



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
BACHELOR OF SCIENCE HONOURS DEGREE
END OF FIRST SEMESTER EXAMINATIONS – APRIL/MAY 2009
INDUSTRIAL INORGANIC CHEMISTRY I – SCH 2114
TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES

Answer **Any four (4)** questions from the **five (5)** questions provided. Each question carries 25 marks.

Start your answers on a new page.

1. a) With the aid of the diagram of the double-column rectifier explain precisely how nitrogen and oxygen separate. (8 marks)
- b) Compare and contrast, in three ways, the Steam-Hydrocarbon Reformation and the Partial Hydrocarbon Oxidation Processes. (6 marks)
- c) Which of the two processes in (b), above, would you select for rocket-fuel hydrogen? Give reasons for your answer. (4 marks)
- d) Complete the following table:

Property	Argon	Helium	N ₂
Boiling Point (K)	87.27		77.35
	150.8	6.1	128.54
Reactivity	Inert	inert	
% in Air		0.0005	78.08
In steel Production	Purging gas		Purging gas
Source		Natural gas	Air
Method of production	Cryogenic		cryogenic

(7 marks)

2. a) Explain the method of raw material preparation at the Sulphuric Acid Plant at Zimphos, Harare. (6 marks)
- b) Using two chemical equations, illustrate how S is extracted from fuel gas. (4 marks)
- c) Sulphuric acid is used to produce Sulphates of Ammonia and Aluminium among other applications. Show the chemical equations of the reactions, stating the strength of the acid used in each case. (6 marks)

- d) Describe two methods of pollution control at Zimphos' sulphuric acid plant. Explain the shortcomings of these methods and suggest areas of improvement. (8 marks)
- e) What is the concentration of 60 Be⁰ acid? (1 mark)
3. a) Write the chemical formulae of the basic ceramic raw materials. (3 marks)
- b) What is a glaze? (2 marks)
- c) Name three glaze opacifiers and explain the opacifying action. (6 marks)
- d) Write the reaction of kaolinisation of feldspar. (2 marks)
- e) Explain, with illustrations, the method of forming of i) cups ii) porcelain iii) basins iv) and v) bricks. (8 marks)
- d) Explain how you would measure the following ceramic properties; i) compression strength ii) fracture toughness (4 marks)
4. a) Write the average chemical composition of the basic clinker materials at Colleen Bawn. (4 marks)
- b) What property of cement results from: i) Alite ii) Belite iii) Aluminate (6 marks)
- c) With the aid of a cement kiln sketch explain the various chemical processes of clinker formation. (7 marks)
- d) What are the four control parameters of the raw mill at Colleen Bawn. For each explain the method of measurement. (8 marks)
5. Explain the following;
- a) Pyrolysis of natural gas (4 marks)
- b) On-site gas plant (4 marks)
- c) Digestion of fluorapatite (4 marks)
- d) Joule-Thompson Effect (4 marks)
- d) Mullitisation (4 marks)
- c) clinkerisation (5 marks)

End of question Paper!!!