Front Cover

Inside Front Cover

Acids and Alkalis

• Corrosive Acids and Alkalis

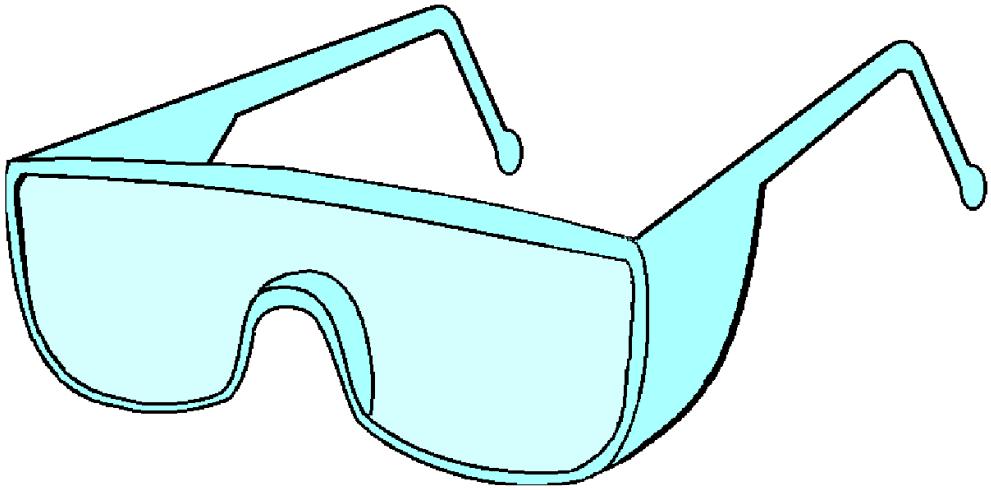
We will be using chemicals called **acids** and **alkalis**.

Some **acids** and **alkalis** are **corrosive** - They can burn holes in things.

You will often see this **safety symbol** on a bottle of **acid** or **alkali**.

corrosive

When we use **corrosive** **acids** or **alkalis**, we must always wear **safety glasses**.



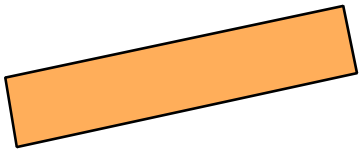
Indicator for Acids and Alkalis

• Universal Indicator

To tell if a chemical is an **acid** or an **alkali**, we use **universal indicator**.

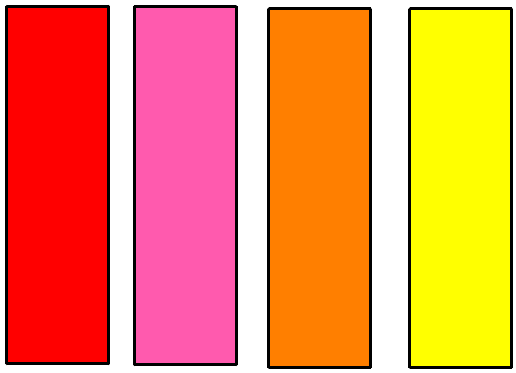
Universal indicator solution or **paper** changes colour when we add an **acid** or **alkali** to it.

universal indicator solution

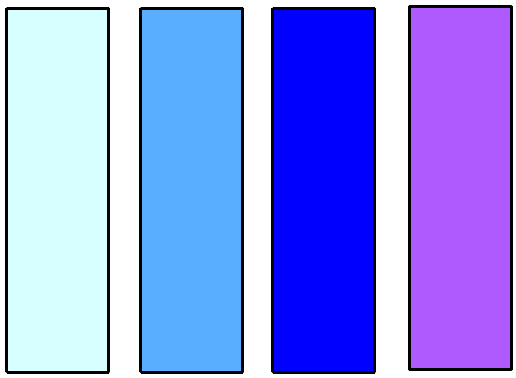


universal indicator paper

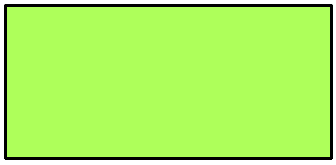
Acids turn universal indicator **shades of red**.



Alkalis turn universal indicator **shades of blue**.



