

# ROCKETS

**CHALLENGE:** Several of your friends are interested in rockets and some research shows it is possible to make a simple rocket using Alka Seltzer as the power supply. This could be a cool way to learn about chemical reactions and find a use for them. Further investigation shows there is a simple way to make a rocket body from a piece of paper that is rolled up and a film canister with water and Alka Seltzer provides the boost. The rocket should go as high as possible while varying the amount and temperature of the water in the film canister. A maximum of one-half tablet of Alka Seltzer can be used in the design and everyone will use the standard rocket design body.

In this design challenge, what is the problem you need to solve?

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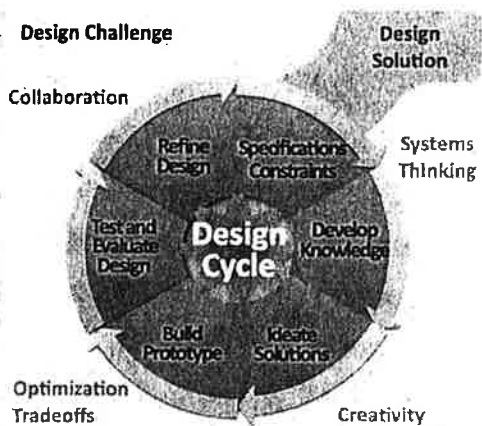
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**Specifications** are the things that my solution must have or do. They are the project requirements. **Constraints** are things that limit my solution. For example, a **constraint** may be how much I'm allowed to spend, or how much time I have to complete the challenge.

Fill in the chart on the next page with the **specifications** and **constraints** for this challenge.

Specifications	Constraints



## RESEARCH AND INVESTIGATION

### KNOWLEDGE AND SKILL BUILDER I: EFFECT OF TEMPERATURE AND ALKA SELTZER AMOUNT ON CHEMICAL REACTION RATE.

#### INTRODUCTION:

Alka Seltzer in water produces carbon dioxide. It is the same reaction as vinegar and baking soda (sodium bicarbonate) because the Alka Seltzer has a chemical in it that makes water acidic like vinegar. When the reaction occurs in a closed container, in this lab a film canister, the gas pressure builds up until the lid "pops." The faster the chemical reaction, the faster the carbon dioxide gas pressure builds up, and the shorter time until the lid pops. In other words, if two reactions in film canisters are compared, the one that pops in the shortest time is the one with the fastest rate of reaction.

**PROBLEM:** How does temperature effect the time of (and the rate of) a chemical reaction?

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**Safety Notes: GOGGLES SHOULD BE WORN.** All safe handling of chemical precautions should be followed.

**MATERIALS:**

- 1 timer
- 1 film canister with cap
- 1 thermometer
- 1 25, 50, or 100 ml graduated cylinder
- 1 tray
- 1 waste beaker

**CHEMICALS:**

1 Alka-Seltzer Tablets (or other generic effervescent product) divided into four equal sections - you will need a total of 3 quarter pieces  
Cold water, about 5° C, room temperature water, water, about 20° C, water, about 45° C (Your teacher will provide the water at the three different temperatures and will tell you the approximate temperatures.)

**Procedures:**

Do your work on the tray to help control spills. Check off each step as you complete it.

- \_\_\_\_\_ 1. Fill canister half full.
- \_\_\_\_\_ 2. Measure and record the temperature of the cold water.
- \_\_\_\_\_ 3. Drop a quarter tablet of Alka Seltzer into the water inside the canister, quickly cap and begin timing the reaction. Stop timing when the lid of the film canister pops off. Record the time in seconds. Dispose of the used solution in the canister into your waste beaker (or sink).
- \_\_\_\_\_ 3. Repeat this procedure for the warm water.
- \_\_\_\_\_ 4. Repeat this procedure with the hot water.
- \_\_\_\_\_ 5. Give your data to your teacher and determine a class average for each temperature.

