Look Mom, No Wings!

Do you ever dream of being able to fly? The good news is, you probably can! The bad news is that you can't fly very high or stay up for very long.

How High Can You Fly?

Try This:

Tape a large piece of paper to the wall. If you're doing this with a group of friends, the shortest person should be able to reach the bottom of the paper standing flatfooted. Touch your index finger to an inkpad or graphite from a pencil rubbing. While standing with your feet flat on the floor, stretch your arm as far as you can and mark the highest point you can reach on the paper. Now jump and mark the paper by touching it at the top of your jump. Try it a few times and challenge your friends to jump higher. (Label each person's marks with initials or have each person use different colored ink or pencil graphite.) Measure the difference in height between your standing and jumping marks. This is how high you can jump.

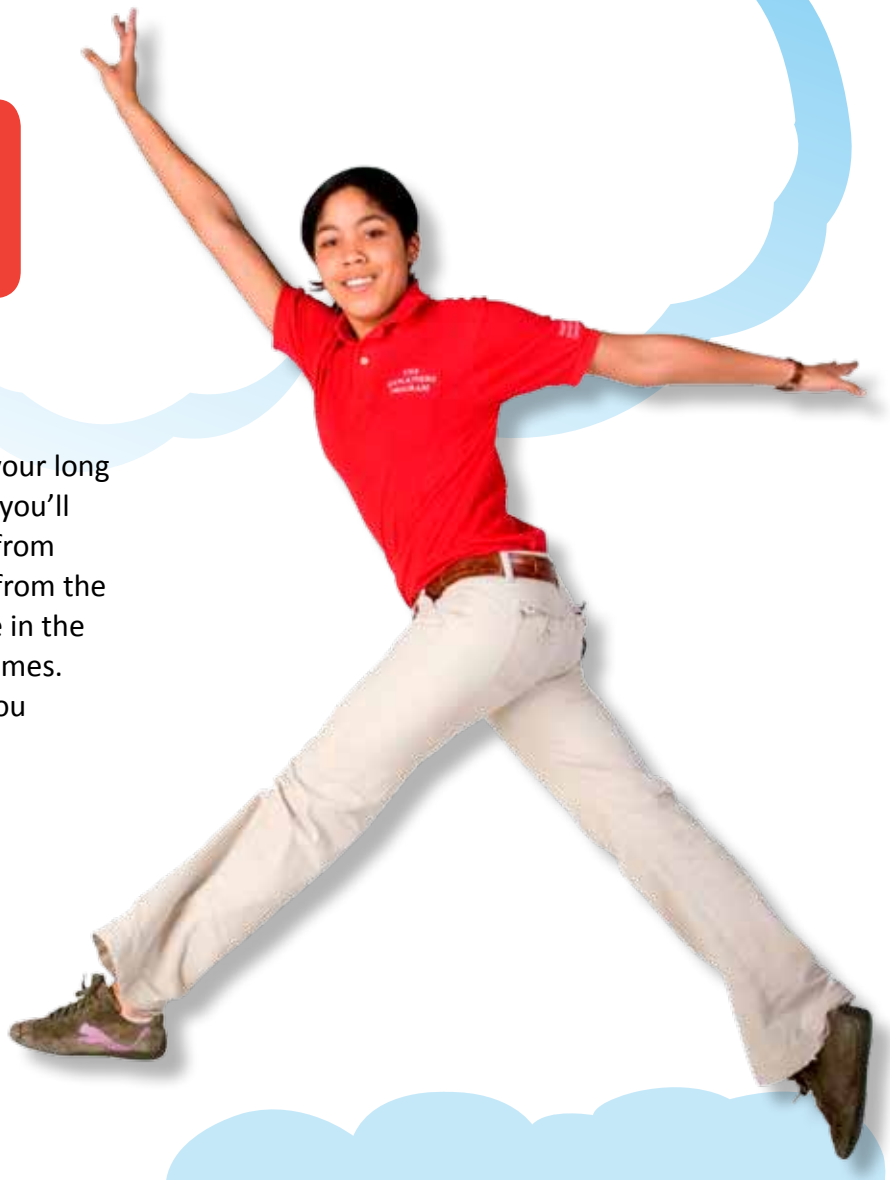
Materials

- **Large sheet of paper or chalkboard**
- **Tape**
- **Colored pencils, colored chalk, or stamp pad**
- **Ruler or tape measurer**

WHAT'S GOING ON?

You probably noticed that taller kids didn't necessarily have higher jumps. Remember, you measured the jump height from your reach and not the ground. The best jumpers in the world can clear heights up to 2.4 meters (8 feet), but they only lift their center of mass much less than that.

How Far Can You Jump?



Try This:

Pick a safe open area outside to practice your long jump. Mark a starting line. This is the line you'll jump from. Get a running start and jump from your starting line. Have a friend measure from the starting line to the closest mark you made in the dirt where you landed. Try it a couple of times. Compete with your friends. How far did you jump? Were you able to take off and fly?

