

CHE 321 HOMEWORK SHEET # 1

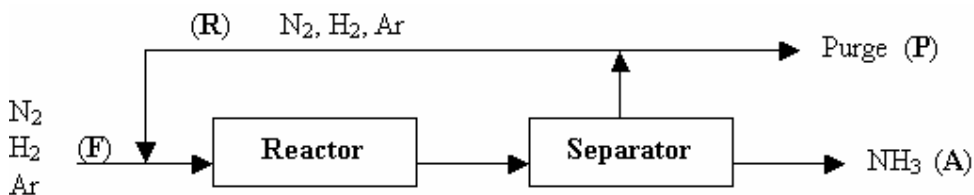
Question one

A petroleum gas mixture containing 65% propane, 25% propylene, and 10% butane (all in mole %) is burned with 40% excess air. All butane and propylene and 90% of the propane are consumed and no CO is found in the product gas. Calculate the stack gas composition on a dry basis assuming the air moisture content is negligible.

Question two

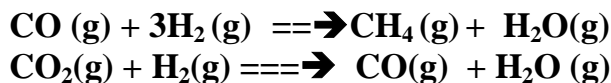
In an ammonia synthesis loop, the fresh feed composed of 75.16% H₂, 24.57% N₂, and 0.27% Ar. The fresh feed is mixed with the recycled gas and enters the reactor with a composition of 79.52% H₂. The gas leaving the ammonia separator contains 80.01% H₂ and no ammonia. The product ammonia contains no dissolved gases. Per 100 moles of fresh feed:

- (1)(1) How many moles are recycled and how many purged?
- (2)(2) What is the percent conversion of hydrogen per pass through the reactor?



Question three

A catalytic reactor is charged with a feed consisting of 5 mols H₂ to 1 mol CO₂ at 400° C and 5 bars. In the reactor, the reactions



Take place with 90% conversion of CO₂. If the reactor operates adiabatically and the exit stream temperature is at 400° C, calculate the composition of the exit stream.