A chemical which turns **universal indicator green** is not an **acid** or an **alkali** - It is **neutral**.



pH Number of Acids and Alkalis

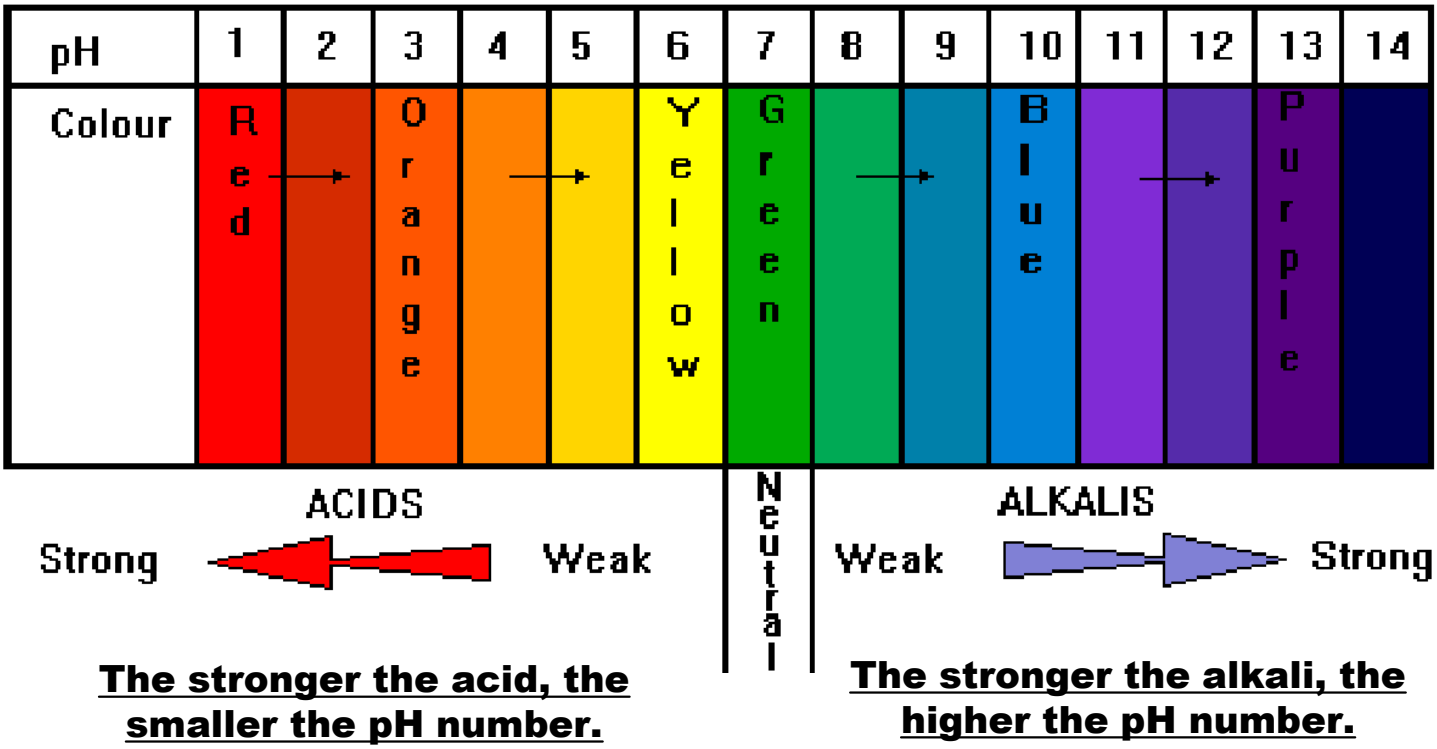
Strong **acids** and **alkalis** are more **corrosive** than weak ones
- They burn holes in things faster.

• Universal Indicator Colours and pH Numbers

Each **colour universal indicator** can turn is given a **pH number** (from **1** to **14**).

The **pH number** tells us if a chemical is a **strong** or **weak** **acid/alkali**.

We call **all the numbers together** a **pH scale**. A **pH scale** is a measure of **acidity**.



The stronger the acid, the smaller the pH number.

The stronger the alkali, the higher the pH number.

A chemical which turns **universal indicator** **green** is not an **acid** or an **alkali** - It is **neutral**. It has a **pH number** = **7**.

type of chemical	colour it turns pH indicator	pH number
acid	shades of red	less than 7
neutral	green	7
alkali	shades of blue	more than 7

