Aim: What is pH?

Mr. M. Gonzalez

Do now:

- What happens when you combine baking soda and vinegar?

A Chemical Reaction!!!

Answer

- The reaction between baking soda ($NaHCO_3$) and vinegar (CH_3COOH) is actually two reactions, an acid base reaction followed by a decomposition reaction.

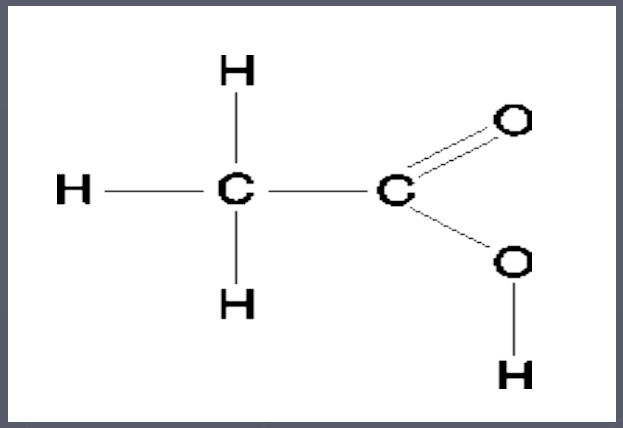
  1) When the two ingredients are mixed, hydrogen ions (H^+) from the vinegar react with the bicarbonate ions (HCO_3^-) from the baking soda to form a new chemical called carbonic acid (H_2CO_3).

  2) The carbonic acid thus formed then immediately decomposes into carbon dioxide gas (CO_2) and water (H_2O).

  H_2CO_3 ---> $H_2O + CO_2$

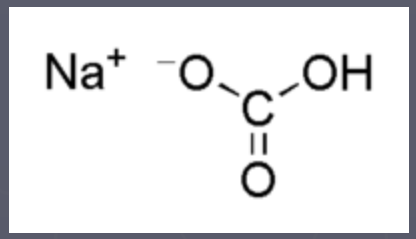
  It's this carbon dioxide gas that you see bubbling and foaming as soon as you mix baking soda and vinegar together.

Vinegar



Acid + Base

Baking soda



Carbonic Acid

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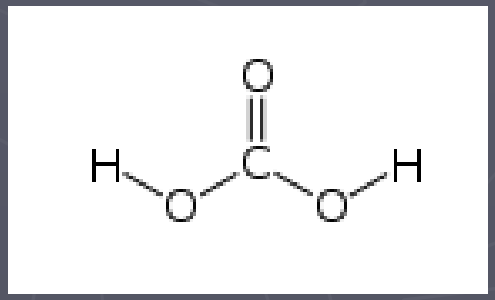
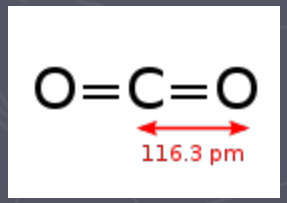
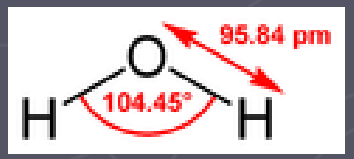


Carbon Dioxide



Decomposition

Dihydrogen Oxide



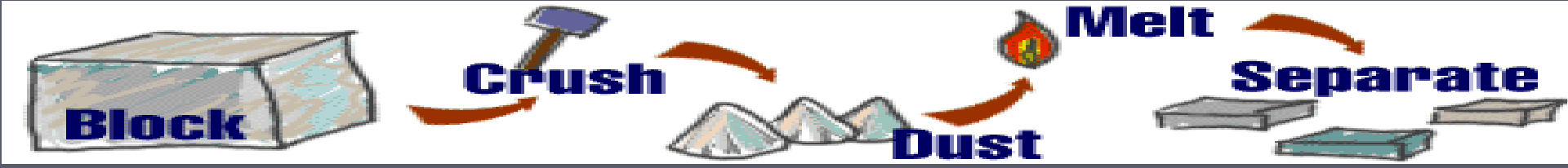
What is pH?

HW

- If you haven't submitted your 1st lab report draft on germination, please do so ASAP.

Objectives

- I can define what mixtures and solutions are.
- I can describe how pH determines how acidic and basic a solution is.
- I can determine the importance of pH in the natural world.



Mixtures and Solutions

- A mixture - combination of substances that retain their own properties and don't react chemically even when mixed.
- Neither component of the mixture changes.
- E.g. = concrete = cement, rock, and sand.
- E.g. = kool aid = water, sugar, coloring, and flavor.

