

# ROCKET POWER!

For high-speed travel, nothing beats a rocket! Many of the world's fastest vehicles get their speed from rocket engines. You'll get to experiment with rocket science yourself as you put your rocket to the test.

## LET'S BUILD IT!

FOAM CAPSULE

### ROCKET BODY

Slide the foam capsule onto the cylinder.

CYLINDER

### STABILIZER FINS

Attach the three fins to the rocket body by sliding them up the cylinder and clicking them into place.

### LAUNCHING BASE

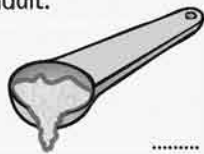
## BLAST OFF!

You don't have to be a rocket scientist to run this rocket! But before you launch, be sure to read all the instructions and get help from an adult.

**INGREDIENTS:**  
Rocket • Vinegar  
Baking soda/bicarbonate of soda

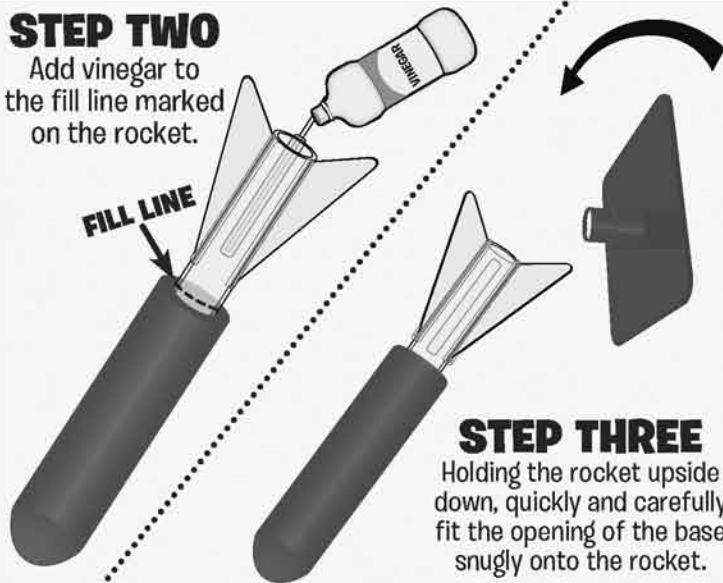
### STEP ONE

Fill the opening of the launching base with baking soda/bicarbonate of soda.



### STEP TWO

Add vinegar to the fill line marked on the rocket.



### STEP THREE

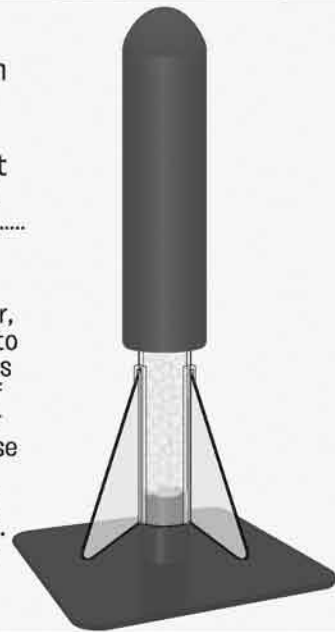
Holding the rocket upside down, quickly and carefully fit the opening of the base snugly onto the rocket.

## STEP FOUR

Now shake it and set down the whole thing with the base on the ground. Step away from the rocket and see how high it goes!

### NOTE:

When you see bubbles starting to form in the cylinder, it means your rocket is about to launch. It may take 30 seconds or more for the fuel to mix. If your rocket hasn't fired after two minutes, hold it by the base (with the foam capsule pointing AWAY from you) and pull the rocket from the base. Rinse the two parts in warm water, dry the base, and refuel.



### SAFETY FIRST:

Make sure you understand these rules before using your rocket. Only launch your rocket in a wide-open space outdoors, with no people nearby.

After you have added the fuels to your rocket, quickly move away from the launching base. Never stand directly above the rocket or look straight down at it on the launching base. It's a good idea to wear protective safety goggles when you set off your rocket.

Do not aim your rocket at people, animals, windows, cars, or other objects that can be damaged or broken.