pH Number of Acids and Alkalis

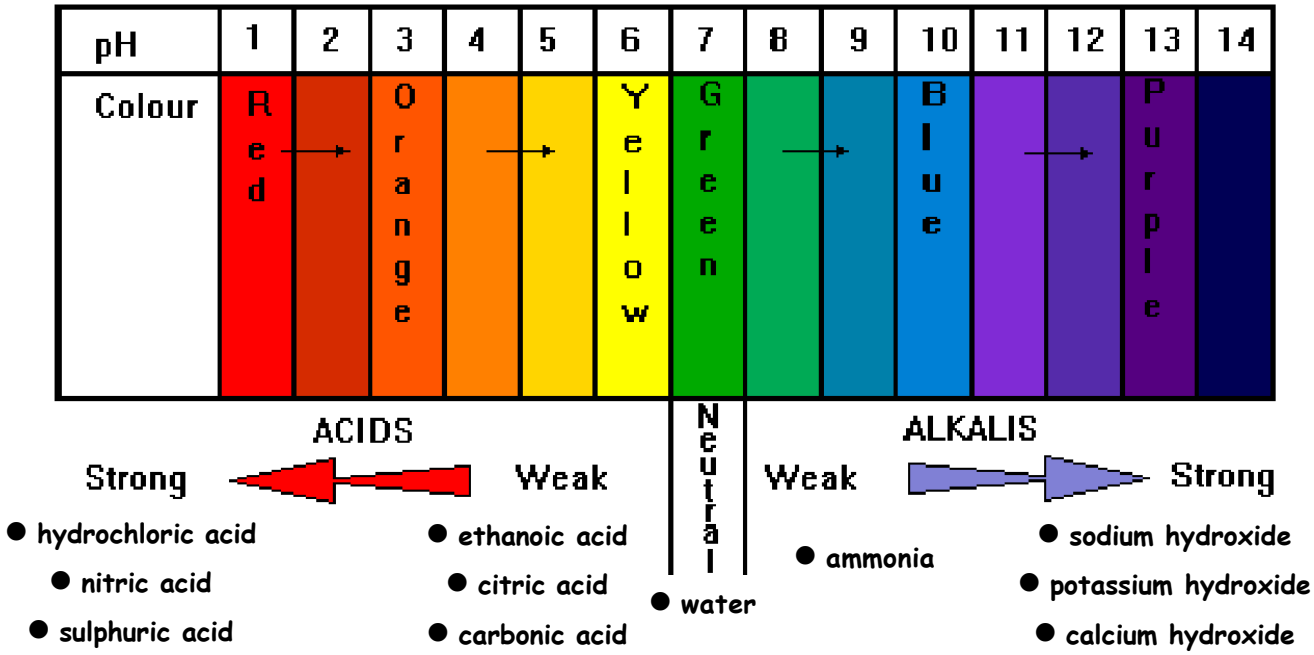
• Universal Indicator Colours and pH Numbers

To tell if a chemical is an **acid** or an **alkali**, we use a special liquid called **universal indicator solution**. (We can also use **universal indicator paper**.)

Universal indicator solution or **paper** changes colour when we add an **acid** or **alkali** to it.

Each colour is given a **pH number** (from **1** to **14**) which can be used to describe the substance added to the indicator - The lower the pH number, the stronger the acid. The higher the pH number, the stronger the alkali. The **pH scale** is a measure of **acidity**.

The colours and the **pH numbers** they represent are shown on a **pH colour chart**:



- Substances (like **water**) which are not **acids** or **alkalis** are said to be **neutral. Neutral substances turn pH indicator solution or paper green.**

type of chemical	colour it turns pH indicator	pH number
acid	shades of red	less than 7
neutral	green	7
alkali	shades of blue	more than 7

Questions

1) What do we use universal indicator solution (or paper) for?
2) Explain how we use it. (Mention colours and pH numbers).
3) What can you say about a substance with pH number: (a) 2, (b) 5, (c) 7, (d) 9, (e) 14?
4) Give examples of: (a) strong acids, (b) weak acids, (c) a weak alkali, (d) strong alkalis.
5) (a) What is a neutral substance?, (b) Give one example, (c) What is its pH number?

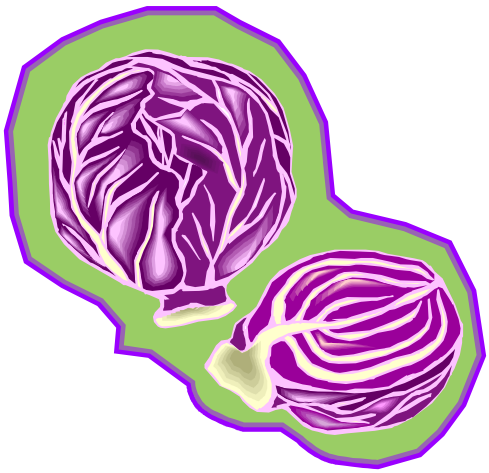
Indicators in Plants

• Making Indicator From Plants

Proper pH indicator solution or paper is expensive.

We can make our own, less-expensive pH indicator solution or paper using certain flowers, fruits and vegetables.

