Air Pressure Change And Its Influence On The Weather

If we didn't have air and water, we wouldn't have any weather. Water reacting to heat and cold causes the water cycle. Air reacting to heat and cold causes a change in air pressure. This change in air pressure is what makes the water cycle work and can cause all kinds of weather.

The experiments in this booklet will help you understand the properties of air and its influence on the water cycle and how it creates all kinds of weather.

Below are the concepts we will be learning about air.

1. **Air is a substance and therefore it takes up space.**
2. **Since air is a substance, it also has weight.**
3. **When air is piled on each other it causes pressure.**
4. **When air is heated it rises.**
5. **When air is cold it sinks.**
6. **Air pressure can change to a high or low pressure.**
7. **High pressure always flows into a low pressure area.**
8. **This pressure change in the air is what causes weather to happen.**

Concept #1:

Air is a substance. It takes up space.

Experiment #1 Magic Air

(student experiment)

1. Fill an ice cream bucket with water.
2. Put a small piece of wood on the water.
3. With a glass put the mouth of the bottle over the piece of wood and push the glass all the way down to the bottom of the bucket.
4. Explain what happened.

The piece of wood went to the bottom of the bucket.

5. Why did the wood do what it did?

The bottle had air in it. When it was placed over the wood, the air pushed it down. That proves that air takes up space and it is a substance and that air is made of small particles.

6. Draw a picture of what happened and label it.

Concept #1:

Air is a substance. It takes up space.

Experiment #2 Staying Dry

(student experiment)

1. Crumple up a piece of paper and place it at the bottom of a drinking glass.
2. Turn the glass upside down (making sure the paper doesn't fall out) and put it open-mouth down into an ice cream bucket.
3. Go all the way to the bottom move it around and then bring it up.
4. Explain what happened?

The paper stayed dry.

5. Explain why this happened?

Since air was in the bottle and air is a substance made up of air particles and takes up space, the air particles pushed the water away and didn't let any in so the paper stayed dry.

6. Draw a picture of what happened and label it.

Concept #1:

Air is a substance. It takes up space.

Experiment #3 Air Power

(teacher demonstration only)

1. Get a pop bottle and put a funnel in its opening.
2. Seal up the sides with clay so that no air can leak out.
3. With a drinking glass, pour water into the funnel so that water is always in the funnel.
4. After a few seconds what do you observe?

The water stopped draining into the bottle.

5. Explain why this is happening.

The air couldn't escape out the top of the bottle or through the funnel and since air takes up space and is made of air particles, the particle jammed the opening of the funnel and stopped the water from coming in.

6. Draw a picture of what happened and label it.

Concept #2:

Air has weight.

Experiment #4 Tipping the Scale

(student experiment)

1. Put a deflated balloon on one side of a balance.
2. Weigh the balloon with something that is light like corn kernels or macaroni.
3. After it is weighed, blow up the balloon and put it back on the scale.
4. What do you notice about the scale?

The scale went down.

5. Explain why the scale did this.

Since air was put into the balloon, the weight of the air made the balloon heavier telling us that air particles have weight.

6. Draw a picture of what happened and label it.

Concept #2:

Air has weight.

Experiment #5 Air Down Draft

(teacher demonstration only)

1. Put a paint stick on a table so that it hangs over the side of it.
2. Hit it with a book. What happened?

The stick flew.

3. Put the stick back in the same spot, but this time, put one piece of butcher paper over the stick. Make sure the paper is flat.
4. Hit the stick again with a book.
5. Explain what happened?

The stick broke.

6. Explain why the stick did this.

After putting the paper on the stick, it made it so there was more air on the stick. This made it so there was more weight on the stick. With more weight on the stick, the stick broke.

7. Draw a picture of what happened and label it.

Concept #3:

The weight of air piled on each other causes air pressure 15 pounds of pressure on Earth's surface.

Experiment #6 Stream of Pressure

(student experiment)

1. In a 2-liter bottle, put four holes evenly apart down the side of the bottle.
2. Put tape over each of the holes. Fill up the bottle up with water to the top.
3. Take the piece of tape off the holes, one at a time, starting from the top.
4. Explain what you see happening.

