UNIVERSITY OF JOHANNESBURG

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| **PROGRAM** | : NATIONAL DIPLOMA<br>*EXTRACTION METALLURGY* |
| **SUBJECT** | : **MINERAL PROCESSING III** |
| **CODE** | : **MPR 32 – 1** |
| **DATE** | : WINTER SSA EXAMINATION<br>SEMESTER I<br>16 JULY 2014 |
| **DURATION** | : SESSION 1 (8:00 – 11:00) |
| **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

A sphalerite (ZnS)- quartz ore contains 10%Zn. After crushing it is fed at the rate of 200t/hr to a 5mm screen. The screen undersize contains 15% of the sphalerite in the screen feed at a grade of 14.43%Zn.
The screen oversize is fed to a DMS circuit. 30% of the quartz in the screen feed goes to the floats at an SG of 2.65.
The DMS sinks join the screen undersize to form the flotation feed.
After further crushing and grinding, this stream is floated and a concentrate produced. It has a mass of 30t/hr and contains 90% of the sphalerite in the flotation feed.

Calculate:

1.1 the mass of solids in the flotation feed. (3)

1.2 the % quartz in the screen undersize (3)

1.3 the % Zn in the DMS sinks (4)

1.4 the SG of the dry solids in the DMS sinks (4)

1.5 the %Zn in the flotation concentrate (4)

1.6 the %Zn recovery to the flotation concentrate from the flotation feed (2)

**[20]**

Zn – 65.4 S – 32.1
SG Sphalerite – 4.0 SG Quartz – 2.65

Question 2

An ore consisting of chromite ($FeCr_2O_4$), magnetite ($Fe_3O_4$) and quartz is fed to a magnetic separation circuit at the rate of 100 t/hour solids. The first stage is a low intensity magnetic separator (LIMS) and the magnetics fraction from this unit is fed to a second stage LIMS unit for further upgrading. The non-magnetics from both LIMS units are combined and fed to a wet high intensity magnetic separator (WHIMS).

Based on the following information:-

% Chromite in feed – 20%
% Magnetite in feed – 10%
% Chrome recovery to LIMS 1 magnetics – 5%
% Fe recovery to LIMS 1 magnetics – 60%
Mass of LIMS 1 magnetic fraction – 12.2 tons/hour
% Chromite recovery to LIMS 2 magnetics – 50%
% Magnetite recovery to LIMS 2 magnetics – 98%
% Chromite in LIMS 2 non-magnetics – 29.5%
% Chrome recovery to WHIMS magnetics – 95%

% Magnetite in WHIMS magnetic fraction – 1.03%
Tons Fe in WHIMS non-magnetic fraction – 0.387

Calculate :-

2.1 the % quartz in the LIMS 1 magnetic fraction. (5)

2.2 the % chrome in the LIMS 1 non-magnetic fraction (5)

2.3 the % Fe in the LIMS 2 feed (5)

2.4 the % magnetite in the LIMS 2 non-magnetics fraction (5)

2.5 the % chromite in the WHIMS feed (5)

2.6 the mass of solids in the WHIMS non-magnetic fraction. (5)

**[30]**

Cr – 52 Fe – 56 O – 16

Question 3

3.1 Describe and illustrate the following important terms as they apply to gravity concentration.

(i) Hindered settling (5)
(ii) flowing film concentration (5)
(iii) Consolidation trickling (5)
(iv) Asymmetrical acceleration (5)

**[20]**

Question 4

In the selection of a suitable site for the disposal of residues from a metallurgical operation what areas should you avoid and why? **[20]**

Question 5

5,1 What are the differences between Paramagnetic and Diamagnetic minerals? (4)

5.2 Define:
(i) Magnetic Flux Density
(ii) Magnetic Field Intensity
(iii) Susceptibility (6)

**[10]**