



Faculty of Engineering and the Built Environment/
Department of Metallurgy
DOORNFONTEIN CAMPUS

AND

Faculty of Science
Department of Geology

B.Eng. METALLURGICAL ENGINEERING(Extraction)

Geology Module
(GMESCB2)

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Sick / Special Theory Test 1
31st August 2020
DURATION: 80 MINUTES
Total Marks: 72

1. why is it necessary (1.0 point)

why is it necessary to understand the minerals of an orebody? (1)

- *a. to be able to distinguish between waste and valuable minerals
- b. to discard the ore into tailings
- c. to remove coarse sized particles from fine grained minerals
- d. to extract the waste minerals for the consumer

2. what is the purpose (1.0 point)

what is the purpose of process mineralogy in mineral extraction? (1)

- a. to understand the grade of an ore
- b. to identify mineral
- c. to understand plant processes through a scientific study of crushed ore
- *d. to study the relationships between ore and gangue, their characteristics of minerals and texture, to optimize recovery and selectivity.
- e. liberation of grains from particles.

3. who conducts process (1.0 point)

who conducts process mineralogy? (1)

- a. geologists
- b. metallurgists
- c. plant engineer
- *d. teams of qualified and skilled geologists, samplers, metallurgists, and various experts in the minerals processing industry.

4. comminution is:(1) (1.0 point)

comminution is:(1)

- a. analysing grain size distribution curves
- b. grain size distribution
- *c. is a single- or multistage process whereby ore is reduced from run-of-mine size to that size needed by the beneficiation process
- d. run of mine ore blending

5. why is size reduction important? (1.0 point)
why is size reduction of feed material important? (1)

- a. to enable easier handling of the ore
- *b. It liberates the valuable minerals from the host rock.
- c. it helps to determine how strong the rock is
- d. it helps uranium to float in gold-bearing rocks of the Witwatersrand basin

6. the following are the major processing methods involved in ore dressing/mineral processing. (1)

- a. Size reduction, enrichment, upgrading, materials handling, slurry handling, wear in operation, operation, and environment process systems
- *b. Size reduction, size control, enrichment, upgrading, materials handling, slurry handling, wear in operation, operation, and environment process systems
- c. Size reduction, size control, materials handling, enrichment, upgrading, slurry handling, wear in operation, operation, and environment process systems
- d. Size reduction, size control, enrichment, upgrading, materials handling, slurry handling, wear in operation, and operation process systems

7. give one type of magnetic mineral classification. (1)

- a. pyrrhotite
- b. magnetite
- *c. paramagnetic
- d. hematite

8. what are some of the (1.0 point)
what are some of the mineral separation techniques? (1)

- a. magnetic
- b. gravity
- c. heavy Liquids
- d. the Shaking Table
- *e. all of the above

9. Theoretical mineralo (1.0 point)
Theoretical mineralogy examines? (1)

- a. The potential of the ore for mining.
 - *b. Is primarily concerned with the identification and characterization of minerals.
 - c. Assesses how the ore must be extracted and beneficiated
 - b. Assists with plant design and optimization.
- True or False questions (5)

10. Chemical analysis in (1.0 point)
Chemical analysis indicates the amount of elements present in a mineral powder. (1)

- *a. True
- b. False

11. Secondary minerals a (1.0 point)
Secondary minerals are alteration products of a primary mineral. (1)

- *a. True
- b. False

12. Sometimes minerals w (1.0 point)
Sometimes minerals will have the exact same chemical composition but different physical properties. (1)

- *a. True
- b. False

13. The degree of libera (1.0 point)
The degree of liberation is the percentage of the mineral occurring as free particles in relation to the total amount of that mineral in the ore. (1)

- *a. True
- b. False

14. Run of mine is the same (1.0 point)
Run of mine is the same as recovery. (1)

- a. True
- *b. False

15. Long Question (7.0 points)
list some of the common analysis techniques or tools used in process mineralogy studies. (7)

Correct Answer:

- *a. X Ray diffraction or XRD. (1)
- *b. X Ray Fluorescence spectroscopy or XRF. (1)
- *c. Optical microscopy. (1)
- *d. Qualitative and quantitative Electron Microprobe Analysis or EMPA. (1)
- *e. Scanning Electron Microscopy with Energy Dispersive X Ray Spectrometer and SEM/EDS. (1)
- *f. Automated SEM and equipment such as the QEMSCAN and the Mineral Liberation Analyser or MLA systems. (2)

16. Long Question 2 (4.0 points)
Mineral processing consists of four major steps to concentrate the mineral or metals. List these steps. (4)