Materials

- **Safe open area**
- **Helper**
- **Measuring tape**

WHAT'S GOING ON?

The farthest anyone has ever jumped with a running start is about 8.95 meters (29 feet, 4½ inches). Gravity pulls all things to Earth. Even professional basketball players and Olympic long jumpers can't stay in the air for very long without assistance.

How Long Can You Stay in the Air?

Try This:

Ask someone to time your jump with a stopwatch or a watch with a second hand. You can also time jumping athletes who are playing basketball or volleyball.

Materials

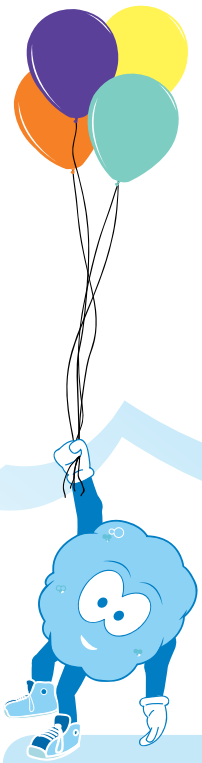
- **One helper**
- **Stopwatch or watch with second hand**

WHAT'S GOING ON?

Did you have a hard time measuring your time in the air? You're not alone. Even the best jumper remains airborne for less than one second. Still, you can compare your airborne time with those of your friends by using the table below. Look down the first column for your jump height and read across to find your time.

Jump Height		**Time in Air**
(centimeters)	(inches)	(seconds)
25	10	0.4
50	20	0.6
75	30	0.8
100	39	0.9

Extend Your Stay



Try This:

How might you stay in the air longer? Look at the jumpers in these drawings. They can stay in the air longer than you can. What are they doing that makes a difference? What else could you do to make your jump last longer?

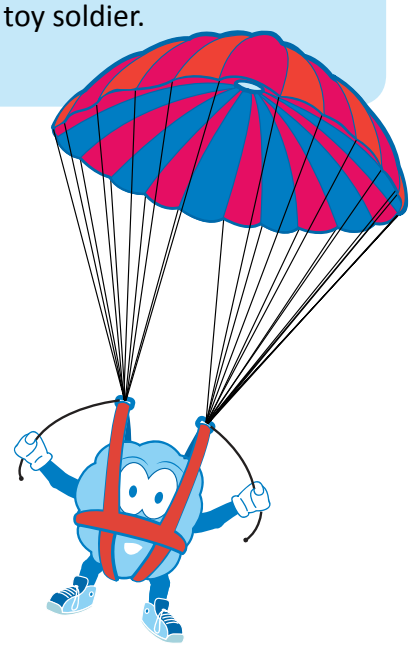
How would a parachute make you stay in the air longer? Find an old handkerchief and make four holes in each corner with a hole-puncher. (Make sure to ask your parents if you can cut up the handkerchief.) Cut four equal lengths of kite string and tie a piece of string to each corner of the handkerchief. Tie the other end of each piece to a small toy soldier. Bunch up the handkerchief and toss the soldier into the air. Did the parachute slow the toy soldier's descent? Why? Compare the descent of the toy soldier under the parachute to the descent of a toy soldier without a parachute. Is there any difference?

Materials

- **Old handkerchief**
- **Kite string**
- **Hole puncher**
- **Scissors**
- **Small toy soldiers**

WHAT'S GOING ON?

One of the four forces of flight, drag, affected the fall of the toy soldier. In this case, gravity was pulling down on your toy soldier, but drag was pushing up on it—slowing it down. Drag acted on the parachute by creating a pressure difference between the top side and the bottom side of the parachute. This is what we call pressure drag. The air below pushed harder against the parachute than the air above, which slowed the fall of the toy soldier.



WHAT DOES THIS HAVE TO DO WITH FLIGHT?

Is jumping really flying? Yes and no. Some things like rockets, cannonballs, and baseballs fly like jumping kids—they are thrust into the air by engines or muscles. What about airplanes? It's true that engines thrust them forward, but air is what pushes or lifts airplanes up. Lift, weight, drag, and thrust are the forces that act on things flying in Earth's atmosphere. If you ever thought having stronger muscles, springy shoes, or a rocket booster might help your jump, then you were thinking about thrust (the "muscle" that pushes you during flight). If you thought that a slick suit could make you jump higher, or that a parachute could keep you in the air longer, then you were thinking about drag (the way air tends to slow things that fly). And obviously weight is important—if you could lose weight by changing clothes, dieting, or standing on the Moon, you could probably jump higher.

Most people understand how weight, drag, and thrust might help them jump higher, but few people are familiar with lift. Lift is a push that comes from the air. You were thinking about this force if you thought wearing wings or holding helium balloons might help you jump higher. Airplanes and birds must be moving to create enough lift to fly. Hot-air and helium balloons are lighter than air, so the air pushes them up whether or not they are moving.

Do all four forces affect everything that flies? Nope! Only two forces—weight and thrust—act on spacecraft. Lift and drag don't affect spacecraft flying in space, where no air exists.