



**FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT
SCHOOL OF MINING, METALLURGY AND CHEMICAL ENGINEERING
DEPARTMENT OF METALLURGY**

**BACHELOR OF ENGINEERING TECHNOLOGY
FUNDAMENTALS OF METALLURGY (EXTRACTION) (METMTB1)
SECOND SEMESTER FINAL EXAMINATION**

TOTAL MARKS: 100

WEIGHT	:	60
EXAMINER	:	MR. G.U. OKEREAFOR
MODERATOR	:	MS M.S. MADIBA
NUMBER OF PAGES	:	12 PAGES
DATE	:	NOVEMBER 2019
DURATION	:	120 MINUTES
INSTRUCTION	:	ATTEMPT ALL QUESTIONS FROM SECTIONS A & B. PLEASE USE THE MULTIPLE-CHOICE ANSWER SHEET FOR SECTION A.

SECTION A

MULTIPLE CHOICE QUESTIONS

[50 marks]

1. Those features or characteristics of a metal that make it useful and distinctive from all others

- A. Properties
- B. Element
- C. Composition
- D. Fusion

2. That division of metallurgy applying to the extracting, refining, and primary shaping of metals into a useable form

- A. Metal
- B. Structure
- C. Alloy
- D. Process metallurgy

3. Which is the most abundant ferrous metal present in the earth's crust

- A. Aluminium
- B. Iron
- C. Nickel
- D. Cobalt

4. A substance which cannot be broken down into two other substances

- A. Alloy
- B. Element
- C. Fusion
- D. Metallurgy

5. The division of metallurgy that applies to the changes in structure and properties of metals as a result of shaping, fabricating and treating

- A. Physical metallurgy
- B. Process metallurgy
- C. Element
- D. Metal

6. The term used to describe the contents of an alloy in terms of what elements are present and in what amount is known as _____

- A. Fusion

- B. Properties
- C. Composition
- D. Alloy

7. Material having metallic characteristics and made up of two or more elements one of which is a metal

- A. Element
- B. Properties
- C. Fusion
- D. Alloy

8. The amount of a force applied to a material is known as _____

- A. Ductility
- B. Fatigue failure
- C. Load
- D. Parent metal

9. Resistance of a material to force which is tending to deform or fail by crushing is called

- A. Parent metal
- B. Physical property
- C. Compressive strength
- D. Elongation

10. Ability of a material to become permanently deformed without failure is known as ____

- A. Ductility
- B. Brittleness
- C. Compressive strength
- D. Modulus of elasticity

11. The term used in describing the tendency of a material to fail suddenly by breaking, without any permanent deformation of the material before failure is known as _____

- A. Ductility
- B. Load
- C. Brittleness
- D. Elongation

12. The type of metallurgy in which elemental metal is extracted from the mineral in which it is formed is called _____

- A. Extractive metallurgy
- B. Hydrometallurgy
- C. Electrometallurgy
- D. Pyrometallurgy

13. 18 Karat gold contains _____ % gold.

- A. 25
- B. 100
- C. 75
- D. 50

14. Selectively dissolving a metal into solution is called _____.

- A. Smelting
- B. Roasting
- C. Flux
- D. Leaching

15. Processes used to reduce metal ores or to refine metals that are based on the process of electrolysis are _____.

- A. Hydrometallurgy
- B. Pyrometallurgy
- C. Calcination
- D. Electrometallurgy

16. Ore of iron is called

- A. Haematite
- B. Chalcopryrite
- C. Bauxite
- D. Halite

17. Process in which some minerals are converted to oxide by heating in air at temperature below their melting point is called

- A. Roasting
- B. Smelting
- C. Bessemerization
- D. Concentration

18. Ore of silicon is called

- A. Galena
- B. Zinc blende
- C. Cassiterite
- D. Silica

19. Ore of chromium is called

- A. Galena
- B. Zinc blende
- C. Cinnabar
- D. Chromite

20. Metallic compounds that occur naturally are called

- A. Metal oxides
- B. Minerals
- C. Ores
- D. None of these

21. Process in which metal ions are reduced to free metals is called

- A. Roasting
- B. Smelting
- C. Bessemerization
- D. Concentration

22. Ore of lead is called

- A. Galena
- B. Zinc blende
- C. Cinnabar
- D. Chromite

23. The last step of metallurgy is

- A. Crushing, grinding or pulverizing of the ore
- B. Concentration of the ore
- C. Extraction of metal
- D. Refining of metal

24. Ore of sodium is called

- A. Haematite
- B. Chalcopryrite
- C. Bauxite
- D. Halite

25. In magnetic separation, magnets are used to separate

- A. mineral and gangue
- B. metal and mineral
- C. metal and gangue
- D. iron and steel

26. Ore of aluminium is called

- A. Haematite
- B. Chalcopryrite
- C. Bauxite
- D. Halite

27. Process of separating metal from ore is called

- A. magnetic separation
- B. floatation process
- C. metallurgy
- D. cyclone separation

28. Process in which mineral is separated from gangue by some physical method is called

- A. Crushing, grinding or pulverizing of the ore
- B. Concentration of the ore
- C. Extraction of metal
- D. Refining of metal

29. Ore of zinc is called

- A. Galena
- B. Zinc blende
- C. Cinnabar
- D. Chromite

30. Ore of tin is called

- A. Galena
- B. Zinc blende
- C. Cassiterite
- D. Silica

31. The second step of metallurgy is

- A. Crushing, grinding or pulverizing of the ore
- B. Concentration of the ore
- C. Extraction of metal
- D. Refining of metal