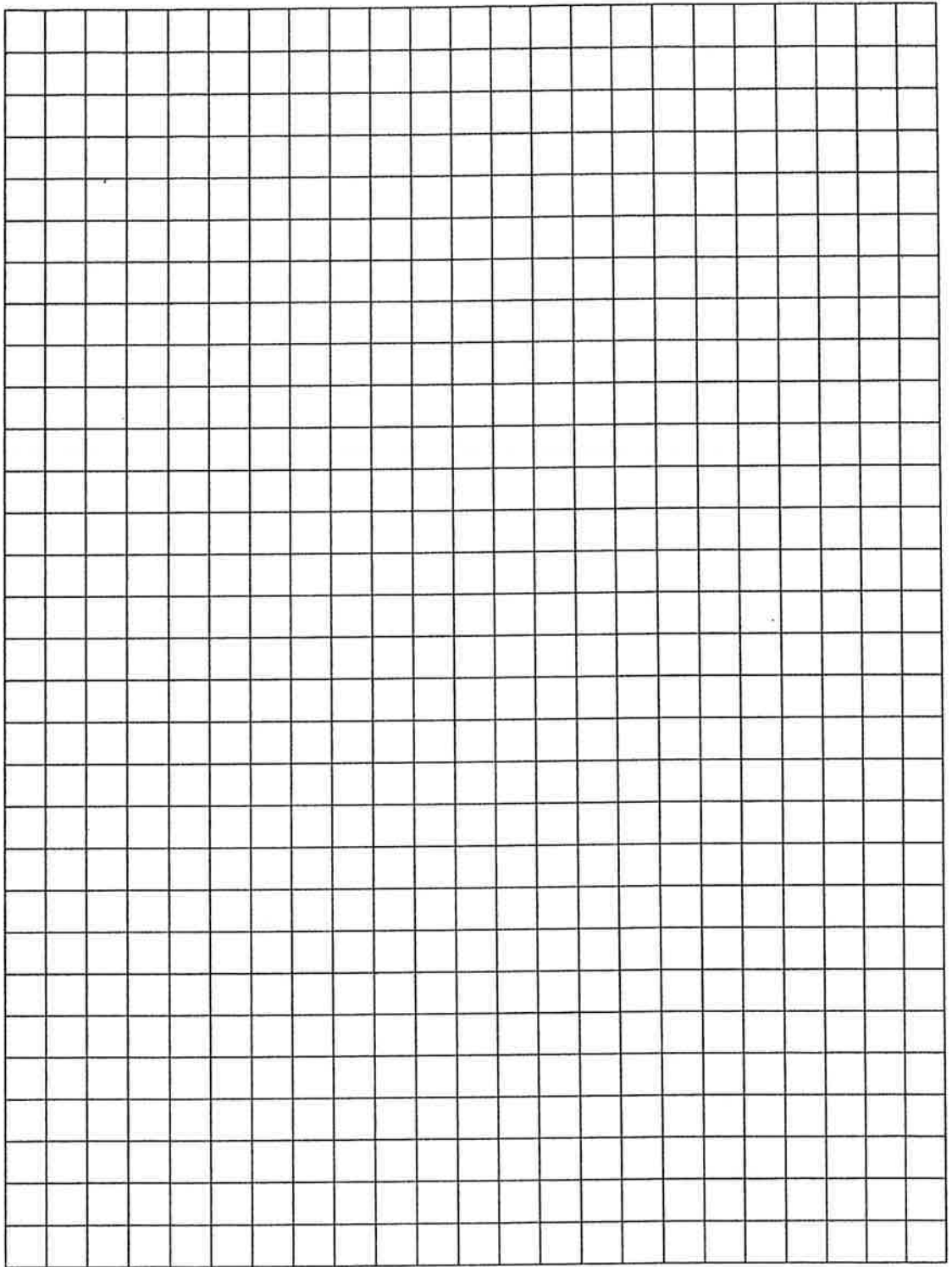
Data

Water Temperature	LAB GROUP	AVERAGE Time
	Time (seconds) until the lid pops	(seconds) until the lid pops
Cold: _____ °C		
Room Temperature _____ °C		
Hot: _____ °C		

Graph the CLASS AVERAGE data on the next page.

- Label the X axis
- Label the Y axis
- Draw a best fit line.





