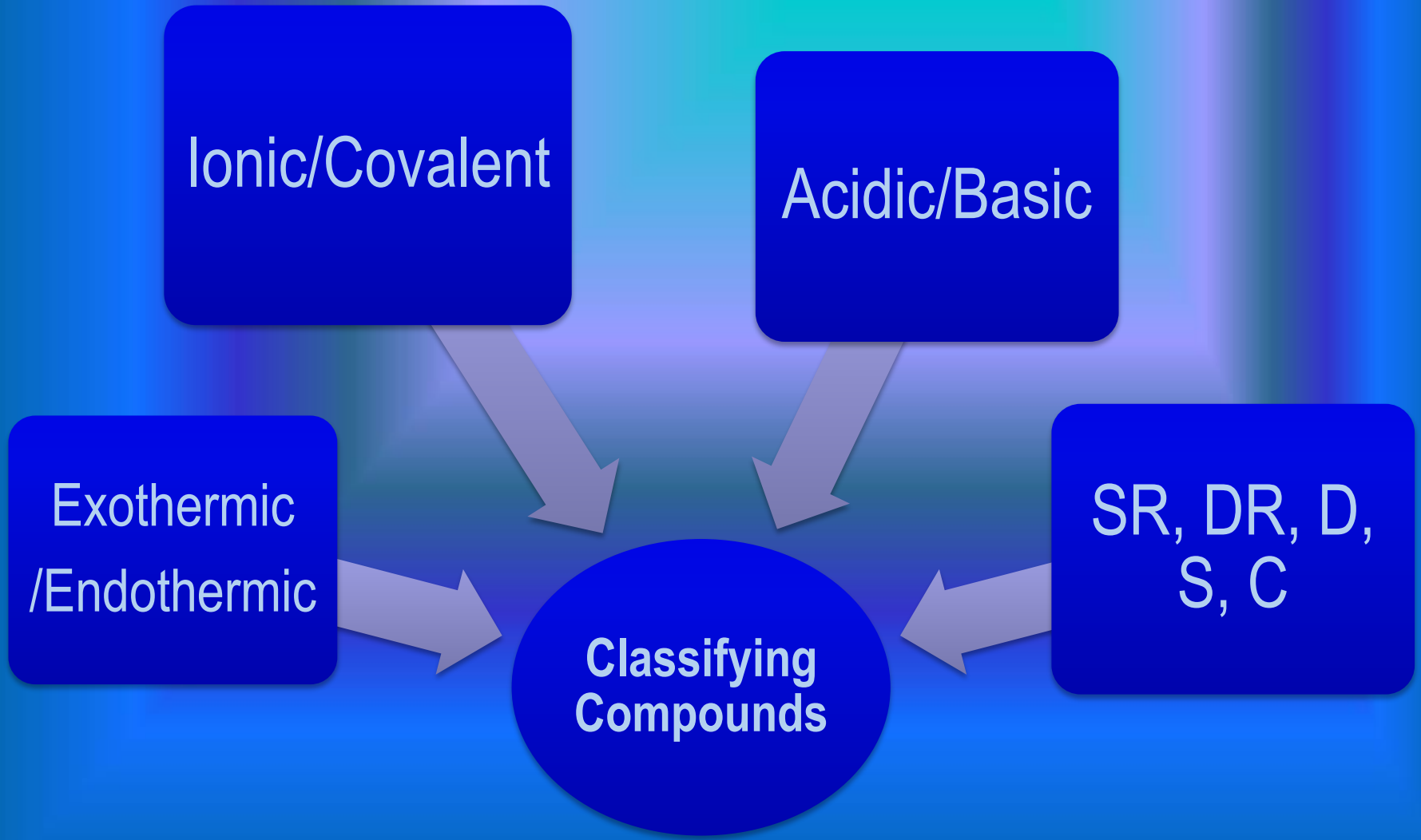
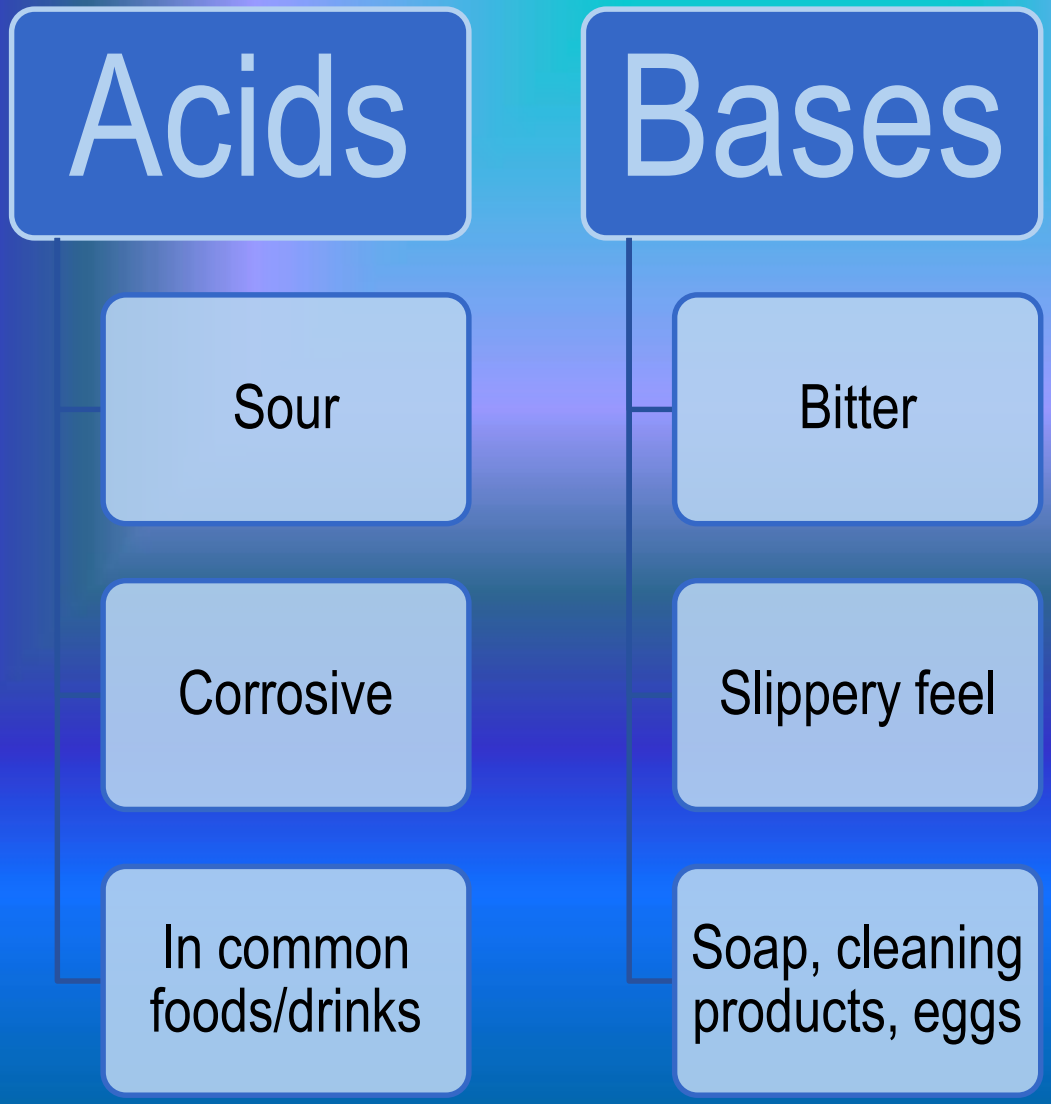
Acids and Bases

Classifying Compounds

What are ways in which we can classify compounds?



Properties of Acids/Bases



Acids and Bases

- Many familiar compounds are acids or bases.
  - Classification as acids or bases is based on chemical composition.
- Acids and bases can be very dangerous.
  - Both can be very corrosive.
    - NEVER try to identify an acid or base by taste or touch!

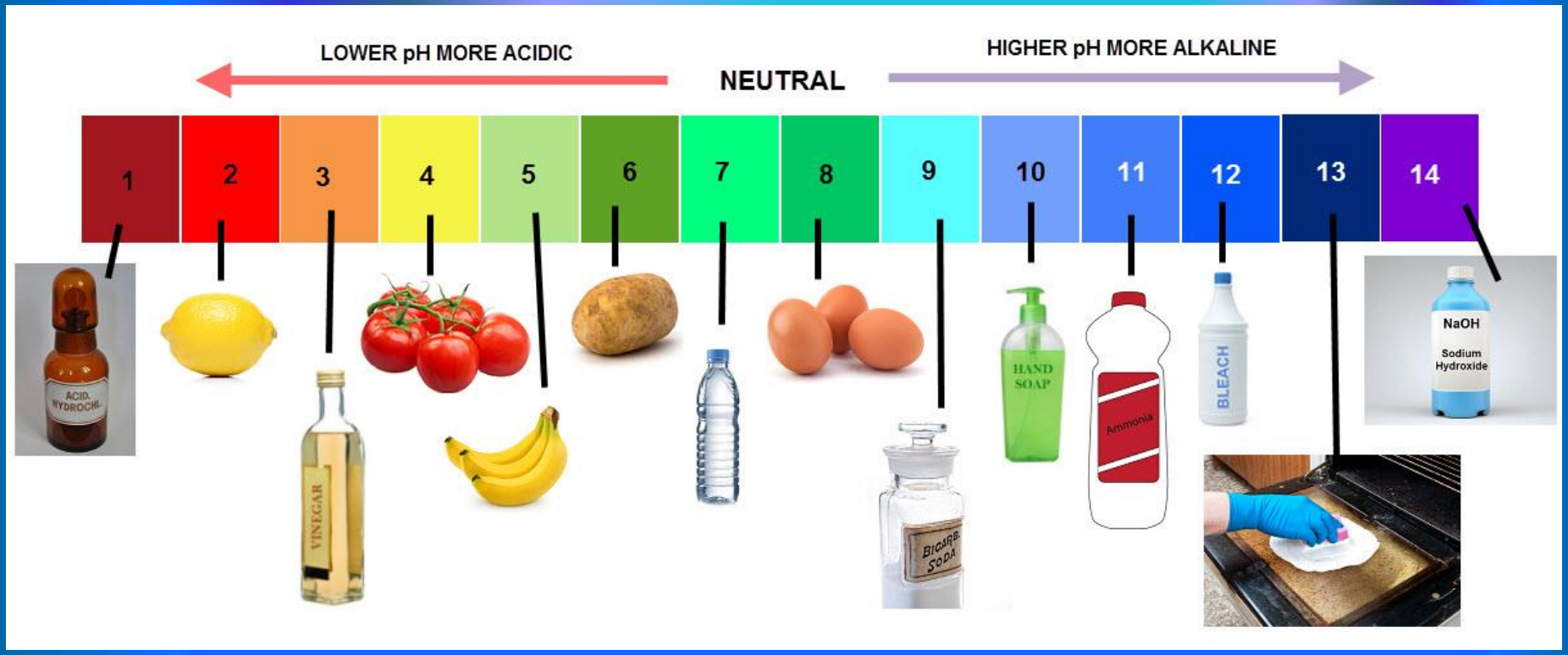
See pages 220 - 222

pH Scale

- The strength of acids and bases in measured on the pH scale.
  - Power of hydrogen
  - Number scale for measuring how acidic or basic a **solution** is
  - pH below 7 = acidic, pH above 7 = basic, pH 7 = neutral
  - 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

    Acids Neutral Bases
  - Each decrease of 1 on the pH scale indicates 10× more acidic
    - For example, pH 4 is **10** times more acidic than pH 5.
    - pH 3 is **1000** times more acidic than pH 6.

pH Scale



pH Indicators

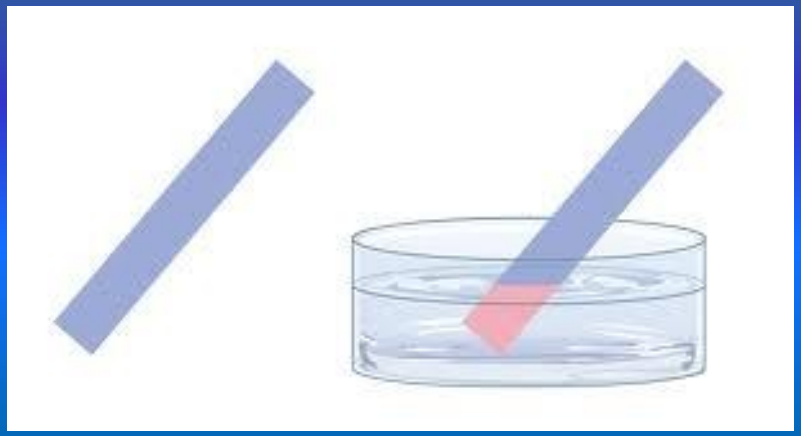
- The pH of acids and bases cannot be determined by sight.
  - Instead, pH is measured by other chemicals called indicators or by a pH meter that measures the electrical conductivity of the solution.

See pages 223 - 224

Indicators

- Many acidic and basic solutions are colourless therefore there needs to be a way to identify what type of compound you have

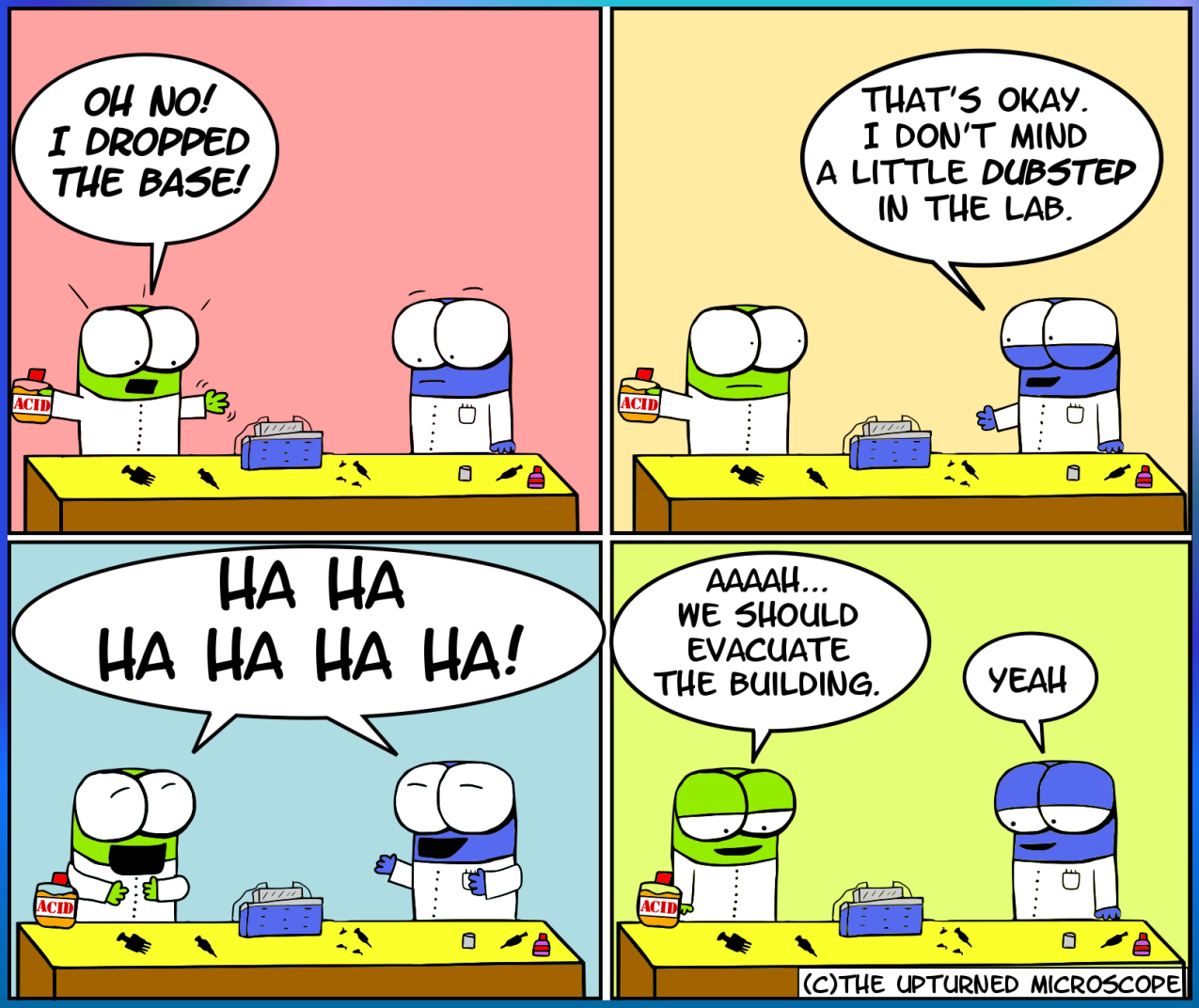
- pH indicators change colour based on the solution they are placed in.
  - Litmus is the most common indicator, and is used on litmus paper.
    - Extracted from lichens (algae/fungus)
    - Two colours of litmus paper: Blue and Red
    - Blue litmus turns red in an acidic solution
    - Red litmus turns blue in a basic solution
      - BAR → Blue Acidic Red



- Universal indicator contains many indicators that turn different colours at different pH values (can be in liquid form, or on paper strips like litmus).
  - A pH meter uses electrical probes to measure how solutions conduct electricity.
  - Indicators change colour at different pH values, so different indicators are used to identify different pH values.
    - Bromothymol blue for pH 6 – 7.6, phenolphthalein for pH 8.2 – 10.
    - Many natural sources, such as beets and cabbage, are also indicators.

Time OUT

- Page 84-85 in workbook



Acids

- **If you know a compound's chemical formula, you may be able to identify whether it as an acid.**
  - **Acids often behave like acids only when dissolved in water**
  - **Therefore, acids often are written with symbol (aq) = aqueous = water.**
    - **Aqueous means dissolved in water**

Sulfuric acid is used in batteries.

