Answer on Question #54937 – Chemistry – Other

Question:

A certain reaction is first order with respect to iodide ions.
(a) Sketch a graph to show the variation in concentration of iodine ions (y-axis) with time (t).
(b) Sketch a graph to show the variation of 1/t (y-axis) with concentration of iodide ions.
(c) Explain the shapes of your sketches.

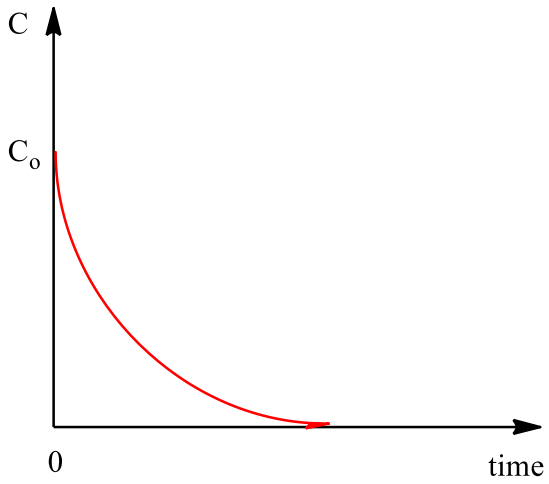
Answer:

Answer for this question is only possible with assumption that other components of the reaction are in excess with respect iodide anion. In this case we can say that their concentrations are constant. Therefore, the rate low should be:

$r = k[A][B]\ldots\times[I^-] = K[I^-]$, where k – the rate constant, [A], [B]… - the concentration of other components, K – the constant which involves the rate constant and concentrations of [A], [B] … .

a) For the reaction being the first-order with respect to iodide ions the concentration is defined by the exponential equation:
$C = C_o\exp(-Kt)$, where C_o – the initial concentration of I^-, K – the constant (mentioned above) and t – the time.

Thus, the graph for the dependence C on time is shown below:

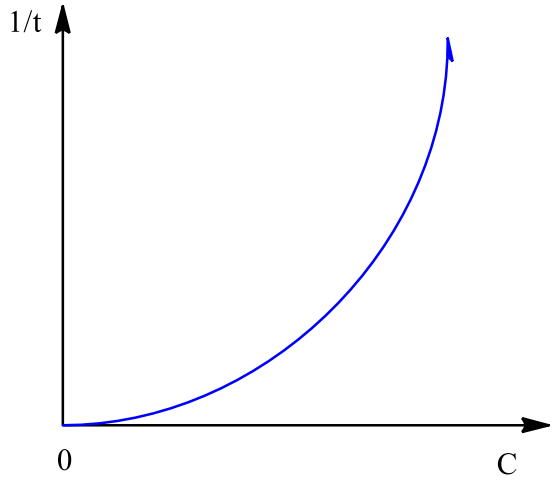


The curve shows that the concentration of I^- decreases exponentially during the reaction.

b) The same equation can be shown in logarithmic form:
$\ln(C) = -Kt + \ln(C_0)$

Thus, $t = \frac{1}{K} \ln(\frac{Co}{C})$ and $\frac{1}{t} = \frac{K}{\ln(\frac{Co}{C})}$.

The plot of this function is depicted in the next picture:



Note: These graphical representations show the variation of the concentration in general. The exact shapes of the curves can be obtained easily when all parameters (K and C_0) will be given.