

# Full of Hot Air

ACTIVITIES YOU CAN DO AT HOME

Helium and hot-air balloons float in air, but how? What holds them up? Is floating a type of flying?

## Don't Float, Don't Sink



Photo by: NASM

Hold a helium balloon and watch as it floats in the air. Now try to make it “balance” in the air so that it’s not floating or sinking. To do this, you’ll need small weights, such as paper clips or pieces of tape. Add and subtract the paper clips or tape to the balloon’s string until it balances in the air. What is holding up the balloon?

Now try an activity that’s little trickier: Make something that neither floats nor sinks in water. You’ll need a bucket of water and something that floats, such as a plastic bag full of air or a balloon. Try to make it “balance” in the water by adding small weights, such as paper clips, to the bag. Keep adding and subtracting the weights until the bag is submerged but not sinking. What is holding up the bag? How is this like a helium balloon that is balancing in air?

- ▶ helium balloon
- ▶ string
- ▶ small weights
- ▶ bucket of water
- ▶ small plastic bag



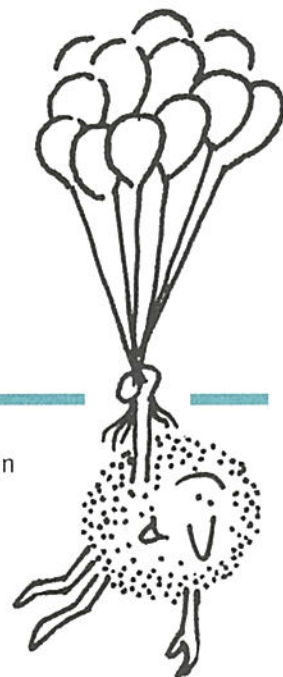
Photo by: NASM

## Balloon Ride

Imagine grabbing a bunch of birthday balloons and flying into the sky. How many balloons would you need? Here’s one way to figure that out: Put small metal paper clips on the balloon’s string, one by one, to find out how

many the balloon can lift. (A small metal paper clip weighs 0.25 grams or 0.01 ounces.) Now weigh yourself. (If you need to convert pounds to kilograms, multiply by 0.45.) Using this information, you can figure out how many balloons you’ll need.

- ▶ helium balloon
- ▶ string
- ▶ small metal paper clips



Available in large-print version.

# Bag-O-Water

Photo by: NASM



Place a bucket of water on a bathroom scale; be sure you can still see the readings on the scale. Dunk a large zip-closing plastic bag under water and fill it half full of water. Carefully squeeze out the air before you close the bag. Now lift the bag completely out of the water. How heavy does it

feel? Lower the bag back into the water, but don't let go of it. How heavy does it feel now? What is holding up the bag of water? Watch the scale. How does the reading change as you raise and lower the bag?

*Hint: You can do this activity without a scale.*

- › bathroom scale (optional)
- › large zip-closing plastic bag
- › bucket of water

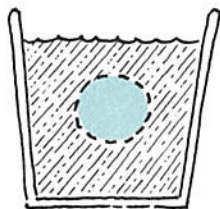
## WHAT'S GOING ON?

Were you surprised how heavy that bag of water felt? It felt lighter in the water because the water was holding up the bag for you. (If you used a scale, you could see that the weight of the bucket of water increased as you lowered the bag.)

What else can water hold up? More water! To picture this, imagine that you can color a small portion of water within a bucket of water. What is holding up this colored water? More water!

If we could remove the colored water and replace it with something else, this new thing may or may not be held up by the water. It all depends on how heavy the replacement is. If it's lighter than the water you took out, such as Styrofoam, the water will hold it up; if it's heavier, such as pennies, it will sink.

Like water, air can hold up the air above it. What about other objects? They would have to be lighter than the air they are replacing. That's why things that float in air—such as helium balloons, hot-air balloons, dandelion fluff—tend to be light for their size. Helium balloons float because they are lighter than the air they replace. It's not



the helium that holds them up; it's the air.

Now you know that objects float when they are submerged in a fluid, such as air or water, that can support them. Think about things that seem to float in outer space. No air or water exists out there, so can something really be floating? What's going on? You'll have to investigate weightlessness to find out!

## WHERE HAVE I SEEN THAT BEFORE?

Scuba divers who wear wetsuits can float to the surface very easily. To stay under water, they often have to wear extra weights.

Old-fashioned hot-air and hydrogen balloons carried bags of sand to weigh them down and keep them drifting. If the balloon started to sink, the pilot threw sand overboard. Today, pilots of sport balloons regulate floating and sinking by adding or releasing hot air.

Astronauts practice underwater to learn how to work in the weightlessness of space. They add weights to their puffy space suits so they can stay under water; they add floats to their heavy tools so the tools don't sink.

## SOLUTION TO BALLOON RIDE

We humans are definitely not light for our size! You know that if you figured out how many helium balloons you would need in Balloon Ride. Remember, one small metal paper clip weighs 0.25 g. If one balloon can carry six paper clips, that's a total of 1.5 g per balloon ( $0.25 \times 6$ ). If you weigh 45 kg (99 lb), you'll need 30,000 balloons for your ride ( $45,000 \text{ g} \div 1.5$ ).

Produced by the National Air and Space Museum's Educational Services Department to accompany **HOW THINGS FLY**, an interactive gallery.

**HOW THINGS FLY** is made possible through the generous funding of The Boeing Company and a grant from the National Aeronautics and Space Administration, with additional support from the National Science Foundation, The Smithsonian Institution Special Exhibition Fund, and the James Smithson Society. Visit our site on the internet at [www.nasm.edu](http://www.nasm.edu).

