

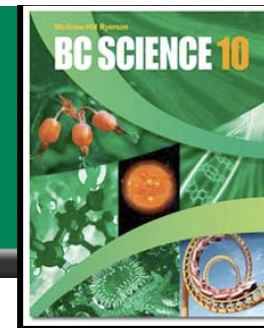
These notes are posted on my site for the following reasons:

- for students to copy in their own hand-writing
  - ◆ in order to complete their class notes
  - ◆ if student did not have enough time in class
  - ◆ if student was away and missed this section
- for assistants and tutors to follow progress of the concepts taught

Photocopied/printed notes can not be used during the Unit Notebook Check in class.

[ndupuis@sd61.bc.ca](mailto:ndupuis@sd61.bc.ca)    [dupuis.shawbiz.ca](http://dupuis.shawbiz.ca)

## 5.1 Acids and Bases



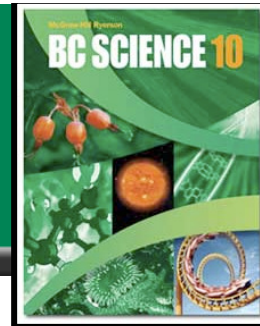
- **Acids and bases are very common.**
  - ◆ Many familiar compounds are acids or bases.
  - ◆ Classification as acids or bases is based on chemical composition.
- **Acids and bases can be very dangerous!**
  - ◆ Both can be very corrosive.
    - NEVER try to identify an acid or base by taste or touch!
- **The strength of acids and bases is measured on the pH scale**
  - ◆ 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 10X more acidic
    - For example, pH 4 is ten times more acidic than pH 5
    - pH 3 is 1000X more acidic than pH 6



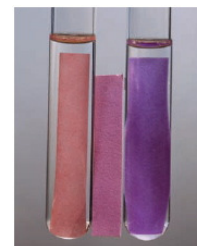
See pages 220 - 222

(c) McGraw Hill Ryerson 2007

# pH Indicators



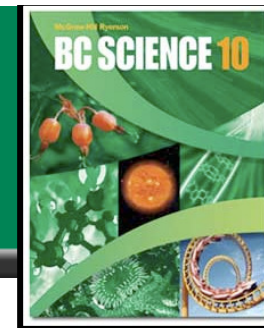
- **The pH of acids and bases cannot be determined by sight.**
  - ◆ **Instead, pH is measured by other chemicals called indicators, or by a pH meter that measures the electrical conductivity of the solution.**
- **pH indicators change colour based on the solution they are placed in.**
  - ◆ **Litmus is the most common indicator, used on litmus paper.**
    - **Two colours of litmus paper: Blue = basic and Red = acidic.**
    - **Blue = pH above 7, Red = pH below 7**
  - ◆ **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**



See pages 223 - 224

(c) McGraw Hill Ryerson 2007

# Acids



- If you know a compound's chemical formula, you may be able to identify it as an acid.
  - ♦ Acids often behave like acids only when dissolved in water
  - ♦ Therefore, acids are often written with subscript (aq) = aquatic = water
- The chemical formula of an acid usually starts with Hydrogen (H-).
  - ♦ Acids with a carbon usually have the C written first.
    - $\text{HCl}_{(aq)}$  = hydrochloric acid,  $\text{HNO}_{3(aq)}$  = nitric acid,  $\text{CH}_3\text{COOH}_{(aq)}$  = acetic acid
- Naming acids
  - ♦ Hydrogen + ...-ide = Hydro...ic acid
    - $\text{HF}_{(aq)}$  = hydrogen fluoride = hydrofluoric acid
  - ♦ Hydrogen + ...-ate = ...ic acid
    - $\text{H}_2\text{CO}_{3(aq)}$  = hydrogen carbonate = carbonic acid
  - ♦ Hydrogen + ...-ite = ...ous acid
    - $\text{H}_2\text{SO}_{3(aq)}$  = hydrogen sulphite = sulphurous acid



See pages 225 - 226

(c) McGraw Hill Ryerson 2007

# Bases



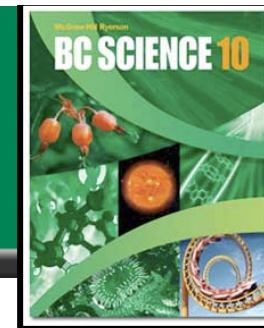
- If you know a compound's chemical formula, you may be able to identify it as a base.
  - ♦ Bases, like acids, often behave like bases only when dissolved in water
  - ♦ Therefore, bases are often written with subscript (aq) = aquatic = water
- The chemical formula of a base usually ends with hydroxide (-OH).
- Bases can be gentle or very caustic
- Examples of common bases