Correct Answer:

- *Run of Mine Ore Handling >Comminution >Separation >Product Handling (4)

17. Long Question 3 (9.0 points)
What information does the metallurgist need from the Mineralogist/Geologist? (9)

Correct Answer:

- *a. Identity of the mineral. (1)
- *b. Geochemical data. (1)
- *c. Its composition. (1)
- *d. Best mineral size distribution. (1)
- *e. Modal abundance. (1)
- *f. Locking characteristics. (1)
- *g. Liberation of the economic minerals/ metals. (1)
- *h. significant mineral associations with other minerals and textural characteristics of minerals/ metal. (1)
- *i. Deportment of the economic metal/ element in ore minerals and within the tailings. (1)

18. Long Question 4 (2.0 points)

The geologist and metallurgist collected some representative ore samples from a new potential mine locality. The metallurgical investigation of the potential prospect must be done. The two disciplines require information from each other. List at least two types of mineralogical information required by the metallurgist: (2)

Correct Answer:

- *a. Mineralogical characterisation of ores and tailings. (1)
- *b. Mineral characterisation of products obtained from ore minerals recovered provided by the metallurgists. (1)

19. Long Question 5 (6.0 points)

Name areas where process mineralogy can provide knowledge/understanding to the Metallurgist. (6)

Correct Answer:

- *Existing processing design and design of new operations. (1)
- *lowering the risk in design of new circuits. (1)
- *Aid correction of poor performance of existing flotation and leaching circuits. (1)
- *Optimisation of plant processing operations to accommodate the characteristics of the various extraction principles relative to the nature of ore. (1)
- *Enhance/optimize metallurgical recoveries. (1)
- *Enhanced by the skilled use of the new generation of automated quantitative instrumentation. (1)

20. Long Question 6 (6.0 points)

The concept of recovery and grade is important in extraction metallurgy. Explain this relationship and provide examples. (6)

Correct Answer:

***Recovery** is a fraction of the valuable metal present in the ore that reports to the concentrate. Therefore, the amount of metal in the concentrate divided by the amount of metal in the original feed (1). If the concentrate contains 90% copper, then the recovery is 90%. Usually 80 to 96% is a typical good recovery (1). ***Grade** is the purity of the product. It is the percentage by mass of the metal in the solids (1). The copper grade of a chalcopyrite concentrate will never be more than 34.6% copper and usually is between 55 and 62% (1). Therefore, grade depends on the chemical composition of the ore (1). Grade and recovery are interdependent. If the grade of a product increases, then the recovery drops (1).

21. Long Question 7 (5.0 points)

Name the potential barriers to a successful Process mineralogy study. (5)

Correct Answer:

- *Cost of the information required. (1)
- *Ineffective communication between teams or narrow views of the problems. (1)
- *Non representative or poor sampling. (1)
- *Inappropriate analysis and/or interpretation. (1)
- *Inadequate training and education at all levels. (1)

22. Long Questions (5.0 points)

Define uses of the following: (5)

- a. Process Mineralogy
- b. Geometallurgy
- c. Mineral Processing

Correct Answer:

- *a. Process Mineralogy. *The application of mineralogical information to understanding and solving problems encountered during mineral processing. (2)
- *b. Geometallurgy *quantifies the variability of an ore deposit in terms of processing behavior from blasting, crushing, grinding, liberation to recovery. (2)
- *c. Mineral Processing *is the Production of concentrates from ores. (1)

23. Long Question 8 (7.0 points)

Mineralogy can be divided into two areas of study. Name the branches and explain what is studied in the two branches. (7)

Correct Answer:

- *a. Theoretical Mineralogy (1)
- *Research establishment (1)
- *Identification and characterisation of minerals (1)
- *Examination of the fundamentals of ore formation (1)
- *b. Industrial Mineralogy (1)
- *Assess how ore is to be extracted or beneficiated (1)
- *Guide decision making throughout the process of discovery, evaluation of the deposit, pilot plant studies, plant design, and optimization of the plant. (1)

24. Long Question 9 (7.0 points)

What is an ore mineral and what are primary and secondary minerals? (7)

Correct Answer:

- *Naturally occurring mineral from which one or more metals can be extracted (1)
- *The ore mineral must be present in payable quantities (1)
- *Economic minerals include both ore minerals and industrial minerals (1)
- *Ore minerals occur as metals or as combinations of metals with other elements (1)
- *A primary ore mineral is one that formed at the same time as the enclosing rock (1)
- *A secondary ore mineral is formed later than the rock enclosing it. Secondary ore

minerals are formed as alteration product of the primary mineral. (2)