OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA

BSc (CHEMISTRY) DEGREE EXAMINATION, 2024/2025

CHM405: INTRODUCTION TO INDUSTRIAL CHEMISTRY

TIME: 1:00mins

INSTRUCTIONS: Answer ALL Questions

1a. Provide the chemical composition of the following Iron Ores:

i. Siderite
ii. Limonite
iii. Magnetite
iv. Hematite

1b. The industrial method of extraction of iron involves charging the blast furnace with the following materials: Iron oxides, Carbon monoxide, coke, limestone and hot air.

Write a balanced chemical equation to show how these compounds reacts with each other in the blast furnace leading to the production of pure iron.

2a. List the four major clinker compounds found in Portland cement and state one function of each in relation to strength or heat of hydration.

2b. Briefly describe the three major thermal zones in a cement rotary kiln and the main transformation occurring in each.

OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA
DEPARTMENT OF CHEMISTRY
B.Sc. Degree Examination Part IV
CHM 405: INTRODUCTION TO INDUSTRIAL CHEMISTRY
Harmattan Semester Examination (2024/2025 Session)

Time Allowed: $2\frac{1}{2}$ *hours* **Date: 13th March 2026**

INSTRUCTION: Answer **ALL** questions in **Section A**, and **ANY 2** questions from **Section B**

SECTION A: *Answer all questions from this section*

1(a). Provide the structures of the following dyes:

(i) cis indigo

(ii). trans indigo

(b). Using structures and appropriates reagents only, prepare the following dyes:

(i). Malachite green (Grignard synthesis)

(ii). 4-chloroanilinocyanurated H-acid

(iii) benzeneazo-2-napthol (bright red)

(iv) 9,10-anthraquinone

(v) Phenolphthalein

(vi) indigo

2(a). Provide the chemical composition of the following Iron Ores:

(i) Siderite

(ii) Limonite

(iii) Magnetite

(iv) Hematite

(b). The industrial method of extraction of iron involves charging the blast furnace with the following materials: Iron oxides, Carbon monoxide, coke, limestone and hot air.
Write a balanced chemical equation to show how these compounds reacts with each other in the blast furnace leading to the production of pure iron.

SECTION B: *Answer ANY 2 questions from this section*

3(a). Explain the role of gypsum during the milling of clinker in cement production.

(b). Briefly describe the process that occurs in the four clinkering zones and the main compounds formed during the process.

(c). Explain the hydration characteristics of the two cement constituents.

(d). Briefly discuss the importance of cyberspace and the Internet of Things (IoT) in the cement manufacturing process.

4(a). Mention and explain three modern food preservation methods.

(b). Briefly describe the following methods of extending the shelf life of food materials:

(i) Modified atmosphere packing

(ii) High-pressure processing.

(c). Mention the four fat-soluble vitamins and their specific function.

(d). Explain two characteristics of textile fibre.

5(a). Write a short note on the following paper-making process:

(i) Bleaching

(ii) Sulfite process.

(b). (i) What is the advantage of mechanical pulp bleaching over chemical pulp bleaching?

(ii) Give three examples of compounds used for mechanical pulp bleaching. NaOH, chlorine gas

(c). Write a short note on the following types of polymerizations:

(i) Addition polymerization

(ii) condensation polymerization.

(d). Write the equation for the condensation polymerization of ethylene glycol and adipic acid.

$HO-CH_2CH_2$ $HOOC(CH_2)_4COOH$

CaO

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BSc (CHEMISTRY) DEGREE EXAMINATION, 2023/2024

CHM 405: INTRODUCTION TO INDUSTRIAL CHEMISTRY

TIME: 1 hour

INSTRUCTIONS: Answer ALL Questions. Answer each question on a fresh page

3 (a). Briefly describe each of the 3 processes involved in Ordinary Portland Cement production

(c). Name and describe any 3 types of non-Portland cement

2 (a). Illustrate the synthesis of nylon 6 from caprolactam.

(b). Using chemical equations only, illustrate the synthesis of a tetramer of trimethylene isophthalate

3a. Define the following: i). Dyes ii). Pigments

Note: not more than 3 lines

b. Classify the following into Chromophores or Auxochromes?

NO_2, OH, CO, COOH, NH_2

c. Provide the structures of the following dyes: i). 1,3-Dinitronaphthalene ii). 2,4-Dinitro-1-naphthol

d. Using structures and **appropriates reagents only**, prepare methyl Orange and para red.

Time Allowed: $2\frac{1}{2}$ hours

Date: 18th February 2025

INSTRUCTION: Attempt ALL Questions
Answer each question on a fresh page

SECTION A

1(a). Define the following, in not more than 3 lines: (i). Dyes (ii). Pigments

(b). Classify the following into Chromophores or Auxochromes:
NO_2; OH; CO; COOH; NH_2

(c). Provide the structures of the following dyes:
(i). 1,3-Dinitronaphthalene (ii). 2,4-Dinitro-1-naphthol

(d). Using structures and appropriate reagents only, show how methyl Orange and para red can be prepared

2(a). Provide the chemical composition of the following iron ores:
(i) Siderite
(ii) Limonite
(iii) Magnetite
(iv) Hematite

(b). The industrial method to smelt iron involves charging the blast furnace with the following materials: (i) Iron ore (ii) Charcoal or coke and (iii) Limestone.
Write balanced chemical equations to show how these compounds react with each other in the blast furnace leading to the production of pure iron.

(c). Write a chemical equation for the reaction of P_2O_5 with calcium oxide in the Basic oxygen steel making process (BOS).

3(a). Give 4 properties of natural rubber.

(b). Starting with simple laboratory chemicals such as ethyne (acetylene), copper(I)chloride (cuprous chloride), hydrochloric acid and potassium peroxodisulfate (potassium persulfate). Show with a chemical equation only how you can prepare Neoprene an important synthetic rubber.

(c). Define an Elastomer

4(a). Why is it that cyano ethene (acrylonitrile) and 1,1-diphenylethylene are not good monomers in cationic polymerization?

(b). Use appropriate equation only to describe the initiation step in (i) Free radical and (ii) anionic polymerization processes

(c). Consider a rod 150 cm in length with cross sectional area of 80 cm^2 was extended in length by 25 cm due to externally applied stress. If the new cross-sectional area is 29 cm^2, determine:
(i) The longitudinal strain on the rod;
(ii) The lateral strain on the rod and
(iii) The Poisson's ratio

Note: $\pi = 3.14$.

5(a). Briefly describe each of the 3 processes involved in Ordinary Portland Cement production.

(b). Name and describe any 2 types of non-Portland cement

6. Give equation for the formation of:
(a). Polyamide from hexamethylene diamine (HMD) and toluene diisocyanate.
(b). Synthesis of Nylon 6,6.