Water came out each hole, but the streams of the water shot out farther as the holes go down.

5. Explain why the streams of water did this.

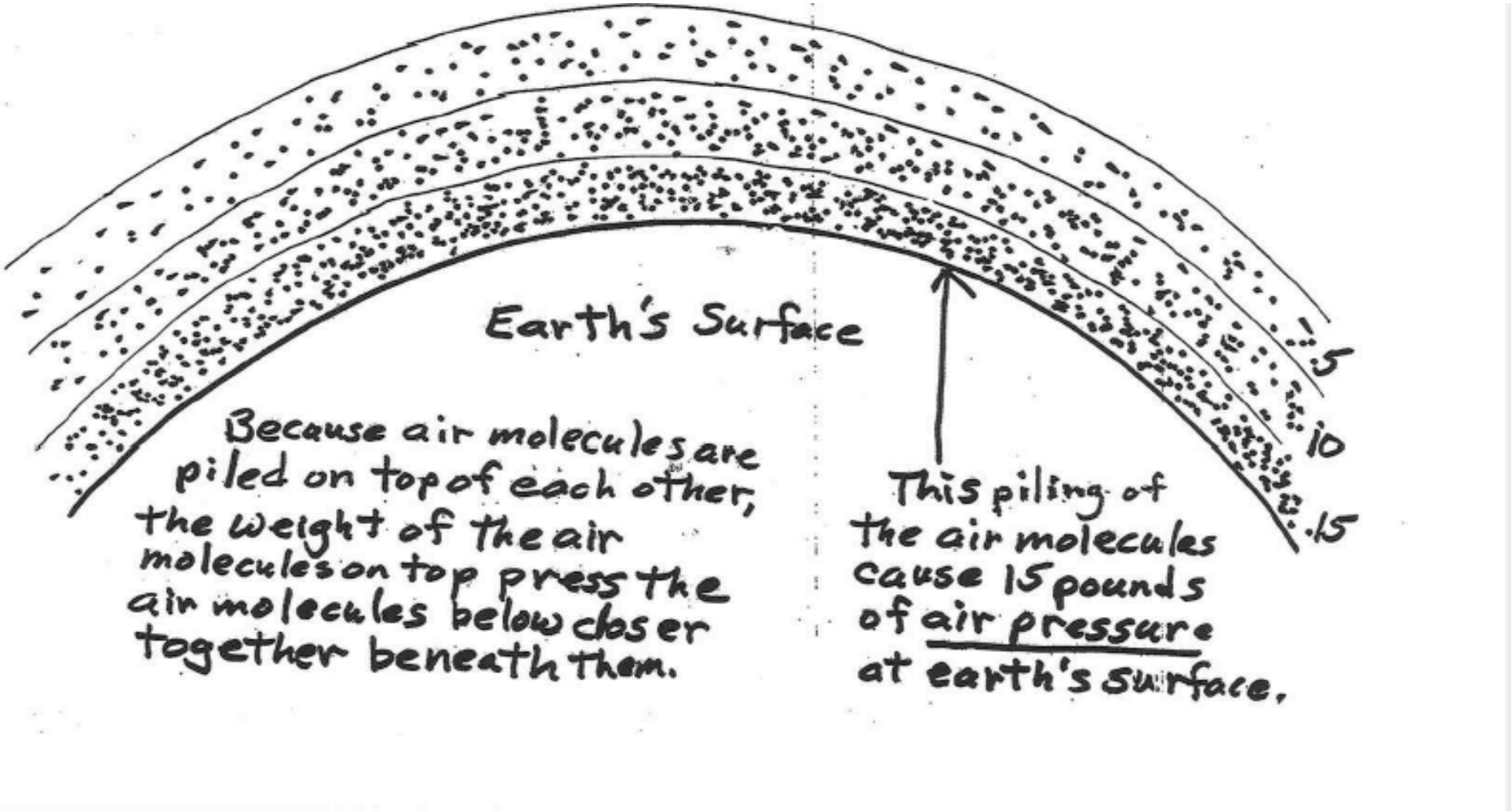
There is more weight (pressure) on each hole going down the bottle causing the streams to shoot out farther from each hole going down.

