Simple Kinetics Demo
To
Simple(?) Kinetics At-Home Lab

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Rich Laboratory Experience:
Place to Design
Collect Authentic Data
Learn How to Use Equipment
Make Mistakes

On-line Everything:
Video
Animation
Simulation

AT-HOME LAB
END OF YEAR LAB

Readily Available Materials

Minimal Amounts of Materials

ISSUE OF EQUITY:

Choice ~ Lemon Ice, Making a Battery or Simple Kinetics

2 to 3 drops each of red, yellow & blue food coloring
3 Tablespoons (approx. 50 mL) of household bleach
SIMPLE KINETICS DEMONSTRATION
by Tom Kuntzleman

Each in 2 cups water (500mL)

Blue: 2 drops blue

Green: 1 drop blue + 1 drop yellow

Yellow: 2 drops yellow

Orange: 1 drop yellow + 1 drop red

Red: 2 drops red

Place ½ cup colored water into a colorless container
Add 10 drops of bleach

* The results of the presentation should look like this: yellow fades to colorless, orange fades to red, green fades to blue, and the red and blue dyes persist.
TO SIMPLE (?) KINETICS LAB
SAFETY

R Recognize the hazards
  (SDS, splash, heat)

A Assessing the risks
  (technique, labels, not alone)

M Minimizing the risks
  (open area, PPE, follow procedure)

P Prepare for emergencies
  (rag or paper towels, clean up)

INCLUDE AT-HOME LAB SAFETY IN STUDENT SAFETY CONTRACT
SIMPLE (?) KINETICS LAB

REPLACE TRADITIONAL LAB:
FACTOR THAT EFFECT RATES OF REACTIONS

1. The Nature of the Reacting Species
   ...essentially the demonstration procedure

2. Effect of Temperature
   ...cool in ice/water bath

3. Effect of Concentration
   ...lower the concentration of the bleach
PART 1: Nature of Reacting Species
GREAT!

PART 2: Effect of Temperature
GREAT!
Lower Temp...Lower Rate

PART 3: The effect of Concentration
THE CULPRIT!
CHANGING CONCENTRATION

Do they need more instruction?
  How to Dilute
  What to Dilute...bleach

Different techniques for drops
Or
Change to 1/8 teaspoon or ¼ teaspoon (1tsp = 5mL)

To Stir or Not to Stir?

...TIME FOR SOME SLEUTHING!
SEARCH FOR A MORE SIMPLE SYSTEM...

Yellow Food Dye: FD&C yellow 5 plus FD&C red 40
GATORADE ZERO, Lemon-Lime: FD&C yellow 5

<table>
<thead>
<tr>
<th>1/2 cup G-Zero</th>
<th>1/2 cup G-Zero + 10 drops bleach</th>
<th>1/2 cup G-Zero Soln + 10 drops bleach (6%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drops Bleach (6.0%)</strong></td>
<td><strong>Bleach Strength</strong></td>
<td><strong>Time</strong></td>
</tr>
<tr>
<td>10</td>
<td>6.0%</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>3.0%</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>1.5%</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>25%</td>
<td></td>
</tr>
</tbody>
</table>
WHY I LIKE THIS: Student Generated Phenomenon/Data

Engineering/Design…from containers to drops of bleach?

Evidence

Claim

Reasoning

Particulate Diagrams

Environmental Link: Oxidation of Pollutants (Fenton Rxn)

Structure of Food Dyes: conjugated double bond systems

Gatorade: Beer’s Law

AP: Crystal Violet & ChemCollective Kinetics Simulation

Now there is a reason to talk about Collision Theory….