

# DIY



BOYS & GIRLS CLUBS  
OF AMERICA

# STEM

# #4

## WEEKLY ACTIVITY GUIDES: AERONAUTICS

This week, you'll be introduced to the four forces of aeronautics – force, drag, lift and weight. In addition to gravity, these affect the movement and interaction of nearly all objects we encounter. You'll design pop, straw, balloon and effervescent rockets with ordinary products. Get ready because this is “rocket science” and it's not hard at all.

### ABOUT THE DIY STEM PROGRAM

DIY STEM is a program supported by Samsung as part of a shared commitment with Boys & Girls Clubs of America to inspire the next generation in science, technology, engineering, and math.

# SAMSUNG

Participate this summer by sharing photos of your experiments on social media **#STEM**



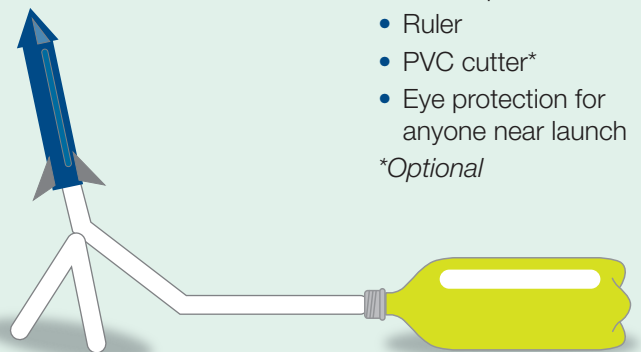
No matter your age,  
please enjoy conducting  
these experiments under  
the supervision of a  
responsible adult.

### MONDAY: POP ROCKET LAUNCHER

PAGE 1

#### MATERIALS:

- Empty (and rinsed) 2-liter plastic soft drink bottle
  - (2) 1/2" PVC tee connectors
  - 1/2" PVC connector
  - (2) 1/2" PVC caps
  - 1- 5' length of 1/2" PVC pipe
  - Duct tape
  - Ruler
  - PVC cutter\*
  - Eye protection for anyone near launch
- \*Optional*



#### LEARNING OPPORTUNITY:

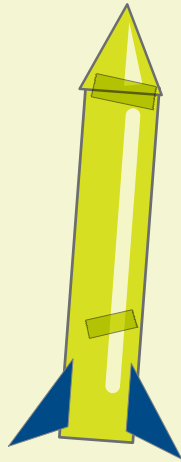
What things can you do to the launcher to make your rocket fly higher?

# TUESDAY: ONE-PIECE ROCKET

PAGE 1

## MATERIALS:

- Eye protection
- Card-stock paper
- Glue stick
- Scotch tape
- Scissors
- Crayons or colored markers
- Ruler
- Pop Rocket launcher from Monday
- Penny



## LEARNING OPPORTUNITY:

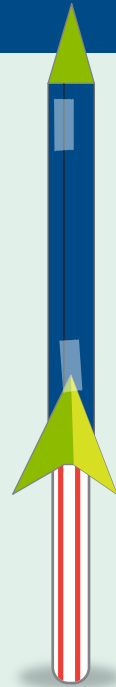
What design changes could you make to your rocket to cause it to fly a greater distance?

# WEDNESDAY: STRAW ROCKET

PAGE 2

## MATERIALS:

- Sheet of 8.5 X 11 paper (white or colored)
- Scotch tape
- Scissors
- Eye protection
- Drinking straws
- Copy of SLS paper rocket plans (can be found online [www.nasa.gov/pdf/153413main\\_Rockets\\_3\\_2\\_1\\_Puff.pdf](http://www.nasa.gov/pdf/153413main_Rockets_3_2_1_Puff.pdf))



## LEARNING OPPORTUNITY:

How can a rocket be stable even if it doesn't have fins?

How do paper rockets work?

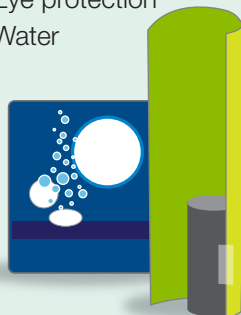
# THURSDAY: EFFERVESCING ROCKETS

PAGE 2

## MATERIALS:

- Heavy paper (60-110 index stock or construction paper)
- Plastic medicine/pill bottle (childproof bottle will not work)
- Scotch tape
- Scissors
- Effervescing antacid tablet

- Paper towels
- Eye protection
- Water



## LEARNING OPPORTUNITY:

How does the amount of water in the cylinder affect how high the rocket flies?

How does the temperature of the water affect how high the rocket flies?

How does the amount of tablet used affect how high the rocket flies?

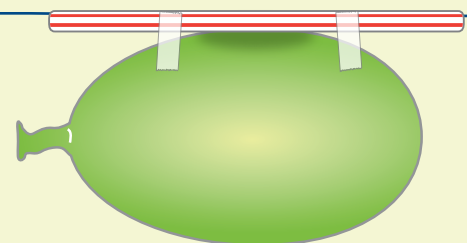
What are three ways you could improve your rocket?

# FRIDAY: BALLOON ROCKETS

PAGE 3

## MATERIALS:

- Latex party balloon
- Painters tape
- Yarn (about 6 feet long)
- Scissors
- Drinking straw
- 2 chairs



## LEARNING OPPORTUNITY:

Inflate the balloon only half full or three-quarters full with air –how does the amount of air affect how far the balloon travels?

