THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

SECOND YEAR MINERAL PROCESSING ENGINEERING

MP215 – MINERAL PROCESSING TECHNOLOGY I

SECOND SEMESTER EXAMINATION

THURSDAY 29th OCTOBER 2020 – 12:50 PM

TIME ALLOWED – 3 HOURS

INFORMATION FOR STUDENTS

1. You have 10 minutes to read the paper. You **MUST NOT** begin writing during that time.
2. **Attempt ALL questions.** Write all answers in the answer booklet provided.
3. Write your **NAME** and **STUDENT NUMBER** clearly on the **ANSWER BOOKLET. **Do this **NOW.**
4. Materials allowed in the examination are **rulers, pens, pencils and calculators.**
5. All **MOBILE PHONES, AUDIO PLAYERS, MP3, and MP4 etc... MUST BE SWITCHED OFF**

Marking Scheme:

All question carry equal marks. Total mark is 100.

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Question 1.0

(a) A detailed mineralogical assessment is required to design the necessary process flow sheet to treat a particular ore body. Discuss the ore characteristics which are important components of the mineralogical assessment.

(b) Figure 1.0 shows the abundances of minerals A and B plotted on a linear – log scale of percentage liberation verses k at uniform particle size. This figure was obtained for a value of n = 25.

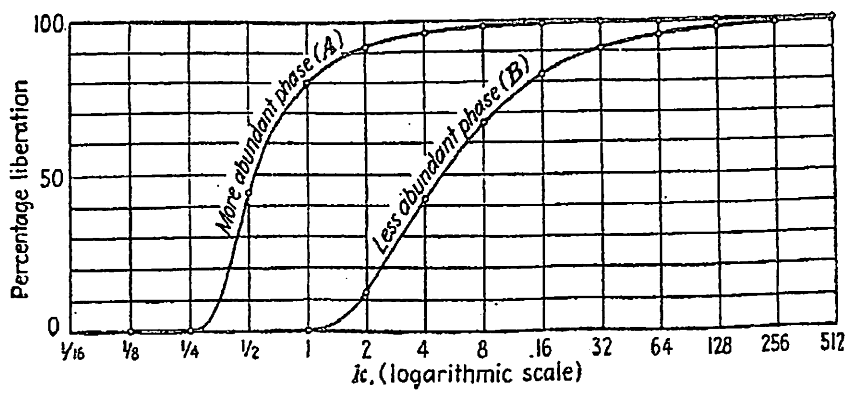

Figure 1.0 Percentage liberation of phases A & B (A>B)

i. Discuss the information depicted by Figure 1.0.

(c)

i. Specify Pierre Gy's theory with a formula.
ii. Define the parameters of Gy's theory.
iii. Discuss the application of Gy's theory in sampling.
iv. What are two types of samples taken from a mineral processing plant? Give reasons for collecting these samples.
v. Explain why the sample cutter is presented at right angles to the flowing material.

Question 2.0

(a) Explain the applications of sub-sieve techniques of sedimentation, elutriation and microscopic sizing methods.

(b) Table 1.0 shows the result of a typical sieve analysis of a laboratory ball mill product. Complete the table and perform a Schumann Plot for the size distribution of particles for the ball mill product.

Table 1.0 Particle size distribution of a ball mill product.

Size (μm)	2360	1700	1180	850	600	425	300	212	150	106	75	Passing 75
Wt. % Retained	8.97	2.69	1.29	1.42	1.69	2.59	4.74	11.73	15.25	16.86	14.18	18.59

From the plot determine the;

i. P_{80}
ii. Size modulus
iii. Size parameter.
iv. Equation representing the size distribution of the product material.
v. Comment on your plot and equation.

Question 3.0

(a) Discuss the factors affecting the screening operation.

(b) A shaking screen with an aperture of 25 mm is fed at a rate of 450 tons of ore material per hour. The size analysis of the feed, overflow and underflow shows that the fraction of material above the cut point size in the feed (*f*) is 0.43, overflow (*c*) is 0.34 and underflow (*u*) is 0.49.

i. Calculate the mass flow rates of the overflow.

ii. Calculate the flow rates of the underflow.

iii. Determine the recovery of the undersize material in the screen underflow.

iv. Determine the screening efficiency of the shaking screen.

vi. Comment on the results.

Question 4.0

(a) Describe the three (3) types of electromagnetic radiation in spectroscopic instruments.

(b) Discuss the steps of charging, fusion, cupellation, parting and annealing in the Fire Assay technique of gold analysis.

(c) A barium assay by atomic absorption spectroscopy to obtain an indication of the purity of the compound. About 21.0 mg of the compound was dissolved in dilute HNO_3 and was diluted to 100 mL by distilled water. About 20.0 mL of the resultant solution was further diluted to 100 mL in distilled water. Absorbance reading for the blank, six standards were recorded in the table below.

Sample	Absorbance
Blank	0
1 ppm Ba	44
4 ppm Ba	178
10 ppm Ba	483
14 ppm Ba	684
20 ppm Ba	993
30 ppm Ba	1512
Test sample	762

Plot the calibration curve and determine the percentage of barium by weight in the original compound.

END of PAPER

DATA SHEET

$F = C + U$, $Ff = Cc + Uu$, $\frac{Cc}{Ff} = \frac{c(f-u)}{f(c-u)}$, $E = \frac{c-f}{c(1-f)}$

$Y = 100\, [\frac{x}{k}]^m$,

Common Units For Expressing Trace Concentrations

Unit	*Abbreviation*	*Wt/Wt*	*Wt/Vol*	*Vol/Vol*
Parts per million	ppm	mg/kg	mg/l	µl/l
(1 ppm = 10^{-4}%)		µg/g	µg/ml	nl/ml
Parts per billion	ppb	µg/kg	µg/l	nl/l
(1 ppb = 10^{-7}% = 10^{-3} ppm)		ng/g	ng/ml	pl/ml[a]
Milligram percent	mg%	mg/100 g	mg/100 ml	