Iodine Clock Reaction: Method of Initial Rates

Interactive Demonstration

- Visualization and application of Method of Initial Rates
- Student prediction based on conceptual understanding of kinetics
- A Power Point Lecture slide set to accompany this demonstration is included.
- A video is available to accompany the demonstration
- A molecular scene comparing the same reaction at two different concentrations. The system that has twice the concentration as the other has an initial rate of reaction twice that as the other.

Iodine Clock Reaction: Method of Initial Rates

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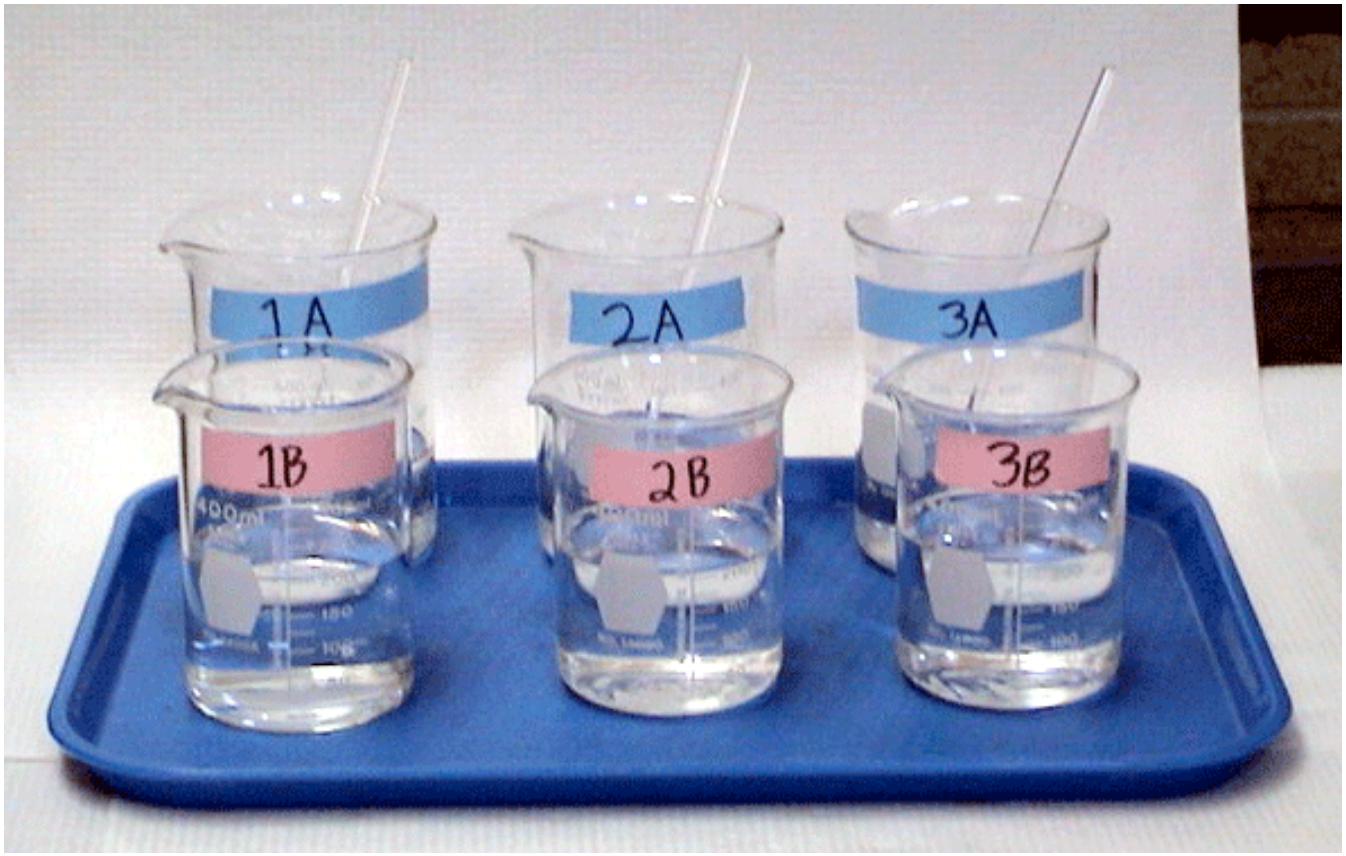
Demo: Iodine clock reaction

