

# Make a Thunderstorm!!

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"When cool dry air aloft moves in over warm, humid air, thunderclouds build due to [convection](#)."

[Make convection currents](#)

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## Activity #1: Make convection currents

### Stuff you need

One clear plastic container, shoebox size



Red food coloring



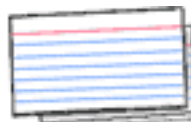
Ice cubes made with water dyed with blue food coloring



Colored pencils



Index cards



### [Teacher Tips](#)

#### **Glossary:**

#### **Convection:**

Convection is the transfer of heat through groups of molecules. In order for convection to occur you need free moving molecules, such as water or air. Warmer molecules will rise, while cooler ones will sink, creating a convection

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current.  
<return>

## Make it happen

1. Fill container 2/3 full with room temperature water.
2. Let the water sit for 30 seconds until completely still.
3. Place a blue ice cube at one end of the plastic container.
4. Add two drops of red food coloring to the water at the opposite end of the plastic container. Be careful not to disturb the water.
5. Observe where the red and blue food coloring goes.
6. Using the red and blue pencils draw what you see happening.



(Just for fun, check this out . . . )

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## Think about it



Where did the red go?  
[Click here to hear one answer.](#) (Requires an mpeg player, e.g. Microsoft's ActiveMovie player)  
Do you agree? Why or why not?

How about the blue?

What type of air mass does the red represent?

How about the blue?

How does this relate to a thunderstorm?

## What's happenin'?



It's all about convection! The cold water sinks while the warmer red water rises, or stays higher than the blue. Convection is the action of warm air rising and cold air sinking. You probably guessed that the blue water represents a cold air mass and the red water represents the warm, unstable air mass. A thunderstorm is caused by unstable air and convection plays an important part. A body of warm air is forced to rise by an approaching cold front. Other things can cause warm air to rise, like a mountain slope.

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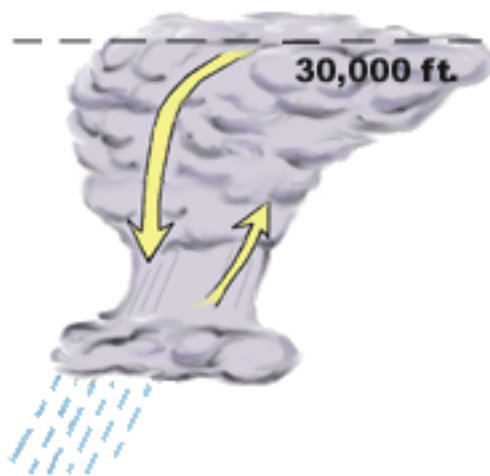
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A strong, persistent updraft of warm moist air is formed and lifted by the approaching cold front. Speeds in an updraft can be as fast as 90 miles per hour! The air cools as it rises, condenses, and forms cumulus clouds. When condensation occurs, heat is released and helps the thunderstorm grow.

The cumulus cloud has grown into a cumulonimbus cloud at above about 30,000 feet (about 9 km).

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At some point, condensation high in the cloud (now in the form of water droplets and ice) falls to the ground as rain. A cold downdraft forms as the rain falls.

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## Activity #2: Make it rain!

### Stuff you need

**L**arge, wide-mouth container, such as a mayonnaise jar

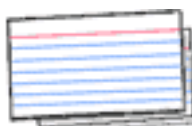
**H**ot water

**I**ce cubes



**S**mall plate to hold ice cubes

**I**ndex cards



### Make it happen

1. Pour two inches of very hot tap water into the glass container and cover with the dish. Allow to sit for a few minutes.
2. Place ice cubes on plate.
3. Watch what happens.

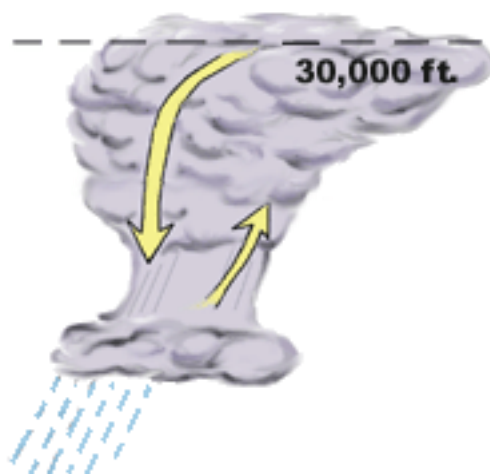
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### Think about it



How does this relate to the formation of the thundercloud in Activity 1?

