

Section 5.1.

Acids and Bases.

Textbook pages 220 to 233.

Before You Read.

Many acids and bases can be found in your home. Describe one acid and one base that you are familiar with.

What are acids and bases?

Many common pure substances can be classified according to whether they are acids or bases. Acids produce **hydrogen ions** and bases produce **hydroxide ions** when dissolved in solution. The **concentration** of hydrogen ions refers to the number of hydrogen ions in a specific volume of solution. Solutions with a high concentration of hydrogen ions are highly acidic. Similarly, solutions with a high concentration of hydroxide ions are highly basic. When an acidic solution is mixed with a basic solution, the solutions can **neutralize** each other, which means that the acidic and basic properties are in balance.

What is p.H.?

Testing the p.H. of a solution is a way of measuring its concentration of hydrogen ions. The **p.H. scale** is a number scale that indicates how acidic or basic a solution is. **Acids** have a p.H. below seven and **bases** have a p.H. above seven. Neutral solutions have a p.H. of seven. On the p.H. scale, one unit of change represents a ten-fold change in the degree of acidity or basicity. For example, a two unit drop in p.H. is a one hundred times increase in acidity.

What are p.H. indicators?

p.H. indicators are chemicals that change colour depending on the p.H. of a solution.

- **Litmus paper** can determine whether a solution is acidic or basic. Blue litmus paper turns red in an acidic solution (below p.H. 7). Red litmus paper changes to blue in a basic solution (above p.H. 7).

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- A universal indicator contains a number of indicators that turn different colours depending on the p.H. of the solution.
- **Phenolphthalein, bromothymol blue, indigo carmine, methyl orange, and methyl red** are other common p.H. indicators. Each determines p.H. within a different range.

A digital p.H. meter or p.H. computer probe that measures the electrical properties of a solution can also be used to determine p.H.

How are acids and bases named?

Generally, the chemical formula for an acid starts with H (hydrogen) on the left hand side of the formula. Acids can be named in several ways. Many compounds take on acidic properties only when mixed with water. If no state of matter is given, the name may be begin with hydrogen, as in hydrogen chloride (H.C.1.). However, if the acid is shown as being aqueous (dissolved in water), a different name may be used—one that ends in **-ic acid**, as in hydrochloric acid. Other acids that do not contain oxygen, such as hydrofluoric acid, H.F.; nitric acid, H.N.O.3.; and sulphuric acid, H.2.S.O.4., also follow this naming system.

Another naming system is followed when oxygen is present in the formula. Names that begin with hydrogen and end with the suffix **-ate** (for example, hydrogen carbonate, H.2.C.O.3.) can be changed by dropping “hydrogen” from the name and changing the suffix to **-ic acid** (for example, carbonic acid, H.2.C.O.3.). When the name begins with hydrogen and ends with the suffix **-ite** (for example, hydrogen sulphite, H.2.S.O.3.), then the name can be changed to end with the suffix **-ous acid** (for example, sulphurous acid, H.2.S.O.3.).

Bases generally have O.H. on the right hand side of their chemical formulas. Common names of bases include sodium hydroxide (N.a.O.H.) and magnesium hydroxide (M.g.(O.H.)2).

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What are the properties of acids and bases?

Some of the properties of acids and bases are compared in the table below.

Taste.

- Acids taste sour. Lemons, limes, and vinegar are common examples.
- Bases taste bitter. The quinine in tonic water is one example.

Touch.

- 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 paper 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.
- Bases have no reaction.

Electrical conductivity.

- Acids are conductive.
- Bases are conductive.

p.H.

- Acids have a p.H. of less than 7.
- Bases have a p.H. of more than 7.

Production of ions.

- Acids form hydrogen ions when dissolved in solution.
- Bases form hydroxide ions when dissolved in solution.

What are some common acids and bases?

- Ethanoic acid or acetic acid is used in vinegar.
- Sulphuric acid is used in automobile batteries.
- Sodium hydroxide is used in drain and oven cleaners.
- Magnesium hydroxide is used in antacids.
- Hydrochloric acid is found in the digestive juices of human stomachs.

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