

Lighter Than Air

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

Bag-O-Water

Try This:

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. 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? Watch the scale. How does the reading change as you raise and lower the bag?

Materials

- Bathroom scale (optional)
- Large zip-closing plastic bag
- Bucket of water



WHAT'S GOING ON?

The bag of water felt lighter in the bucket, because the water was holding up the bag for you. (If you used a scale, you should have seen the weight of the bucket increase as you lowered the bag and decrease as you raised it.) Water can hold up water. Do you think water can hold up other things? Can air hold up anything?

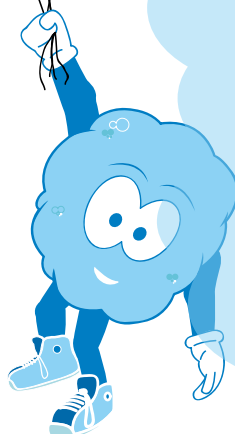
Don't Float, Don't Sink

Try This:

Hold a helium balloon and watch as it floats in the air. Now add paper clips to its string until it “balances” in the air, not floating or sinking. What is holding up the balloon?

Materials

- Helium balloon
- String
- Small metal paper clips



WHAT'S GOING ON?

Helium balloons float because they are lighter than the air they replace. It's not the helium that pushes the balloon up; it's the air around it. By adding weight to the balloon, you were able to “balance” the balloon in the air. When the weight of the balloon and paper clips equaled the weight of the air they replaced, the balloon did not float or sink.

Balloon Ride

Try This:

Imagine grabbing a bunch of helium balloons and flying into the sky. How many balloons would you need? Put small metal paper clips on a helium 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.) Use this information to figure out how many balloons you'd need.

Materials

- Helium balloon
- String
- Small metal paper clips
- Calculator

WHAT'S GOING ON?

Humans are definitely not light for their size! You know that if you figured out how many helium balloons you would need to lift you off the ground. Remember, one small metal paper clip weighs 0.25 grams. If one balloon can carry six paper clips, that's 1.5 grams per balloon (0.25×6). If you weigh 45 kilograms (99 pounds), you would need 30,000 helium balloons ($45,000 \text{ grams} / 1.5 \text{ grams}$) to lift you off the ground!

WHAT DOES THIS HAVE TO DO WITH FLIGHT?

Hot-air balloons and other lighter-than-air aircraft fly because the air pushes them up. This upward force is called buoyancy. When the weight of the balloon is equal to or less than the buoyant force, the balloon will float. This is sometimes called buoyant flight or aerostatic flight.

