Main exam & memo

UNIVERSITY OF JOHANNESBURG

PROGRAM	BACHELOR OF ENG -TECHNOLOGY *EXTRACTION METALLURGY*
SUBJECT	**INDUSTRIAL MINERALS 4**
CODE	**INMMTB3**
DATE	NOVEMBER EXAMINATION
DURATION	(SESSION 1) 08:30 - 11:30
WEIGHT	40 : 60
TOTAL MARKS	100

ASSESSOR	MS MAPILANE MADIBA
MODERATOR	MR. OSCAR CHAUKE
NUMBER OF PAGES	4 PAGES AND A 2-PAGE ANNEXURE

INSTRUCTIONS

- First read carefully through all questions; only then
- Answer all questions in any sequence – but
- Please start answering each question on a new page
- Finally: Check whether an answer makes sense; is the result likely?

QUESTION 1 [16]

Magnesite

Magnesium alloys are desirable for use in manufacturing cars or aeroplanes because they have specific properties. Name eight (8) of them and explain why they are desirable.

QUESTION 2 [20]

Limestone

2.1 Draw the limestone flowchart process used by >90% of the industry excluding aggregates. (15)

2.2 What are five factors limestone consumption depends on? (5)

QUESTION 3 [14]

Vermiculite

3.1 What is a definition of industrial minerals? (2)

3.2 What is vermiculite and what is exfoliated vermiculite? What is the latter used for? (8)

3.3 What are two micas of established commercial value in South Africa? (4)

QUESTION 4 [20]

Manganese

4.1 Explain the cuprion ammoniacal leach process for manganese production. (10)

4.2 If you were to produce Mn via silicothermic process, how would you go about? (10)

QUESTION 5 **[15]**

Chromite

Explain how the beneficiation of chromite ore is conducted. Be more specific.

QUESTION 6 **[15]**

Magnesium

If you were to use the Dow process to produce magnesium from the sea, how would go about it?

TOTAL = 100

Annexure

Industrial minerals memo- Main Exam 2019

Question 1

Magnesite

Magnesium alloys are desirable for use in manufacturing cars or aeroplanes because they have specific properties. Name eight (8) of them and explain why they are desirable.

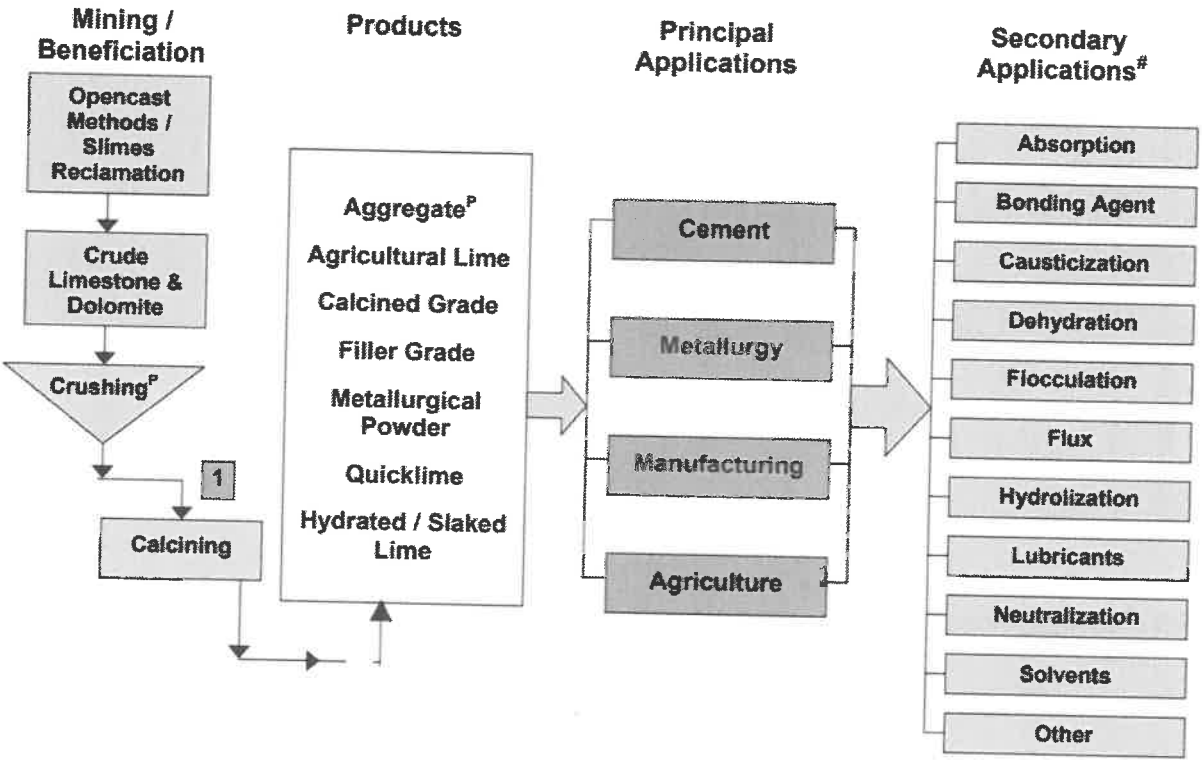
1. Can be anodized , painted, electroplated, or plated with electro nickel, gives excellent corrosion resistance.
2. Excellent dent resistance, keeps appearance of cars.
3. Excellent compatibility with alkalis, corrosion resistance, where salt is used on the road.
4. Low galling tendency, resists fungal growth. Appearance remains good.
5. Excellent damping capacity, absorbs vibration in air craft and cars.
6. Excellent electrical conductivity per unit weight, light wiring in air craft.
7. Low tendency to spark, safe around aircraft fuel.
8. Less tendency to cause wear on cables, ropes belts e.g important n aircraft.
9. Non sticking with snow, ice, sand etc. aeroplane wings will remain clear.
10. Non-magnetic, will not affect instruments on aircraft.