$3\ I^- + H_2O_2 + 2\ H^+ \rightarrow I_3^- + 2\ H_2O$

$I_3^- + 2\ S_2O_3^{2-} \rightarrow 3\ I^- + S_4O_6^{2-}$

I_3^- + starch → starch-I_5^- complex + I^-

Iodine Clock Reaction - Kinetics



Iodine Clock Reaction - Kinetics

$3I^-(aq) + 2\ H^+(aq) \Longrightarrow I_3^-(aq) + 2\ H_2O(l)$

$I_3^-(aq) + 2S_2O_3^{2-}(aq) + H_20_2\ (aq) \Rightarrow 3\ I^-(aq) + S_4O_6^{2-}(aq)$

$2\ I_3^-(aq) + \text{starch} \Longrightarrow \text{starch-}I_5^-\ \text{complex} + I^-(aq)$

Iodine Clock Reaction - Kinetics

Experiment of	$[H_2O_2]$, M	[KI], M	Reaction Time	Initial Rate of Reaction
A	0.045	0.100		
B	0.045	0.050		
C	0.0225	0.100		

Identify the dependent, independent, and control variables in this series of experiments.

We will do experiment “A” first. Record the time it takes for the

Lecture Demonstration Iodine Clock Reaction

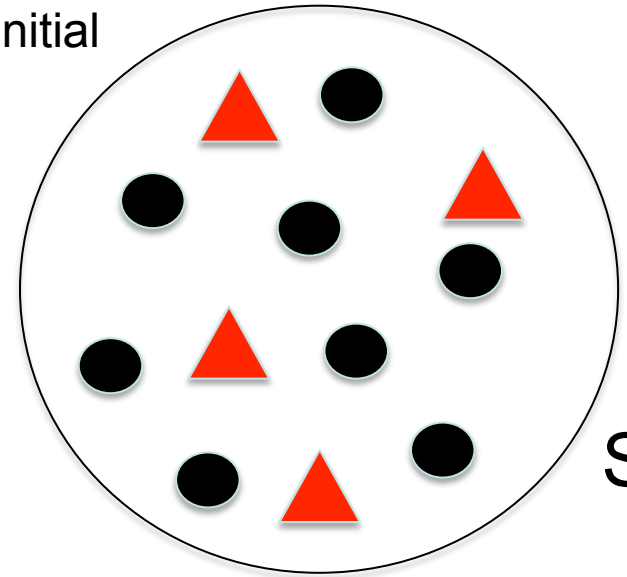
Iodine Clock Reaction - Kinetics

Experiment of	$[H_2O_2]$, M	[KI], M	Reaction Time	Initial Rate of Reaction
A	0.045	0.100	15 sec	
B	0.045	0.050		
C	0.0225	0.100		

Predict the time it will take for the reaction to be completed for Experiments B and C.

Same reaction, different concentration

Initial

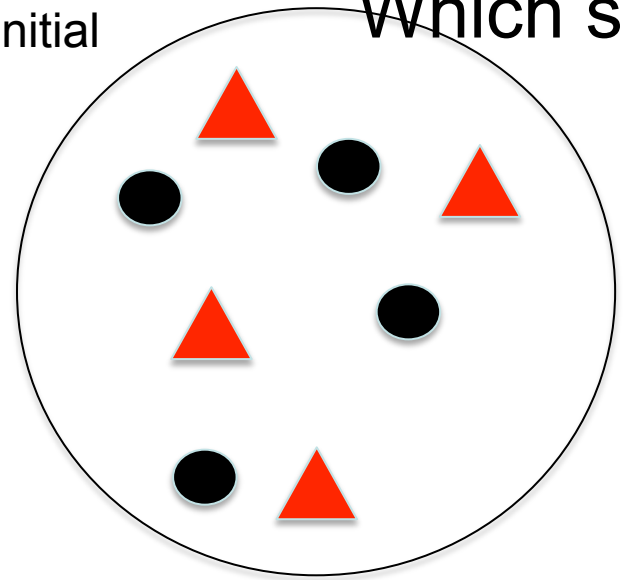


A + B -> C

System X

Which system will have the faster initial rate?

Initial



System Y

A. System X

B. System Y

C. Both will have the same rate

Iodine Reaction - Kinetics

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Estimate the rate of reaction for each experiment.

Iodine Clock Reaction - Kinetics

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What are the orders of reaction for $[H_2O_2]$ and [KI]?
Write the rate law.

Iodine Clock Reaction - Kinetics

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experimentally determined (by us!) rate law:

$$\text{rate} = k\,[H_2O_2]^1\,[I^-]^1$$