

Year 10 Chemistry Unit One: Acids and Bases

Acids and bases are found almost everywhere. They can be found in food, drink, used around the house, or at school, and used in industry. Here are a few examples of basic acids and bases you will probably use at school:

ACID	FORMULA	BASE	FORMULA
Hydrochloric Acid	HCl	Sodium Hydroxide	NaOH
Sulfuric Acid	H ₂ SO ₄	Calcium Hydroxide Solution	Ca(OH) ₂
Nitric Acid	HNO ₃	Ammonia Hydroxide (Ammonia Solution)	NH ₃ , NH ₄ OH
Ethanoic (or acetic) acid	CH ₃ COOH		

Measuring Acidity and Alkalinity of Substances

This can be shown in another table. The acidity or alkalinity of substances is recorded on a scale numbered 1 (highly acidic) to 14 (highly alkaline). The scale for measuring this is called pH.

If a substance has pH of 7, it is neutral and is neither acid nor alkaline. A pH table is below, with acids on the left (1-7) and alkalis on the right (8-14).

Acidic Substance	pH number and colour	Alkali Substance	pH number and colour
Hydrochloric Acid, Battery Acid	1	Sea Water	8
Stomach Acid, Cola, Lemon Juice	2	Baking Soda	9
Vinegar, Orange Juice, Apple Juice	3	Milk of Magnesia	10
Tomato	4	Ammonia Solution	11
Black Coffee	5	Soapy Water	12
Urine	6	Bleach	13
Pure Water	7	Sodium Hydroxide	14

NOTE: this is only a rough colour guide, and may possibly not be accurate.

pH is measured using indicators. Indicators are made using special plant dyes, or Litmus. It can also be measured by a pH meter. A probe is dropped into the substance, and a pH number comes up on the screen.

Common Reactions using Elements of the Periodic Table

First of all, there are several things you must know about acids and how they form compounds. Each acid has an example.

☐ Hydrochloric Acid produces Chloride Salts

Hydrochloric Acid + Ammonium Hydroxide = Ammonium Chloride + Water

☐ Sulfuric Acid produces Sulfate Salts

Sulfuric Acid + Ammonium Hydroxide = Ammonium Sulfate + Water

☐ Nitric Acid produces Nitrate Salts

Nitric Acid + Ammonium Hydroxide = Ammonium Nitrate + Water

☐ Ethanoic (or Acetic) Acid produces Ethanoate (Acetate) Salts

FORMULA	EXAMPLE	EXPLANATION
Acid + Base = A Salt + Water	H ₂ SO ₄ + NaOH = Na ₂ SO ₄ + H ₂ O	When I add Sulfuric acid (H ₂ SO ₄) and Sodium Hydroxide (NaOH), I get a salt of the two, and water.
Acid + Metal = A Salt + Hydrogen Gas	HNO ₃ + Li = LiNO ₃ + H ₂	When I add Nitric Acid (HNO ₃) to Lithium (Li), I get Lithium Nitrate (LiNO ₃) and Hydrogen Gas (H ₂).

When I add Hydrochloric Acid (HCl) to Lead Carbonate (PbCO₃), I get Lead Carbonate (PbCl₂) + Carbon dioxide (CO₂) + Water (H₂O).

Soaps and Detergents

Sodium Hydroxide (NaOH) is a reactant in making soap. The other reactant is fat or oil. Soap works the way it does because there are two ends, a hydrophobic (doesn't like water) end, and a hydrophilic (likes water) end.

The hydrophobic end buries itself in the dirt and the water is pulled away from the dirt. It 'wins' and the dirt is pulled away from the article of clothing.

An equation for making soap is: fat or oil + Sodium Hydroxide = (with heat) = Soap (+ Glycerol).

Detergents are made using oil and concentrated amounts of sulfuric acid. Detergents form a lather in 'hard' water, (which has extra calcium or magnesium particles), and soap doesn't. Soap only lathers in 'soft' water (which doesn't have magnesium or calcium).

Common Applications of pH, Acids and Bases

The last thing this topic will cover is common uses of pH, acids and bases. This is where they appear in society - in brief form.

In the body

Acids

☐ Plaque in the mouth, causing decay - neutralised by toothpaste.

☐ Skin is slightly acidic, so that bacteria can not survive there.

☐ Stomach acid has a pH of 2, to allow enzymes to digest food.

☐ DNA is held in a molecule called deoxyribose acid.

Bases

☐ Blood has a pH of 7.4, which is controlled by the amount of carbon dioxide in it. If there is too much, the body rids itself of the excess CO₂ by hyperventilating.

In First Aid

Acids

☐ Heartburn happens because stomach acid burns the stomach lining or oesophagus

☐ Bark of the willow tree contains a painkilling acid similar to aspirin.

☐ Bee stings are acidic

☐ If spills happen in the science lab, wash with water. Do not neutralise.

Bases

Wasp stings are basic.

If spills happen in the science lab, wash with water. Do not neutralise.

In Food and Drink

Acids

☐ Carbon dioxide dissolves to create carbonic acid in soft drinks.

☐ Acid used to preserve food

☐ Raising agents - baking soda, an acid, are used in baking.