Answer on Question #69833 - Chemistry – Inorganic Chemistry

Task:

A first-order reaction has a rate constant of 0.33 min^{-1}. It takes ___ min for the reactant concentration to decrease from 0.13 M to 0.088 M

Solution:

For the reaction $aA + bB = cC + dD$

$$rate = -\frac{1}{a}\frac{\Delta[A]}{\Delta t} = -\frac{1}{b}\frac{\Delta[B]}{\Delta t} = +\frac{1}{c}\frac{\Delta[C]}{\Delta t} + \frac{1}{d}\frac{\Delta[D]}{\Delta t}$$

$$K_c = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

1st order reactions:

$\ln[A]_t = -kt + \ln[A]_0$

$t_{1/2} = 0.693/k$

Then,

k = 0.33 min^{-1}; ln[A]$_0$ = 0.13 M; ln[A] = 0.088 M;

ln[A]$_0$ - ln[A] = kt;

ln[0.13] - ln[0.088] = 0.33*t;

-2.04 - (-2.43) = 0.33*t;

t = 1.18min.

Answer: 1.18 min.