

Below is a lesson plan that I will be using this year in chemistry. In this lesson students are exploring the different aspects of acid/base chemistry. In doing so, students will become familiar with indicators. Indicators are used to determine the pH of a solution or specifically if it is an acid or a base. I have a lot of different ideas for this topic. I have thought about allowing students to create their own pH paper using different types of foods, blue berries, strawberries, beets, etc. I have also considered using cabbage juice as an indicator and allowing students to test different substances, thus creating a 'rainbow' effect. I would like to use the Connecting in visual arts, "Utilize inquiry methods of observation, research, and experimentation to explore unfamiliar subjects through art making"

Main Idea/Focus: Acids, Bases, pH

Standard(s): CHEM1.PS1.8 - Identify acids & bases as a special class of compounds with a specific set of properties.

Phenomenon: pH paper dipped in vinegar turns red.

Goals(s): What will you do? What will you investigate?

1. Plan and conduct an investigation to compare the relative strengths of acidic solutions.
2. Develop and use models to explain the chemical properties of acids and bases.

Resources: What do you need? Computer or internet access, calculator

Terms: acid, base, acidic solution, basic solution, conjugate acid, conjugate base, Arrhenius model, Bronsted-Lowry model, Lewis model, amphoteric, strong acid, weak acid, acid ionization constant, strong base, weak base, base ionization constant, pH, pOH, neutralization, salt, titration, equivalence point, acid-base indicator, end point, salt hydrolysis, buffer, buffer capacity

- acid** - substance that produces hydronium ions (H_3O^+) when dissolved in water
- base** - substance that produces more hydroxide ions (OH^-) when dissolved in water
- acidic solution** - contains more hydrogen ions than hydroxide ions; pH between 0-7
- basic solution** - contains more hydroxide ions than hydrogen ions; pH between 7-14
- conjugate acid** - the species produced when a base accepts a hydrogen ion from an acid
- conjugate base** - the species produced when an acid donates a hydrogen ion to a base
- Arrhenius model** - a model of acids and bases; states that an acid is a substance that contains hydrogen and ionizes to produce hydrogen ions in aqueous solution and a base is a substance that contains a hydroxide group and dissociates to produce a hydroxide ion in aqueous solution.
- Bronsted-Lowry model** - a model of acids and bases in which an acid is a hydrogen-ion donor and a base is a hydrogen-ion acceptor
- Lewis model** - states that an acid is an electron-pair acceptor and a base is an electron-pair donor
- amphoteric** - describes water and other substances that can act as both acids and bases
- strong acid** - an acid that ionizes completely in aqueous solution
- weak acid** - an acid that ionizes only partially in dilute aqueous solution
- acid ionization constant** - value of the equilibrium constant expression for the ionization of a weak acid
- strong base** - a base that dissociates entirely into metal ions and hydroxide ions in aqueous solution
- weak base** - a base that ionizes only partially in dilute aqueous solution to form the conjugate acid of the base and hydroxide ion
- base ionization constant** - value of the equilibrium constant expression for the ionization of a base
- pH** - the negative logarithm of the hydrogen ion concentration of a solution; acidic solutions - 0 to 7, basic solutions - 7 to 14, neutral solutions - 7.0
- pOH** - the negative logarithm of the hydroxide ion concentration of a solution; pOH above 7.0 - acidic, pOH below 7.0 - basic, pOH = 7.0 - neutral
- neutralization reaction** - a reaction in which an acid and a base react in aqueous solution to produce a salt and water
- salt** - an ionic compound made up of a cation from a base and an anion from an acid
- titration** - the process in which an acid-base neutralization reaction is used to determine the concentration of a solution of unknown concentration
- equivalence point** - the point at which the moles of H^+ ions from the acid equals moles of OH^- ions from the base
- acid-base indicator** - a chemical dye whose color is affected by acidic and basic solutions
- end point** - the point at which the indicator that is used in a titration changes color
- salt hydrolysis** - the process in which anions of the dissociated salt accept hydrogen ions from water, or the cations of the dissociated salt donate hydrogen ions to water

- z. **buffer** - a solution that resists changes in pH when limited amounts of acid or base is added
- aa. **buffer capacity** - the amount of acid or base a buffer solution can absorb without a significant change in pH

Guiding Questions:

- What are the physical & chemical properties of acids & bases? How are solutions classified: acidic, basic or neutral?
- How do the Arrhenius, Bronsted-Lowry and Lewis models of acids and bases compare?
- How does the strength of a weak acid compare with the strength of its conjugate base?
- What are pH and pOH? How are the pH and pOH of aqueous solutions calculated?
- What do chemical equations of neutralization reactions look like?
- How are neutralization reactions used in acid-base titrations?
- How do the properties of buffered and unbuffered solutions compare?

ACT Connection:

SIN 404 - Identify similarities and differences between experiments.