6. Draw a picture of what happened and label it.

Concept #3

The weight of air piled on each other causes air pressure 15 pounds of pressure on Earth's surface.

1. The picture below demonstrates how the air particles are piled on each other about 75 miles up into the air.
2. Notice that the air particles near the earth are closer together because of the weight of the air particles on top of them.
3. This causes 15 pounds of air pressure at the earth's surface since all the weight is on the air right next to the earth.
4. Notice the farther the air goes up the farther apart the air particles are since there is less weight above them less pressure on them. So as the air goes up, there is less air pressure until there is none at all.
5. Do experiment 6 "Streams of Water" to show what happens when water molecules are piled on each other from bottom to top



Concept #3:

The weight of air piled on each other causes air pressure 15 pounds of pressure on Earth's surface.

Experiment #7 And the Winner Is…..

(student experiment)

1. Fill up a glass of water to the top. Put a piece of cardstock on the open end of the glass.
2. With the glass over a big bowl carefully turn the glass upside down with your hand on the cardboard.
3. Let go of the cardboard.
4. Explained what happened?

The card stayed on the bottle even though it was upside down.

5. Why did this happen?

The 15 pounds of air pressure is stronger than 1 pound of water therefore making the card hold the water back.

6. Draw a picture of what happened and label it.

Concept #3:

The weight of air piled on each other causes air pressure 15 pounds of pressure on Earth's surface.

Experiment #8 The Case of the Leaky Can

(student experiment)

1. Get a V-8 size can and, with a nail, put a hole near the bottom of the can. Put tape over the hole and then put water in the can to the near of the top.
2. Cut the mouthpiece off of a balloon. Now stretch the balloon over the top of the can.
3. Take the tape off. What do you see happening to the balloon and the water?

The balloon is going down inside the can.

4. Explain why this happened?

Since there are 15 pounds of air pressure in the air, as the water leaves the can, the air pressure is pushing down on the balloon trying to get into the can.

5. Draw a picture of what happened and label it.

Concept #4 and 5:

Air separates and rises when heated. Air gathers and sinks when cooled.

Experiment #9 Air Outlet—Air Inlet

(student experiment)

1. Put a plastic bottle in very cold water (with ice) and place a balloon over the top of a plastic bottle.
2. Put the plastic bottle in hot water. Wait a couple of minutes.
3. Explain what happened to the balloon?

The balloon filled up with air.

4. Why did this happen to the balloon?

As air gets hot the air particles separate from each other because they need more room to move around. Because they needed more room to move around, some of them had to leave the bottle and go up into the balloon.

5. What can you say about air that gets hot?

When air gets hot, the air particles get farther apart and get lighter in weight and rise.

6. Take the bottle out of the hot water and it put in the cold water.
7. Explain what happened to the balloon this time.

The balloon lost all of its air and went back to its position of having no air in it.

8. Why did this happen to the balloon?

As air gets cold the air particles gather toward each other because they don't need a lot of room to move around. Because they need less to move around, the air in the bottle gathered opening up a space for the air in the balloon to go back into the bottle.

9. What can you say about air that gets cold?

When air gets cold, the air particles gather and get heavier in weight and sinks.

10. Draw a picture of what happened and label it.

Concept #4 and 5:

Air separates and rises when heated. Air gathers and sinks when cooled.

Experiment #10 Too Much Hot Air

(teacher demonstration only)

1. Tie a string around the middle of a stick so that the stick is balanced when the string is held. Tape two sacks with strings at each end of the stick. Open the sacks.

2. While holding the sack, put a barbeque lighter under one of the sacks. What do you observe?

The sack that the flame was under went up.

3. Take the lighter away from the sack. What do you observe now?

The sack that went up went back down to its starting position.

4. Explain why the sacks did what they did.

When the air was heated, the air particles separated because they needed more room to move. All of them couldn't fit in the sack anymore and so some were pushed out making the sack lighter in weight making the sack rise.

When the air cooled the air particles gathered leaving a space in the sack for the air to come back in. When the air came back in, the sack got heavier and went back down.

5. Draw a picture of what happened and label it.

Concept #6

Air pressure can change to a high pressure or to a low pressure.