## What's happenin'?



The cold plate caused the moisture in the warm air to condense and form water droplets. This is the same thing that happens in the atmosphere as warm, moist air rises and meets colder temperatures high in the atmosphere. Water vapor condenses and forms precipitation that falls to the earth.

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## Activity #3: Make a hot air balloon!

### Stuff you need

**T**issue paper (16 sheets, 24" x 30", various colors except black)

**C**utting pattern

**P**ins (about 6 per balloon)

**S**cissors (2)

**R**ubber cement or glue sticks (2)

**F**ishing line for tether (50 foot roll) - optional

**W**ire (24", 16 gauge, or use pipe cleaners)

**W**ire cutters

**P**ropane stove and chimney apparatus

**F**light data sheet

Tag with name and address - optional

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## Make it happen

1. Using the [tissue balloon pattern instructions](#), draw and cut out a pattern and set it aside.
2. Overlap two pieces of tissue paper to make one 5 foot long panel and use the glue stick or rubber cement to glue the 2 pieces together. Repeat for 7 more panels (total of 8 long panels). Be creative with colors. Plan how your balloon will look.
3. Place the long panels in an even stack. Straighten them and smooth them out.
4. Fit the pattern made in step 1 over the sheets and pin it in place. Be careful not to tear the tissue paper.
5. Cut out the tissue paper along the pattern. Carefully remove the pins and the pattern and save them. Keep the tissue sheets in a stack.
6. To glue the tissue panels together to make the balloon:

Take 2 panels off the stack. (Panels 1 and 2) Place them together so one side of the bottom panel extends 1" past the edge of the top panel. Fold that 1" margin over the edge of the top sheet and glue it along the edge of the top sheet.

Glue the next panel (3) to the bottom panel (2) in the same way, except along the opposite edge.

Continue glueing the panels together on opposite edges. When all are glued together it will be in one long line, folded like a fan. Check that the panels are folded this way, but don't open it up yet.

Glue the first and last panels together as you did the

other panels along their unglued sides.

7. Lay the balloon flat. Cut a circle of tissue to cover the top opening and glue it over the top hole in the balloon.

8. To hold the bottom of the balloon open:

- a. Form the wire or the pipe cleaner into a circle the size of the bottom opening
- b. Gently open the bottom edge of the balloon, position the wire on the inside about one inch up from the edge
- c. Fold the tissue over the wire and glue in place

9. Gently open the finished balloon and check for large holes. (Be careful not to make any new ones!) Patch them with pieces of tissue paper cut to fit. Small holes are ok. They won't keep the balloon from flying. If desired, attach the tether line and name and address tag.

10. To [launch the balloon](#), hold the bottom, open end of the balloon over the hot stove and allow it to fill with hot air. When the balloon begins to float, give it a gentle push and WATCH IT FLY!!

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### Think about it



How does this relate to Activity 1?

Which time of day would this activity likely work better? What season? Why?

If your balloon didn't fly well, what do you think went wrong?

If your balloon flew, why did it come down eventually?

[Check out some fun these students had with this project!](#) (You need a way to run "mpeg" video clips on your computer like Microsoft's ActionMovie Player.)

## What's happenin'?



Again, it's all about convection! The cold air is more dense and sinks while the warmer, less dense air in the balloon rises. Convection is the action of warm air rising and cold air sinking. The balloon will stay afloat as long as the air in the balloon stays warmer than the air around it.

