MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE, APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PHYSICAL AND BIOLOGICAL SCIENCES

UNIVERSITY ORDINARY EXAMINATION

2021/2022 ACADEMIC YEAR

THIRD YEAR **FIRST** SEMESTER EXAMINATION FOR, BACHELOR OF INDUSTRIAL CHEMISTRY

ACH 318: BASIC INDUSTRIAL CHEMICALS

DURATION: 2 HOURS

Instructions to candidates:

1. Answer question **one** and **any other two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) A slag is formed during the reduction of iron ore. Briefly explain the importance of the slag. (3 marks)

b) Sulphur is an important raw material used during the manufacture of sulphuric acid. Using a sketch explain how sulphur using the frasch process. (5 marks)

c) Briefly discuss one negative impact of fertilizers on the environment. (4 marks)

d) Caustic soda is manufactured in mercury cell
   (i) Write chemical equations showing the reactions that occur at the anode and cathode (2 marks)

   (ii) Explain how the caustic soda is formed from the products of the reactions in (i) above. (1 mark)

   (iii) Identify one risk of using the mercury cell. (1 mark)

e) Suggest the raw materials used in the manufacture of
   i) Portland cement (2 marks)
   ii) Lead glass (1 ½ marks)
   iii) Ammonium phosphate (1 ½ marks)

f) Hydrometallurgy is used in the extraction of gold. Identify three advantages of the method. (3 marks)

g) Briefly discuss
   i) Magnetic separation (3 marks)
   ii) Smelting (3 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

2. A chemist suspected that some soil contained $CuFeS_2$ which is a source of copper.
   i. The chemist needed to determine the levels of copper in the soil, suggest an analytical technique that would be used to determine both the percentage of copper and the mineral present. (2 marks)
   ii. It found that the soil contains the mineral $CuFeS_2$. Describe a method that would be used to concentrate the ore. (5 marks)

iii. Using chemical equations. Explain how the ore would be reduced to obtain blister copper. (5 marks)

iv. A major use of copper in transmission of electric current. State two properties of copper that make it useful for transmission of current. (2 marks)

v. Copper is purified through electrolysis. Using a diagram, explain the purification process and write all the chemical equations involved. (4 marks)

b) Suggest two ores of titanium. (2 marks)

QUESTION THREE (20 MARKS)

3. a). Fertilizers are required for provision of certain minerals in the soil. However, not all nitrogen containing compound is a fertilizer. Suggest criteria that may be used to qualify a nitrogen containing compound as a fertilizer. (6 marks)

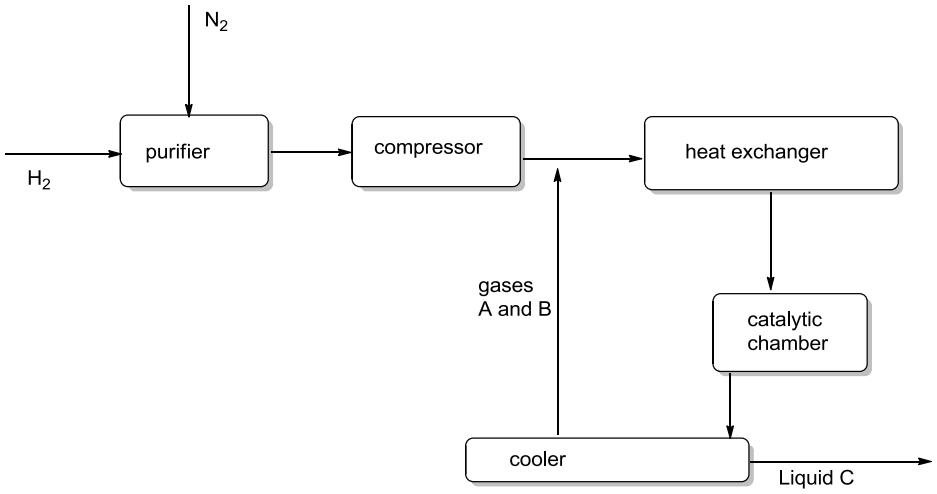
b). Urea is an important nitrogeuom fertilizer who's formula is NH_2CONH_2.

i. Determine its % of nitrogen. (2 marks)

ii. The manufacture of urea is a two step process. Write the two chemical equations involved with NH_3 and CO_2 as starting materials. (2 marks)

iii. Briefly explain how urea is converted into nitrates when applied to the soil. (4 marks)

c) The chart below shows the process of making ammonia.



i. Identify the gases marked A, B, and C. (3 marks)
ii. Suggest two compounds used to catalyse the reaction in the catalytic chamber. (2 marks)
iii. State another use of hydrogen gas apart from the one above. (1 mark)

QUESTION FOUR (20 MARKS)

4. a) Discuss the processes below giving the chemical reactions involved and conditions required.

i) Manufacture of chlorine using the Diaphram electrolytic process. (10 marks)

ii) Manufacture of nitric acid using the ostwald's process. (10 marks)