## Discussion

1. Which temperature caused the fastest reaction (the lid popped off in the shortest time)?

2. Why do you think this temperature caused the reaction to be faster?

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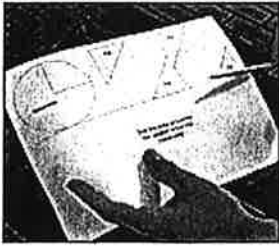
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3. Use the graph to predict the number of seconds for the lid to pop off when the water temperature is:

• 30° C \_\_\_\_\_

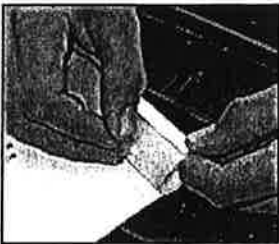
• 90° C \_\_\_\_\_

## KNOWLEDGE AND SKILL BUILDER II: BUILDING YOUR ROCKET BODY



Step 1

Cut out the rocket template pieces. You will need the big rectangle piece first.



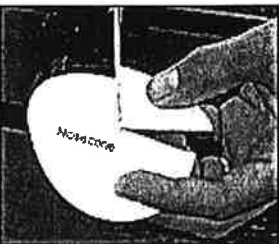
Step 2

Take the lid off the film canister and use cellophane tape to attach the paper to it.



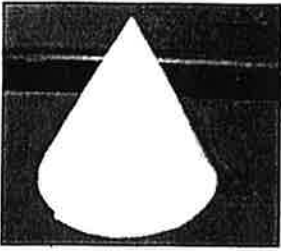
Step 3

Now roll the paper around the canister and attach with cellophane tape. The canister should be at the bottom.



Step 4

Take the nosecone template and cut out the triangle to make a cone. *You may need to cut out a bigger triangle.*



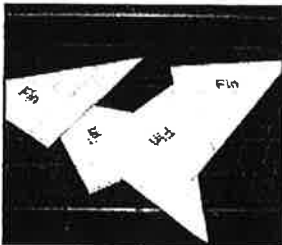
Step 5

Use cellophane tape to stick the ends together to form the cone. It should look like this.



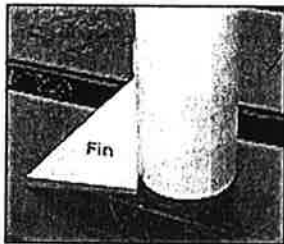
Step 6

Using cellophane tape, stick the cone on to the top of the rolled piece of paper. Make sure the film canister is at the bottom.



Step 7

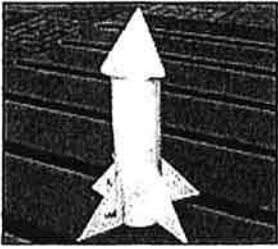
Now cut out all the fins for the rocket and fold along the dotted line.



Step 8

Attach the fins to the base of the rocket using the folded strip and tape.





Step 9

Your rocket is now ready to launch!

### ALTERNATIVE SOLUTIONS:

Now you need to figure out what temperature of water and how much Alka Seltzer to use in your rocket. Give two choices you are thinking about and indicate which one you think will make the rocket go the highest.

Temperature \_\_\_\_\_

Amount of Alka Seltzer \_\_\_\_\_

Design 1

Reason 1:

Reason 2:

Temperature \_\_\_\_\_

Amount of Alka Seltzer \_\_\_\_\_

Design 2

Reason 1:

Reason 2:

**OPTIMUM SOLUTION**

Circle your best idea. Why is this the best design?

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**INSTRUCTOR SIGN-OFF.** \_\_\_\_\_

**CONSTRUCTING THE PROTOTYPE**

Construct your rocket. Indicate below the amount of water, water temperature, and Alka Seltzer size that you are using.

Place a photograph or make a drawing of your Rocket in the space below. Label the important features. Show how all of the specifications have been met.

### **REVISING YOUR DESIGN**

How did your final design differ from your initial design? Why did you make the changes you did?

## REFLECTIONS

Would you change the specifications and constraints? If so, indicate how you would change them and why?

## EXTENSION

A team member says there is a way to join two canisters together forming one twice as large as the one you used. What amount of water and Alka Seltzer would you use? Why?