

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**DEPARTMENT OF APPLIED CHEMISTRY**  
**BACHELOR OF SCIENCE HONOURS DEGREE**  
**END OF SECOND SEMESTER EXAMINATIONS – AUGUST 2009**  
**INDUSTRIAL ORGANIC CHEMISTRY I – SCH 2215**  
**TIME: 3 HOURS**

**INSTRUCTIONS TO CANDIDATES**

Answer **ANY FOUR (4)** questions from the **FIVE (5)** provided. Each question carries 25 marks. Start your answer to each question on a new page.

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1. a) With the aid of the diagram of the coke oven explain the importance of the following parameters indicating the practical methods of their measurement in a coke plant:
- temperature (4marks)
  - pressure (4marks)
  - coal level (4marks)
  - bulk density (4marks)
  - volatile content (4marks)
- b) Explain why metallurgical coke is spongy and lumpy. (3marks)
- c) Name the machine used to mine coal at Hwange. (2marks)
2. Read the following passage and answer the questions that follow. Illustrate your answers with appropriate diagrams and/sketches.

During the spring of 1866, a series of accidents occurred during shipping and storage of blasting oil, which generated much negative publicity. Nobel understood that he had to find a way of blending nitroglycerine with an absorbent material so that it could be handled and transported safely. He tested and tested: black powder, charcoal powder, wood flour, sawdust and cements. But the results were unacceptable. Then he happened to mix nitroglycerine with a highly absorbent sand known in Germany as *kieselguhr* (diatomaceous earth) and the mixture became a soft pliable material, like dough. Nobel succeeded in detonating the mixture with his initial blasting cap.

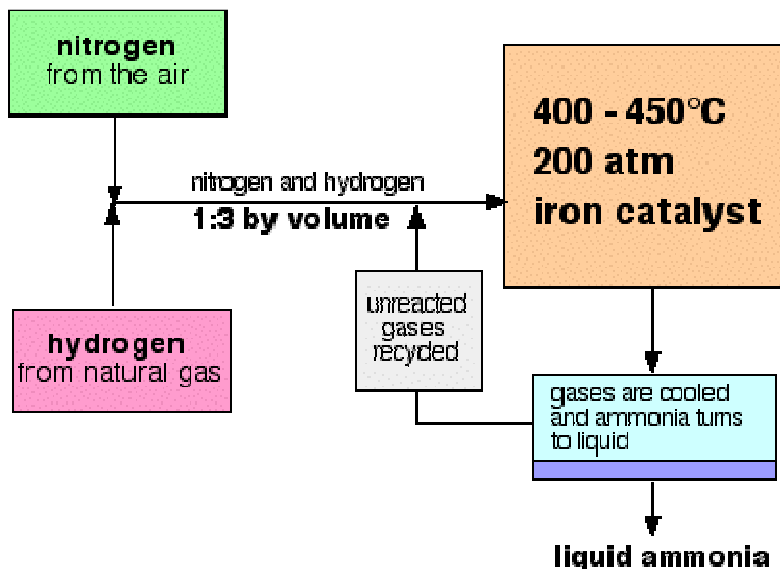


### Nobel's Extra-Dynamite.

At last he had a safe explosive, which he called dynamite. It was patented in Sweden in 1867. Dynamite was Alfred Nobel's answer to safety demands. Production started immediately at Vinterviken. Two types of dynamite were manufactured: No. 1 with 75 percent nitroglycerine, and No. 2 with 64 percent. Demand was immediate and grew rapidly. Nitroglycerin Aktiebolaget heeded Nobel's directive to develop dynamite even further. The products were improved, and sales increased. Blasting gelatine, patented in 1876, was introduced, followed later by [Extra-Dynamite](#).

- a) What name would you give to 'blasting oil'? Also write the chemical formula of the compound? (3marks)
- b) Describe the steps that you think Alfred Nobel undertook to convert the blasting oil to a safe explosive. Use a process flow chart to support your answer. (8marks)
- c) Describe the propulsion system of either i) the American cruise missile or ii) the Russian scud missile (5marks)
- d) **Amatol** is a highly [explosive material](#). Typically, Amatol was used as an [explosive](#) in military weapons such as aircraft [bombs](#), [shells](#), [depth charges](#) and [naval mines](#).
  - i) Explain how this explosive is manufactured. (7marks)
  - ii) Why has the use of this explosive been discontinued? (2marks)

3.



- Identify and justify 5 operating conditions for the process represented by the flow-chart above. (10marks)
- Explain two difficulties likely to be encountered in a urea manufacturing plant. (4marks)
- Name two uses of ethanolamine (2marks)
- How is Ammonium Nitrate stabilized at Sable Chemicals? (5marks)
- List 4 difficulties that are experienced at Sable Chemicals during the manufacture of  $\text{NH}_4\text{NO}_3$  (4marks)

4. Chemicals derived from wood include: bark products, cellulose, cellulose [esters](#), cellulose ethers, [charcoal](#), dimethyl [sulfoxide](#), ethyl alcohol, fatty acids, [furfural](#), hemicellulose extracts, [kraft](#) lignin, [lignin](#) sulfonates, pine oil, rayons, [rosin](#), sugars, tall oil, [turpentine](#), and vanillin.

- Select any five(5) of the above and provide the following information;
  - chemical properties
  - production methods
  - uses
 (25marks)

5. Using relevant illustrations, discuss the following:

- Thermo-mechanical pulping (5marks)
- Sizing (5marks)
- Composite paper (5marks)
- Friedel-crafts (5marks)
- Halogenations (5marks)

*End of question Paper!!!*