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*Thanks go out to Bowlus School Supply, Inc. Pittsburg, Kansas; Raven Industries, Inc., Applied Technology Divison in Sioux Falls, South Dakota; and to Zimmerman, Presentation at NSTA Regional Convention, Little Rock, Arkansas November 1988.*

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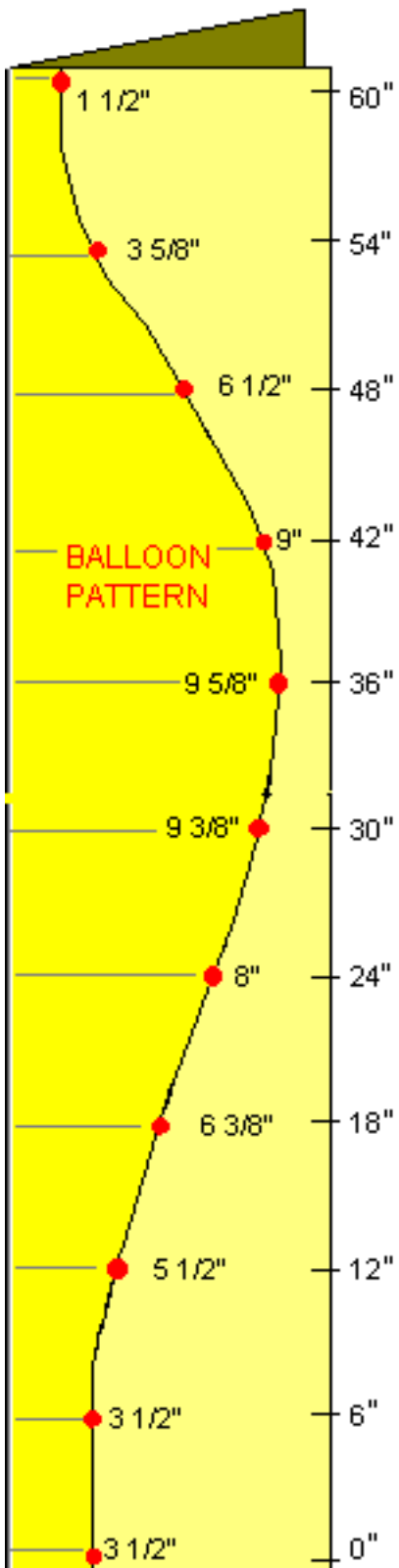
## Look here for more information:

[USA Today Weather Page - What goes on in thunderstorms?](#)

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## Tissue Balloon Pattern Instructions:

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Fold a piece of paper (60" x 20") lengthwise.

Measure and mark points as shown.

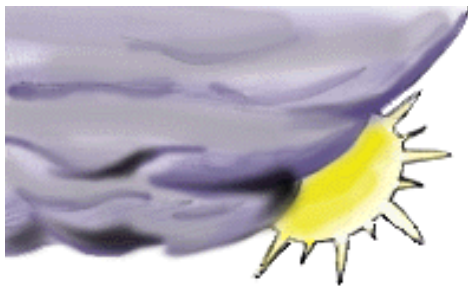
Connect the dots.

Cut out the pattern.

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### Interesting Hot Air Balloon Facts:

- They average 70 - 80 feet tall
- They hold 56 -77,000 cubic feet of air
- They weigh 1,600 pounds
- They have three pilot lights
- They are fueled by propane
- Flying them requires a pilot license
- They have a large mass and a very low pressure and can fly with a hole 3 feet or larger
- Conditions for flying:
  - RED** - Winds are greater than 15mph - No flying
  - YELLOW** - Winds are 10 - 15 mph - Caution in flying
  - GREEN** - Winds are less than 10 mph - Good flying



# Teacher Tips

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"Other teachers who have done these experiements have this to say... "

Send us your tips, suggestions, improvements, alternatives, comments, etc. Or, tell us a story of how your class or group responded to the activities. Please include your name, email address, and if possible, a photo of yourself or your class! Email to: [Susan Foster at UCAR](mailto:Susan.Foster@ucar.edu).



Use these links to jump to tips for:

[Thunderclouds](#)

[Make Lightning](#)

[Hearing Thunder](#)

[Make a Tornado](#)

**General comments:**

"The weather activities were a lot of fun. The students enjoyed the hands on and retained the information well.

It was a lot of fun learning about the weather, so give it a try. The setups were not that difficult, but time consuming. The easiest set up was for the convection activity where you had to prepare some blue ice cubes. Depending on your time, you can bring in many more of the Science Education Standards than we indicate below. Consider especially how weather systems affect humans and how humans affect global environments, for example the greenhouse effect and acid rain." *Anitta Frant and Gregg Cruger, Sixth grade teachers at Casey Middle School, Boulder, CO.*

## Thunderclouds:

For the Convection activity:

**Meets the [National Science Education Standard: A, D](#)**

Convection currents can be found on earth in the atmosphere and oceans, as well as in the sun. You can't talk about El Niño without talking about convection.

