

ENGINEERING

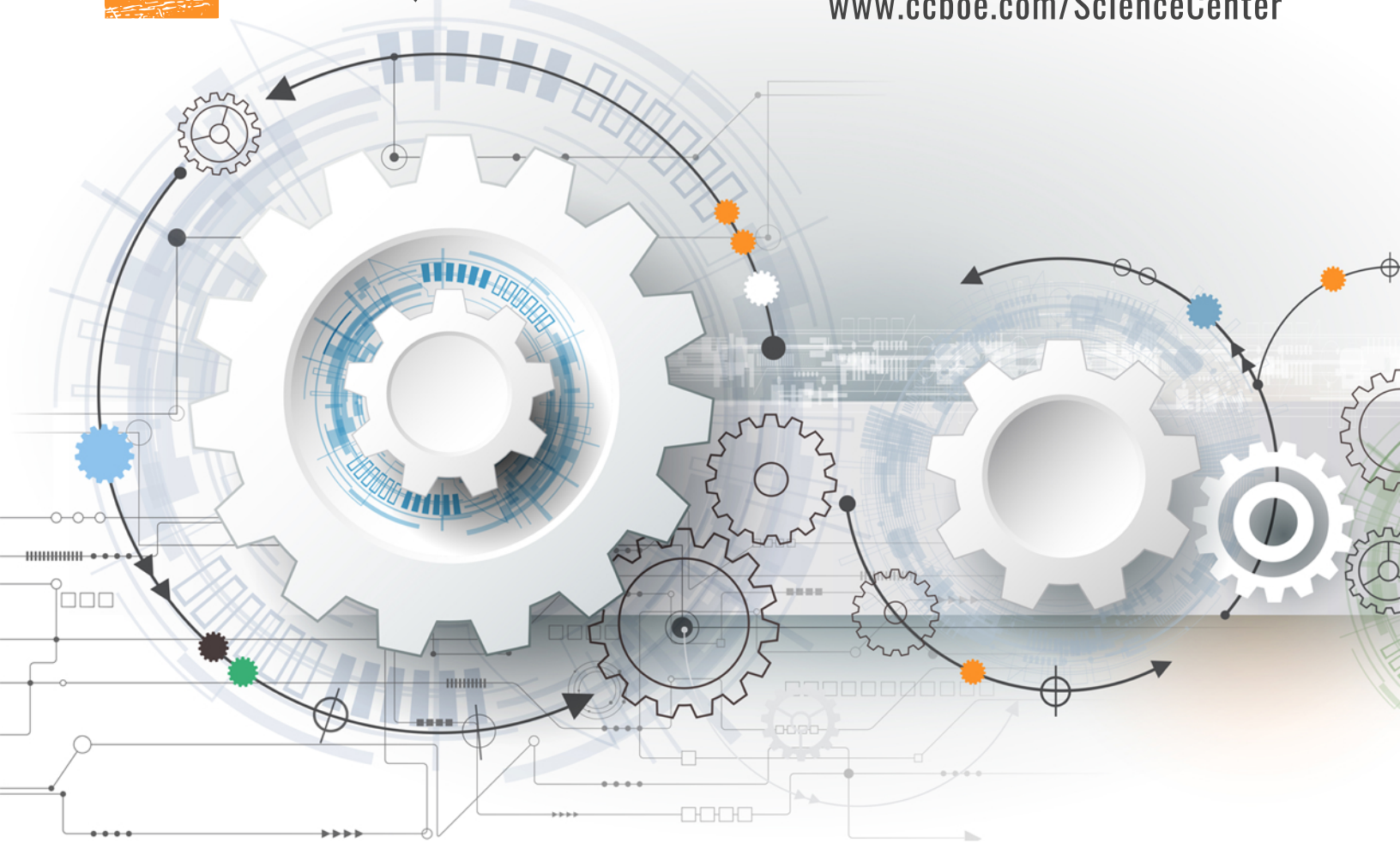
DESIGN

ALL ABOUT AIR  
A SCIENCE @ HOME ACTIVITY

mini  
challenges



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# LESSON OVERVIEW FOR PARENTS



## All about air

These mini challenges will focus on activities designed to generate interest and understanding of the scientific principals about air. Following these mini challenges you student will have the opportunity to construct a working hot air balloon, building on these concepts.

### THESE MINI CHALLENGES WILL

- Demonstrate that air has weight
- Demonstrate that warm air is lighter than room temperature air
- Demonstrate that as air is cooled, the volume of air is reduced

**Note to parents:** If you do not have the materials that are suggested on the materials list, your student can experiment with other substitute materials. Please make sure that you are monitoring the selection and use of any materials.

### ADDITIONAL RESOURCES

How much does air weigh?

[https://www.weatherstreet.com/weatherquestions/How\\_much\\_does\\_air\\_weigh.htm](https://www.weatherstreet.com/weatherquestions/How_much_does_air_weigh.htm)

What is air pressure?

<https://clever.discoveryeducation.com/learn/videos/cb8a9897-f930-46b3-b6aa-b5a368514ceb/>

Hot air and air pressure

<https://clever.discoveryeducation.com/learn/videos/da5f6ec5-be1a-49af-a0fc-3b2b39258a7a/>

Properties of Air Videos

<https://www.youtube.com/watch?v=Grziaq-caVE&list=PLeYGN8ajy8NmdVaharNEL3aEnVxhighH>

We hope you and your student enjoy and learn from these activities.

Please share your experience at James E. Richmond Science Center on Facebook and Twitter or drop us a line at [jersciencecenter@ccboe.com](mailto:jersciencecenter@ccboe.com).