- ♦  $\text{NaOH}_{(aq)}$
- ♦  $\text{Mg}(\text{OH})_{2(aq)}$
- ♦  $\text{Ca}(\text{OH})_{2(aq)}$
- ♦  $\text{NH}_4\text{OH}_{(aq)}$

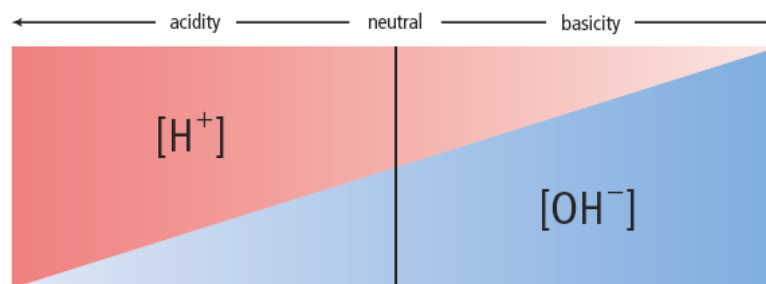


See page 227

# Production of Ions

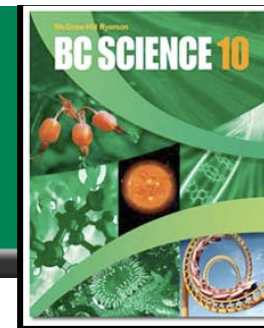


- Acids and bases can conduct electricity because they release ions in solution.
  - ◆ Acids release hydrogen ions,  $\text{H}^+_{(aq)}$
  - ◆ Bases release hydroxide ions  $\text{OH}^-_{(aq)}$
- The pH of a solution refers to the concentration of ions it has.
  - ◆ Square brackets are used to signify concentration,  $[\text{H}^+_{(aq)}]$ ,  $[\text{OH}^-_{(aq)}]$ 
    - High  $[\text{H}^+_{(aq)}]$  = low pH, very acidic
    - High  $[\text{OH}^-_{(aq)}]$  = high pH, very basic
  - ◆ A solution cannot have BOTH high  $[\text{H}^+_{(aq)}]$  and  $[\text{OH}^-_{(aq)}]$ ; they cancel each other out and form water. This process is called neutralization.
  - ◆  $\text{H}^+_{(aq)} + \text{OH}^-_{(aq)} \rightarrow \text{H}_2\text{O}_{(l)}$



See page 228

# Properties of Acids and Bases



**Table 5.6** Properties of Acids and Bases

Property	Acid	Base
<b>Taste</b> CAUTION: Never taste chemicals in the laboratory.	<ul style="list-style-type: none"><li>• Acids taste sour. Lemons, limes, and vinegar are common examples.</li></ul>	<ul style="list-style-type: none"><li>• Bases taste bitter. The quinine in tonic water is one example.</li></ul>
<b>Touch</b> CAUTION: Never touch chemicals in the laboratory with your bare skin.	<ul style="list-style-type: none"><li>• Many acids will burn your skin. Sulphuric acid (battery acid) is one example.</li></ul>	<ul style="list-style-type: none"><li>• Bases feel slippery.</li><li>• Many bases will burn your skin. Sodium hydroxide (lye) is one example.</li></ul>
<b>Indicator tests</b>	<ul style="list-style-type: none"><li>• Acids turn blue litmus paper red.</li><li>• Phenolphthalein is colourless in an acidic solution.</li></ul>	<ul style="list-style-type: none"><li>• Bases turn red litmus blue.</li><li>• Phenolphthalein is pink in a basic solution.</li></ul>
<b>Reaction with some metals, such as magnesium or zinc</b>	<ul style="list-style-type: none"><li>• Acids corrode metals.</li></ul>	<ul style="list-style-type: none"><li>• no reaction</li></ul>
<b>Electrical conductivity</b>	<ul style="list-style-type: none"><li>• conductive</li></ul>	<ul style="list-style-type: none"><li>• conductive</li></ul>
<b>pH</b>	<ul style="list-style-type: none"><li>• less than 7</li></ul>	<ul style="list-style-type: none"><li>• more than 7</li></ul>
<b>Production of ions</b>	<ul style="list-style-type: none"><li>• Acids form hydrogen (<math>H^+</math>) ions when dissolved in solution.</li></ul>	<ul style="list-style-type: none"><li>• Bases form hydroxide (<math>OH^-</math>) ions when dissolved in solution.</li></ul>

See page 229

[Take the Section 5.1 Quiz](#)