Mixtures and Solutions

- A solution is a mixture in which one or more substances (solutes) are distributed evenly in another substance (solvent) and they dissolve.

- Sugar molecules (solute) in a powdered drink dissolve in water (solvent) to form a solution.

Question 1

What is the difference between a mixture and a solution? (NY: St 4 KI 6.1c)

In a mixture there are substances that don’t react, they are just nearby to each other while in a solution the substances can react in many different ways.

What are acids and bases?

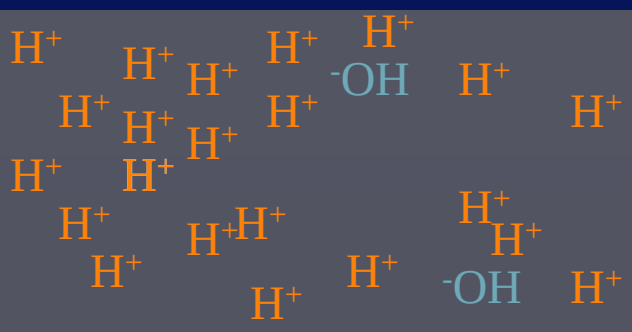
- Chemical reactions can occur only when conditions are right. Especially reactions that involve enzymes in living things.
- A chemical reaction may depend on:
  - energy availability
  - temperature
  - concentration of a substance
  - pH of the internal or surrounding environment

Acids and bases

- The pH is a measure of how acidic (H^+) or basic (^-OH) a solution is.
- A scale with values ranging from below 0 to above 14 is used to measure pH.

Acids and bases

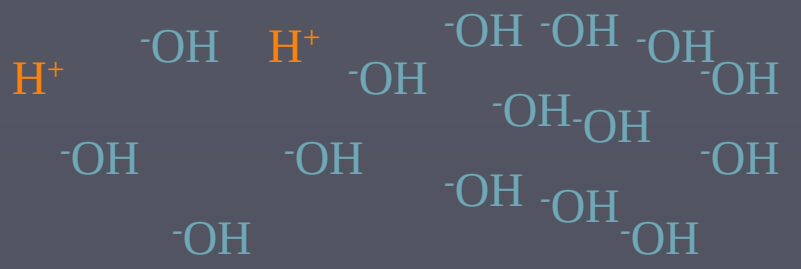
- Acids have a lot of Hydrogen ions (H^+) and bases have a lot of Hydroxide ions (^-OH).
- A solution is neutral if its pH equals seven.



Neutral

$(H^+) + (^-OH) =$

H_2O



What is pH?

Acids and bases

- Substances with a pH above 7 are basic. A base is any substance that forms hydroxide ions (^{-}OH) in water.

Ammonia (pH 11)

Acids and bases

- Substances with a pH below 7 are acidic. An acid is any substance that forms hydrogen ions (H^+) in water.

Vinegar (pH 3)

Question 2

What are acids and bases? Give examples.

An acid basically has an excess of Hydrogen ions (H^+) and a base has an excess of Hydroxide ions (^-OH) .

Examples can be: lemon juice, ammonia, vinegar, drinking water, hydrated lime, clorox, drano, seltzer water, etc.

Importance of pH in the natural world

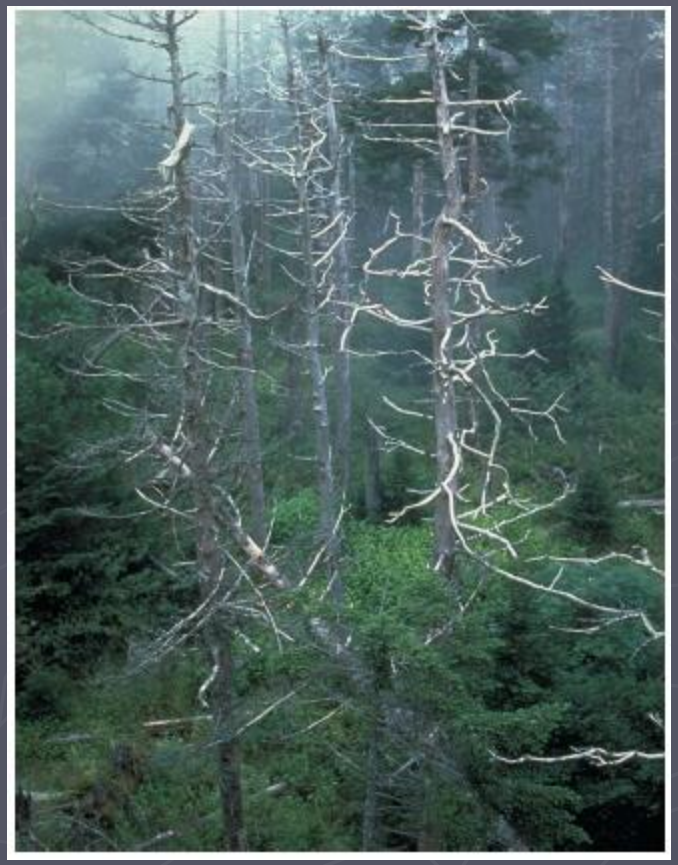
- **Chemical reactions rate is affected by the pH.**
  - **If the reaction involves a proton, or H+, a more acidic solution will have faster rate.**
  - **Similarly, if OH- is a reactant, than a high pH will make the reaction go faster because at a high pH, the concentration of OH- is large.**

