



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
BACHELOR OF SCIENCE HONOURS DEGREE
END OF SECOND SEMESTER EXAMINATIONS – MAY 2014
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. This Paper comprises 2 printed pages.

1. a) With the aid of process flow charts, explain the route followed in the manufacture of the following products from coal:
 - benzene
 - carbon black
 - vinyl
 - metallurgical coke
 - Ammonium sulphate (25 marks)

2. You are a process chemist at Chochoma Coal Works. Upon analysis of the flue gas from the coke oven batteries you notice a sudden increase in the concentration of CH₄ and homologs and sharp drop in H₂ content.
 - a) Design a troubleshooting checklist for the oven operation. (8 marks)
 - b) What corrective action will you propose to the plant manager? (4 marks)
 - c) Show the composition of the flue gas expected from a properly functioning oven producing high quality metallurgical coke. (8 marks)
 - d) With a chemical equation illustrate the process of aromatization of n-Heptane (5 marks)

3. You are given the following statistics on explosives;

Where:

 - ΔE_f - Heat of formation
 - CO, CO₂ and H₂O are assumed to be in gaseous form.
 - ΔE_f for N₂, H₂, O₂ and all other elements are all zero.

Name	Formula	MW (g/mol)	ΔE_f (kJ/mol)
	CO	28	-111.8
	CO ₂	44	-393.5
	H ₂ O	18	-240.6
Nitroglycerin	C ₃ H ₅ N ₃ O ₉	227	-333.66
RDX	C ₃ H ₆ N ₆ O ₆	222	+83.82
HMX	C ₄ H ₈ N ₈ O ₈	296	+104.77
PETN	C ₅ H ₈ N ₄ O ₁₂	316	-514.63
TNT	C ₇ H ₅ N ₃ O ₆	227	-54.39
TETRYL	C ₇ H ₅ N ₅ O ₈	287	+38.91

- a) Calculate the heat of explosion of 1kg of each explosive. (14 marks)
- b) Which explosive would you select among those shown in the table to demolish a steel-reinforced masonry structure? Explain your answer. (4 marks)
- c) Use a sketch to explain a High explosive train. (3 marks)
- d) Explain the mechanism of toxicity of the weapon whose structure is shown below; (4 marks)



4. a) Identify wood extractives used in the following processes. Explain their use. (21 marks)
- Rock drilling
 - Paper sizing
 - Tablet coating
 - Solvent
 - Bactericide
 - Candle making
 - Dietary supplement
- b) Draw the structure of a nitrocellulose molecule (4 marks)
5. Using process flow diagrams and examples explain any *five* of the following processes (25 marks)
- Calendering
 - Wood hydrolysis
 - Rocket propulsion
 - Fractional distillation
 - Sulphite pulping
 - Cellulose beating
 - Benzene acid washing

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