



**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**DEPARTMENT OF APPLIED CHEMISTRY**  
**BACHELOR OF SCIENCE HONOURS DEGREE**  
**END OF SECOND SEMESTER EXAMINATIONS – MAY 2011**  
**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.

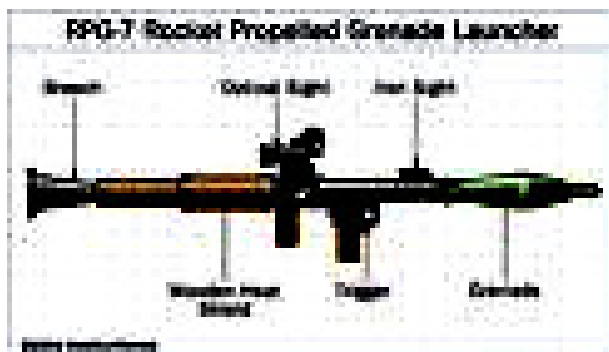
Start your answers to each question on a new page.

1. Study the picture shown below and answer the questions that follow:



Product A (Left) and Product B (Right)

- a) Identify and name the products. (2 marks)
- b) Compare five characteristics of the products. (10 marks)
- c) Draw a detailed process flow chart for the manufacture of benzene from any one of the products shown (13 marks)
2. Study the following picture and accompanying text and answer the questions that follow:



The **RPG-7** ([Russian](#) ППГ-7) is a widely-produced, portable, [shoulder-launched](#), [anti-tank rocket-propelled grenade](#) launcher. Originally the RPG-7 (Ручной, *Ruchnoy* [*Hand-held*] Противотанковый, *Protivotankovyy* [*Anti-Tank*] Гранатомёт, *Granatomyot* [*Grenade Launcher*]) and its predecessor, the [RPG-2](#), were designed by the [Soviet Union](#), and now manufactured by the [Bazalt](#) company. The weapon has the [GRAU](#) index **6G3**.

The ruggedness, simplicity, low cost, and effectiveness of the RPG-7 has made it the most widely used anti-tank weapon in the world. Currently around 40 countries use the weapon, and it is manufactured in a number of [variants](#) by nine countries. It is also popular with [irregular](#) and [guerrilla forces](#). The RPG has been used in almost all conflicts across all continents since the mid-1960s from the [Vietnam War](#) to the present day [War in Afghanistan](#). For high effectiveness to amour the warhead comprises thermobaric explosives or "fuel-air bomb".

a) Suggest the most appropriate explosive system of the RPG-7 giving reasons for your selection. (10 marks)

b) Draw the structures of the following explosives:

- RDX
- HMX
- PETN (9 marks)

For each indicate:

- The area of application
- Explosive Energy (6 marks)

3. Identify three wood species from the NUST forest and answer the following questions:

a) Name the wood species (scientific and indigenous names) (6 marks)

b) Categorize the wood according to:

- i) cellulose fibre size,
- ii) type of extractives and iii) area of commercial application (9 marks)

- c) Explain how three valuable extractives can be obtained from each of the wood species. (9 marks)
- d) Explain the tub-sizing in pulp and paper manufacturing (1 mark)
- 4.
- a) Draw the process-flow chart for black liquor fortification in the sulphate pulping process. (8 marks)
- b) What causes the characteristic foul odour in a sulphate pulping plant? Support your answer with chemical structure(s). (4 marks)
- c) Name two uses of tall oil (2 marks)
- d) Write down three chemical reaction equations during the sulphite pulping process (6 marks)
- e) Name five process control variables in the sulphite pulping reactor (5 marks)
5. a) Draw a schematic diagram of the nitrator used in the nitration of benzene to nitrobenzene. (4 marks)
- b) Explain three functions of sulphuric acid in the nitration process (use reaction equations) (6 marks)
- c) Name four constituents of the acid tar from benzene acid washing. How would you characterize these constituents? (12 marks)
- d) Name three uses of wood lignin (3 marks)

..... *THE END* .....