



UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

SCHOOL OF ENGINEERING

EXAMINATIONS: JUNE 2019

COURSE AND CODE: MINERAL PROCESSING

ENCH4MP

DURATION: 2 HOURS

TOTAL MARKS: 100

INTERNAL EXAMINER(S): DR J POCOCK

INTERNAL MODERATOR(S): PROF BK LOVEDAY

EXTERNAL MODERATOR: DR L MAHARAJ

INSTRUCTIONS:

1. **ALL** questions should be attempted.
2. Any programmable or non-programmable calculator may be used provided it has been cleared of any information that would subvert the purpose of the examination.
3. Calculations must be shown in sufficient detail to illustrate your understanding of the procedure.
4. This examination question paper, together with all associated diagrams **MUST BE HANDED IN TOGETHER WITH YOUR SCRIPT.**

Student Number:

SECTION A – SELF STUDY**QUESTION 1**

Using at least two contrasting examples from the case studies covered, demonstrate the manner in which the mineralogy of an ore body (i.e. The physical and chemical properties along with the liberation size of the values) influences the design of the minerals processing plant used to concentrate the values of the ore.

TOTAL /25/**QUESTION 2**

With the aid of a block diagram, briefly describe the processing route used in the concentration of diamonds from kimberlite ores. Give reasons for the use of crushers as opposed to milling of the ore and the properties being exploited to affect separation of the diamonds from the kimberlite gangue.

TOTAL /15/**QUESTION 3**

Health and safety is of paramount importance in the mining and minerals processing industry. Using examples from the case studies, list the main health and safety concerns that have to be considered in mining and minerals processing operations.

TOTAL /10/

SECTION B – LECTURED MATERIAL**QUESTION 4**

- a) A Dense Medium Separation circuit is being used to concentrate a fine coal fraction with a size distribution of between 5mm and 500 μ m. Analysis of the feed material is given in the table below. Given that the DMS cyclones used in the circuit have an E_p of 0.05, for a separation density of 1600 kg/m³, calculate the ash content of the coal product, and what would the organic recovery be (percentage of combustibles recovered). Tromp equations are given on page 4.

(20)

Specific Gravity Range	Mass Percentage in Feed (%)	Ash Content in fraction (%)
-1.4	12	2
-1.6+1.4	42	8
-1.8+1.6	24	24
-2.0+1.8	12	50
+2.0	10	68

- b) What medium would be used for carrying out the above separation, and what properties must the medium have that make it suitable for use in the circuit?

(5)

TOTAL /25/

QUESTION 5

What is the difference between paramagnetism and ferromagnetism, and what effect does this have on the magnetic separators used for wet processing of paramagnetic materials?

TOTAL /5/

QUESTION 6

A mixed sulphide ore is being concentrated using the froth flotation circuit given in Figure 1. For a given set of rate constants, what will be the recovery of values to the concentrate based upon the recoveries at the various stages?

TOTAL /20/

FORMULA SHEET**Tromp Function Equations:**

For recovery to the overflow

$$T(x) = 50 \exp \left[\frac{(x' - x)}{z} \right] \text{ for } x > x'$$

$$T(x) = 100 - 50 \exp \left[\frac{(x - x')}{z} \right] \text{ for } x < x'$$

$$z = - \frac{E_p}{\ln 0.5}$$

x' = separation density in SG units

x = nominal fraction density in SG units

E_p = Ecart moyen probable