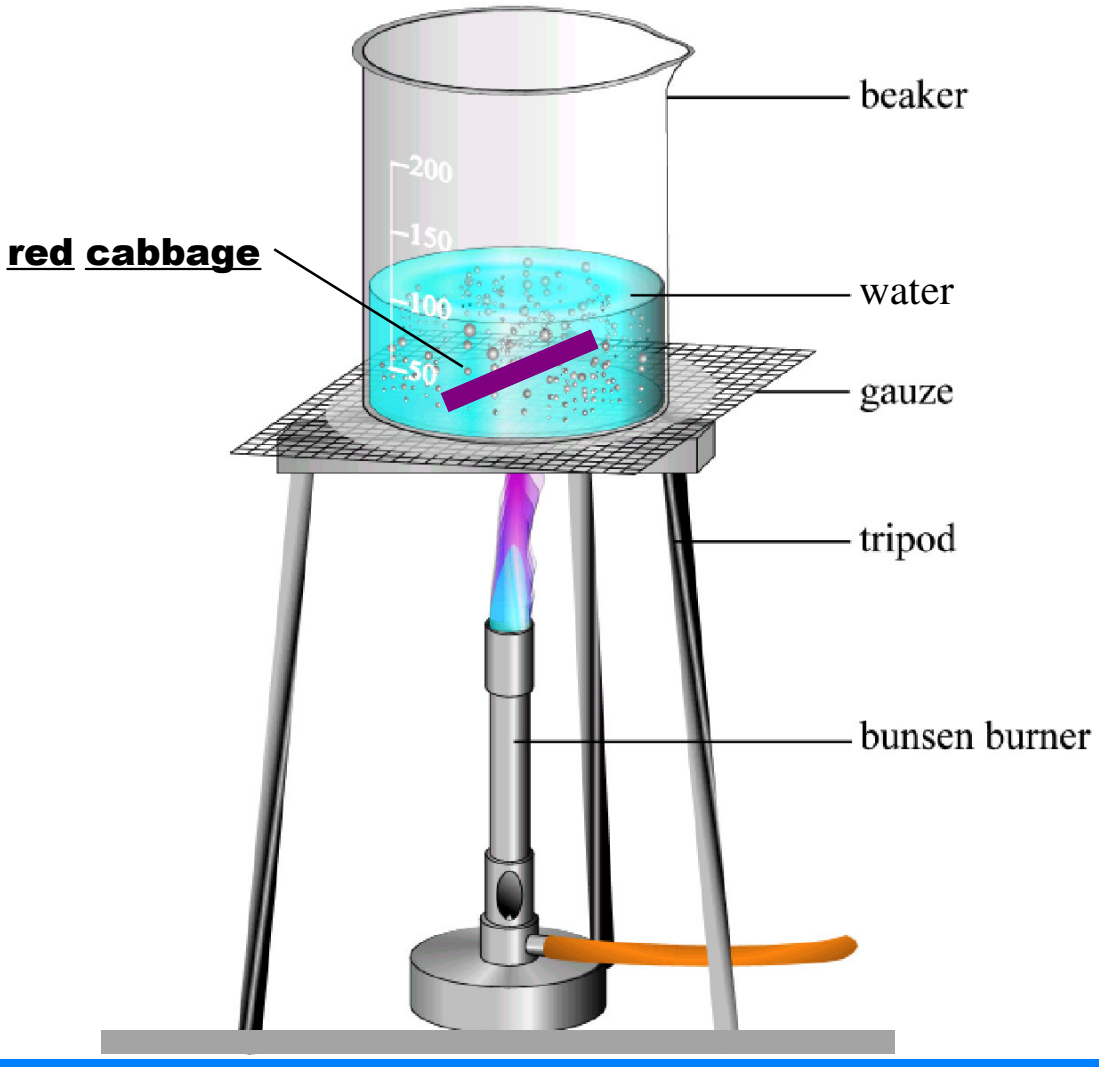
Red cabbage is a good example.



We can boil **red cabbage** in water for about 15 minutes, then let the solution cool.

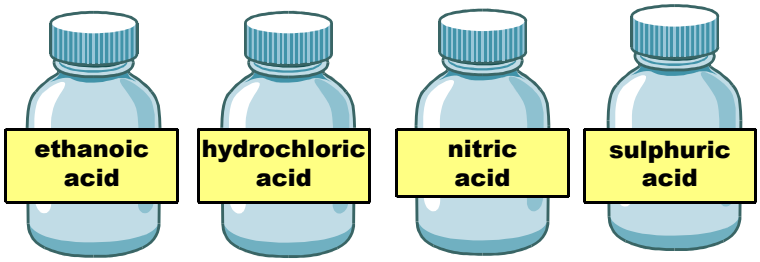
The solution is a good **pH indicator**.

To make **indicator paper**, dip filter paper in the solution, then let the paper dry.



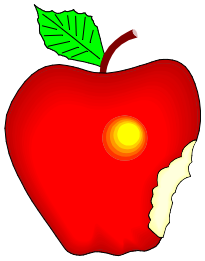
Some Common Acids

In a **chemistry** lab, you will often see bottles of these **acids**:



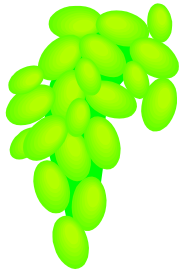
There are many **different** **acids**.

Acids are present in lots of **foods**, **drinks** and **other things**:



• apples contain malic acid

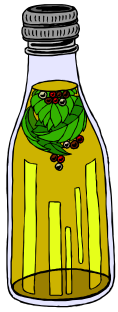
• citrus fruits like lemons, limes and oranges contain citric acid



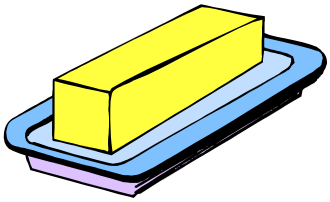
• grapes contain tartaric acid

• colas contain phosphoric acid

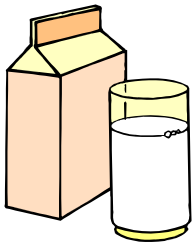
• tea contains tannic acid



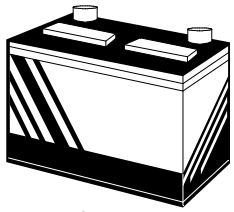
• vinegar contains ethanoic acid



• rancid (rotting) butter contains butanoic acid

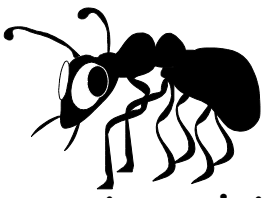


• sour milk contains lactic acid

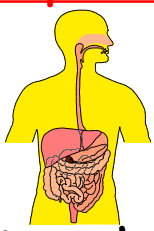


• car batteries contain sulphuric acid

• paint remover contains nitric acid



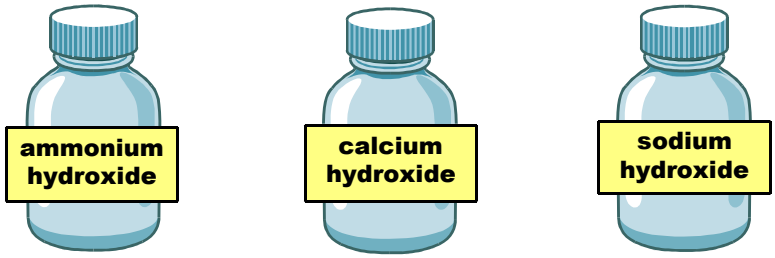
• ants squirt methanoic acid



• human stomachs contain hydrochloric acid

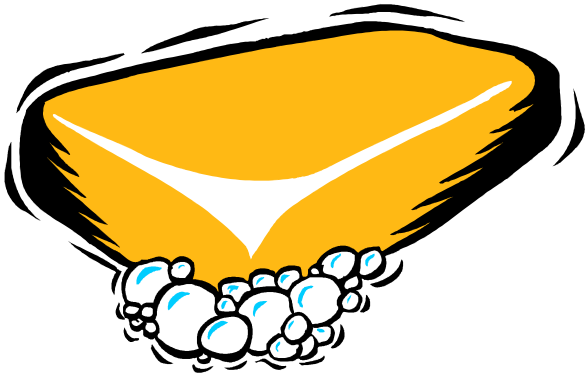
Some Common Alkalis

In a **chemistry** lab, you will often see bottles of these **alkalis**:



There are many **different alkalis**.

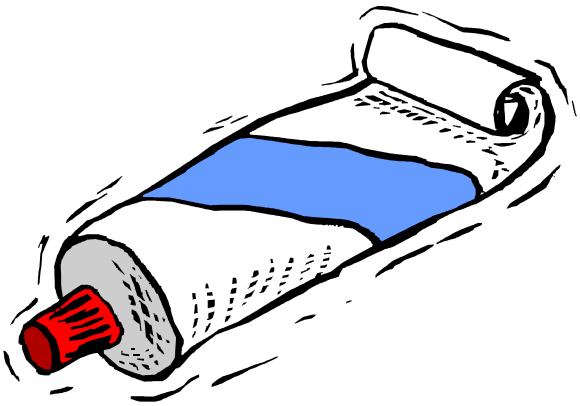
Alkalis are present in lots of **different things**:



