BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF CHEMISTRY

Programme: HBScCHT Part 2.2

Course code: CH216 Industrial Chemistry II

MAR 2024

Duration: 2 Hours

ANSWER QUESTION ONE AND ANY TWO FROM SECTION A AND TWO FROM SECTION B. EACH QUESTION CARRIES TWENTY MARKS

****

Q1 a) Briefly, describe the composition of crude oil. **[5 Marks]**

b) State the four processing steps for fats and oil. **[4 Marks]**

c) Write chemical reactions for:
   i. Steam reforming of natural gas.
   ii. Water gas shift reaction
   iii. Partial oxidation of methane
   [2x3 Marks]

d) Draw a simplified process flow diagram for the production of methanol from synthesis gas. **[5 Marks]**

SECTION A

Q2 a) Explain the production of acetic acid through:
   i. Liquid phase oxidation of naphtha or butane
   ii. Hydroformylation of methanol
   [3+5 Marks]

b) Draw a process flow diagram for the Monsanto Acetic Acid Production process. **[5 marks]**

c) Describe the hydroformylation of propylene. **[7 Marks]**

Q3 a) What are plasticizer and detergent alcohols? **[4 Marks]**

b) Describe with help of appropriate reaction schemes, the production of fatty alcohols. **[6 Marks]**

c) With the help of appropriate equations describe the production of higher alcohols through:
   i. Hydroformylation of higher alkenes
   ii. Partial oxidation of paraffins.
[2x5 Marks]

Q4 a) Explain the mechanism of cracking heavier alkanes or crude. **[6 Marks]**

b) Draw a diagram to illustrate an industrial steam cracker. **[4 Marks]**

c) Describe the processing of cracked gas **[6 Marks]**

d) One of the main products of steam cracking is ethylene. State any four applications of ethylene. **[4 Marks]**

SECTION B

Q5 a) Describe the Mobil-badger process for ethylation of benzene. **[6 Marks]**

b) How is bis-phenol A produced? **[6 Marks]**

c) State any two applications of bisphenol A. **[4 Marks]**

d) Draw a process flow diagram for the production of cyclohexanol. **[4 Marks]**

Q6 a) Explain the production of benzene from toluene. **[5 Marks]**

b) Why is the mono nitration of toluene carried at less than 60°C? **[4 Marks]**

c) Write the six possible chemical structures that can be obtained from nitration of mononitrotoluene. **[6 Marks]**

d) How are dinitroanilines produced from dinitrotoluenes? **[5 Marks]**

Q7 a) Briefly explain the purpose of the following methods in the processing of fats and oils.
   i. Winterization
   ii. Hydrogenation
[2x4 Marks]

b) What is a detergent? **[4 Marks]**

c) How are detergents classified? **[4 Marks]**

d) Detergents are complex formulations that contain 25 different ingredients. What are the categories of these ingredients? **[4 Marks]**

END OF EXAM