CHE311 | **MidTerm Exam** | **Oct4,2021**

Open Book | Max.Marks:100 | Time:2 hours

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1. (20 marks) The following reaction is investigated in a constant density batch reactor:

$$A + 2B \rightarrow 2C+D$$

The reaction rate is: $-r_A = k\, C_A\, C_B$

The reactor is initially charged with A and B. The initial concentration of A is 0.1 mol/litre and that of B is 0.2 mol/litre. Find the value of the rate constant if after 10 min of reaction the conversion of A is 50 percent.

2.(20 marks). Find the reaction order and rate constant of the irreversible liquid phase reaction A→ products from the data given below obtained at 50^0C:

Initial concentration of A, kmol/m^3	0.5	0.2
Half-life, seconds	270	170

3.(20 marks) A homogeneous liquid phase reaction

$$A \rightarrow R, \qquad -r_A = kC_A^2$$

takes place in a CSTR and the conversion is 50%

(a) What will be the conversion if this reactor is replaced by one 6 times as large - all else remaining unchanged. [10]

(b)What will be the conversion if the original reactor is replaced by a plug flow reactor of equal size - all else remaining unchanged . [10]

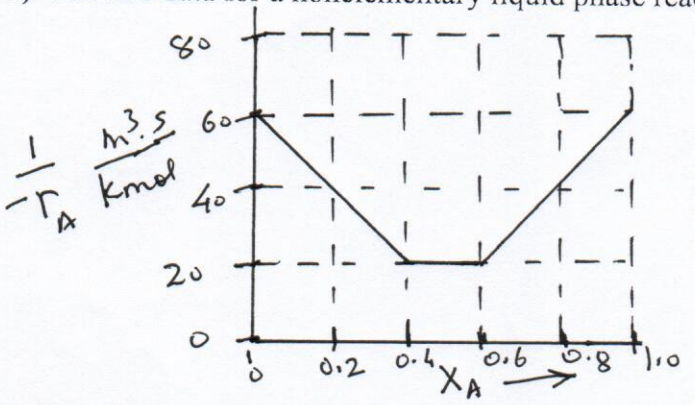
4.(20 marks). In the Deacon process, chlorine is produced by the gas phase reaction of HCl and O_2 by the following reaction:

$$4HCl + O_2 \rightarrow 2Cl_2 + 2\,H_2O$$

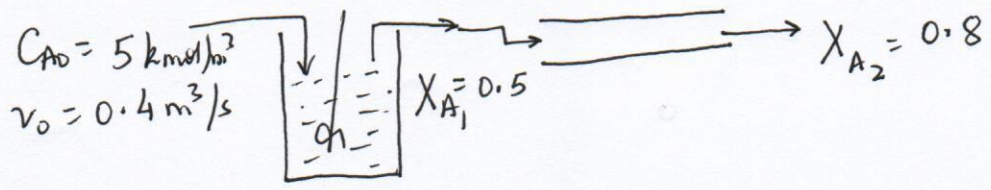
The feed consists of 20 mol% HCl in air at 10.0 bar and 327^0C.

Determine the concentration of all species at the exit of a PFR for a HCl conversion of 50%.The reactor can be assumed to be isothermal and isobaric.

5.(20 marks). The rate data for a nonelementary liquid phase reaction A→B is given below:



The inlet concentration of A is 5 kmol/m^3 and the volumetric flow rate is 0.4 m^3/s. Consider the reactor system shown below.



Determine the volume of the CSTR and PFR..