# Mini Lab – Prove That Air Has Weight

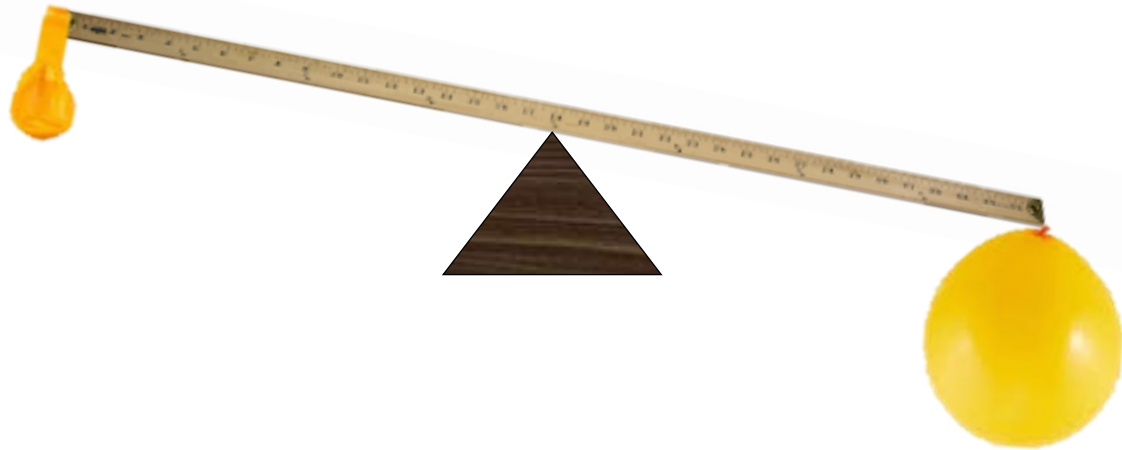
## Materials:

- Yard Stick
- Block of wood (to balance the yard stick on)
- 2 balloons (same size)
- Tape and/or paper clip



## Procedure:

- Locate the mid-point of the yard stick.
- Set the block of wood on the corner of a table so the yardstick will move freely.
- Place the midpoint of the yard stick on the block of wood making sure the yardstick is perfectly balanced.
- Attach a empty balloon (not blown up) to each end of the yard stick.
- Adjust the yardstick to make sure it is evenly balanced with the balloons.
- Remove and blow up one balloon.
- Re-attach the blown up balloon at the exact location you had it before blowing it up.



## Observation:

- Did the addition of the air into the balloon have any effect on the balance of the two balloons?

## Conclusion:

- If there was no change then you have proven that the air has no weight.
- If the balance tipped toward the inflated balloon then you have proven that the air has weight.

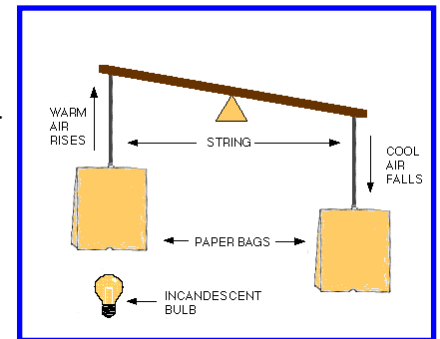
# Mini Lab – Prove that Warm Air is Lighter than Room Temperature Air

## Materials:

- Yard Stick
- Block of wood (used as the center to balance the yard stick on)
- 2 paper lunch size bags
- needle
- string
- scissors
- incandescent lamp (old style filament bulb - not CFL or LED)
- tape and/or paper clip

## Procedure:

- Locate the mid-point of the yard stick.
- Set the block of wood on the corner of a table so the yardstick will move freely.
- Place the midpoint of the yard stick on the block of wood making sure the yardstick is perfectly balanced.
- Open the lunch bags so they maintain the same open shape.
- Use the needle or pointed object to make a hole in the bottom center of each lunch bag.
- Cut two, 1 foot pieces of string and tie a knot in one end of each string.
- Thread the un-knotted end of each string through each lunch bag.
- Tie or attach the other end of each string and lunch bag exactly 1 inch from the end of the yard stick.
- Adjust the yardstick to make sure it is evenly balanced.
- Now place the light below one of the bags and turn it on.



## Observation:

- Watch what happens to the balance as the light bulb heats up and the warm air fills the lunch bag.
- Did the addition of the warm air into the lunch bag have any effect on the balance of the two lunch bags?

## Conclusion:

- If there was no change then you have proven that the warm air has no weight difference than room temperature air.
- If the balance tipped away from the light, then you have proven that the warm air weighs less than the room temperature air.

# Mini Lab – Prove that as air is cooled, the volume of air is reduced

## Materials:

- Empty water bottle with cap
- Hot tap water from sink
- Freezer



## Procedure:

- Turn on the hot water spigot and let run 'til hot
- Remove and save the top from empty water bottle
- Fill and pour out hot water from bottle (raising temperature of the bottle)
- Hold bottle under the hot running water for 2 minutes (heating the air inside the bottle)
- Replace the top tightly to seal in the warmer air
- Place the bottle in your freezer
- Wait at least 2 hours and take the bottle out and see if there have been any changes



## Observation:

- Do you notice anything different about the empty bottle?
- If you saw a change, what caused it to happen?
- Did the addition of the warm air into the bottle have any effect on the change?
- What would have been different if you just put the bottle in the freezer without increasing the air temperature first?



### **Make a hot air balloon that actually flies.**

Now that we have learned about properties of air you should try one of the “Engineering Challenges.” You may want to involve your family in these projects because having extra hands is sometimes helpful. You may even challenge other members of your family to try it, too. Remember to think about the **engineering design process** and redesign your project to get better results.