Experiment #11 Squeezing and Release
(student experiment)

1. Squeeze a plastic bottle (like a 12 oz pop bottle) until the two sides are really about an inch away from each other.
2. At this point have your partner put a balloon over the opening of the bottle. The balloon should just be hanging down the side of the bottle.
3. Let go of the bottle. Explain what happened to the balloon.

   The balloon went into the bottle.

4. Explain why you think the balloon did this.

   When the bottle was released, it expanded out. However, no air was able to go into the bottle therefore making the air already in the bottle less dense because the air particles were spread out more in a larger area. Therefore there was a low pressure in the bottle and the high pressure outside the bottle pushed the balloon in

5. Push on the plastic bottle again until the two sides almost touch. Explain what happened to the balloon.

   The balloon popped out of the bottle.

6. Explain why you think the balloon did this.

   As the bottle was pushed, it pushed the air particles together making the air particles push close together in a smaller area making the air denser and causing a high pressure. Because the air pressure was greater in the bottle than outside the bottle, the high pressure in the bottle pushed the balloon out of the bottle.

7. Draw a picture of this.

8. Concept #7:

Air pressure can change causing high air pressure to flow into a low pressure area.

Experiment #12 Message In A Bottle

(teacher demonstration only)

1. Get a hardboiled egg and a bottle with an opening that a shelled-egg could barely fit through.
2. Lubricate the egg with light cooking oil or water.
3. Put a lit match into the glass bottle.
4. Quickly place the tapered end of the egg in the mouth of the bottle.
5. Explain what happened?

The egg went into the bottle.

6. Explain why this happened.

When the air was heated, the air particles separated and some of the air left the bottle. (The egg started to shake.) When the air cooled it left a space in the bottle and air wanted to go back into the bottle. For this to happen the air pressure pushed the egg into the bottle.

7. Draw a picture of what happened and label it.

Concept #7:

Air pressure can change causing high air pressure to flow into a low pressure area.

Experiment #13 Popping the Lid

(teacher demonstration only)

1. Get a pint-sized canning jar with a lid.
2. Put some birthday candles in some clay and place the clay at the bottom of the jar.
3. Light the candles and quickly screw the lid on the jar. Watch and listen to what happens.
4. Explain what you heard and saw.

The lid popped and the lid wouldn't come off.

5. Explain why this happened.

As the air heated, the air particles separated and some of the air particles went out the bottle. When the air cooled the air gathered leaving a space for the air that left to come back in. However the lid is stopping the air from going into the bottle. The air trying to get into the bottle is holding the lid tight on top of the bottle.

7. Draw a picture of what happened and label it.

Concept #7:

Air pressure can change causing high air pressure to flow into a low pressure area.

Experiment #14 Rising to the Occasion

(teacher demonstration only)

1. Get a flat low-rimmed container like a cake pan. Put some water in it about an inch deep. Put some food coloring in the water. (This is so you can see the water.)
2. Put some clay in the middle of the pan.
3. Put some birthday candles in the clay making sure the water is not higher than the candles.
4. Light the candles.
5. Put a wide-mouthed bottle over the candles into the water.
6. What is happening in the jar?

The water went up into the bottle.

7. Explain why this happened.

As the air heated, the air particles separated and went out of the bottle. When the air cooled the air particles gathered leaving a space for the air to come back in. The air tried to get in by pushing on the water in the tray and pushed the water into the bottle.

8. Draw a picture of what happened and label it.

Concept #7:

Air pressure can change causing high air pressure to flow into a low pressure area.

Experiment #15 Air "can" overcome.

(teacher demonstration only)

1. Put water into a saucepan and put it on a heating unit.
2. Put a little water into a pop can and put the can into the saucepan.
3. Let the can sit for a few minutes until you see steam coming out of it.
4. Put some clay on top of the opening, making sure it is air tight.
5. Put the can on a hot pad on the counter.
6. Describe what you see happening to the can.

The can was crushed

7. Explain why this happened.

As the air heated, the air particles separated and went out of the can. When the air cooled the air particles gathered leaving a space for the air to come back in. The air tried to get in but couldn't get in because there was clay on the opening. Therefore, it crushed the can trying to get in.

