UNIVERSITY
OF
JOHANNESBURG

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| **PROGRAM** | : NATIONAL DIPLOMA<br>*EXTRACTION METALLURGY* |
| **SUBJECT** | : **MINERAL PROCESSING III** |
| **CODE** | : **MPR 32 – 1** |
| **DATE** | : WINTER EXAMINATIONS 2015<br>30 MAY 2015 |
| **DURATION** | : (SESSION 2). 12:30– 15:30 |
| **WEIGHT** | : 40: 60 |
| **TOTAL MARKS** | : 100 |

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| **EXAMINER** | : DR W. NHETA |
| **MODERATOR** | : MR M. HENDERSON |
| **NUMBER OF PAGES** | : 4 PAGES |

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**INSTRUCTIONS** : ANSWER ALL QUESTIONS.
DRAW NEAT DIAGRAMS AND WRITE CLEARLY.
MARKS CAN BE DEDUCTED FOR UNTIDY WORK.
FOR THE CALCULATION QUESTIONS, PUT ALL YOUR FINAL ANSWERS AT THE END OF EACH QUESTION.
ENSURE THEY ARE CORRECTLY NUMBERED.
USE 4 DIGITS IN ALL CALCULATIONS UNLESS STATED OTHERWISE.
PUT ALL YOUR WORKING IN THE SCRIPT.
NO VISIBLE WORKING IN THE SCRIPT MEANS NO MARKS WILL BE AWARDED.

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Question 1

An ore containing bornite ($Cu_5FeS_4$) and silica ($SiO_2$) is treated in a flotation plant consisting of rougher/scavenger/cleaner cells. The scavenger follows the rougher and both scavenger and rougher concentrates are combined to form the cleaner feed. The cleaner produces a cleaner concentrate and cleaner tailings.

The following circuit data is available:

- feed rate 150t/hr
- % S in feed 1.19%
- the rougher concentrate contains 1.428t/hr Sulphur at a grade of 11.2% S
- 65% of the bornite in the scavenger feed reports to the scavenger concentrate in 15.51% of the scavenger feed mass.
- The copper in the cleaner feed is upgraded 2.5 times into the cleaner concentrate
- 95% of the Fe in the cleaner feed reports to the cleaner concentrate.

Calculate:-

1.1 the mass of the rougher concentrate (2)

1.2 the %Cu in the feed (3)

1.3 the %S in the cleaner feed (3)

1.4 the % Cu in the cleaner tailings (3)

1.5 the % of the copper in the feed going to the rougher tailings (3)

1.6 the % of the sulphur in the feed going to the scavenger tailings (3)

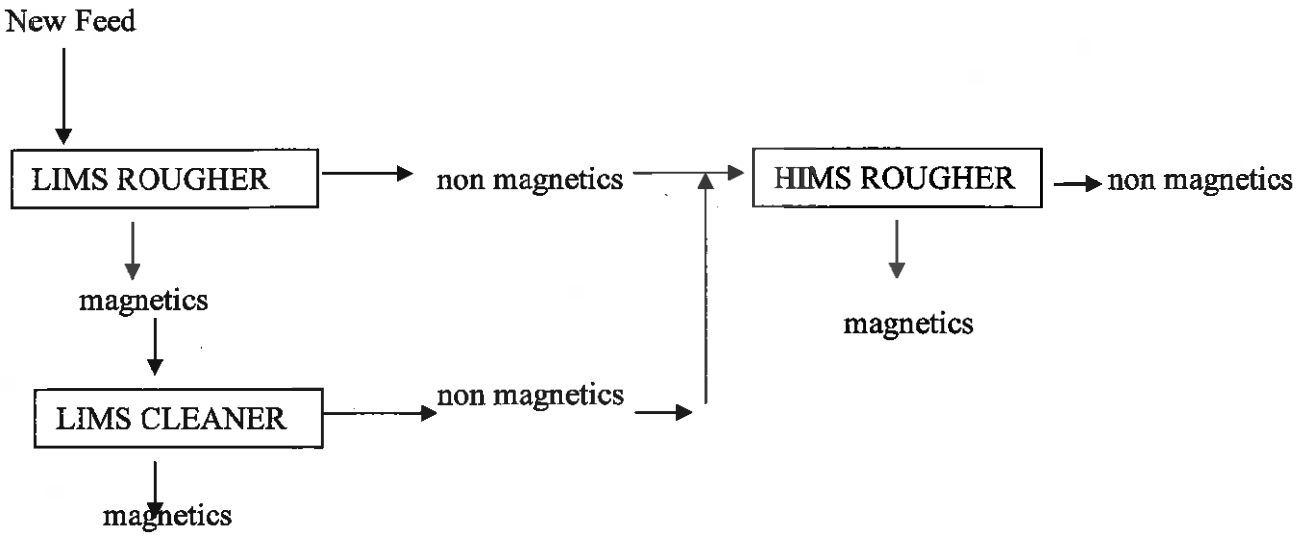
1.7 the % copper recovery from the feed to the cleaner concentrate (3)

**[20]**

Cu – 63.5 Fe – 56 S – 32

Question 2

A magnetic separation plant is treating an ore containing chromite ($FeCr_2O4$), magnetite ($Fe_3O_4$) and dolomite ( $CaMg(CO_3)_2$).
The circuit is as follows:




Use the following information:

LIMS ROUGHER
New Feed – 6.96%Cr
New Feed – 2.5t/hr magnetite
Magnetics – 7.052% Cr
Magnetics – 2.096t/hr Fe
Magnetics – 10t/hr mass
Non-magnetics – 6.937%Cr

HIMS ROUGHER
Magnetics – 8.952 t/hr
Magnetics – 1.94t/hr dolomite
Non-magnetics – no magnetite.

LIMS CLEANER
Magnetics – 38.3% of cleaner feed mass
Magnetics – 1.198t/hr dolomite
Magnetics – contains 95% of magnetite in LIMS Cleaner feed

Calculate:-

2.1 % Fe in new feed (6)

2.2 % Fe in LIMS ROUGHER non magnetics (6)

2.3 % Fe in LIMS CLEANER magnetics (6)

2.4 % Fe in HIMS ROUGHER magnetics (6)

2.5 % Cr in HIMS ROUGHER magnetics (6)

**[30]**

Fe – 55.9 Cr – 52 O-16

Question 3

3.1 What are the roles of collectors, frothers, activators and depressants in flotation. (8)

3.2 For each one, give an example of how they work in sulphide flotation. (12)

**[20]**

Question 4

4.1 Sketch the arrangement of magnets for radial and axial magnets. (8)
4.2 What is each one used for and why? (5)
4.3 Comment on their characteristics (2)

**[15]**

Question 5

5.1 Why are the properties of the solid phase of the medium used in DMS/HMS important?

**[15]**