32. Smelting is defined as the

- A. reduction of metal oxides
- B. oxidation of minerals
- C. oxidation of metals
- D. melting of metals

33. The third step of metallurgy is

- A. Crushing, grinding or pulverizing of the ore
- B. Concentration of the ore
- C. Extraction of metal
- D. Refining of metal

34. Ore of mercury is called

- A. Galena
- B. Zinc blende
- C. Cinnabar
- D. Chromite

35. Ore of copper is called

- A. Haematite
- B. Chalcopryrite
- C. Bauxite
- D. Halite

36. A solid deposit containing a sufficiently high percentage of a mineral to make extraction of metal economically feasible is called

- A. Metal oxide
- B. Gangue
- C. Ore
- D. None of these

37. The first step of metallurgy is

- A. Crushing, grinding or pulverizing of the ore
- B. Concentration of the ore
- C. Extraction of metal
- D. Refining of metal

38. What is the charge on the copper ion in the mineral azurite, $\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$?

- A. 2+
- B. 1+
- C. 1-
- D. 2-

39. Some metals are found in the uncombined free state while other metals are found in the combined state. What is a deciding factor?

- A. Metals with negative reduction potentials can occur in the free state while metals with positive reduction potentials occur in the combined state.
- B. The active metals can occur in the free state while the less active metals occur in the combined state.
- C. Metals with positive reduction potentials can occur in the free state while metals with negative reduction potentials can occur in the combined state.
- D. There is no way we can predict which metals will be free or combined.

40. Soluble metal compounds tend to be found in the _____, whereas insoluble metal compounds tend to be found in the _____ .

- A. oceans; earth's crust
- B. earth's crust; oceans
- C. oceans; salt beds
- D. rivers; oceans

41. In the process known as 'roasting,' a(n) _____ is chemically converted to a(n) _____.

- A. sulfide; oxide
- B. hydroxide; oxide
- C. oxide; sulfate
- D. phosphate; phosphide

42. The range of energy efficiencies in comminution in Mining and Processing:

- A. Is improving each year with the development of new technologies.
- B. Is extremely low with most energy being emitted as low-quality waste heat
- C. Increases as particle size decreases
- D. Is measured in terms of Bond Work Index

43. Mesh size is a direct measure of:

- A. Number of openings per square inch of the screen
- B. The inverse linear dimension of the opening in microns
- C. How close the particles are being perfect cubes
- D. Number of openings per linear inch of the screen

44. Classification in a SAG-milling is done using:

- A. Rake classifiers
- B. Spiral classifiers
- C. Screens
- D. Bowel classifiers

45. Classification in a ball-milling circuit may be done using:

- A. Spiral separators
- B. Cyclones
- C. Cone separators
- D. a, b or c

46. Which one of the following is not an ore of aluminium?

- A. Bauxite
- B. Corundum
- C. Epsomite
- D. Cryolite

47. Hematite ore is concentrated by

- A. Gravity separation method
- B. Froth floatation
- C. Amalgamation
- D. Hand picking

48. Which one of the following process has the objective of Selective dissolution of metal.

- A. Cementation
- B. Leaching
- C. Converting
- D. Roasting

49. Flash smelting is used to produce

- A. Copper
- B. Lead
- C. Tungsten
- D. Aluminium

50. Which one of the following minerals is a source of Lead?

- A. Pyrolusite
- B. Malachite
- C. Calomel
- D. Cerussite

SECTION B.

ATTEMPT ALL QUESTIONS [50 marks]

Question 1

- 1.1. After the ore has been crushed, grounded and classified. Concentration of minerals take place and there are difference techniques that are employed. Name five and explain each concentration techniques that are used in mineral processing **[10 marks]**
- 1.2. What are the main purposes of screening in mineral processing? **[4 marks]**
- 1.3. Dewatering is the separation of water and solids at larger scale, further name three dewatering techniques and explain them. **[6 marks]**

Question 2

After, ore handling is the stage that occur before comminution in mineral processing. With the aid of the figure below,

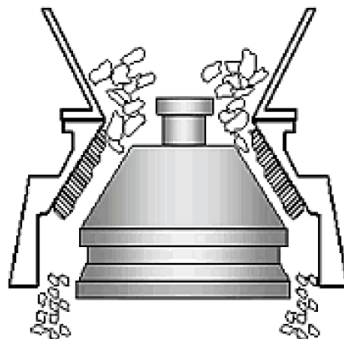


Figure 1

- 2.1 What is the name of the equipment in figure 1 **[2 marks]**
- 2.2 Is it primary or secondary crusher? **[1 mark]**
- 2.3 What is the name of the primary crusher similar to this unit equipment **[2 marks]**
- 2.4 Briefly explain the principles of the unit process in figure 1 **[10 marks]**
- 2.5 As a young metallurgist, outline 6 major reasons why you will recommend a wet grinding process to dry grinding. **[5 marks]**

Question 3

3.1. Name and explain four leaching techniques that are used in hydrometallurgy processing.

[8 marks]

3.2. In leaching, by using a suitable liquid reagent the metallic values in an ore are selectively dissolved. Selective dissolution depends upon the nature of reagent. Further list 4 factors that affects the rate of leaching.

[2 marks]