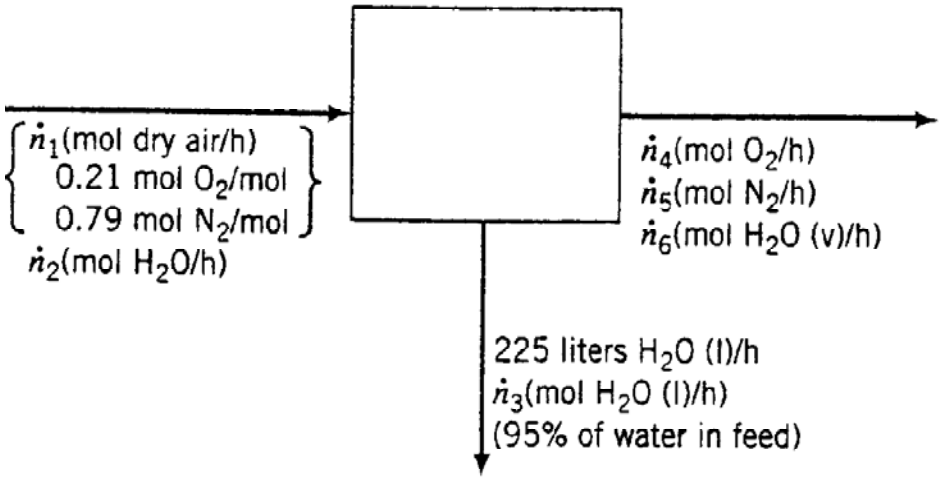
CHEN200 Introduction to Chemical Engineering
Drop Quiz 2 Answers

P1. Stoichiometry [20 points]

(a) No, The reaction should be $2C_2H_4 + O_2 \rightarrow 2C_2H_4O$
(b) C_2H_4 is the limiting reactant. 100% is the excess.
(c) 50 kmol of O_2 will be left; 100 kmol of C_2H_4O will be formed; 50 kmol is the extent of reaction.
(d) 50 kmol C_2H_4, 75 kmol of O_2 and 50 kmol of C_2H_4O are present at the end; 25 kmol is the extent of reaction.
(e) The fractional conversion of C_2H_4 is 0.8; the fractional conversion of O_2 is 0.4; the extent of reaction is 40 kmol.

P2. Degrees of Freedom analysis and mass balance [30 points]

There are 3 components and 3 streams; therefore, the total number of variables is 12. However, a number of variables and equations will be trivial; namely the moles of nitrogen and oxygen in the condensed water stream will be equal to zero, the problem can be reduced to the following sketch.



There are six unknowns on the sketch given above: $\dot{n}_1 - \dot{n}_6$.
There are three material balances (one for each of the three species, oxygen, nitrogen and water) and two other relationships are given (the relationship between the volumetric and molar flow rate of the condensate and that 95% of the water is condensed). This gives a total of five equations.
The degrees of freedom are therefore equal to one and the problem is therefore underspecified.