



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF CIVIL, MINING AND PROCESS ENGINEERING

QUALIFICATION : BACHELOR OF ENGINEERING IN METALLURGY, CHEMICAL ENGINEERING & MINING ENGINEERING	
QUALIFICATION CODE: 08BEMT/08BECE/08BMEG	LEVEL: 7
COURSE CODE: MPC711S	COURSE NAME: MINERAL SEPARATION PROCESSES 314
SESSION: JUNE 2023	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

SECOND OPPORTUNITY QUESTION PAPER	
EXAMINER(S)	Dr Clement Kwasi Owusu
MODERATOR:	Prof. Godfrey Dzinomwa

INSTRUCTIONS
5. Answer all questions. 6. Read all the questions carefully before answering. 7. Marks for each question are indicated at the end of each question. 8. Please ensure that your writing is legible, neat and presentable.

PERMISSIBLE MATERIALS

3. Examination paper.
4. Non-programmable calculator.

Question 1**(31 marks)**

- a. Mention 3 differences between cone crusher and gyratory crusher (9 marks)
- b. An alluvial ore containing Gold (SG 19.0) and Quartz (SG 2.65) is to be separated by Knelson concentrator. If the SG and viscosity of water are 1 and 0.001Pas respectively, discuss whether the selected density-based process is appropriate (10 marks)
- c. A plant is being fed with metallic ore assaying 2.5 g/t Au, producing a concentrate product assaying 65 g/t Au and tailings assaying 0.21 g/t Au. What is the recovery of Au, enrichment ratio and ratio of concentration? (12 marks)

Question 2**(36 marks)**

- a. Explain the significance of the contact angle between mineral particles being floated and air bubbles in water. How does the addition of collectors affect the contact angle? (8 marks)
- b. After blending at the ROM pad, it was estimated that the feed rate of pyrite and quartz to a continuous flotation circuit were 8 t/h and 81 t/h respectively. If a single cell in the bank of flotation cells gives pyrite and quartz recoveries of 35% and 2.5% respectively, at a residence time of 5 minutes
 - i. Determine the total recoveries of each mineral for a bank of 10 cells of the same size and design (12 marks)
 - ii. Estimate the tonnages of quartz and pyrite in the concentrate? (8 marks)
- c. Explain why conveyor belts used in the mining industries are always equipped with pull wires and underspeed sensors. (8 marks)

Question 3**(33 marks)**

- a. Discuss briefly how separation of magnetic material from diamagnetic material is achieved by the drum separator (6 marks)
- b. A plant treats an ore containing Pyrite (FeS_2), Arsenopyrite (FeAsS) and Bornite (Cu_5FeS_4). After ore upgrading and analysis, the Arsenic (As), Copper (Cu) and

Iron (Fe) concentration in the concentrate were 21.6%, 42.5% and 73.3% respectively. What is the concentration of pyrite, arsenopyrite, chalcopyrite in the concentrate? (Molar masses of As, Cu, Fe and S are 74.92 g/mol, 63.55 g/mol, 55.85 g/mol and 32.07 g/mol respectively) *(12 marks)*

- c. An ore after mineralogical studies was found to contain mixtures of minerals as shown below with their properties. As a consultant, propose a suitable flowsheet for recovering Tantalite and Zircon from the mineral mixtures. Also, give reasons for the selection of equipment that you would use to separate all the minerals of interest. *(15 marks)*

Mineral	Composition	S. G	Magnetic response	Electrostatic response
Quartz	SiO ₂	2.65	None	None
Talc	Mg ₃ Si ₄ O ₁₄ (OH) ₂	2.75	None	None
Tantalite	(Fe,Mn)(Ta, Nb) ₂ O ₆	6.2-8.2	Paramagnetic	Conductive
Zircon	ZrSiO ₄	4.7	None	None
Rutile	TiO ₂	5.6	None	Conductive

THIS QUESTION PAPER CONSISTS OF 3 PAGES (Including this front page)