Investigating Reaction Rates
Lesson Plan

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Course Name 8th Integrated Science
Core Curriculum Standard Fulfilled
Standard I: Students will understand the nature of changes in matter.
Core Curriculum Objective Fulfilled
Objective 4: Identify the observable features of chemical reactions.
Objective 4d: Experiment with variables affecting the relative rates of chemical changes (e.g., heating, cooling, stirring, crushing, and concentration.)

Intended Learning Outcomes (ILOs) Fulfilled
1d: Select the appropriate instrument; measure, calculate, and record in metric units, length, volume, temperature and mass, to the accuracy of instruments used.
1e: When given a problem, plan and conduct experiments.
4a: Provide relevant data to support their inferences and conclusions.
4b: Use precise scientific language in oral and written communications

Time Needed to Complete Inquiry 1-2 class periods

Inquiry: What is the research question to be scientifically investigated by the students? Will you use Structured Inquiry, Guided Inquiry, or Open Inquiry as the teaching method?
What factors can affect the rate of a reaction?
Structured Inquiry

Prior Knowledge Needed: What background knowledge and skills do the students need to be prepared for this inquiry? How will they obtain it?
Student should be familiar with basic lab skills (testing variables and using constants, making data tables, etc.) and the use of lab equipment. This lab would come in the middle of a chemical energy/reactions unit, prior to discussing reaction rates.

Introduction: Tell how you will introduce the inquiry to your students to make it meaningful and relevant.
Introduce the lab with the demonstration of ¼ tablet of Alka Seltzer dropped in water. While demonstrating the Alka Seltzer/water reaction, make a point of talking about the importance of using constants (e.g., a fixed amount of water (100 ml), fixed amount of Alka Seltzer (1/4 tablet) and a constant temperature of water (room temperature)). Time the reaction.
Explain to students that the amount of time it takes for a reaction to occur is called the rate of the reaction. Discuss other rates that students might be familiar with including mph, $/hr, etc.

Materials / Resources Needed for the Investigation:
-1-2 Alka Seltzer tablets per student group
-chemical splash goggles for each student
Have the following supplies available for students to use around the lab:
-beakers/flasks
-graduated cylinders
-stopwatches
-water
-plastic knives to cut up tablets
-mortar and pestle sets
*heat source
*ice
*crucible
*thermometers
*various solvents (I've used vinegar, ammonia, and hydrogen peroxide)

* denotes materials for further investigations (see Assessment portion of lesson plan)

Procedures of the Investigation: Describe the actual investigation. What will the students do? If applicable, identify the independent and dependent variables, the constants, and the repeated trials.
Begin the lab by asking the students the question "What do you think that you could do to speed up or slow down the Alka Seltzer reaction?" Have students brainstorm with their lab partner(s) and write down their ideas/hypotheses.

The students' assignment for this lab is to investigate their hypotheses of what they can do to change the rate of the Alka Seltzer/water reaction. Students will be allowed to test any of their ideas with the materials that you have provided for them. They will need to keep track of their data in a data table. (See the next section.) They should test at least three variables (sizes of particles) while keeping the water temperature, amount of water, and amount of Alka Seltzer constant.

(You may want to guide students through the beginning and set up of the lab, your dialog might be "Cut your Alka Seltzer into four equal parts. Test your first variable, ¼ of a tablet. How long did that take? Now you need to test three more variables, remember your constants are…" At this point, students will only be testing particle size/surface area.)

Data Collection: How will students collect and organize data (tabulation)?
Students will be given a lab report to complete during the lab (attached). They will be required to keep their data in a data table on the lab report; they should be familiar with making data tables and lab reports already.

If your students are not familiar with constructing data tables, on an overhead/board draw a data table to show students how they can get started and record the data from the teacher demonstration on this data table. Example:

Reaction Rate of Alka Seltzer/Water (Or their own title)

Independent Variable	¼ Alka Seltzer tablet (whole)			
Dependent Variable (Time: minutes)	1:04 minutes			

Constants: amount of water, temperature of water, amount of Alka Seltzer (1/4 tablet)

Data Analysis: How will students be able to interpret the data (e.g., graphs), to reach consensus (if appropriate)? How will they draw conclusions?
Students will interpret their data by reading their data tables to see how each variable affected the rate. They will need to come to a conclusion based on their data and write a paragraph to explain how the variables affected reaction rate.

Assessment: How will you know that your students have met the objective? Are there application extensions to this activity, interpretative test items, etc.?

The students' assessment will be in the form of a class discussion after students have finished their lab and written their conclusion. (Now would be a great time to introduce vocabulary: surface area.)

Now, have the students brainstorm for other ideas that could affect reaction rates. Ideas include the temperature of the water, amount of water/solvent or changing the solvent. Have them design their own experiment now complete with a list of constants and their own data table. (Temperature could be hot, room temp, cold, etc. Alternative solvents could include vinegar, ammonia, hydrogen peroxide, etc.)

Lab report worksheet:

Name_____ Hour_____

Title:

Purpose: To affect the rate of a reaction.

Hypothesis:

Materials:

Data:

Conclusion: