**UNIT 10 – Acid and Bases - Test June 3, 2016**
Textbook Chapter 18
Kavanah pp. 173-192 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



# Acids and Bases

## Usually found as an aqueous solution

## Cannot determine if a solution is acid or base by appearance

## Look at taste, touch, reactions with metals, conductivity, indicators

## Two definitions of acids: Arrhenius and Bronsted-Lowry

# Properties of acids and bases

## Taste

### Acids taste sour (Latin word *acidus* means sour)

### Examples of acidic foods are:

#### oranges (citric acid)

#### grapefruits

#### yogurt (lactic acid)

#### carbonated beverages (carbonic acid)

#### vinegar (acetic acid)

### Bases taste bitter

#### Ex is soap

### NEVER TASTE A CHEMICAL IN THE LABORATORY

## Touch

### Dilute acids sting on broken or injured skin

#### Ex. Eating a lemon when you have a sore in your mouth

### Bases feel slippery

#### Ex. soap

### DO NOT TOUCH CHEMICALS IN THE LABORATORY

## Reaction with metals

### Acids react with most metals to produce hydrogen gasMg(s) + HCl(aq) 🡪 MgCl2(aq) + H2(g)

### Bases do not react with metals

## Electrical Conductivity

### Acids and bases are both electrolytes

### Electrolytes conduct electricity in solution

## Litmus Paper

### Used to identify acids and bases

### Acids turn litmus paper red

### Bases turn litmus paper blue

## Indicators

### Indicator: a liquid that changes color when the pH changes

### Indicators are listed in Table M

### Phenolohthalein is most commonly used for titrations

# Neutralization Reaction

## Reaction of acid and base produce a neutral productProduct is neither an acid nor a base

## Ionic compound produced is called a “salt”

### Salts are also electrolytes when dissolved

## Other product is often water

## Ex. HCl(aq) + NaOH(aq) 🡪 NaCl (aq) + H2O(l)

# Arrhenius Acids and Bases

## Molecular definition made by Swedish chemist Svante Arrhenius in 1884

## Acids dissociate in water to produce hydrogen ions (H+)

## Bases dissociate in water to produce hydroxide ions (OH-)

## Arrhenius acids begin with H, ex. HCl, HNO3 nitric acid, sulfuric acid, carbonic acid HCO3Dissociation: HCl 🡪 H+ + Cl-

## Arrhenius acids produce H+ and an anion. The anion may be a non-metal ion or a polyatomic ion. *Give an example of each from the list above*

## Arrhenius bases end in OH, ex. NaOH, KOH, Ca(OH)2

## Arrhenius bases produce OH- and some cation in solution. The cation is a metal or a polyatomic ion

## Neutralization of Arrhenius acid and base always produces water and a salt, becauseOH- (aq) + H+ (aq) 🡪 H2O (l)

# Bronsted-Lowry Acids and Bases

## More detailed than Arrhenius definition (remember the atomic models?)

## Acids and bases do NOT have to be in aqueous solutions. You can have a gaseous Bronsted-Lowry acid or base.

## Proposed in 1923 independently by Johannes Bronsted (Denmark) and Thomas Lowry (England)

## Definitions:

### B-L acid: any substance that can donate H+ ions

### B-L base: any substance that can accept H+ ions (forget about OH-)

## H+ ions

### What are the subatomic particles of hydrogen?

### Atomic number is 1 🡪 1 proton and 1 electron

### Mass number of most common isotope is 1 🡪 1-1=0 neutrons

### Positive ion loses its one electron, so **H+ is just a proton**

### A cation walks into a bar. “Help, I’ve lost my electron.” Are you sure? “Yeah, I’m positive.”

### Rewrite B-L definitions using “proton” in place of H+ ionB-L acid: proton donorB-L base: proton acceptor

### Monoprotic, diprotic, and triprotic acids

#### Monoprotic acids donate one proton

#### Diprotic acids can donate 2 protons

#### Triprotic …

#### Copy table K, names and formulas and classify each as mono-, di-, or triprotic

## Hydronium Ion

### Look in Table E H3O+

### H+ (aq) is just a proton, therefore strongly attracted to electrons in waterH+ + H2O 🡪 H3O+

## Conjugate Acid-Base Pairs

### When an acid loses an H+ ion it becomes its conjugate base

### When a base gains an H+ ion it becomes its conjugate acid

### Watch the video and take notes here:<https://www.youtube.com/watch?v=7qBRIWSA3Yc>

### Write the three examples from the video:

### Define amphoteric:

# Strong and Weak Acids

## Ex. Hydrochloric acid is dangerous and burns the skinCitric acid is found in many fruits

## Strong acid – an acid that completely ionizes

## Weak acid – an acid that does not fully ionize

## Strong acids are good electrolytes

## Use single arrow to represent strong acids and double acids for weak acids

## Hydrochloric, nitric, and sulfuric acids are common strong acids

## Strong base – a base with a strong affinity for H+ ions – good electrolyte

## Calcium oxide (lime, used in cement) is the strongest base

## All bases in Table L are strong except ammonia

## Watch the video and take notes here:<https://www.youtube.com/watch?v=ar2jfLE0iHI>

## List the strong acids from the video

## List the strong bases from the video

# Titration

## Watch the video <https://www.youtube.com/watch?v=8UiuE7Xx5l8>

## Use titration to find out the concentration of an unknown acid or baseUsed A LOT in industry to run commercial processes

## Phenolphthalein is an indicator. pH<8 🡪 colorlesspH>9 🡪 pink

## Erlenmeyer flask is used to prevent sloshing of liquids while swirling

## Neutralization reaction:

## Titration formula:NA x VA = NB x VB

## Normality – similar to molarity

## Diprotic acids have double the normalityEx. A 1.0M solution of H2SO4 is 2.0 N because there are 2 moles of H+ ions per liter of solutionEx. A 1.0M solution of Ca(OH)2 is also 2.0N because there are 2 moles of OH- ions per liter of solution

# pH Scale

## pH tells how acidic or basic a solution is

## Notes are on the pH and pOH handout. No need to copy.

## pH range 0-7 acidic7 is neutral : concentration of hydrogen ions equals concentration of hydroxide ions7-14 is basic

## Square brackets mean “concentration” measured in molarity.

### [H+] is concentration of hydrogen ions

### Arrhenius \_\_\_\_\_\_ dissociate in water to produce hydrogen ions

### Therefore, more hydrogen ions means more acidic

### [OH-] is concentration of hydroxide ions

### Arrhenius \_\_\_\_\_ dissociate in water to produce hydroxide ions

### Therefore, more hydroxide ions means more basic

## Look at formulas on handout

### We use logs to compress the data, because the concentration changes over such a broad range.

### Each change of one pH point represents a ten-fold change in H+ ion concentration

### Negative of the exponent of the hydrogen ion is the pH

### Negative of the exponent of the hydroxide ion is the pOH

### pH + pOH = 14