

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
END OF SEMESTER EXAMINATIONS – DECEMBER 2002
INORGANIC INDUSTRIAL CHEMISTRY I – SCH 2114
TIME – (3) THREE HOURS

INSTRUCTIONS TO CANDIDATES

Answer **ALL** questions from Section A and **ANY THREE** questions from Section B.
Each question in every Section carries 20 marks.

SECTION A (Answer all questions. Each question carries 20 marks)

1.
 - (a) Name **three (3)** gases that can be produced via the cryogenic manufacturing method. (3 marks)
 - (b) State the boiling points of these three gases. (3 marks)
 - (c) List **three (3)** industrial applications of any two of the gases you have mentioned. (3 marks)
 - (d) What is an **on-site** gas plant? Give one example of such a plant in Zimbabwe. (4 marks)
 - (e) State the fundamental principles in the cryogenic manufacture of industrial gases. (4 marks)
 - (f) Name **three (3)** catalysts employed in the manufacture of Hydrogen. For each indicate the area of application. (3 marks)

2.
 - (a) What is **clinker** in cement manufacturing? (2 marks)
 - (b) Briefly describe the **calcining process** indicating chemical reactions that take place. (6 marks)
 - (c) Why is gypsum added to cement? (2 marks)
 - (d) Identify **five (5)** groups of ceramic products in terms of their application. (5 marks)
 - (e) What is **mullite**? Support your answer with a chemical conversion reaction upon heating of kaolinite. (5 marks)

SECTION B (Answer any three questions. Each question carries 20 marks)

1. (a) What is "**Dry Ice**"? Explain, with the aid of a process flow chart, how "dry ice" can be produced from coal, sugar or fuel oil. (10 marks)
- (b) List **ten (10)** industrial uses of Nitrogen. (10 marks)
2. (a) With the aid of a schematic diagram describe the Sulphur mining process. (10 marks)
- (b) List **five (5)** possible chemical reactions of the tail gas scrubbing of Sulphur Dioxide in the manufacture of Sulphuric Acid. (10 marks)
3. (a) Compare and contrast the **Wet-Process** and the **Electric-Furnace** manufacturing methods of Phosphoric acid. (16 marks)
- (b) List the uses of phosphoric acid. (4 marks)
4. In the manufacture of Ammonium Nitrate, both Ammonia and Nitric Acid are used as raw materials.
- (a) Briefly describe how you would obtain sufficient quantities of these raw materials to produce commercially viable amounts of the Nitrate. (10 marks)
- (b) How would you granulate the nitrate product? (3 marks)
- (c) Write **two (2)** reactions that occur during the manufacture of urea. (4 marks)
- (d) What problems are likely to be encountered in a urea manufacturing plant? (3 marks)
5. Describe the manufacture and uses of **any four (4)** of the following materials:
- (a) Cermets
(b) Vitreous enamel
(c) Corundum
(d) Forsterite
(e) Porcelain
(f) Glass-ceramic (20 marks)

END OF QUESTION PAPER!!!