See pages 225 - 226

Naming Acids

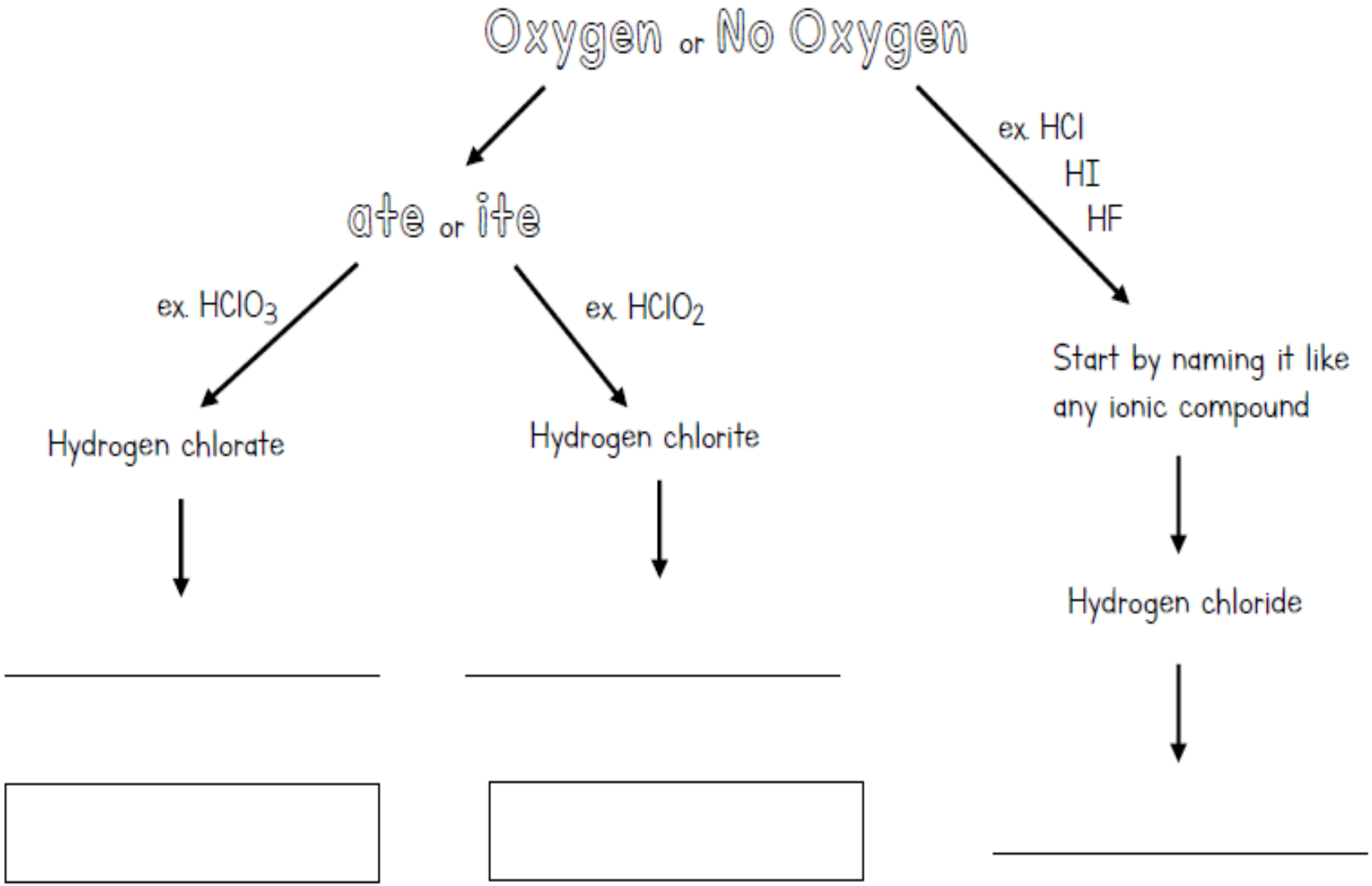
- The chemical formula of an acid **usually** starts with hydrogen (H).
  - Example:
    - HCl = hydrogen chloride
    - $HCl_{(aq)}$ = hydrochloric acid
  - Exception:
    - Acids with a carbon usually have the C written first with the H on the end of the compound
      - $CH_3COOH_{(aq)}$ = acetic acid (vinegar)

- Naming acids
  - If no state of matter is present then compound is named via ionic rules
    - Example: HF: Hydrogen fluoride
  - *If stated to be aqueous (aq)*
    - Write out the name in regular ionic form
    - Hydro minus "gen" + non metal minus-*ide*
      - Add "ic acid" suffix
      - Example
        - $HF_{(aq)}$ = hydrogen fluoride = hydrofluoric acid

