



**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**DEPARTMENT OF APPLIED CHEMISTRY**  
**BACHELOR OF SCIENCE HONOURS DEGREE**  
**END OF FIRST SEMESTER EXAMINATIONS – JANUARY 2013**  
**INDUSTRIAL INORGANIC CHEMISTRY I – SCH 2114**  
**TIME: 3 HOURS**

**INSTRUCTIONS TO CANDIDATES**

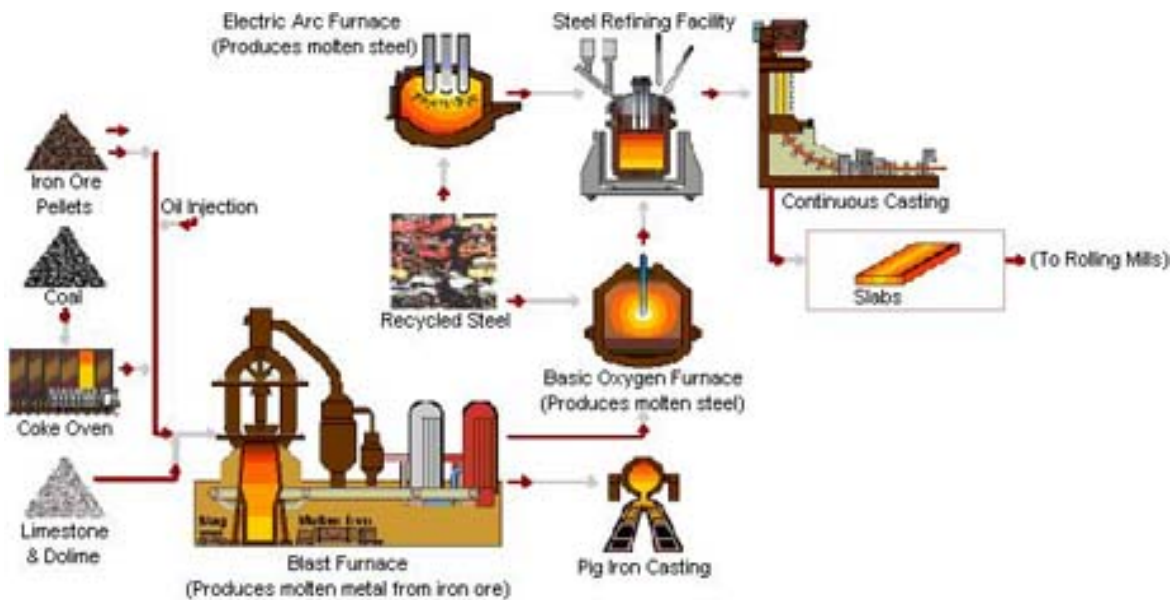
Answer ***any four*** questions from the five provided. Start your answers to different questions on new pages. Each question carries 25 marks.

1. (a) Copy and complete the following table:

Name of gas	Bp (K)	T <sub>cr</sub> (K)	Method of manufacture	Main catalyst used	Application
Hydrogen		13.19			Spacecraft
	90.19		Cryogenic air separation		Steel making
Helium		5.2	Cryogenic separation of NG	Platinum	
Nitrous Oxide	88.5	126.19			Anaesthesia
Sulphur trioxide	317.8	490		V <sub>2</sub> O <sub>5</sub>	
Ammonia		405.4			Fertilizer
Carbon Dioxide	304		Fermentation of sugars, synthesis of ammonia		
	294.1	430.8		Co <sub>3</sub> O <sub>4</sub>	Nitric acid production

(20 marks)

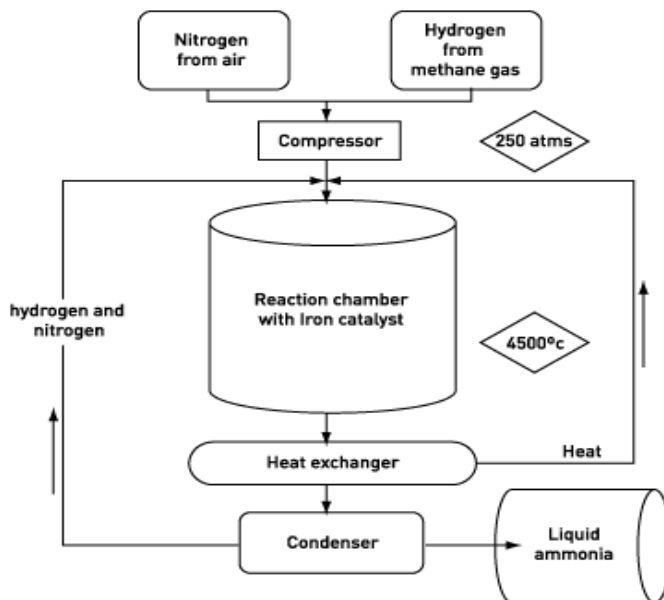
- (b) During conversion of SO<sub>2</sub> to SO<sub>3</sub> it is important to control Temperature and Pressure. Give reasons why these parameters need strict control.  
(5 marks)
2. Study the process shown by the flowchart below and answer the following questions.



- Write a summary of the process (6 marks)
- Identify the areas in the process requiring use of industrial gases (name the gases). (4 marks)
- Explain how the industrial gases are used to enrich the quality of the process and/or product (10 marks)
- Draw a flowchart illustrating the Girbotol Process (5 marks)

3. Study the process flow chart for the manufacture of ammonia and answer the questions that follow:

**The Haber Process for Manufacturing Ammonia**



- a) Identify process conditions that are at variance with the normal Haber process and explain why you think they are incorrect. (6 marks)
- b) Explain what you understand by HT Shift and LT Shift in the manufacture of hydrogen from methane gas. (10 marks)
- c) Explain 3 hazards in a sulphur mine and suggest ways of minimizing the effects of these hazards (9 marks)
4. (a) Draw a labelled diagram of a furnace you can use to manufacture phosphorus. (8 marks)
- (b) Show the areas that require ceramic insulating material in the furnace you have drawn. Explain your choice for each material (8 marks)
- (c) Name four (4) categories of materials used in dental porcelain compositions. (4 marks)
- (d) Use a sketch to demonstrate the process of blow moulding of glass. (5 marks)
5. (a) Write short notes on the following:
- Nanotechnology
  - Vitrous enamel
  - Bright annealing
  - Glass hardening
  - Flame weeding
- (25 marks)

*End of question Paper!!!*