



**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 45678**

**COURSE CODE:** CHM316  
**COURSE TITLE:** INDUSTRIAL CHEMICAL TECHNOLOGY I  
**TIME:** 2 Hours  
**INSTRUCTION:** Answer question one and any other three questions.

**QUESTION ONE**

- (1a) Describe heat exchangers and give four examples (6 marks)
- (1b) Draw a sketched diagram to explain a tubular heat exchanger (9 marks)
- (1c) Give four examples of industrial processes in which mass transfer takes place (2marks)
- (1d) Discuss the two modes by which reactors can be run (5marks)
- (1e) Vacuum cleaner is used at home to clean carpet. Explain how it works (3marks)

**QUESTION TWO**

- (2a) For effective use of bioreactors for chemical reactions, some of their characteristics must be controlled. Outline four of these characteristics. (6marks)
- (2b) What is a bio-reactor? (2marks)
- (2c) What are the advantages of bioreactors over the normal reactor? (3marks)
- (2d) Chemical reactions are often followed by one separation process or the other. Why? (3marks)
- (2e) State the law of conservation of energy. (1mark)

### QUESTION THREE

(3a) Give a brief discussion on how the rate of reaction can be affected by some process variables

(4 marks)

(3b) A solution of  $\text{CuSO}_4$  contains 2.25g in  $250\text{cm}^3$ . What is the concentration and molarity of the solution [Cu=63.55, S=32, O=16]

(6marks)

(3c) Explain the term “unit operation” (2marks) and give six examples (3marks)

### QUESTION FOUR

(4a) Give four examples each for the unit operations that are based on

(i) mass transfer (ii) mechanical principles (iii) heat transfer

(6marks)

(4b) Give a brief discussion of “steady state conduction”

(4marks)

(4c) Outline three basic knowledge required to perform a successful chemical conversion

(3marks)

(4d) What is heat transfer?

(2marks)

### QUESTION FIVE

(5a) Give a schematic block diagram only, show the unit operations involved in the manufacturing of sugar from sugar cane

(8 marks)

(5b) Outline five factors that must be considered for choice of right equipment for mixing liquids

(5 marks)

(5c) Itemize four basic requisite knowledge required to perform chemical conversion (2marks)