*The items below can be found in a grocery or hardware store.*

### *Materials:*

One clear plastic shoe box size container (Tupperware, Sterilite, or Rubbermaid brands are appropriate)

Red food coloring

Ice cubes made with water dyed with blue food coloring

Colored pencils

Index cards

### **TIPS**

*Thanks to Tara Chace, Science Discovery at the University of Colorado for the following tips:*



"Make sure water in the clear container is room temperature! If it is ice cold tap water the experiment does not work very well.

"If you don't have time to make blue ice cubes, you can put the ice cube in on one side of the clear container, and then put a drop or two of blue food coloring directly on the ice cube.

"You may notice that room temperature red food coloring initially sinks, because food coloring is slightly more dense than water. For more dramatic results heat the red food coloring, by placing the whole vile of food coloring in a cup of very warm tap water, then add a drop or two of warm red food coloring to the clear container of water. "

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For the Hot Air Balloon activity:

**Meets the [National Science Education Standard: A, B](#)**

This site can work for you in the classroom when you study matter in terms of solid, liquid and gas, particularly the way molecules work when they are heated up. It shows how density changes with temperature. In the thundercloud activities (especially the hot air balloon activity) they will discover how hot air rises and what happens when it cools.

*Thanks to Gregg Cruger, teacher at Casey Middle School, Boulder, CO.*

"The hot air balloons were a blast. The kids really got into making them and took

ownership. The cost was minimal for the tissue paper and the glue sticks. The trick is to find a way of getting hot air. If you have a long extension cord it can be done with a popcorn popper or a hair drier. An outdoor campstove with a stove pipe is also a possibility. If you have to buy the set-up it is around \$250. Before you go to that expense, check with your shop teacher, they might just have one. This is an item that would be great for your district to purchase to loan out to teachers."

After the activity, think about hanging the balloons around the classroom or raffle them off to students.

*Suggestions for the Hot Air Balloon Launcher:*

1. Use your Coleman stove and add a sheet metal chimney on wire mesh screen secured on the top. The chimney should be a minimum of 26 inches high.
2. PITSCO is a company with a patent pending launcher that sells for \$245. It is save, stays cool and is easy for students to use with supervision.

PITSCO  
PO Box 1328  
1004 E. Adams  
Pittsburg, KS. 66762  
1-800-835-0686

[Out takes: Teachers had fun with this too!](#)

(Video clip requires mpeg player like Microsoft's ActiveMovie player.)

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For the Shower activity:

**Meets the [National Science Education Standard: A, B, D](#)**

This is a good opportunity to explain the water cycle: evaporation, condensation, precipitation.

*Materials:*

Large, wide-mouth container, such as a mayonnaise jar  
Small plate for ice cubes  
Ice cubes  
Hot water  
index card

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**Make lightning!**

## Meets the [National Science Education Standard](#): A, B, D

This activity can be done when you study electricity and weather. It is good if the students have some prior knowledge of the atom and ions and what static electricity is. A fun extension is to use the Van de Graaff static electricity generator. (Can be purchased through the Flynn science catalog and many others.)

*The items below can be found in a local grocery or hardware store unless otherwise noted.*

### Materials:

Styrofoam pan or plate

Thumbtack

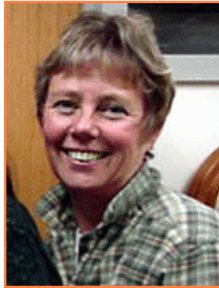
Pencil with new eraser

Aluminum pie pan

Small piece of wool fabric (available at any fabric store)

Neon bulb (available at Edmund Scientific for about \$20 each 609-573-6250)

### TIPS



*Thanks to Anitta Frant, 6th and 8th grade teacher at Casey Middle School, Boulder, CO.*

This activity was neat. The glass rod is expensive, but if you have just one, you will have a great demo. In our district we will be able to get these kits on loan, which is a great way to get around the cost of the materials."



