Air Pressure

The atoms and molecules that make up the various layers in the atmosphere, despite their tiny size, actually exert some weight on us. We feel this weight as pressure.

Air pressure is simply the weight of air above an object. The weight of air is directly related to the number of air molecules in a given volume. So, air pressure depends on the number of air molecules in a given volume above an object and how fast the molecules are moving.

From sea-level to the top of the atmosphere, the weight of all molecules above each square inch of any object (for example, a one inch by one inch piece of paper), is about 14.7 pounds.

As elevation increases, the number of molecules decreases and the weight of air therefore is less, meaning a decrease in air pressure.

The two most common units in the United States to measure the pressure are “Inches of Mercury” and “Millibars”. Inches of mercury refers to the height of a column of mercury measured in hundredths of inches. This is what you will usually hear from the NOAA Weather Radio or from your favorite weather or news source.

1. How is air pressure defined above? _______________________________________________________________

2. The weight of the air above any object is about _______ pounds per square __________.

3. What units are used to measure air pressure? ________________________   _____________________________

Although the changes are usually too slow to observe directly, air pressure is almost always changing. This change in pressure is caused by changes in air density, and air density is related to temperature. Warm air is less dense than cooler air because the gas molecules in warm air have a greater velocity and are farther apart than in cooler air.

On top of daily fluctuations due to sunrise and sunset, there are the larger pressure changes as a result of the moving weather systems. These weather systems are identified by the blue H’s and red L’s seen on weather maps. The H’s represent the location of the area of highest pressure. The L’s represent the position of the lowest pressure.

Generally, if you read your barometer at noon and it reads 29 inches and then you read it again at 4 pm and it reads 31 inches, the barometer is rising. This means a high pressure area has moved in. High pressure usually means good (sunny) weather.

Conversely, if you read your barometer at noon and it reads 31 inches and then you read it again at 4 pm and it reads 29 inches, the barometer is falling. This means a low pressure area has moved in. Low pressure usually means bad (stormy) weather.

4. When the pressure rises the weather should get ________________________.

5. When the pressure falls, the weather generally gets ________________________.

6. The instrument used to measure the pressure is a __________________________.

7. _______ air is less dense and tends to ____________ in the atmosphere.   (Warm, Cold, Rise, Fall)

8. _______ air is more dense and tends to ____________ in the atmosphere.   (Warm, Cold, Rise, Fall)

Source: Adapted from http://www.srh.weather.gov/srh/jetstream/atmos/pressure.htm
Air Pressure Questions

1. How is air pressure defined by the handout?

2. What is air pressure dependant on?

3. Is air a compound, element, or mixture? Why?

4. What two units or systems are used to measure air pressure here in the U.S.?

5. Does air pressure change from hour to hour, day to day? What causes a change in air pressure?

From our class discussion:

8. ________ air has a _________ pressure, while _________ air has a low pressure.

9. ________ weather is associated with _________ pressure while _________ weather is associated with ________ pressure.

10. Draw molecules of high pressure in a box below, then draw molecules under low pressure. Label each box as high or low.
6. How is air pressure defined by the handout?
    Air Pressure is simply the weight of air above an object.

7. What is air pressure dependant on?
    Air pressure depends on the number of air molecules in a given volume above an object and how fast the molecules are moving.

8. Is air a compound, element, or mixture? Why?
    Air is a mixture made of nitrogen, oxygen, and argon and other elements in small quantities. Because the elements are not combined to form compounds nor is air an element itself, air is classified as a mixture.

9. Write the volume of air vs. the number of molecules as a ratio.
    
    1: 400,000,000,000,000,000,000,000 or 1: 4 x 10^{23} or 1: 400 x 10^{21}

10. What two units or systems are used to measure air pressure here in the U.S.?
    Millibars or inches of Mercury.

11. Does air pressure change from hour to hour, day to day? What causes a change in air pressure?
    Yes, air pressure changes constantly. The change in air pressure is caused by changes in air density, and air density is related to temperature. Warm air is less dense than cooler air because the gas molecules in warm air have a greater velocity and are farther apart than cooler air.

12. What is the scientific unit for pressure? Who was it named after?
    Pascal (or kilopascal), named after Blaise Pascal in the 1600’s.

From our class discussion:

11. COLD air has a HIGH pressure, while WARM air has a low pressure.

12. GOOD weather is associated with HIGH pressure while BAD (PRECIPITATION) weather is associated with LOW pressure.

13. Draw molecules of high pressure in a box below, then draw molecules under low pressure. Label each box as high or low.

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