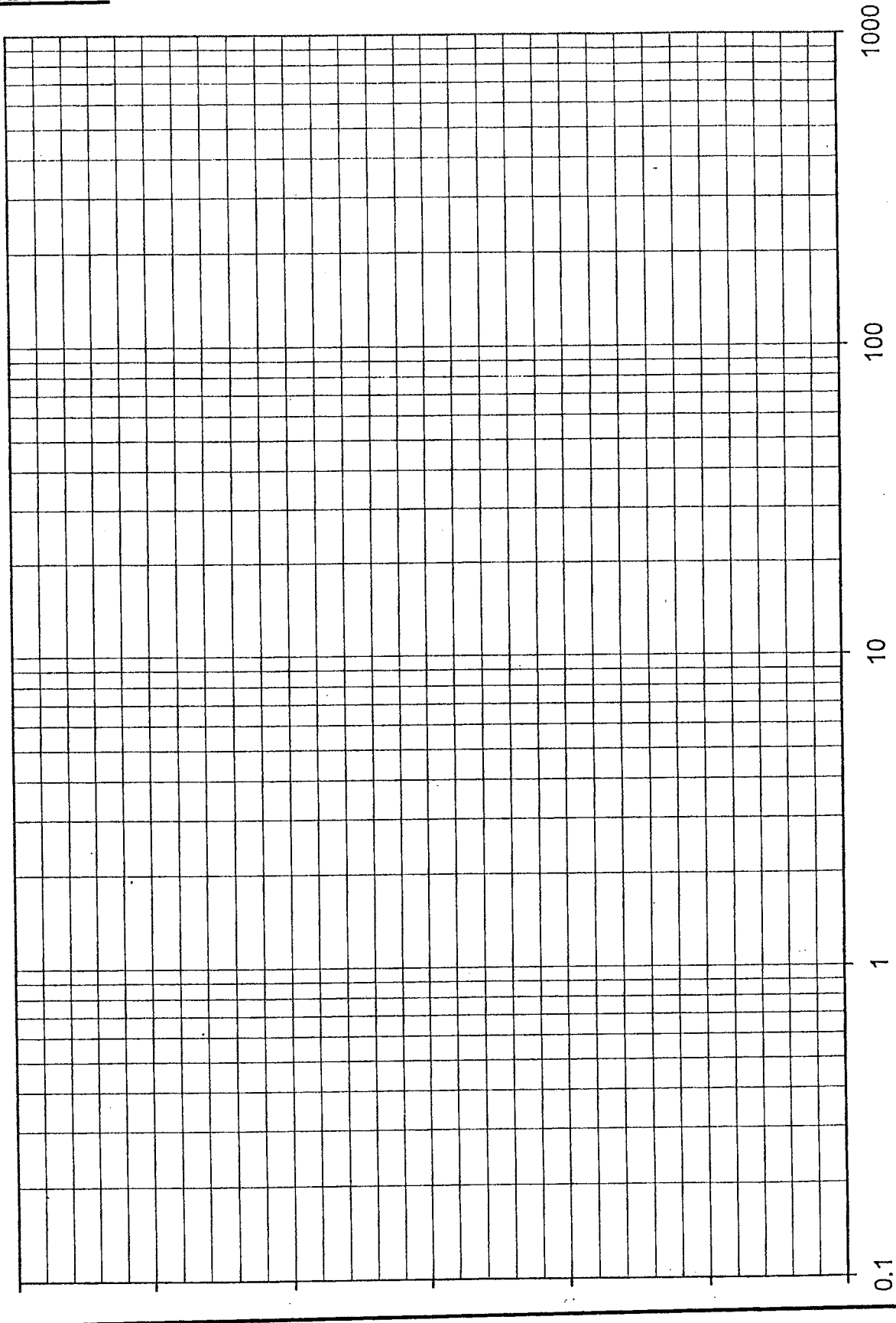
Table Q7

Mineral	Hardness	Fracture
Cassiterite	6.0 – 7.0	Brittle
Pyrite	6.0 – 6.5	Brittle
Quartz	7.0	Brittle
Arsenopyrite	5.5 – 6.0	Brittle
Galena	2.5	Soft

(100 marks)

- oooOooo -

APPENDIX



APPENDIX