*Thanks to Tara Chace, Science Discovery at the University of Colorado*

"If students are having trouble getting the spark be sure they are rubbing the wool very vigorously on the styrofoam pan. Then have one person place pie pan on top of the styrofoam using the pencil without touching any part of the pie pan. Then have a different student touch the EDGE of the pie pan with ONE finger.

"Sometimes rubbing the pie pan on each others head can have the same effect as using the wool, and generates some good laughs!

"Try to purchase at least one neon tube. They are a huge hit with students. Follow the same procedure, only instead of touching the edge of the pie pan with your finger touch it with one end of the neon tube, keeping one finger pressed on the other end. A countdown and turning the lights off at "1" , and as you (or the students) are touching the tube to the pie pan makes the demonstration more dramatic and fun!

"It might help to have your students review this web site before doing the experiments, as this student is doing."



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## Hearing thunder!

Meets the [National Science Education Standard: A, B](#)

Expanding on this, you could include the entire electromagnetic spectrum, specifically, the way sound travels in waves, radio waves, light waves, infrared, radar, etc.

### *Materials:*

A stopwatch (Ask your Gym teacher if he/she has one.)

### *TIPS*



*Thanks to Anitta Frant, 6th and 8th grade teacher at Casey Middle School, Boulder, CO.*

An alternative to actually listening for thunder is to create your own! Get two 2x4 pieces of wood, maybe hinged on one end so they can clap together. Go outside where there is a broad and tall wall nearby. Maybe the side of a barn or house. This works best if there aren't other large structures nearby. Measure off about 500 feet from the wall and stand there. Use the boards to make a loud clap and then listen for the echo. Time how long it takes the echo to reach you. This illustrates the speed of sound without being out in a thunderstorm!

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## Make a tornado!

*The items below can be found in a grocery or hardware store unless otherwise noted.*

For the Tornado activity:

**Meets the [National Science Education Standard](#): A, B, D**

This could also include discussions of the impact of tornadoes on human populations (Standard #5). Consider including discussions about hurricanes and tsunamis. Add information about high and low weather pressure systems to your discussions.

### *Materials:*

10" x 12" piece of wood (lumber yards are often willing to cut a sheet of plywood if you need multiple pieces of plywood for a school activity)

Glue gun

Two 9" x 10" vinyl sheet with thickness of 010 (proper thickness can be hard to find. It is available at Colorado Plastics 303-443-8271)

Small hand fan (available at McGuckin Hardware in Boulder 303-443-1822 or other large hardware store)

Deli dish or cup

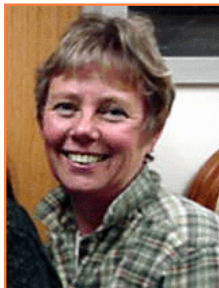
7" clear plastic plant saucer with a 2" diameter hole cut in the middle

Water

Dry ice (available at large grocery stores)

**IMPORTANT SAFETY NOTE: Dry ice will severely burn your skin. Handle it only with gloves on!**

### **TIPS**



*Thanks to Anitta Frant, 6th and 8th grade teacher at Casey Middle School, Boulder, CO.*

"The tornado activity was awesome. It requires some hunting for the plastic sheets and a small fan. You will also have to hunt for some dry ice. But it is worth it!"



*Thanks to Tara Chace, Science Discovery at the University of Colorado*

"Notice "top view" diagram in Make It Happen Section. It is important that the vinyl is glued on the piece of wood and around the cup in this way. If students are going to do the glueing, it may be helpful to draw exactly where the vinyl is to go on the wood. It is difficult to glue the vinyl individually - have the students work in teams.

"A teacher should handle the dry ice (with gloves), and place it in the cup, then

one student places the saucer upside down on top of the two pieces of vinyl, and a different student turns on the fan, and places it in the saucer hole. Students always want to blow the fan down, perhaps because they think of a tornado touching down. Try to get them to think about why the fan should blow up -- can relate it to the updraft in a tornado. Sometimes adding a tiny bit more water will activate the dry ice again."

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For the Mini-tornado activity:

**Meets the [National Science Education Standard](#): A, B, F**

This activity can be done with minimal effort and preparation.

*Materials:*

8 oz jar  
water  
vinegar  
clear liquid dish soap  
glitter (available at any hobby shop)

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