



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESS WAY, JABI - ABUJA.**  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF PURE AND APPLIED SCIENCE**  
**SECOND SEMESTER EXAMINATION 2021\_2<sub>2021</sub>**

**COURSE CODE:** CHM415  
**COURSE TITLE:** INDUSTRIAL CHEMICAL TECHNOLOGY II  
**TIME:** 2 HOURS  
**INSTRUCTION:** Answer question one and any other three questions.

**QUESTION ONE**

- a. Enumerate the three principles of producing syngas based on feedstock used 3 marks
- b. With suitable equations, discuss the sources of hydrogen 6 marks
- c. Give elemental composition of crude oil and coal  
4marks
- d. How can soya bean oil be manufactured by solvent extraction 6 marks
- e. Enumerate the major causing of Air pollution indicating the major and minor pollutant  
6 marks

**QUESTION TWO**

- a. Explain the classification of natural gas 3 marks
- b. Discuss the component of a lignocellulosic biomass 4 ½ marks
- c. Describe full, the variable costs of producing a chemical 7½ marks

**QUESTION THREE**

- a. Discuss the fixed costs involved in producing chemicals 8 marks
- b. 10kg of a 10% (by mass) NaCl solution is concentrated to 50% in a continuous evaporation. Calculate the production rate of concentrated solution (c) and the rate of water removal (w) from the evaporator 4 marks
- c. Using an appropriate example, define the stoichiometric equation of a chemical reaction  
3mk

#### **QUESTION FOUR**

- a. Enumerate the various characteristics of oil 4 marks
- b. Explain the techniques of extracting essentials oils 6 marks
- c. What are mineral oils 5marks

#### **QUESTION FIVE**

- a. Mention the factors to consider before collecting air samples and the devices needed for collecting samples 4 marks
- b. Enumerate the methods of disposing acid tars 4 marks
- c. Discuss the types of industrial waste and their methods of removal 7marks