

$$\chi_A = \chi_{A\text{EQ}} (1 - e^{-kt})$$

$$0.9682 = 0.9641 (1 - e^{-5.288 \times 10^{-3} t})$$

$$\begin{aligned} \frac{0.9682}{0.9641} &= 1.0043 = 1 - e^{-5.288 \times 10^{-3} t} \\ &= 0.0043 = -e^{-5.288 \times 10^{-3} t} \\ -0.0043 &= e^{-5.288 \times 10^{-3} t} \end{aligned}$$

ASIDE

what do you
do to get all the * to react?



glucose →

Glucose 6P



Fructose 6P

↓

Fructose 1,6P₂

$$c) \quad \left. \begin{array}{l} C_{A0} = 0 \\ \gamma = 0 \\ \chi_{Aeq} = 0.9834 \end{array} \right\} \text{SAME VALUES AS IN PART A)}$$

$$C_A = C_{A0} (1 - \chi_A)$$

$$C_{Aeq} = C_{A0} (1 - \chi_{Aeq})$$

$$C_{Aeq} = 8.453 \times 10^{-7} (1 - 0.9834)$$

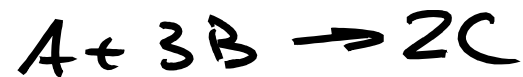
$$C_{Aeq} = 0.140 \times 10^{-7} \text{ mol/L}$$

$$0.140 \times 10^{-7} \frac{\text{mol}}{\text{L}} \times \frac{182 \text{ g}}{\text{mol}} \times \frac{10^6 \mu\text{g}}{\text{g}} = \underline{\underline{2.55 \text{ ppb}}}$$

EXAMPLE 5

THE FOLLOWING REACTION IS SECOND ORDER

IRREVERSIBLE:



IF $C_{A0} = 100 \text{ mmol/L}$ & $C_{B0} = 250 \text{ mmol/L}$

AT WHAT TIME WILL C_C REACH 80 mmol/L ?

$k = 1.5 \times 10^{-4} \text{ L/(mmol min)}$

$$x_A = \frac{\gamma [e^{qt} - 1]}{\gamma e^{qt} - 1}$$


where $\gamma = \frac{C_{B0}}{3C_{A0}}$

$$q = (C_{A0} - 3C_{B0})k$$

$$r = \frac{C_{B0}}{3C_{A0}} = \frac{250}{3(100)} = 0.833$$

$$r = (C_{B0} - 3C_{A0})k = (250 - 3(100)) \left(1.5 \times 10^{-4} \right) \frac{\text{mol}}{\text{L}} \frac{\text{L}}{\text{mol min}}$$

$$= -0.0075 \text{ min}^{-1}$$

$x_A = ?$

WHAT IS RELATIONSHIP BETWEEN A & C?

$$2 \left(\begin{array}{c} \# \text{ moles of A} \\ \text{consumed} \end{array} \right) = \begin{array}{c} \# \text{ moles of C} \\ \text{generated} \end{array}$$

$$2(C_{A0} - C_A) = C_C - C_{C0}$$

$$2(C_{A0} - C_A) = C_C$$

$$2(100 - C_A) = 80 \rightarrow C_A = 60 \text{ mol/L}$$

"AT WHAT TIME WILL C_e REACH 80 mmol/L ?
IS EQUIVALENT TO

"AT WHAT TIME WILL C_A REACH 60 mmol/L ?"

$$X_A = \frac{C_{A0} - C_A}{C_{A0}} = \frac{100 - 60}{100} = 0.40$$

SO...

$$0.40 = \frac{0.833(e^{-0.0075t} - 1)}{0.833e^{-0.0075t} - 1}$$

↓

$$t = \underline{19.1 \text{ min}}$$

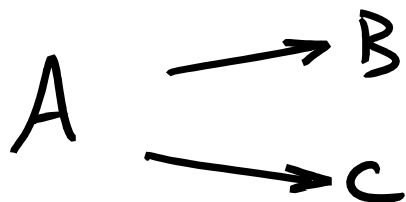
WE COULD ALSO USE:

$$t = \frac{1}{2} \ln \left[\frac{\delta - X_A}{\delta(1 - X_A)} \right]$$

6) MULTIPLE REACTIONS

a) INTRODUCTION

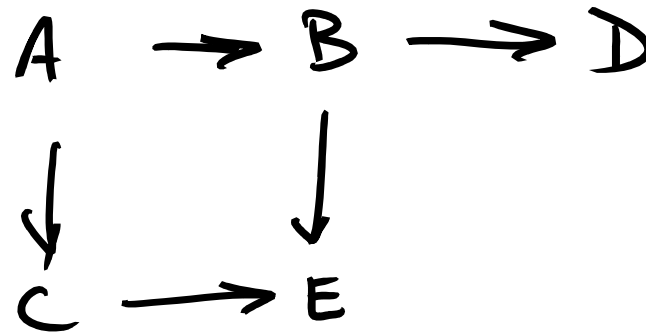
PARALLEL : REACTIONS WHICH USE SAME REACTANT(S)



SERIES : REACTIONS IN WHICH PRODUCT(S) OF ONE REACTION ARE REACTANT(S) FOR A SECOND REACTION

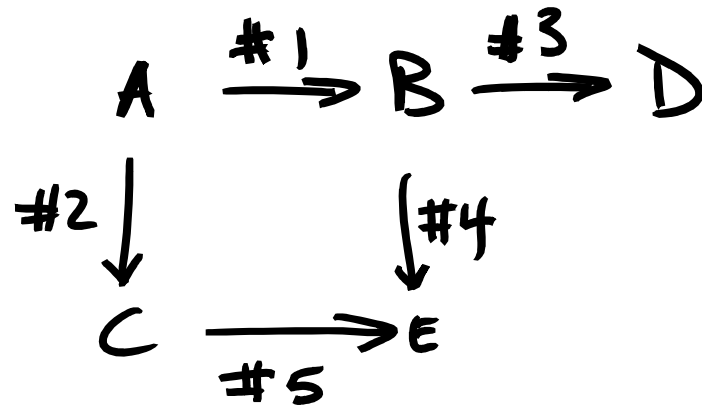


COMPLEX



3 SERIES $\neq$
2 PARALLEL

EXAMPLE 6



GIVEN: k_1, k_2, k_3, k_4, k_5
 $C_{A0}, C_{B0}, C_{C0}, C_{D0}, C_{E0}$

ALL
FIRST
ORDER
RXNS!

$$R_A = \frac{dc_A}{dt} = -k_1 c_A - k_2 c_A$$

$$R_B = \frac{dc_B}{dt} = +k_1 c_A - k_3 c_B - k_4 c_B$$

$$R_C = \frac{dc_C}{dt} = +k_2 C_A - k_5 C_C$$

$$R_D = \frac{dc_D}{dt} = +k_3 C_B$$

$$R_E = \frac{dc_E}{dt} = +k_5 C_C + k_4 C_B$$

USE SOFTWARE TO SOLVE MULTIPLE DIFF. EQN
SIMULTANEOUSLY, OR WRITE YOUR OWN CODE!