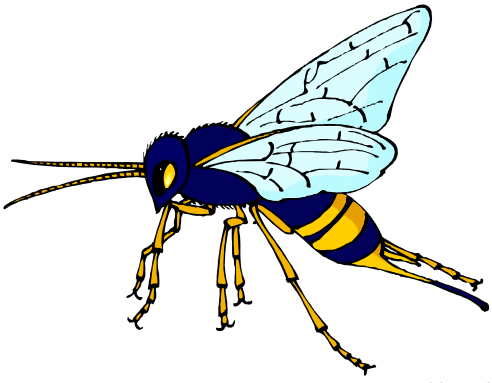
- soap is an alkali

- baking powder is an alkali

- indigestion tablets contain alkalis



- toothpaste contains alkalis



- wasp stings are an alkali

- ammonia cleaning fluid is an alkali

Cancelling Out Acids and Alkalis

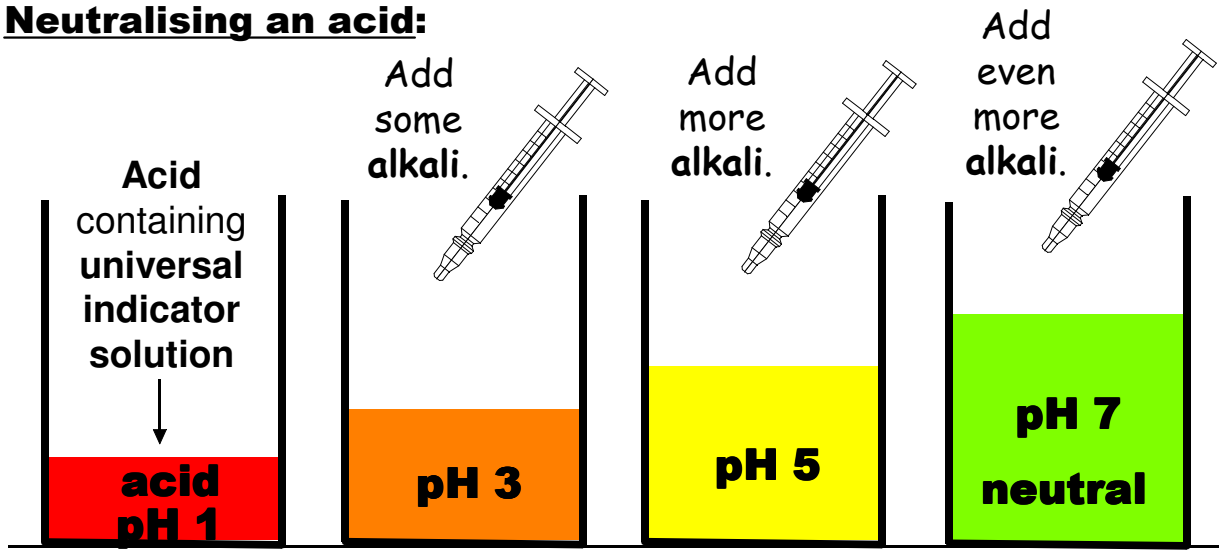
• Neutralisation

By mixing an **acid** solution with an **alkali** solution **in the correct amount**, we can **cancel them out**.

The solution formed is **neutral**. (It has a **pH** of **7**.)

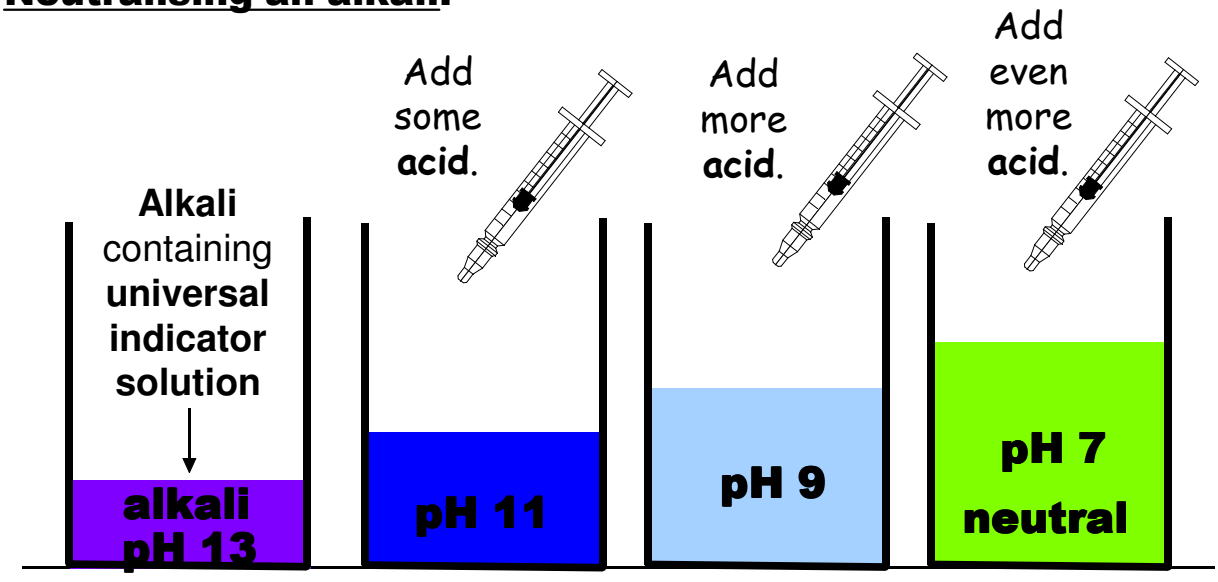
When we **cancel out** an **acid** and **alkali** like this, we **neutralise** them. This is called **neutralisation**.

