Name: _____

Measuring Gas Pressure

It is invisible…but it certainly changes the weather.

Look at today's weather report. Find the barometric pressure. Then find if it is rising or going down. What would you predict about tomorrow's weather?

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Barometers and Air Pressure

It is hard to believe that the air around us exerts any pressure on our bodies. After all, air seems almost like nothing. But in fact, air pressure at sea level is about 14.7 pounds per square inch. Think about what that number means. There is a weight of 14.7 pounds pressing down on every square inch of your body. That is how much a one-inch column of air, all the way up to outer space, weighs. We have lived with air always pressing on our skin and we are used to it.

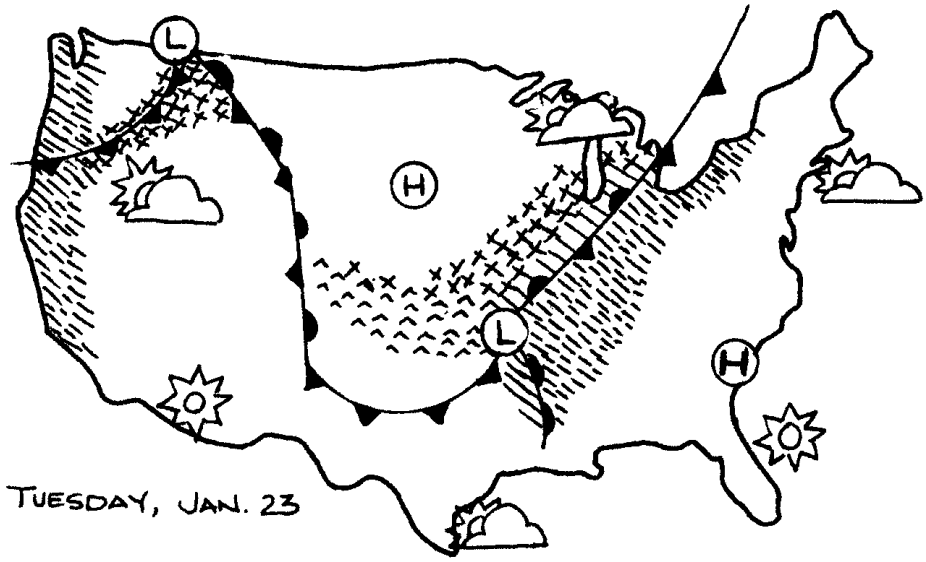
How does the air pressure exerted on us compare to the pressure inside a car's tire? Rather than 14.7 pounds, there is a weight or force of 30-35 pounds pressing on every square inch of the inside of a car's tire; and there's 70-90 pounds per square inch inside a bike's tire.

When you go under water, the weight of the water above you exerts a pressure on you, too. This becomes quite great if you scuba dive to a depth of, say, 50 feet. You may have seen movies where submarines dive to 500 or 600 feet to avoid enemy subs – depths where the pressure of the water is enough to crush the sub's hull.

The air pressure on the top of a mountain is less than 14.7 pounds per square inch because there is less air above the mountain. If you carried a barometer from sea level to the top of a mountain, you could watch its reading go down considerably. On the peaks of the highest mountains, people often need to carry oxygen tanks because the air is so 'thin.'

Jets fly high over mountains, at altitudes where the air is very thin and the air pressure is much less than on even the tallest mountains. The air is so thin that the cabins of passenger jets are pressurized so that people have enough air to breathe. What would you observe if you took a barometer that measured outside air pressure up in an airplane? The barometer would show that the air pressure decreases the higher you fly. In fact, this is how airplane equipment measures altitude – by using a barometer.

Air pressure varies from place to place across the country. National weather maps show this. Weather maps show "H" for areas of high pressure, and "L" for areas of low pressure. Storms generally circulate around areas of low pressure, as you can see on the weather map below.



Meteorologists measure air pressure in "mm of Hg" rather than pounds per square inch. Low pressures are in the range of 29-30 mm of Hg (or just "mm" for short) and high-pressure areas are in the range of 30-31 mm.

Where do those units come from? An Italian physicist named Evangelista Torricelli, an assistant of Galileo's, invented a barometer that used a long tube of mercury (chemical symbol Hg). You may have seen these in classrooms. The mercury in the tube of this kind of barometer is held up by the weight of the air pressing down on the pool of mercury below the tube. When the air pressure is great and the mercury in the pool below is pressed down harder, the mercury rises in the tube above. When the air pressure is less, it presses down less on the mercury pool below, and the mercury in the column above goes down. The tube is calibrated in millimeters – hence, the units of "mm of Hg." The tube does not have to be very long because mercury is very dense, so the column of mercury is very heavy. If water were used instead of mercury, you would need a column 34 feet high. In other words, the weight of the atmosphere pressing down on us is the same as the weight of a column of water 34 feet high! And we still do not notice it!

Meteorologists commonly used units of millibars to list pressures in the atmosphere. (One "bar" is too large for measuring air pressure, so millibars —1/1000ths of a bar — were needed; barometers measure barometric pressure.) Today, meteorologists use hectopascals as their unit of measurement.

Today, the barometers used most often in weather forecasting are called aneroid barometers. They do not contain liquids. They work by using a sensitive metal diaphragm that moves in or out, depending on how much air is pressing on it. The diaphragm controls the movement of a metal pointer that indicates the pressure reading. Aneroid barometers are much smaller than mercury barometers and are often used as altimeters in aircraft.

Make Your Own Barometer

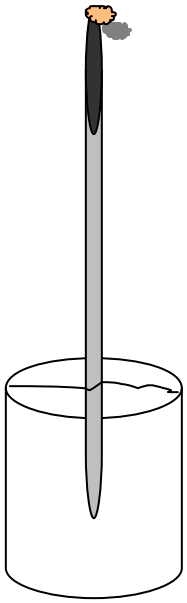
Procedure:

1. Get a disposable pipette, a pea-sized ball of clay, and a beaker half filled with colored water from your teacher.

2. Using a rubber bulb, gently draw the colored water half way up the pipette. Then put a ball of clay in the bottom (small) end of the pipette. You should have a sealed section of the pipette with air in it.

3. Put the filled end of the pipette in the colored water. Using tape across the top of the beaker, arrange the pipette so that it will stay up.

4. Record the point on the pipette where the colored water reaches.



5. Continue to record the level of the colored water every day for a week. Also record the barometric pressure from the news or Internet sources.

Calibrating a Barometer

Day	**Level of Colored Water**	**Barometric Pressure**

6. After you have "calibrated" your homemade barometer for five days, carefully observe it on the sixth day. Is the pressure rising or falling?_____

7. Based on your findings, make a weather prediction_____
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