8. Draw a picture of what happened and label it.

Concept #8:

If high pressure exists when hot air rises and water vapor is in the air and later a low pressure comes in, the low pressure will cause the air to get cold and the water vapor will condense into clouds.

Experiment #16 Making a Cloud in a Bottle

(student experiment)

1. Get a two-liter bottle and put two inches of luke-warm water into the bottle for evaporation.
2. Put some baby power in the bottle for dust.
3. Put a cork on the bottle with an inflation needle in it.
4. Put a ball pump on the needle.
5. With one student holding the cork, another student will put about five pumps of air into the bottle to create a high pressure.
6. Turn out the lights and turn the flashlights on and aim the light directly into the bottle keeping it there the whole time during the experiment.
7. Quickly take the cork off the bottle.
8. Explain what you see in the bottle.

There is a cloud in the bottle.

9. Explain why this happened.

The warm water in the bottle made the air particles separate. When more air was pumped into the bottle it pushed those air particles together causing a high pressure in the bottle.

When the cork was taken off the bottle, the air escaped with a boom causing the air to escape quickly. The air cooled making the air to gather quickly. With water vapor in the bottle the water vapor cooled causing it to condense into water making a cloud.

10. Put the cork back on and put five more pumps of air into the bottle.

11. Explain what happened in the bottle.

The clouds goes away.

12. Explain why this happened.

As air is pumped into the bottle it causes the air to be pushed together causing a high pressure in the bottle. High pressure makes the air warm that makes the cloud turn back into water vapor.

13. Predict what will happen when you take the cork off the bottle again when there is high pressure inside the bottle.

It will turn back into a cloud.

14. Draw a picture below of what happened and label it.

Concept #8
Winter Scenario Pattern of a Traditional Winter Storm*

Basic Weather Elements	Dropping Barometer	Low Barometer	Rising Barometer	High Barometer
Clouds	Cirrus clouds are spotted days earlier in the sky. As the barometer drops, high clouds will form.	Stratus clouds will move in and will stay as long as the barometer stays low.	Stratus clouds will break up then gather continually until the barometer is high.	Skies will clear. Occasional cumulus clouds will appear and disappear.
Wind Direction	The wind usually comes from the south.	The wind will come from the north.	The slight wind could continue to come from the north.	No wind at all or a northwesterly breeze will dominate.
Wind Speed	Wind speed will get stronger and stronger as the barometer keeps dropping.	Strong winds will prevail for a while but will turn light to moderate after the front passes.	The wind speed could be light to moderate.	The wind will be calm or light.
Temperature	The temperature will get warmer because of the south winds.	Temperature will be cooler or cold as long as the barometer is low.	The temperature will still be cooler or cold for a while more.	Will be a gradual warming trend as long as the high pressure is present.
Precipitation	None.	Rain or snow usually will come according to the air temperature.	Rain or snow will be off and on for a while.	None

Remember the barometer predicts what is going to happen in a day or two.
This is what you would expect to happen a day or two later at each of the barometer readings.

Can You Explain What Happened?
October 3rd Through October 9th

Date	Barometer Air Pressure	Thermometer Temperature	Anemometer Wind Speed	Weather Vane Wind Direction	Rain Gauge Rainfall	Ruler Snow fall
October 3	30.15	75 Degrees	10 mph	South	None	None
October 4	29.85	80 Degrees	20 mph	South	None	None
October 5	29.65	85 Degrees	30 mph	South	None	None
October 6	29.55	50 Degrees	20 mph	North	.76 inches	None
October 7	29.85	55 Degrees	10 mph	North	.5 inches	None
October 8	30.00	65 Degrees	5 mph	North	None	None
October 9	30.15	70 Degrees	5 mph	NW	None	None

1. What happened to he temperature when the barometer began to drop?

It went up.

2. Why did the temperature do this?

Usually before a storm there is a wind from the south which is usually a warm wind and makes the temperature go up.

3. What happened to the wind when the barometer began to drop?

The wind came from the south and got stronger.

4. Why did the wind do this?

5. **As a low pressure is nearing a high pressure area, high pressure flows into low pressure and causes the wind. The lower the pressure the stronger the wind will be.**