

Answer on Question #55575 – Chemistry – General Chemistry

Question:

A particular reactant decomposes with a half-life of 145 s when its initial concentration is 0.329 M. The same reactant decomposes with a half-life of 213 s when its initial concentration is 0.224 M. Determine the reaction order?

Answer:

Firstly, we have to write the equations from which we can find half-life time according to reaction order.

Zero order:

$$t_{1/2} = \frac{[A]_0}{2k}$$

First order:

$$t_{1/2} = \frac{\ln(2)}{k}$$

Second order:

$$t_{1/2} = \frac{1}{k[A]_0}$$

From the first order reaction half-life time is independent on initial concentration. It means that it is not our case.

Because we have decomposition of the same reactant, it means that **k** (rate constant of the reaction) has to be **the same**.

If we use formula for the second order reaction, we will obtain:

$$k = \frac{1}{[A]_0 t_{1/2}} = \frac{1}{0.329 * 145} \approx 0.021$$

and

$$k = \frac{1}{[A]_0 t_{1/2}} = \frac{1}{0.224 * 213} \approx 0.021$$

This confirms that the **order** of our reaction is **second**.