

**Chemical Engineering 201  
Fall 2001**

**Midterm # 2**

Name \_\_\_\_\_

Problem # 1 \_\_\_\_\_

Problem # 2 \_\_\_\_\_

Problem # 3 \_\_\_\_\_

Problem # 4 \_\_\_\_\_

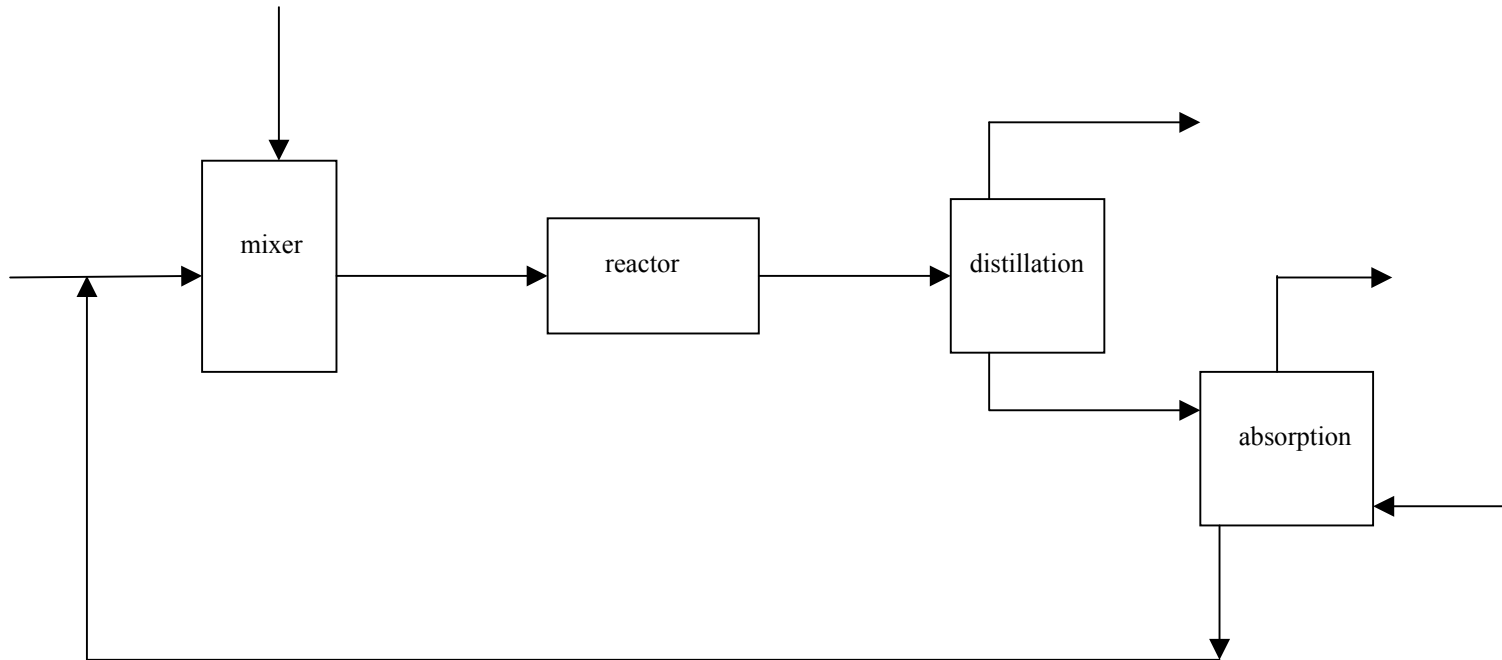
Problem One (10 points):

Solve the following system of equations for 10 points. **You must get the correct answer in order to receive any credit on this problem:**

$$\begin{aligned}3 F_1 + 5 F_2 &= 10 \\2 F_1 + 4 F_2 &= 7\end{aligned}$$

Problem 2

a) (14 points) Write 7 total **mass** balances for the following process flowchart. Number all streams you use and be consistent with that notation:



1)

5)

2)

6)

3)

7)

4)

b) (5 points) Which stream is probably your primary product stream and why do you think this?

c) (6 points) In general terms, what do you think is being sent back to the mixer at the front of the process from the absorption column?

Problem 3 (30 points):

Draw the flowsheet for the following process and translate all of the information given in the problem statement onto the diagram. Also, translate the subsidiary relationships for the process into mathematical terms. DO NOT SOLVE THIS PROBLEM.

A mixture of benzene and toluene that has 40 wt% benzene is fed into a mixer where pure xylene is added. The resulting mixture is sent to a catalytic reactor where half of the toluene is converted to xylene through the addition of methyl radicals to the reactor. The reactor effluent is sent to a distillation column where 96 % of the remaining xylene is removed in the bottoms product while the overhead product has 78% benzene. This overhead stream is recycled to the beginning of the process and mixed with a fresh benzene/toluene mixture to make the 40 wt% benzene stream.

Problem 4 (35 points):

Solve the following mass balance problem: 100 kilograms of a water and ethanol mixture that has 50 wt% water is mixed with 80 liters of pure water. What is the mass of the final mixture? What is the exiting stream's mole percent of ethanol? What is the exiting stream's mass percent of ethanol?