Neutralising an acid:



Neutralisation moves the **pH number** of an **acid** towards **7**.

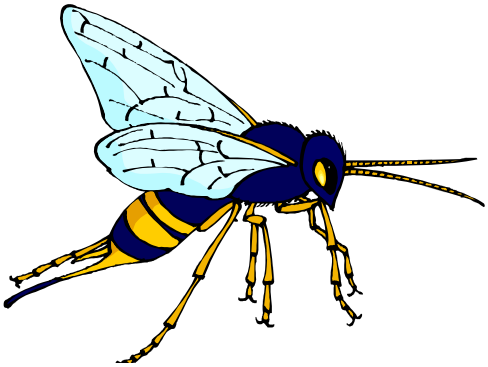
Neutralising an alkali:



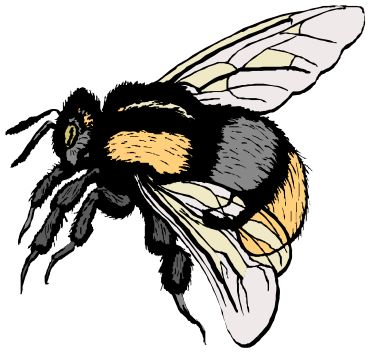
Neutralisation moves the **pH number** of an **alkali** towards **7**.

Neutralisation

• Everyday Examples of Neutralisation

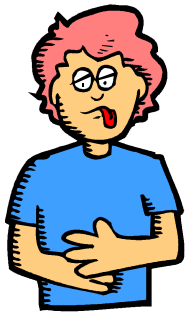


Wasp stings are alkali. To neutralise them, we use an acid like vinegar.



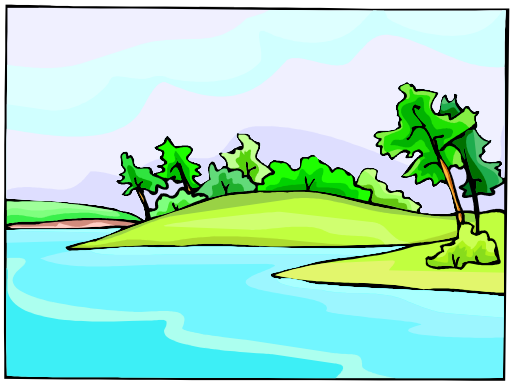
Bee stings are acid. To neutralise them, we use an alkali like baking soda.

Acid in our mouth damages our teeth. To neutralise the acid, we brush our teeth with toothpaste which contains alkalis.



Acid in our stomach digests our food. If our stomach makes too much acid, we feel sick. We neutralise the extra acid by taking indigestion tablets or liquids which are alkalis.

Acid rain can make the soil acidic. To neutralise their acid soil, farmers add the alkali lime to their fields.



Acid rain can make water in lakes acidic. To neutralise the acid water, we add the alkali lime to the water.

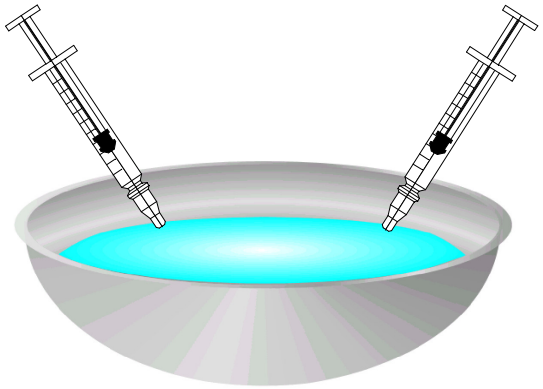
Products of Neutralisation

• The Products of Neutralisation

When an **acid** **neutralises** an **alkali**, 2 things are formed: **water** and a **salt**.

There are many different types of **salt**.

When **hydrochloric acid** solution **neutralises** **sodium hydroxide** solution, **table salt** (**sodium chloride**) and **water** are formed.



We can mix 10 ml of **hydrochloric acid** solution and 10 ml of alkali **sodium hydroxide** solution in an **evaporating dish** - The solutions should have the **same concentration**.

This forms **table salt** (**sodium chloride**) dissolved in **water**.

We can **evaporate** off the **water** to leave **solid white crystals** of **table salt** (**sodium chloride**).