Importance of pH in the natural world

- Acids and bases cause many substances to fall apart because they break bonds by taking away **Hydrogens** and **Hydroxides** from them to make *water*.
- Acids and bases are used in cooking, cleaning, making computers, batteries, enzyme reactions in your body, digestion, and countless other things.

Importance of pH in the natural world

- **Carbon Dioxide** from burning **fossil fuels** increases the amount of **acid rain** in the atmosphere.
- **Acid rain** kills trees and fish by changing the **pH values** of their habitat.
- Humans affected by:
  - limiting oxygen in atmosphere,
  - Kills fish we depend on as food or fish meal.
  - Global warming and sea rise.



What's the perfect pH for a plant?

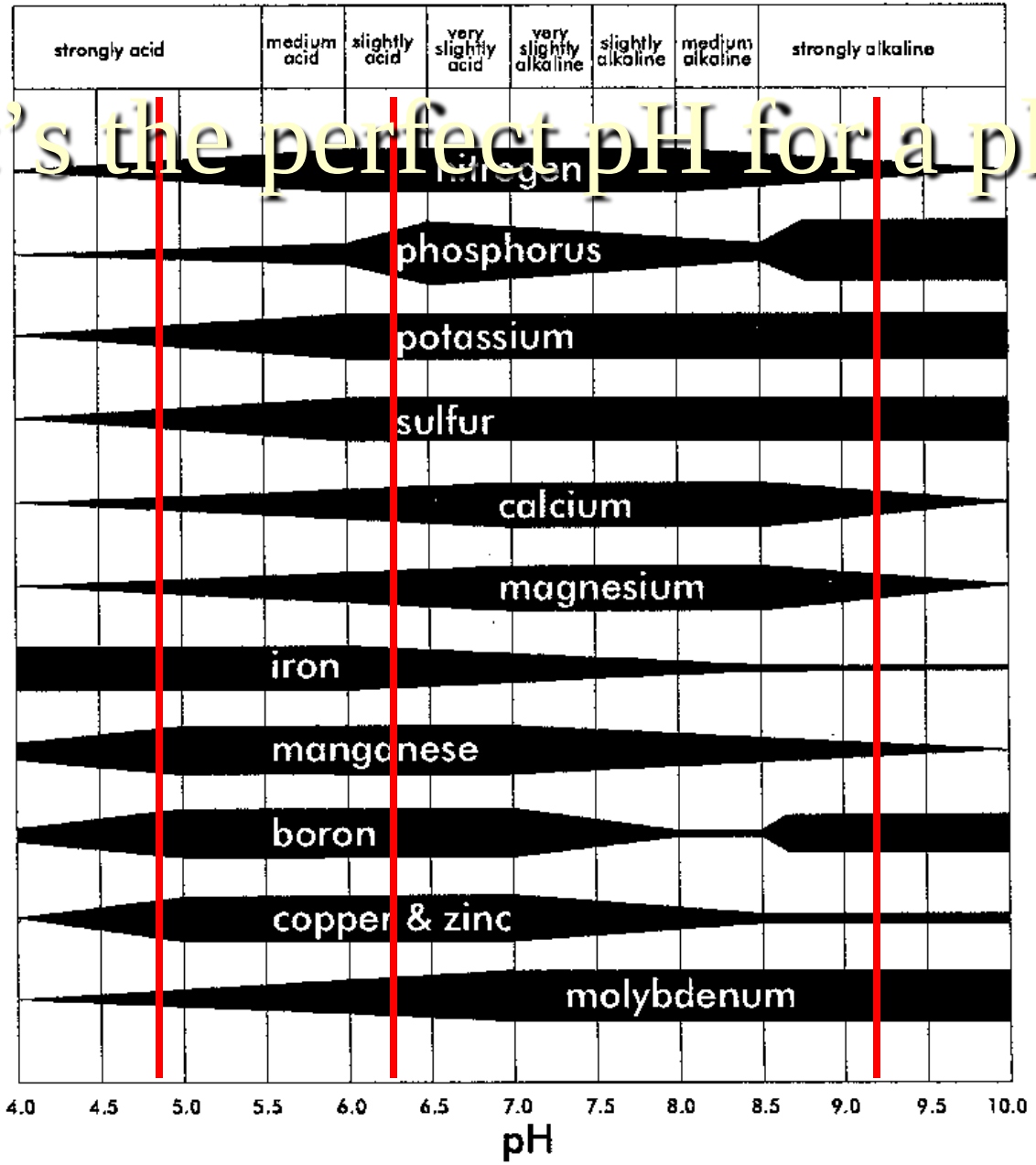
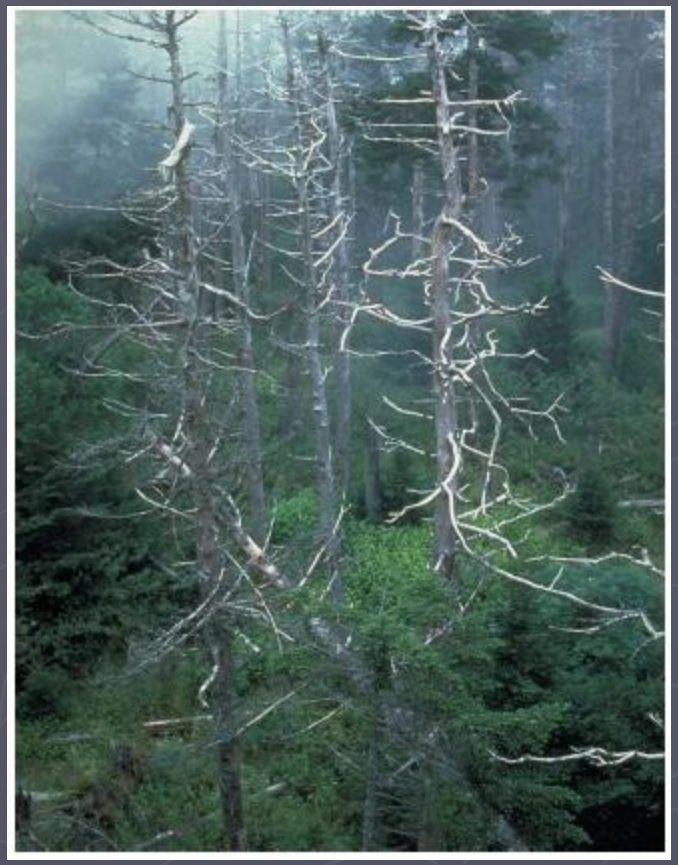


