

LESSON 13 ACIDS & BASES

- Some chemicals can be classified as either an acid or a base.
- Both acids and bases are corrosive, which means they can burn your skin/eyes.

Acids

- Chemicals that produce hydrogen ions (H^+) when dissolved in water; the more H^+ ions, the stronger the acid.
- Acids take on acidic properties when dissolved in water $\rightarrow$ referred to as aqueous solutions. e.g., $HCl \rightarrow H^+(aq) + Cl^-(aq)$ (Note that it is the free H^+ that produces the acidity).
- Conductive due to the hydrogen ions and anions.
- Most acids can be identified by their chemical formula starting with an “H”
 - e.g., HCl , H_2SO_4 , H_3PO_4 . (Exception: H_2O is not an acid!)
- Many acids show up in household products such as vinegar – acetic acid, pop – carbonic acid, lemons – citric acid, etc. The sour flavour in these foods is due to the acid.
- Many acids show up in industrial applications such as paper bleaching and automobile batteries.
- Some animals and plants use acids as a defense mechanism such as stinging nettle and various types of ants.

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Orally:

Q: If acids are corrosive and show up in foods that we eat or drink, why are they not harmful?

A: They are weak acids and do not produce enough H^+ to be immediately harmful.

Bases

- Chemicals that produce hydroxide ions (OH^-) when dissolved in water; the more OH^- ions, the stronger the base. e.g., $NaOH$, $Mg(OH)_2$
- $NaOH \rightarrow Na^+(aq) + OH^-(aq)$
- Conductive due to the hydroxide ions and cations.
- Many bases used in the home are cleaners; many feel slippery and are bitter to taste. (e.g. soap, oven cleaner, etc.)

- Bases are frequently used in industrial applications such as pulp and paper. E.g., NaOH is used to soften lignin in wood. Lignin is like a glue that holds cellulose fibers together. Cellulose needs to be separated in order to make high quality paper.

pH Scale

- The pH scale is used to identify the strength of an acid or base
- Numbered scale ranging from 0 (very strong acid) to 14 (very strong base) that increases by a factor of 10 for each whole number change on the scale
 - Each jump of 1 means the acid or base is 10 times stronger
 - An acid with a pH of 3 is 10 times stronger than an acid with a pH of 4 and 100 times stronger than an acid with a pH of 5
- A pH of seven is considered to be neutral (i.e., not acidic or basic).

pH Indicators

- pH indicators are chemicals that react with acids and bases to produce a known colour change.
- Example: Litmus paper → changes to red in acids and to blue in bases.
- Other indicators are: methyl orange, methyl red, bromothymol blue, phenolphthalein and indigo carmine. See colour indicators page from data pages.

Homework: Assign worksheets from section 5.1: pages 85 and 87.

TEK example

The following story is from the Cecil King family on how they used traditional science principles to make corn soup:

White corn (mahndawmin) or big corn, as it is known to the Anishinabek people, can be used in a variety of recipes. The corn is picked; the husk is removed and set in the sun to dry. White corn must be put through a lyeing process before it can be made into corn soup. The lye (binugzignug) may come from hardwood ashes of cedar but many used maple tree (nenawtik) burnt into ashes (bungue). The ashes are an extremely strong *acid* (**wrong: the ashes are basic**). Usually the ashes would be gathered from the campfire itself. The lyeing process involves the ash being placed into water in a cast iron pot (cotkik) with the corn to boil for about two hours. The corn is allowed to sit in the pot until the ashes have settled to the bottom. The ash will cause the outside

layer of the corn to soften (nohkuzut), allowing it to pop like popcorn (bagushkazewut). The process allows the two black eyes, or hulls, on the kernel to be washed off. After the corn has popped, it is rinsed to free it of the lye and to make it ready for soup. The individual preparing the soup must be a very knowledgeable person and take into consideration many factors: 1. The pH level in the boiling mixture must be correct for the reaction to occur. Too little ash will prevent the reaction from occurring. 2. A high amount of ash will destroy the corn and make it inedible. 3. The temperature of the reaction is maintained through the use of birch trees because they burn at a higher heat, whereas the poplar burns too quickly, and pine throws off thick gum smoke plus a lot of sparks. Summary First Nations people understood part of the world of chemistry through the art of preparing and cooking meals. They understood the process required to open white corn through a recipe using the proper amount of ash from the maple tree. They knew ash from other trees would not work due to different ash qualities. This knowledge or oral history was passed down from one generation to another generation.