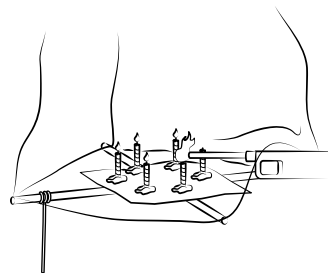
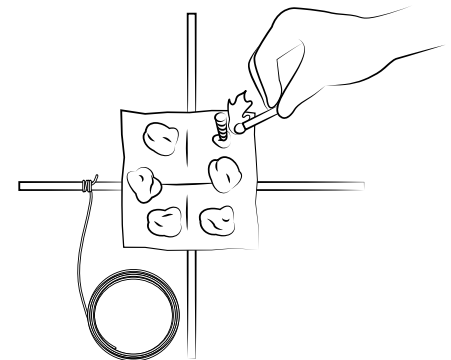
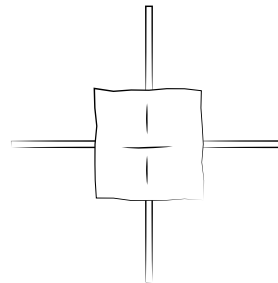
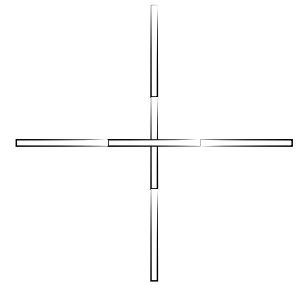


## EXTENSION: HOW DOES A HOT AIR BALLOON WORK?

A hot air balloon has gas heaters to heat the air inside the balloon. As the air is heated, the air molecules begin to move faster which causes them to move farther apart. As they move farther apart, the overall density of the air in the balloon becomes less than the density of the air outside the balloon. The balloon begins to rise because the less dense hot air lifts the balloon and “floats” on top of the denser, cooler air around it. To bring the balloon down, some of the hot air is let out in openings at the top and cooler air is brought in through the bottom (the heat is turned off). This increases the density of the balloon and causes it to descend.

### Procedure

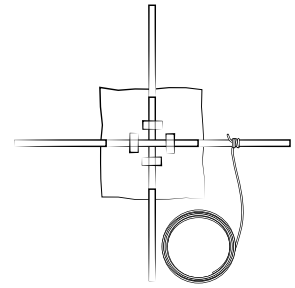
1. Measure the diameter of the opening to the garbage bag. Multiply that number by .75 to find how long to make the straws for the base. Example: If the opening is 24 inches, then the straws need to be 18 inches long.
2. Make a straw base by making a ½ inch slit in one end of a straw and inserting that end in the end of another straw. Continue until you reach the length calculated above. Repeat for the second straw.
3. Form a cross with two straws so that the two straws form right angles. Tape the two straws together using a small amount of tape.
4. Attach the 5-inch square piece of aluminum foil in the center of the base by taping it to the four straws.
5. Cut the birthday candles in half and attach the six pieces to the foil.
6. Insert the base into the opening of the bag. Have a partner hold the top of the bag while you tape the bottom of the bag to each end of the four straws.



### CAUTION!

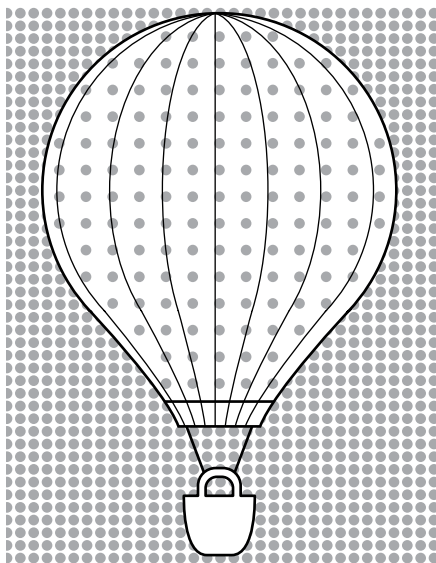
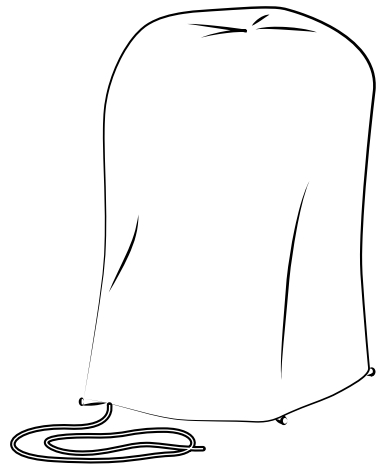
You will be using plastic bags and small candles. You must be very careful not to let the candle burn the plastic bags you are using as the hot air balloon.

7. Attach a lightweight string to one of the straws
8. While your partner holds the completed balloon vertically, carefully light the six candles. (Fireplace lighters work, but keep the flame away from the bag.)
9. Continue to hold the bag vertically as it fills with hot air.
10. Once the bag is fully filled, gently set it down on the floor. It should remain fully extended while on the floor.
11. In a few minutes, the bag will begin to rise. Use the string to keep it at a desired height. If it fails to rise after a few minutes, check to see if all the candles are lit.

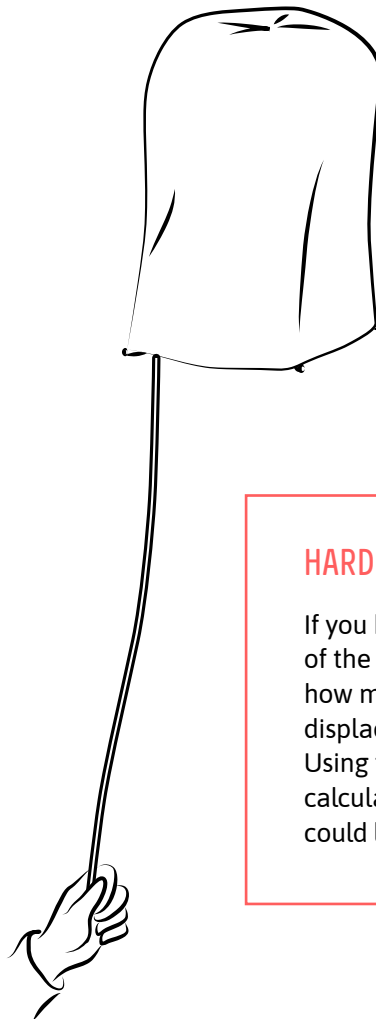


It will stay up until the candles burn out (4 to 5 minutes) and then sink slowly.

The balloon rises because the air in the bag is displaced. As the hot air rises, cooler air comes in to replace the displaced air and we have wind.



Heating air causes it to expand and become less dense.



### HARD QUESTION

If you know the volume and mass of the balloon, you can determine how much air you need to displace to lift a given mass. Using this number, students can calculate the size of the bag that could lift a member of the class.