Table 2. Effects of soil reaction on availability to plants of soil nutrients (after Truog). The width of the bar determines the relative availability of each element with a change in soil reaction.

Background Information

- Living things are especially sensitive to changes in pH.
- Plants, for example, will be incapable of absorbing nutrients from the soil if the pH is:
  - too low (acidic) or
  - too high (basic).



pH Facts

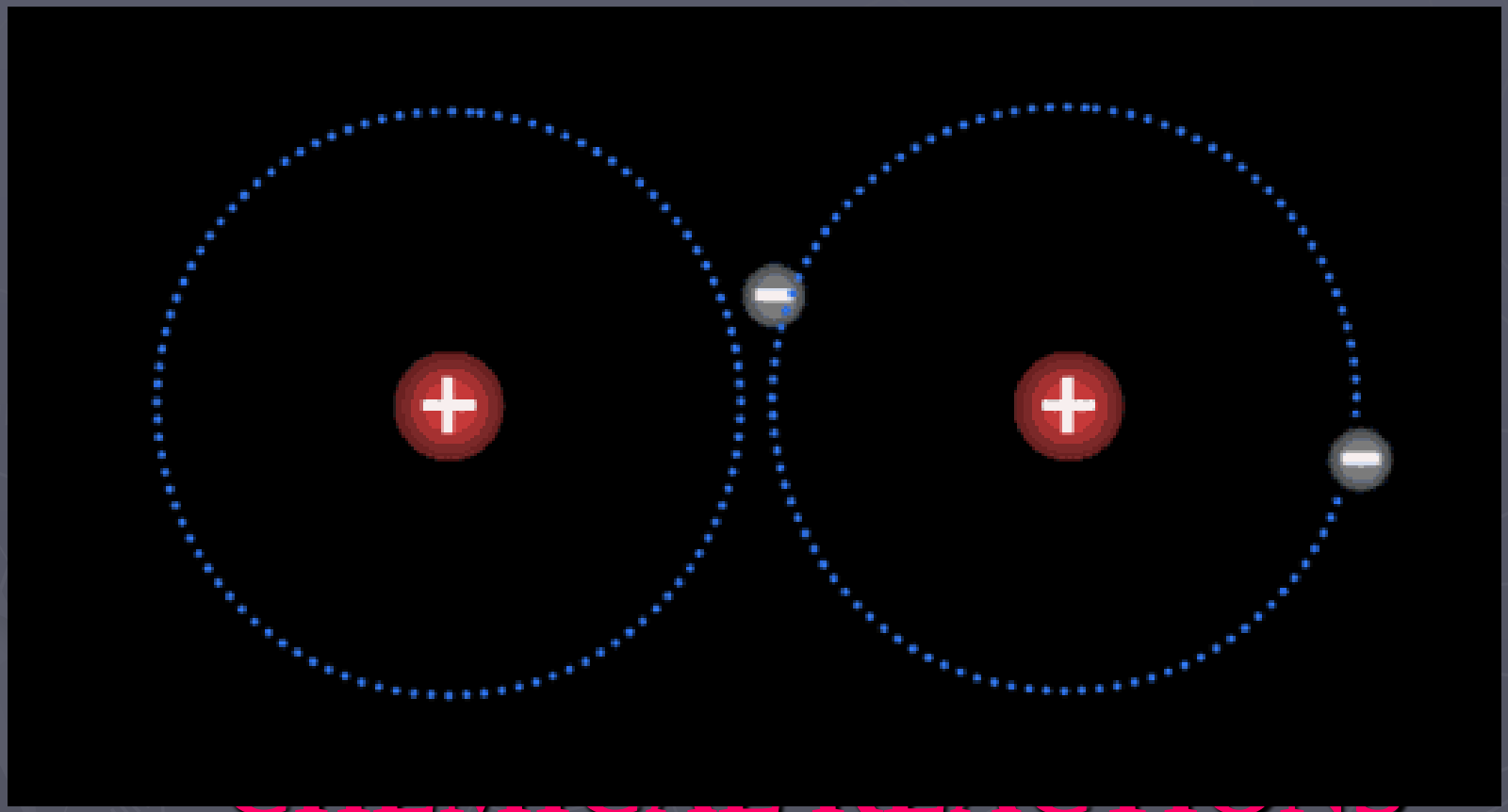
Item	pH
Human Blood	7.41
Ocean Water	8.2
Acid Rain	< 5.6
Milk	~ 6.4
Beer	4 - 5
Vinegar	~ 3
Human Stomach	1.5 - 3
Nitrification	7
Hydroponics	5.8 – 6.2
Ultra-filtered/Distilled water	~ 4.5

REMEMBER:

The reason why acids and bases are so important is that they can speed up or slow down chemical reactions.

What are chemical reactions?

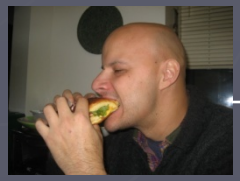
WHEN

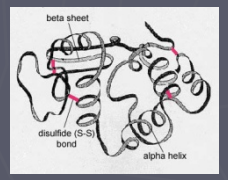


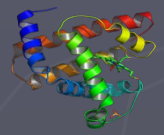
CHEMICAL REACTIONS

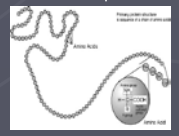
What is pH?

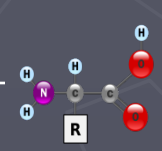
Compound Molecule Spiral

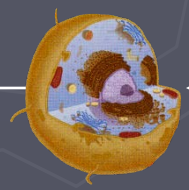


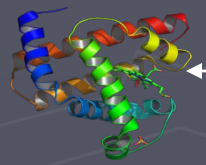


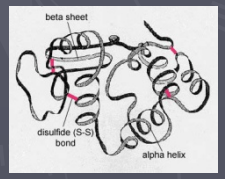












What is pH?

Journal entry

- What's the importance of pH in the natural world and you?
- Give 2 specific examples.

HW

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Bibliography

- "Biology: The Dynamics of Life." Glencoe Interactive Chalkboard. The Living Environment Edition. CD-ROM. New York: McGraw Hill, 2003.
- Yahoo Answers . 06/17.08 http://answers.yahoo.com/question/index?qid=20080609132156AAHSCxH