

FULL OF HOT AIR

Help your students' STEM knowledge take flight as they explore weather, climate, motion and forces, and transfers of energy as they build small hot air balloons.

GOALS

All students should develop an understanding of motion and forces and the transfer of energy. (*National Standards, Content Standard B*)

All students should develop abilities of technology design and understanding about science and technology. (*National Standards, Content Standard E, Science and Technology*)

The learner will conduct investigations and use appropriate technology to build an understanding of weather, motion and forces, and the transfer of energy.

SUCCESS INDICATOR

The student will construct a hot air balloon that will be able to stay in flight for 60 seconds and carry a load of 30 grams.

ENGAGEMENT

You are the director of a new company called "Full of Hot Air." Your company is giving rides at low prices. The rides will last 30 seconds and the hot air balloon basket must hold 30 grams of weight. Safety is of the utmost concern as you are giving rides and you do not want anyone to get hurt.

MATERIALS

- Various assortments of bags (plastic or paper)
- Wire baskets (non-flammable, could be sprayed with fire retardant)
- Wire rings
- Cotton balls
- Rubbing alcohol
- String and wire
- Pictures or posters of hot air balloons

Students may come up with ideas of other materials they think will work.

METHOD

1. Students will use the various materials to make a small hot air balloon. Students can choose which bag they would like to use. The students will use the wire baskets to hold a mass of 30 grams.
2. The students should have the balloon decorated with a logo of their business. Students will use the wire or string to attach the basket to the bag. There must be an area for the passenger and an area for the balloon to be fueled by hot air. This process must be repeated as students will test their balloons over again.
3. Students will start to make the balloons more stable. After completing the balloon, students should test out their balloon to see if it will fly with a mass of 30 grams to sustain a flight of 30 seconds.
4. After the students have tested their balloons, you will then have a trial run. They must be able to perform the experiment three times. Have students record how long their balloons stayed in the air.

To be successful the hot air balloon must be able to sustain flight on all three trials for the given time.

FOLLOW UP

1. Share what you did.
 - What methods did you come up with to fuel your hot air balloon?
 - What materials were the best to use? What materials did not work out?
 - Would you change anything with your hot air balloon to make it more efficient?
 - What were some of the problems that came up while you were designing your balloon?
2. Process what's important.
 - What could you do to make your balloon sustain a longer flight time? (Make a lighter basket, provide more hot air)
 - While observing your hot air balloon, estimate the height at which your balloon flew, would it have been fun for the passenger?

3. Generalize to your life.
 - How does the hot air concept apply to your home? (Hot air rises to the ceiling or the second floor)
 - How would you run your hot air balloon business so people are safe?
 - What factors should you consider while making a hot air balloon?
4. Apply what you learned.
 - How could you recycle hot air that is in your home? (vents, accept other answers as well)
 - What are other ways to heat air that would be beneficial to people? (hair dryer, cooking)
 - What are beneficial aspects of using hot air balloons as a means for transportation? What are the negative aspects? (very little pollution, takes longer to get from point A to point B)

EXTENSION ACTIVITIES

- Students could make their balloon climb to a certain height.
- Students could design a larger or more efficient model of a hot air balloon.

BACKGROUND INFORMATION (FOR FACILITATOR)

The basic physics behind hot air balloon travel is the effect of increased temperature on the motions of molecules of a gas, and thereby on the density of the gas. In order to understand this, you'll need a little algebra, and one of the basic ideas of thermodynamics, called the Ideal Gas Law.

A hot air balloon stays afloat in the cooler air surrounding it due to the buoyant force on it. This is the same force that acts on you when you are in a pool of water. You have probably noticed it is much easier to lift someone if you are both in a pool of water, and this is due to the partial support the water is offering: the buoyant force.

GLOSSARY

Gravity — The natural force of attraction exerted by a celestial body, such as Earth, upon objects at or near its surface, tending to draw them toward the center of the body.

Mass — A property of matter equal to the measure of an object's resistance to changes in either the speed or direction of its motion.

Density — The quantity of something per unit measure, especially per unit length, area or volume. Air that is less dense will rise.

NOTES

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