- **In order to name an acid you must first recognize if oxygen is present or absent**
  - **If Oxygen is present**
    - **Write out name in regular ionic form**
    - **If it starts with hydrogen and ends with “ate”**
      - **Drop hydrogen and add “ic acid”**
        - **$H_2CO_{3(aq)}$ = hydrogen carbonate = carbonic acid**
    - **If it starts with hydrogen and ends with “ite”**
    - **Drop hydrogen and add “ous acid”**
      - **$H_2SO_{3(aq)}$ = hydrogen sulphite = sulphurous acid**
      -

Naming Acids:

- You can recognize an acid by the _____ on the _____ side of the formula (ex. HCl)



- Time out
- Page 86 in workbook

Bases

- If you know a compound's chemical formula, you may be able to identify it as a base.
  - Bases often behave like bases only when dissolved in water.
  - Therefore, bases are often written with the symbol (aq) = aqueous = water.
- The chemical formula of a base usually ends with hydroxide (OH).
- Bases can be gentle or very caustic.
- Examples of common bases:
  - $NaOH_{(aq)}$
  - $Mg(OH)_{2(aq)}$
  - $Ca(OH)_{2(aq)}$
  - $NH_4OH_{(aq)}$

See page 227

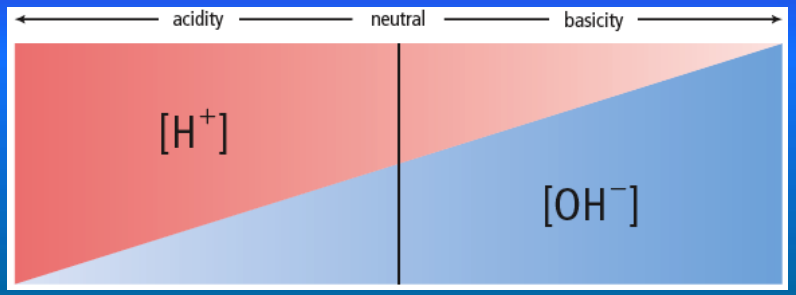
Naming Bases:

- You can recognize a base by the _____ on the _____ side of the formula (ex. NaOH)
- Naming bases follows the _____ we learned in Chapter 4

NaOH = _____ $Mg(OH)_2$ = _____

Production of Ions

- **Acids and bases can conduct electricity because they release ions in solution.**
  - **Acids release hydrogen ions, H^+.**
  - **Bases release hydroxide ions OH^-.**
- **The pH of a solution refers to the concentration of ions it has.**
  - **Square brackets are used to signify concentration, $[H^+]$, $[OH^-]$**
    - **High $[H^+]$ = low pH, very acidic**
    - **High $[OH^-]$ = high pH, very basic**
  - **A solution cannot have BOTH high $[H^+]$ and $[OH^-]$; they cancel each other out and form water. This process is called neutraliztion.**
  - **$H^+ + OH^- \rightarrow H_2O$**



See page 228

Properties of Acids and Bases

Table 5.6 Properties of Acids and Bases

Property	Acid	Base
Taste CAUTION: Never taste chemicals in the laboratory.	• Acids taste sour. Lemons, limes, and vinegar are common examples.	• Bases taste bitter. The quinine in tonic water is one example.
Touch CAUTION: Never touch chemicals in the laboratory with your bare skin.	• Many acids will burn your skin. Sulfuric acid (battery acid) is one example.	• Bases feel slippery. • Many bases will burn your skin. Sodium hydroxide (lye) is one example.
Indicator tests	• Acids turn blue litmus paper red. • Phenolphthalein is colourless in an acidic solution.	• Bases turn red litmus blue. • Phenolphthalein is colourless in slightly basic solutions and pink in moderate to strongly basic solutions.
Reaction with some metals, such as magnesium or zinc	• Acids corrode metals.	• No reaction
Electrical conductivity	• Conductive	• Conductive
pH	• Less than 7	• More than 7
Production of ions	• Acids form hydrogen (H^+) ions when dissolved in solution.	• Bases form hydroxide (OH^-) ions when dissolved in solution.