[16]

QUESTION 2

Limestone

2.1 Draw the limestone flowchart process used by >90% of the industry excluding aggregates. **(15)**



2.2 What are five factors limestone consumption depends on? **(5)**

- The type of product,
- Limestone purity,
- Degree of calcining,
- Water temperature,
- and the quantity of waste products.

[20]

QUESTION 3

Vermiculite

3.1 What is a definition of industrial minerals? **(2)**

Industrial minerals are naturally occurring non-metallic Earth materials that are used in a variety of industrial operations.

3.2 What is vermiculite and what is exfoliated vermiculite? What is the latter used for? **(8)**

Vermiculite is a natural mineral that expands with the application of heat.

Exfoliated vermiculite is the expanded vermiculite and it is usually used in purpose-designed commercial furnaces.

3.3 What are two micas of established commercial value in South Africa?

(4)

Muscovite and phlogopite-muscovite

[14]

QUESTION 4

4.1 **Explain the cuprion ammoniacal leach process for manganese production.**

Manganese dioxide is reduced in an aqueous ammoniacal solution containing an excess of copper (I) ion at 50^0C. The cobalt, nickel and copper are solubilised in an aqueous solution of ammonia and carbon dioxide at 50^0C and atmospheric pressure. The separation and purification of the metals is identical Carbon gas reduction process. (10)

4.2 **If you were to produce Mn via silicothermic process, how would you go about?**

The production of manganese by silicothermic reduction resembles that of low-carbon ferromanganese in electric arc furnace of 1 -3MW power consumption. The raw material used is either low-iron ore or manganese slag concentrate. The silicon is in the form of special silico-manganese with ca.33% Si and < 3% Fe. It is made from a manganese slag concentrate or from pure ore. Reduction as complete as possible is ensured by the addition of lime which forms a basic slag. Many slag changes are carried out during the process as in the silicothermic manufacture of low-carbon ferromanganese. The refined metal has the following typical composition:

93 – 97% Mn

< 0.1% C

1.5 % Si

< 0.06% P

The system is moderately efficient and the manganese yield is 63 – 64% with slag losses accounting for the remainder. (10

[20]

QUESTION 5

Explain how the beneficiation of chromite ore is conducted. Be more specific.

Gravity separation technique are the principle method used. Hand-sorting for lumpy chromite is still used. When dense media separation is employed, the 'Snail' type unit has found favored. The principle units used are spiral concentrators. Flotation of the fine chromite has not at present successful due to environmental aspects. The reagents required, such as fluorides have to be completely contained which requires any slimes dams having no run off or seepage underground. (15)

Question 6

If you were to use the DOW process to produce magnesium from the sea, how would you go about it?

Partly dehydrated magnesium chloride can be obtained by the Dow process, in which seawater is mixed in a flocculator with lightly burned reactive dolomite. An insoluble magnesium hydroxide precipitates to the bottom of a settling tank, whence it is pumped as a slurry, filtered, converted to magnesium chloride by reaction with hydrochloric acid and dried in a series of evaporation steps to 25 percent water content. Final dehydration takes place during smelting.