## WEEKLY ACTIVITY GUIDES: AERONAUTICS

*This week, you'll be introduced to the four forces of aeronautics – force, drag, lift and weight. In addition to gravity, these affect the movement and interaction of nearly all objects we encounter. You'll design pop, straw, balloon and effervescing rockets with ordinary products. Get ready because this is "rocket science" and it's not hard at all.*

### Monday: Pop Rocket Launcher

#### Materials:

- Empty (and rinsed) 2-liter plastic soft drink bottle
- (2) 1/2" PVC tee connectors
- 1/2" PVC connector
- (2) 1/2" PVC caps
- 1- 5' length of 1/2" PVC pipe
- Duct tape
- Ruler
- PVC cutter\*
- Eye protection for anyone near launch

\*Optional

#### Make a Pop Rocket Launcher

1. Cut the PVC pipe into the following lengths:
  - a. 3 pieces 12" long
  - b. 3 pieces 6" long
2. Insert the end of one 12" pipe a few inches into the neck of the bottle and tape it securely with duct tape.
3. Follow the construction diagram for assembly of the launcher. [LINK to NASA PDF.]
4. Place the launcher in an open space and tilt the launch tube in the desired direction. If there is a light wind, aim in the direction of the wind. You're ready to launch your rockets tomorrow.

### Tuesday: One-Piece Rocket

#### Materials:

- Eye protection
- Card-stock paper
- Glue stick
- Scotch tape
- Scissors
- Crayons or colored markers
- Ruler
- Pop Rocket launcher from Monday
- Penny

#### One-piece Rocket

1. Use a ruler and the edge of a penny to score (dent) the fold lines on the template.
2. Place the ruler along a dashed line and hold the penny at an angle.
3. Run the edge of the penny across the paper to make a small groove. This groove ensures the fold line is both accurate and straight.
4. Cut out the pattern on the solid lines.
5. Tape a penny to the inside of one of the nose cone triangles
6. Fold the three rectangles into a triangular prism with the large tab inside. Tape the seam.
7. Fold the triangles inward to form the nose cone. The tabs should be inside. They will provide support for taping.
8. Bend the fins outward. The rocket is ready for flight.

9. Attach the rocket to the launcher you built yesterday. Make sure the landing zone is clear of anyone who might be hit by the rocket.
10. Put on eye protection and do a countdown to zero.
11. Stomp or jump on the label of the bottle. This will force most of the air inside the bottle through the tubes and launch the rocket.
12. After you retrieve the rocket, re-inflate the 2-liter bottle. Separate the bottle from the launcher by pulling it from the connector. Wrap your hand around the pipe end to make a loose fist and blow through opening into the pipe. Doing so keeps your lips from touching the pipe. Reconnect the bottle to the launcher and it is ready to go again.

## Wednesday: Straw Rocket

### Materials:

- Sheet of 8.5 X 11 paper (white or colored)
- Scotch tape
- Scissors
- Eye protection
- Drinking straws
- Copy of SLS paper rocket plans (can be found online [www.nasa.gov/pdf/153413main\\_Rockets\\_3\\_2\\_1\\_Puff.pdf](http://www.nasa.gov/pdf/153413main_Rockets_3_2_1_Puff.pdf))

### Make a Straw Rocket

1. Begin with a strip of paper, which will form the body of your rocket.
2. Roll the paper strip around the pencil.
3. Tape along the seam.
4. Close off one end to make a nose cone.
5. Cut out three or four fins.
6. Tape the fins to the open (lower) end of the rocket.

7. Bend them outward to space them equally. Hold your rocket horizontally at eye level and drop it to the floor.
8. If the nose of the rocket hits the floor first, the rocket is stable and ready for flight.
9. If the rocket falls horizontally or the fins hit first, the rocket is unstable, and you will need larger fins to stabilize it.
10. Insert a straw into the rocket body.
11. Aim the rocket at a target directly in front of you, approximately 10 feet away.
12. Puff strongly into the straw to launch their rocket.

## Thursday: Effervescing Rockets

### Materials:

- Heavy paper (60-110 index stock or construction paper)
- Plastic medicine/pill bottle (childproof bottle will not work).
- Scotch tape
- Scissors
- Effervescing antacid tablet
- Paper towels
- Water
- Eye protection

### Make and Launch an Effervescing Rocket

1. Making the Rocket
  - a. Wrap and tape a tube of paper around the pill bottle. The lid end of the pill bottle goes down.
  - b. Tape the fins to the rocket.
  - c. Roll a cone of paper and tape it to the rocket's upper end.

2. Launching the Rocket
  - a. Launch their rockets two to five times, encouraging them to make variations in:
    - i. Amount of water used.
    - ii. Whole tablet versus half a tablet.
    - iii. Crushed tablet versus whole tablet.
    - iv. Use of warm water versus cold water.
  - b. Put on your eye protection.
  - c. Turn the rocket upside down and fill the pill bottle one-third of the way with water.
  - d. Work quickly on the next steps so the rocket will launch! Once you put the tablet in the water, it reacts quickly so you will have to move quickly!
  - e. Drop 1/2 of an effervescent tablet into the water.
  - f. Snap the lid on tight.
  - g. Stand the rocket on the launch platform.
  - h. Stand back!

## Friday: Balloon Rockets

### Materials:

- Latex party balloon
- Yarn (about 6 feet long)
- Drinking straw
- Painters tape
- Scissors
- 2 chairs

### Make a Balloon Rocket

1. Tie one end of your yarn to the back of a chair.
2. Thread your drinking straw through the other end of the yarn.
3. Tie that end to the other chair.
4. Place the chairs apart from each other until the yarn is stretched all the way out.
5. Attach two strips of tape to the drinking straw.
6. Inflate the balloon and leave it untied.
7. Attach the inflated balloon to the straw using the tape.
8. Pull the balloon to the end of the chair and let go.