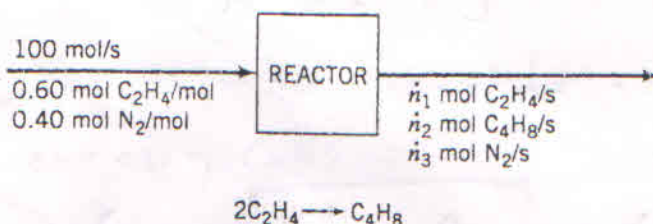


TUTORIAL SHEET 6: MEB(UCH301)

Q.1

A mixture of ethylene and nitrogen is fed to a reactor in which some of the ethylene is dimerized to butene.



How many independent molecular species are involved in the process? How many independent atomic species are involved? Prove the latter claim by writing balances on C, H, and N.

Q.2

Acetylene is hydrogenated to form ethane. The feed to the reactor contains 1.50 mol H_2 /mol C_2H_2 .

- Calculate the stoichiometric reactant ratio (mol H_2 react/mol C_2H_2 react) and the yield ratio (kmol C_2H_6 formed/kmol H_2 react).
- Determine the limiting reactant and calculate the percentage by which the other reactant is in excess.
- Calculate the mass feed rate of hydrogen (kg/s) required to produce 4×10^6 metric tons of ethane per year, assuming that the reaction goes to completion and that the process operates for 24 hours a day, 300 days a year.
- There is a definite drawback to running with one reactant in excess rather than feeding the reactants in stoichiometric proportion. What is it? [Hint: In the process of part (c), what does the reactor effluent consist of and what will probably have to be done before the product ethane can be sold or used?]