Lesson Title: 3-2-1 Pop! - An Effervescent Race
Estimated Lesson Time: One class period / extra-curricular session (~ 50-60 minutes).
Overview & Purpose: Students will develop a working knowledge of the Engineering Design Process, including how to keep a lab notebook.
Standards: *Idaho Core Standards and Next Generation Science Standards (NGSS) relevant to the lesson.* Idaho Core, RST.6-8.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. Idaho Core, WHST.6-8.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. NGSS, MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. NGSS, MS-PS2-2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object

Goals and Objectives:	Students will be able to follow and apply the Engineering Design Process in constructing a series of rocket designs. Students will be able to keep a detailed record of the steps of the Engineering Design Process in their Idaho TECH lab notebook.
Assessment:	*Formative* – Monitor student discussion and participation to ensure comprehension. *Summative* – Review lab notebooks for adherence to Engineering Design Process.
Needed Materials:	• Timer / watch that tracks seconds • 4 Alka-Seltzer tablets • Tweezers • 2 beakers • Warm and cold water • Thermometer • 33mm film canisters with internal sealing lids • Construction paper • Tape • Scissors • Paper towls • Pens / pencils • Idaho TECH Lab Notebook

Teacher preparation requirements: In addition to this lesson plan, review the materials in the Teacher and Student activity books. Prepare laboratory stations with listed materials. Review safety information in the Teacher activity book.

Student configuration: As team size dictates, the reaction rate experiment can either be done in small groups or as a whole-team activity.

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Lesson Procedures	Procedure Description	Estimated Time
1. Introduction to lesson.	Inform students that they will be conducting an engineering experiment, to design the best film canister rocket. Introduce the concept of the Engineering Design Process, a methodical set of steps for creating the best design. Explain that the Engineering Design Process is also a model for keeping a record of the experiment.	5 minutes.
2. Engineering Design Process.	Introduce the 6 steps of the Engineering Design Process: 1) Identifying problems; 2) setting goals; 3) brainstorming design ideas; 4) selecting and constructing a design; 5) testing and revising the model; and 6) presenting the final product. Write the steps on a board, and prompt students to provide a summary of what each step consists of.	5-10 minutes.
3. Newton's Laws	Instruct students to read about Newton's Laws of Motion from the student activity book independently. Briefly review the laws and their definitions, prompting students for definitions of each.	5-10 minutes.
4. Rocket Propellant	Allow students to continue reading from the student activity book, including the description of film canister rockets, the application of Newton's 2^{nd} law, surface area, temperature, and the list of materials, and the directions for propellant research. Before starting the experiment, have students inventory their materials. Reiterate the importance of considering surface area and	5-10 minutes.

	temperature during the experiment.	
5. Design Process	Instruct students to continue with the experiment. Reiterate that students should be conducting the experiment according to the Engineering Design Process. Emphasize to students that they must write in their lab notebooks, and should follow the step-by-step instructions from the student activity book. Advise students that they should aim to spend 3-5 minutes on Steps 1-3 and 6 of the process, and 8-10 minutes on Steps 4-5.	20-25 minutes.
Summary & Evaluation Debriefing	Review lab notebooks, providing feedback on how future entries might be improved. Have students give a short presentation on the final project, detailing their initial design, testing, and revision. Explain to students that the lab notebooks and the Engineering Design Process will be used throughout the process of designing their rover. Lead a discussion about the Engineering Design Process, prompting students to consider what they have learned about using it.	5-10 minutes.

References and Resources:

Idaho Core Standards - **http://www.sde.idaho.gov/site/common/**

Next Generation Science Standards (NGSS) – **http://www.nextgenscience.org/next-generation-science-standards**

Idaho TECH website – **http://ed.isu.edu/Idaho_TECH/index.shtml**

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