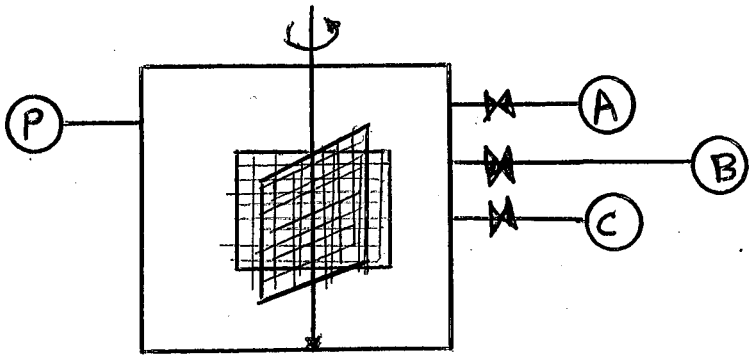
ChE 4410 **Midsemester Exam**

A catalytic reaction has been studied in a constant volume, stirred batch reactor:



Ten grams of catalyst were supported between screens on a rapidly rotating impeller. At time t = 0, known initial pressures of reactant A and products B and C from the irreversible reaction:

$$A \rightarrow B + C$$

were admitted to the previously evacuated vessel. The time required for the pressure to increase 10 torr (10 torr = 0.0132 atm) is recorded in each case in the attached data table. Assume ideal gases, temperature is constant at 313°K, total volume of the reactor system is 1.5 liters. Furthermore, since the pressure change is so small, assume that differential reaction conditions exist.

A. (30 pts.) Examine the data qualitatively and write a LHHW rate model that you expect can be used to correlate the data. Drop any terms you can by qualitative arguments.

B. (50 pts.) Determine all parameters in the model. Equilibrium adsorption constants (K's) should be in atm^{-1}. Write out the rates in terms of $\left(\frac{\text{moles A converted}}{\text{minute} \cdot \text{gram of catalyst}}\right)$ and determine the overall rate constant using a rate in these units.

C. (20 pts.) How long would be required for the reactor pressure to increase 1.00 atm (760 torr) starting with the same conditions as run #5 (pure A at 4.10 atm initially)?

Run #	Pa (atm)	Pb (atm)	Pc (atm)	Time (min) for P to increase 10 torr
1	1.05	0.00	0.00	1.30
2	1.76	0.00	0.00	0.90
3	2.25	0.00	0.00	0.76
4	3.02	0.00	0.00	0.64
5	4.10	0.00	0.00	0.55
6	2.25	1.30	0.00	1.64
7	2.25	1.55	0.00	1.81
8	2.25	1.97	0.00	2.10
9	2.25	2.30	0.00	2.32
10	2.25	2.90	0.00	2.72
11	2.25	0.00	0.33	0.76
12	2.25	0.00	0.87	0.76
13	2.25	0.00	1.55	0.76
14	2.25	0.00	2.43	0.76