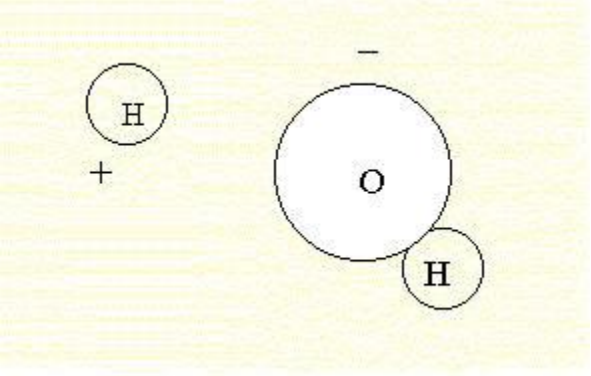
Lab 2:
How are acids and bases formed?



You have learned that hydrogen and oxygen are held together by a hydrogen bond to form water. When water naturally "breaks up" into H^+ and OH^- , the process is known as dissociation. When water dissociates, the hydrogen atom breaks its bond with oxygen and leaves behind its electron. The hydrogen atom is now positively charged and is called a hydrogen ion. The remaining hydrogen is still connected to the oxygen, which now has an extra electron, giving this pair a negative charge. The OH^-molecule is called a hydroxide ion. The amount of dissociated water molecules in relation to all the water molecules is very small, and since the overall amounts of H^+ and OH^- are equal, they cancel each other out. This state of equilibrium gives us our neutral point of 7 on the pH scale.

If, for some reason, the H^+ and OH^- are not balanced, an acid or base is formed. The acidity or alkalinity (baseness) of the solution is rated on the pH scale. The range of this scale is from 0 to 14. Numbers below seven are acidic, while numbers above seven are basic. It is important to note that this scale is logarithmic. Thus, a pH of 2 is not twice as acidic as a 4, but rather 100 times as acidic. That same pH of 2 is not three times as acidic as a pH of 6, but rather 10,000 times as acidic.

Acids are aqueous solutions that have more H^+ than OH^-. This can be caused by adding H^+ ions or by taking away OH^- ions (actually, the process is far more complicated than this, but for what you will need to do this definition will work fine). Acids are characterized by their sour taste and their ability to dissolve metals. Many of the foods you eat, such as oranges, green apples, and rhubarb, taste sour due to the acids which they form. Many cleaners have acids in them. It is important that you read the warning labels on your household cleaners as we do not advise that you use acidic solutions to clean water pipes in your home.

Bases are aqueous solutions that have more OH^- than H^+. This can be caused by adding OH^- ions or by taking away H^+ ions (again, the process is far more complicated than this, but for what you will need to do this definition will work fine). Bases are generally slippery and taste bitter. The scales of fish are coated with a base that makes them slippery. Soaps are also bases, and naturally are quite slippery. When you squeeze lemon on your fish before eating it, what you are actually doing is neutralizing the basic, bitter taste with an acid, thus making it more palatable. You may have also experienced this acid-base neutralization reaction if you have ever drank orange juice after brushing your teeth. Be advised that bases can be just as damaging as acids, and in some cases even more damaging (the slipperiness makes it hard to wash out of your eyes should it get into them). One advantage to using bases as cleaners is that they do not react with metals. The cleaners used to unclog sinks (Liquid Plumber) are strong bases that readily dissolve hair and grease.

Many common fluids are acids or bases, yet they do not harm us. Be advised that either an acid or a base, can cause serious injury. Always use caution when working with either substance. Confused? We will study this concept many more times in Anatomy and Physiology One and Two. This is just an introduction to this concept.

Activity

Identify Substances as Either Acid or Base

A universal indicator is a dye that will change colors when an acid or a base is added to it. Each dye has its own color change properties. If you have ever tested pool water, you have used this principle. See the color chart above to get an idea of the pH level for different colors with a universal indicator. Some dyes are indicators for only bases or only acids.

In this activity we are using mustard as an indicator. The dye that gives classic mustard its yellow color is turmeric. Turmeric is an indicator for base, changing from yellow to red when a base is added. We want to find out if ammonia or vinegar is a base.

Materials Needed:

- Yellow Mustard
- Ammonia (look in the cleaning section of your grocery store)
- Vinegar
- Three straws
- Four small clear plastic cups

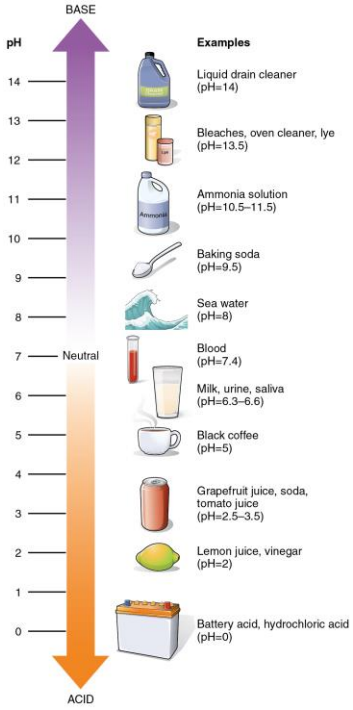
Procedure:

You will report your observations on your lab report.

1. Pour a little mustard in two of the cups.
2. Pour about 1/4 cup of ammonia in another cup
3. Pour about 1/4 cup of vinegar in another cup
4. Place a straw in the cup of ammonia. Cover the end of the straw with your finger, allowing a small amount of the ammonia to stay in the straw when you remove it. Place the straw over the mustard in one of the cups. Carefully move you finger from the end of the straw to allow add few drops of ammonia to mix with the mustard. Do you see a color change? Record your results on your lab report.
5. Repeat the above procedure with the other cup of mustard and the vinegar. Remember to use a new straw to avoid contamination of your results. Do you see a color change? Record your results on your lab report.
6. Determine from your work which substance is basic and which is acidic and record this on your lab report and answer the associated questions.
7. With a new straw, place drops of the substance you identified as acidic (NOT *the acid /mustard mixture)* into the mustard/basic substance mixture. *Remember: Mustard is NOT the acid or the base. It is the 'indicator' for the experiment.*

Observe any change and record your results on your lab report, and answer the related questions.

You will also draw a pH scale on your lab report and indicate the pH of some common substances. The instructions for this are on the lab report. The picture below can also be found in your text.



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