Lesson Title	Iodine Clock Reaction (Factors Affecting Reaction Rates)
Length of Lesson	90 min
Created By	David Wilson
Subject	AP Chemistry
Grade Level	10-12
State Standards	4e
DOK Level	DOK 2
DOK Application	Describe
National Standards	K-12: Unifying Concepts and Processes / 9-12: B: Physical Science
Graduate Research Element	In my research I study the kinetics associated with the proteins with which I work. Students will determine the effect of altering parameters like temperature on reaction rates.

Student Learning Goal:

State Standards: (Chemistry)

4) Analyze the relationship between microscopic and macroscopic models of matter.

e. Describe and identify factors affecting the solution process, rates of reaction, and equilibrium. (DOK 2)

National Science Standards: (9-12)

Unifying Concepts and Processes:

As a result of activities in grades K-12, all students should develop understanding and abilities aligned with the following concepts and processes:

- Systems, order, and organization
- Evidence, models, and explanation
- Constancy, change, and measurement
- Evolution and equilibrium
- Form and function

B: Physical Science: Chemical Reactions

- Chemical reactions can take place in time periods ranging from the few femtoseconds (10^{-15} seconds) required for an atom to move a fraction of a chemical bond distance to geologic time scales of billions of years. Reaction rates depend on how often the reacting atoms and molecules encounter one another, on the temperature, and on the properties—including shape—of the reacting species.

Materials Needed (supplies, hand-outs, resources):
Be Careful and always read the Materials Safety Data Sheet (MSDS) written for chemicals you use. Federal Law requires the vendors of chemicals to provide MSDS sheets for all their chemicals

(All quantities specified here are for approximately one lab group.)

1) 0.010 M KI
2) 0.0010 M $Na_2S_2O_3$
3) distilled water
4) 0.040 M $KBrO_3$
5) 0.10 M HCl (Concentrated HCl is 12.0 M HCl.)
6) Two large test tubes
7) Two 100 mL beakers
8) Plastic transfer pipettes
9) Test tube rack
10) Graduated cylinder
11) Timer (to record the rate in seconds)

Lesson Performance Task/Assessment:
Students will

- Determine the effect of temperature, concentration, and presence of a catalyst on the rate of a reaction.

Lesson Relevance to Performance Task and Students:
The concepts associated with this topic are very abstract and difficult to understand as a new student to chemistry. This lab is an opportunity for students to gain some perspective into what the concepts involved mean.

Anticipatory Set/Capture Interest:
The students have become familiar with the calculations involved in this lab already. However, the students will be given a pre-lab assignment (attached) to complete before the lab for homework to give them more directed experience in completing the calculations necessary in the lab. To further focus their minds, I will show them the effect of sulfuric acid dehydration of sucrose with and without a catalyst ($KClO_3$).

Guided Practice:
The pre-lab assignment qualifies as guided practice for the skills needed in the lab.

Independent Practice:
Completing the lab is the independent practice.

Remediation and/or Enrichment:
Remediation: Individual IEP.
Enrichment: These students will postulate the effect of surface area (i.e. smaller particles of reagents) on reaction rates in paragraph form in preparation for the AP exam.

Check(s) for Understanding:
Students should be able to complete all the calculations involved in the lab, and explain the observations in paragraph form.

Closure:
I will review the data collected by each lab, and show them the lycopodium silo explosion demonstration.

Possible Alternate Subject Integrations:
None.

Teacher Notes:
Procedures can be found in the following reference, or purchased form Flinn Scientific. The author's preferred procedure can be purchased from Flinn, since the chemicals and procedure come ready mixed for the lab.

Reference:

1) CHE-106 Lab Manual used at The University of Southern Mississippi; Woodruff, Frank and Howell, J. Emory. Chemical Principles in the Laboratory. The University of Southern Mississippi. 2000. {This particular lab was copyrighted in 1975.}
2) Dehydration of Sucrose –
    a. Without catalyst - http://youtu.be/nqDHwd9rG0s
    b. With catalyst - http://youtu.be/FhLS7RLp1mo
3) Lycopodium Silo Explosion
    a. http://youtu.be/TAdElO1FCSM