Rinse your rocket with water after each firing. Carefully wash the plastic parts of your rocket with warm, soapy water when you are finished experimenting.

Do not add any fuels other than the ones described in the instructions. Do not eat, taste, or drink any of the rocket fuels.

# HOW BAKING SODA & VINEGAR POWER YOUR ROCKET

Your rocket gets its power from a chemical reaction between two ordinary kitchen items: baking soda/bicarbonate of soda and vinegar.

## SOLID FUEL

Baking soda/bicarbonate of soda, which scientists call *sodium bicarbonate* (SO-dee-um by-CAR-buh-nate).


## LIQUID FUEL

Vinegar, which is a mixture of water and a chemical called *acetic acid* (uh-SET-ik) *acid*.

## REACTION

When you mix these two fuels, they don't just hang out together. They react chemically to form a bubbling, fizzing foam. The foam you see is made of two brand-new substances formed during the reaction: plain water and carbon dioxide gas.

The chemical that makes your rocket move is *carbon dioxide*. This odorless, colorless gas escapes through the opening at the back of your rocket and sends the rocket off into the air.

 Carbon dioxide gas is produced by your body when you breathe, and it is the bubbly part of soda pop.

## HOW HIGH DID IT GO?

What goes up must come down, and your rocket is no exception. When the rocket flies up in the air, there are two opposing, or opposite, forces acting on it.

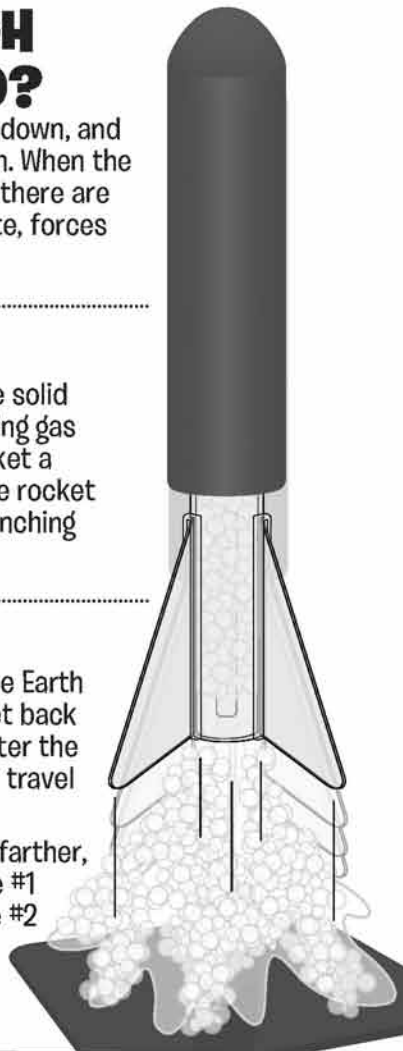
### FORCE #1

When you mix together the solid and liquid fuels, the escaping gas you produce gives the rocket a push. This force pushes the rocket upward, away from the launching base.

### FORCE #2

Gravity is the force that the Earth exerts as it pulls the rocket back to the ground. You can't alter the force of gravity unless you travel to outer space.

To make the rocket travel farther, you need to increase force #1 so it is stronger than force #2 (gravity).



## SPEED IT UP!

Now that you've learned how your rocket works, experiment with ways to make it blast off more quickly.

## POWDER POWER

Use a spoon or rock to crush an Alka-Seltzer tablet into a fine powder.

Pour the powder into the opening of the launching base.

Pour  $1\frac{1}{2}$  tablespoons of warm water into the rocket body. Combine the water and Alka-Seltzer and launch as you did with the vinegar and baking soda.

## ALTERNATIVE FUELS

Vinegar isn't the only acidic food ingredient that reacts with baking soda/bicarbonate of soda. Instead of vinegar, try using each liquid listed below with baking soda/bicarbonate of soda in your rocket. Log your results!

## REACTIONS

ALTERNATE LIQUID FUELS	BARELY BUBBLING	FIZZING FINE	FAST BLAST
VINEGAR			
LEMON JUICE			
GRAPE JUICE			
SODA POP			
CRANBERRY JUICE			

The more fizz you see, the more gas is being created by the reaction.