A common question exists regarding the use of logarithm base 10 (\(\log\)) vs. logarithm base \(e\) (\(\ln\)). The logarithm base \(e\) is called the natural logarithm since it arises from the integral:

\[
\ln (a) = \int_1^a \frac{dx}{x}
\]

Of course, one can convert from \(\ln\) to \(\log\) with a constant multiplier.

\[
\ln (10^{\log a}) = \log (a) \ln(10) \approx 2.3025 \log (a)
\]

but \(10^{\log a}=a\) so

\[
\ln a \approx 2.4025 \log a
\]

The analysis of the reaction order and rate constant using the method of initial rates is performed using the \(\log\) function. This could have been done using the \(\ln\) function just as well. The initial rate is given by

\[
[r_0=ka][0]^a
\]

The analysis can proceed by taking the logarithm base 10 of each side of the equation

\[
[\log r_0 = \log k + a\log [A][0]]
\]

or the \(\ln\) of each side of the equation

\[
[\ln r_0 = \ln k' + a\ln [A][0]]
\]

as long as one is consistent.

Once can think of the \(\log\) or the \(\ln\) as a way to 'linearize data' that has some kind of power law dependence. The only difference between these two functions is a scaling factor (\(\ln 10 \approx 2.3025\)) in the slope. Obviously, if you multiply both sides of the equation by the same number the relative values of the constants remains the same on both sides.

Contributors

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