Take the Section 5.1 Quiz

See page 229

- Properties of Acids and Bases (pg 83 workbook)
- Homework
- Pg 87-88 in workbook
- Bring in something to test for tomorrow
  - Suspected acid/base
  - BE CAREFUL and read safety warnings if bringing in cleaning products

Reaction Type # 6: Neutralization (Acid Base Reactions)

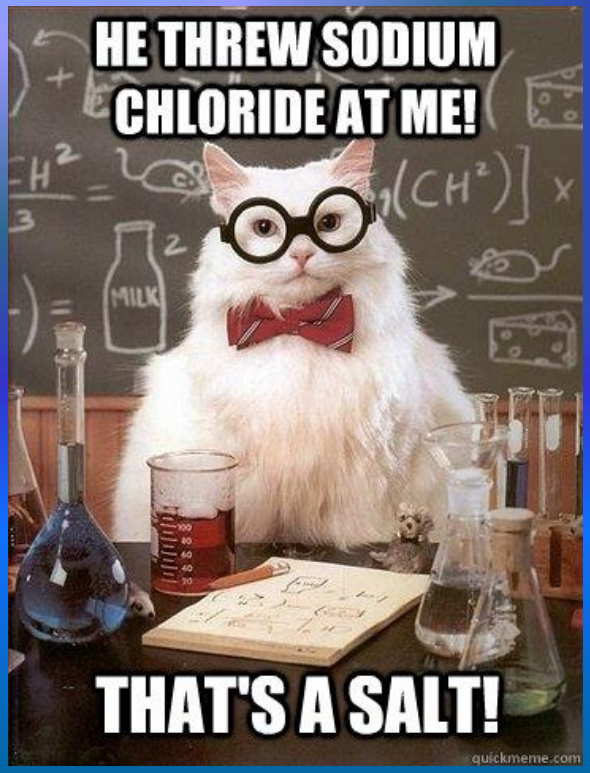
- **Neutralization reactions occur when an acid (most compounds starting with H) and a base (most compounds ending in OH, or beginning with NH_4) react to form a salt and water.**
  - **Acid + base $\rightarrow$ salt + water**
  - **HX + MOH $\rightarrow$ MX + H_2O where X and M are elements**

- **Sulfuric acid is used to neutralize calcium hydroxide:**
- $H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + 2H_2O$

- **Phosphoric acid helps to neutralize the compounds that cause rust, such as iron(II) hydroxide.**
- $H_3PO_4 + 3Fe(OH)_2 \rightarrow Fe_3(PO_4)_2 + 6H_2O$

5.2 Salts

- Salts are ionic compounds formed when acids and bases react.
- Table salt, NaCl, is found in sea water, salt lakes or rock deposits.
  - Iodine is now added to salt to minimize goiter (a disease of the thyroid).
- NaCl is only one kind of salt.
  - A salt is made up of a positive ion from a base and a negative ion from an acid.



See pages 234 - 235

Pg 91&92 in workbook & Neutralization Practice

Table 6.1 Summary of Chemical Reactions

Reaction Type	Reactants and Products	Notes on the Reactants
Synthesis (combination)	$A + B \rightarrow AB$	• Two elements combine (Figure 6.9).
Decomposition	$AB \rightarrow A + B$	• One reactant only (Figure 6.9)
Single replacement		
If A is a metal	$A + BC \rightarrow B + AC$	• One element and one compound
If A is a non-metal	$A + BC \rightarrow C + BA$	
Double replacement	$AB + CD \rightarrow AD + CB$	• Two compounds react.
Neutralization (acid-base)	$HX + MOH \rightarrow MX + H_2O$	• Acid plus base
Combustion	$C_xH_y + O_2 \rightarrow CO_2 + H_2O$	• Organic compound with oxygen

Lets Practice