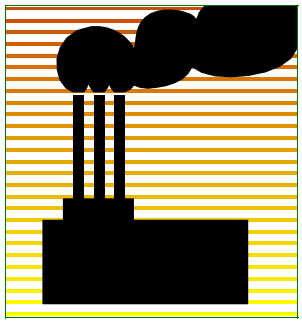
Acid Rain

• Fossil Fuels Cause Acid Rain

Coal, **oil** and **gas** are **fossil fuels**.

They are burned in **factories**, **power stations** and **vehicles**.

These give off **smoke** and **fumes** which have **acid** in them.



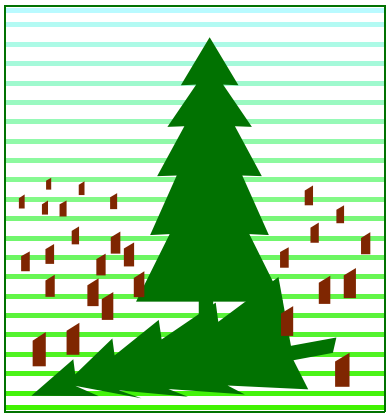
The **acid** gets into the **clouds**.

Because of this, the **rain** which falls from the **clouds** has **acid** in it.

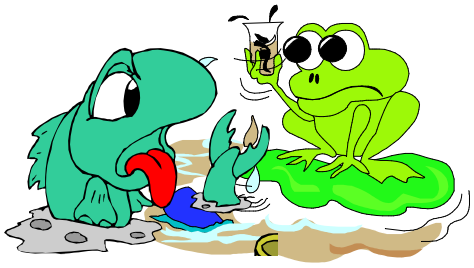
We call this **acid rain**.

• Damage Caused by Acid Rain

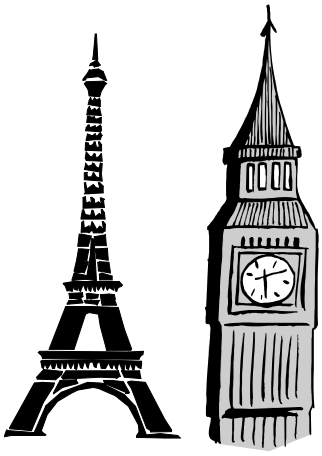
Acid rain:



Damages and kills trees.



Damages and kills fish and other wild animals.



Damages metal and stone buildings.

• Best Way to Cause Less Acid Rain

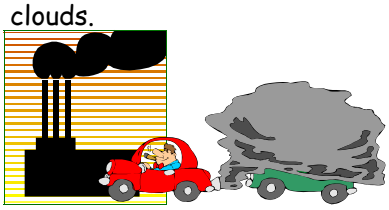
The best way to cause **less** **acid rain** is to **burn less fossil fuels** (**coal**, **oil** and **gas**).

Acid Rain

• Definition and Main Cause of Acid Rain

Normal rain is **slightly acidic** - It has a **pH number** of about **6**.

- **Acid rain** is **rain made much more acidic than normal due to the activities of human beings.**
- The main cause of **acid rain** is **human beings burning fossil fuels (coal, oil** and **gas) in factories, power stations and vehicles**. This produces the **acid gases sulphur dioxide** and **nitrogen oxides**.



1) Burning fossil fuels (coal, oil and gas) in factories and power stations produces sulphur dioxide gas.

Vehicle exhaust fumes contain nitrogen oxide gases.

These gases are ACIDIC.

2) Acidic Sulphur dioxide and nitrogen oxide gases dissolve in clouds.

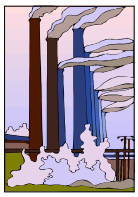
3) Wind blows acidic gases in clouds to other parts of the country (or to different countries).

4) Acid rain falls from clouds.

5) Acid rain damages and kills trees, fish and wildlife. It also damages stone and metal buildings.

• Ways of Reducing Acid Rain

Acid rain can be **reduced** by:

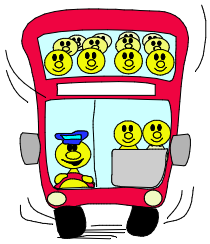


- Fitting devices called scrubbers to factory/power station chimneys.

These remove most of the acidic sulphur dioxide gas from the smoke.

- Fitting devices called catalytic converters to vehicle exhausts.

These change acidic nitrogen oxide gases into gases which are not acidic.



- Making more use of public transport.

This means less fuel is burned in cars, so less acidic gases are emitted into the clouds.

Questions

1) (a) What is "**acid rain**"? (b) Describe, in detail, how "**acid rain**" is formed.

2) Describe some of the problems caused by "**acid rain**".

3) Describe 3 ways of reducing "**acid rain**" and explain how each way does so.