NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF SCIENCE, MATHEMATICS AND TECHNOLOGY EDUCATION - BSCED

INDUSTRIAL CHEMISTRY (PST 2041)

Supplementary Examination Paper

2024

This Examination Paper consists of 5 pages

Time Allowed:	3 HOURS
Total Marks:	100
Special Requirements:	Nil
Internal Examiner:	MR I MATIBELA

INSTRUCTIONS

1. Answer ***ALL*** questions in **section A** and any ***THREE*** questions in **section B**
2. Each question carries **20 marks.**
3. Begin each question on a new page

Section A (40 marks)

*Answer **all** questions in this section A*

Question 1

(a)The following reaction summarises the Haber Process:

$N_2\,(g) + 3H_2\,(g) \rightarrow 2NH_3\,(g)$

(i) State the optimum conditions for the Haber process. [3]

(ii) Justify these industrial conditions. [7]

(b) Nylon 66 is a polymer manufactured from diacid and diamine monomers.

(i) Draw structures showing

1. hexanedioic acid, [2]

2. 1,6-diaminohexane, [2]

2. nylon 66 polymer molecule [2]

(ii) Write a mechanism illustrating the formation of nylon 66. [2]

(iii) Name the bond formed between the nylon monomers. [2]

[Total = 20]

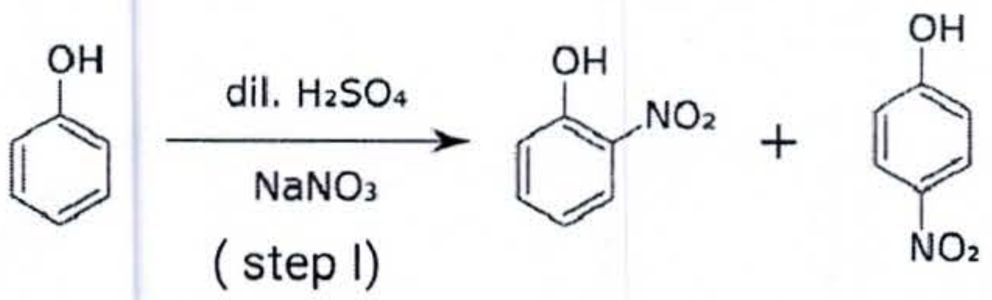
Question 2

(a)(i) Describe the extraction of aluminium from its bauxite ore. [4]

(ii) Aluminum is purified using electrolysis. With the aid of a clearly labeled diagram, outline this process. Include reactions occurring on the electrodes. [4]

(iii) Relate properties of aluminium metal to its functions. [2]

(b) Fig. 2.1 below shows the production of paracetamol, a drug used to relieve pain and inflammations.



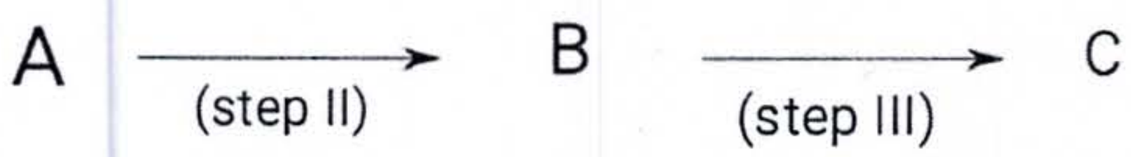


Fig.1 steps in synthesis of paracetamol

(i) Name the unit process and state the reagent(s) for:

1. Step II [2]

2. Step III [2]

(ii) Draw the chemical structure for

1. Compound A. [2]

2. Compound B [2]

3. Compound C. [2]

[Total = 20]

Section B

Answer any three questions

Question 3

(a) Three children of an Inyati family in Jowa Village died during the 2021 Christmas period due to a pesticide containing aluminum phosphide, (Sunday Mail, 30 December 2021).

(i) Give chemistry details on the industrial manufacture of aluminum phosphide. [5]

(ii) Describe how aluminum phosphide works as a pesticide. [4]

(ii) From your description in (a)(ii), create safety instructions to stick on the label of an aluminum phosphide based pesticide that can be formulated to control rats at home. [4]

(b) What are the benefits of researches in manufacturing and limitations to practical use of artificial leaf technology. [4]

(c) Name any three unit processes involved in biotechnology process of fermentation. [3]

[Total = 20]

Question 4

(a) For the following polymers:

1. PVC.

2. Kevlar.

(i) Identify the type of polymer, [2x1]

(ii) Draw the molecule of polymer, and [2x2]

(iii) State two uses. [2x2]

(b) A fizzy drink contains some of these food additives:

caramel (E150), sodium benzoate (E211), Citric acid (E330), saccharin (E954),

(i) Classify these food additives and explain the role(s) of these chemicals in the fizzy drink. [4x2]

(ii) Suggest one advantage and one disadvantage of food additives. [2]

[Total = 20]

Question 5

(a) Ammonia is vital in fertiliser manufacturing.

Give an account of the manufacture of ammonia sulphate pellets from ammonia.

Include a balanced chemical equation for the reaction. [6]

(b) Relate the importance of chemistry in the following fields:

(i) forensic science. [2]

(ii) electronic industry. [2]

(c) TNT is used in defense for military and bomb fills.

Outline, giving structures and conditions for the synthesis of TNT from benzene. [10]

[Total = 20]

Question 6

In Zimbabwe, there are prospects of extracting crude.

(a) Outline how crude oil is processed. Use suitable chemical reactions and flow diagrams. [10]

(b) What are the potential benefits of crude oil discovery to the Zimbabwean chemical industries? [10]

[Total =20]

END OF EXAMINATION