POP ROCKETS

GRADE LEVEL

K – 12th

TIMELINE

45 – 60 minutes

NGSS STANDARDS

- K-PS2-1
- 2-PS1-4
- K-2-ETS1-3
- MS-PS3-1
- MS-PS3-2

INTRODUCTION

OBJECTIVES

Students will:

- Simulate rocket launches using the chemical reaction of Alka-Seltzer® and water.
- Identify independent and dependent variables and choose a variable to manipulate related to the "fuel" for their pop rocket.
- Use the Scientific Method to test their hypothesis, collect data, and draw conclusions related to their pop rockets.

MATERIALS

- Alka-Seltzer® (~20 tablets per group)
- Film Canisters (1 per group)
- Graduated Cylinder (1)
- Pitchers of Water (warm water works best) (~5 pitchers or easy access to refill)
- Stop Watches (1 per group)
- Cookie Sheets (~5)
- Data Collection Worksheet (1 per group)
- Pens/Pencils (1 per group)

TEACHER PREPARATION

- Prepare a table with a graduated cylinder, several pitchers of warm water, film canisters, and lots of Alka-Seltzer® tablets. Pour some warm water into the cylinder.
- Prepare a "launch pad," using cookie sheets, where students have a flat, even surface to launch their pop rockets repeatedly. Outside works best as this is a messy activity.

LESSON INSTRUCTIONS

ENGAGE (5 MINUTES)

- Ask students to explain what happens when Alka-Seltzer® is added to water. Demonstrate by dropping a tablet into the graduated cylinder full of warm water. They should notice the

formation of bubbles or fizzing. This is the production of CO_2 gas during a decomposition reaction between the Alka-Seltzer® and water.

- Explain to students that they will be using Alka-Seltzer® and water as fuel for their pop rocket engines. The gas will build up in the film canister (engine) eventually causing enough pressure to pop the lid off and send their rocket into the air.
- Quickly review independent and dependent variables and have students identify which parts of their pop rockets could fall into each category. Remind students that good scientific tests only change one independent variable at a time.

EXPLORE (35 MINUTES)

- Students will be working in pairs to test two different variables: the amount of a tablet used, and the amount of water used. They will change these variables to study the effect it has on their pop rocket's launch time.
- They will test ¼ tablet, ½ tablet, a whole tablet, and ¼ full, ½ full, and full film canister. This means there will be lots of different combinations of variables to try as they should only change one variable at a time.
- Lead students to the launch pad area and demonstrate the best method to launch their pop rockets.
    a. Fill the cannister with the correct amount of water.
    b. Place the correct amount of Alka-Seltzer® tablet on the underside of the canister lid.
    c. In one smooth movement, invert the lid onto the cannister, dropping the tablet into the water, and seal the lid tightly.
    d. Have your partner start the stopwatch.
    e. Quickly place the pop rocket, lid down on the cookie sheet, and step away.
    f. Watch the launch, stopping the time as soon as you hear the "pop!"
- Have students conduct between three and five trials on each variable. Make sure they record their findings on the worksheet (a simple worksheet example is provided below).

EXAMPLE

Trial #	Amt of Tablet	Amt of Water	Time to Launch
1	¼	¼	?
2	¼	¼	?
3	¼	¼	?
4	½	¼	?
5	½	¼	?
6	½	¼	?
7	Whole	¼	?

- Once every group has tested all their variables, or time has expired, bring students back inside to discuss their findings.

EXPLAIN (10 MINUTES)

- Have students present their findings and explain which combination of variables led to the fastest launch time and which had the slowest launch time.
- Compare results and see which groups agree, and which maybe had a different result.

ELABORATE (15 MINUTES)

- To elaborate on these concepts students can:
    - Brainstorm other variables that could be tested.
    - Test a different dependent variable such as height of the rocket launch, loudest "pop," or least wasted materials (leftover tablet) left on the launch pad.
- Experiment with other chemical reactions, like baking soda and vinegar or Coke® and Mentos®.

EVALUATE (5 MINUTES)

Have students create a hypothesis for one of the variables that they brainstormed. What factors from their experiment help to support that hypothesis?