

Answer on Question #55573 - Chemistry - General chemistry

Question:

The table to the right gives the concentrations of $C_2H_4O(g)$ as a function of time at a certain temperature for the following reaction $C_2H_4O \rightarrow CH_4 + CO$. Verify that this is a first order reaction by plotting $\ln[C_2H_4O]$ versus time and determining the value of the rate constant

Table-

C_2H_4O : Time (min):

0.0860 0.00

0.0465 56.0

0.0355 80.0

0.0274 103.0

0.0174 144.0

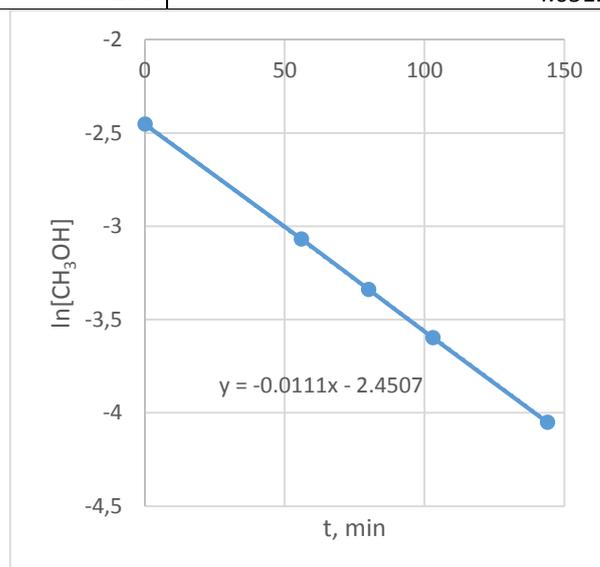
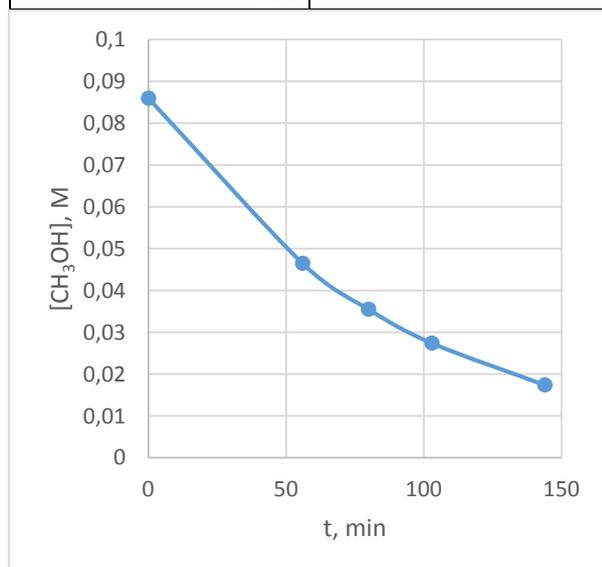
Solution:

First order reaction equation:

$$\ln[CH_3OH] = \ln[CH_3OH]_0 - kt$$

Kinetic plot is linear in semilog coordinates.

t, min	$[CH_3OH]$, M	$\ln[CH_3OH]$
0	0.086	-2.45341
56	0.0465	-3.0683
80	0.0355	-3.33822
103	0.0274	-3.59721
144	0.0174	-4.05129



As we can see, kinetic plot is linear that is natural for first order reactions. Analysis gives the following equation:

$$\ln[CH_3OH] = -0.0111 t - 2.4507$$

$$k = 0.0111 \text{ min}^{-1}$$