The **initial rates method** is a technique that lets you use the initial rate of an experiment to work out the orders of reaction. They have to be done by:

- Carrying out separate experiments using different initial conc. of one reactant. Change only one conc. and keep the rest constant.
- See how the change in initial conc. affects the initial rates and find the order of reaction.
- Could be done using continuous monitoring method and drawing conc. time, or volume time graph. Calculating the gradient at t=0 gives **initial rate.**

Clock reaction

Example of initial rates method.

- You measure how the time taken for a set amount of product to form changes as you vary the conc. of one of the reactants.
- There will be a sudden increase in the conc. of a certain product as a limiting reactant is used up.
- Usually there is easily observable end point – colour change – to tell when the desired amount of product has formed.
- Quicker the reaction finished, the faster the initial rate of reaction.
- **Assumptions made:**
    - The conc. of each reactant doesn't change significantly over time period of the clock reaction.
    - The temp. stays constant.
    - When end point is seen the reaction has not proceeded too far.

Iodine clock reaction:

Monitored reaction:

- $H_2O_2 + 2I^- + 2H^+ \rightarrow 2H_2O + I_2$
- Small amount of sodium thiosulfate solution and starch (indicator) are added to an excess of hydrogen peroxide and iodide ions in acid solution.
- Sodium thiosulfate reacts **instantaneously** with iodine: $2S_2O_3^{2-} + I_2 \rightarrow 2I^- + S_4O_6^{2-}$