ASPIRE
INTERNATIONAL SCHOOL

Science Department

2023/2024

Year 7

Term 2, Revision Pack (Unit 5)

Name: …….

Class: ……

Unit 5: Properties of materials

Properties of Metal and Non-Metal

Metals are widely used materials. Most of them are found on the left side of the periodic table.

Property	Metal	Non-Metal
State (generally)	Solids (except mercury is liquid)	Gases (except bromine is liquid)
Strength	Strong	Easily shatter
Metallic Luster	Shiny	Dull
Malleability	Malleable	Brittle
Ductility	Ductile	Not ductile
Ringing	Sonorous	Not sonorous
Magnetism	Most are magnetic	Non-magnetic
Melting point (Boiling point)	High	Low
Electric conductivity	Good electric conductors	Poor electric conductors (insulators)
Thermal conductivity	Good thermal conductors	Poor thermal conductors

We can distinguish (identify) metals from non-metals by examining their properties.

Such as electric conductivity, by connecting the material to a working circuit and checking the flow of the electric current.

5.3 Metal Mixtures (Alloys):

Alloys are made by mixing different metals together and melting them.

Note:

- The atoms of the different metals mix but do not bond together.
- The properties of the alloys are different from the metals they contain.

Examples of alloys:

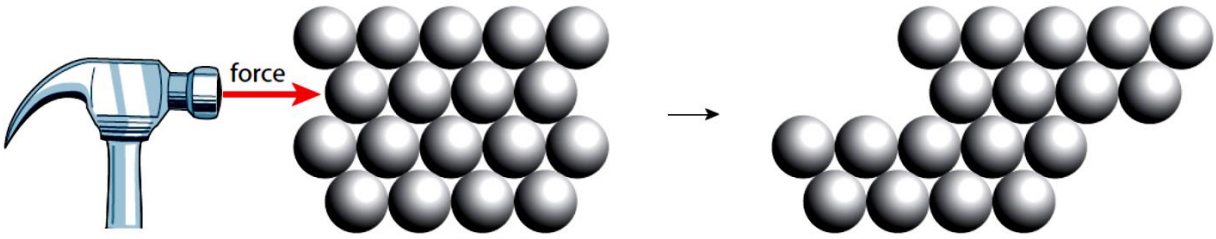
Alloy	Types of metals	Result
Bronze	Copper + Tin	Harder alloy
Steel	Iron + Carbon	Harder alloy
Stainless steel	Steel + Chromium + Nickel	Harder and doesn't rust
Brass	Copper + Zinc	resistant to corrosion

Why do the alloys have different properties from the pure metal?

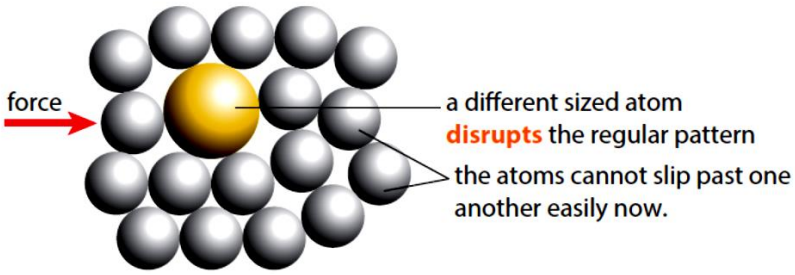
- Because of the arrangement of the particles of the elements.

Explanation:

In a pure metal, the atoms are all the same size and arranged in regular rows. The layers can slide over one another easily, while in an alloy the layers of atoms can't slide over each other as easily now. They get stuck in place.
This makes the alloy a lot harder and stronger than the original metal.



When a force is applied, layers slide over one another easily in a pure metal.



An alloy. The layers of atoms can't slide over each other as easily now. They get stuck in place. This makes the alloy a lot harder and stronger than the original metal.

Note:

- The melting point of copper 1085 °C and zinc 419.5 °C. Both have just one temperature. However, brass has a range of temperatures of 900–1000 °C. There are many different types of brass, which are made by using different amounts of copper and zinc. So, there is no specific melting point for brass; it depends on the proportions of copper and zinc that have been used.
- Bronze is an alloy that is made by mixing copper with tin. Sometimes, other elements such as manganese, phosphorous, aluminium or silicon are added. Mixing different amounts of copper and tin makes the different forms of bronze. Each different mixture has its own different melting point.

Uses of Alloys:

1- Coins

Coins must be hardwearing but also malleable enough to be stamped with complex patterns.

- Silver coins: are made of alloys containing copper and nickel
- Copper coins: are made of alloys containing copper, zinc and tin.

2- Jewellery

Pure gold is soft, so most gold jewellery is not pure gold; it is an alloy of gold and copper.

Pure gold is 24 carat: that means that 24 parts out of 24 are gold.
18-carat gold has 18 parts out of 24 of pure gold, and six parts of other metals such as copper, silver or zinc.

3- Aeroplanes:

Planes are mainly made of aluminium, but pure aluminium would not be strong enough and the plane's wings would fall off because of the great stress put on them during flight. By adding magnesium and copper, an alloy called **duralumin** is formed. Duralumin is about five times stronger than pure aluminium.

4- Artificial joints

The joints in our bodies take a lot of wear and tear. Sometimes, the joints are attacked by arthritis. This is a very painful and crippling disease. Now people can be fitted with replacement joints. These are made of plastic and alloys, often alloys of titanium.

5- Modern alloys

Some glasses frames are made of shape memory alloy. This alloy is called Nitinol. Nitinol is made of nickel and titanium.

5.4 Using the properties of materials to separate mixtures

1- Making mixtures

Mixtures contain different substances that are not combined together chemically.

2- Separating mixtures

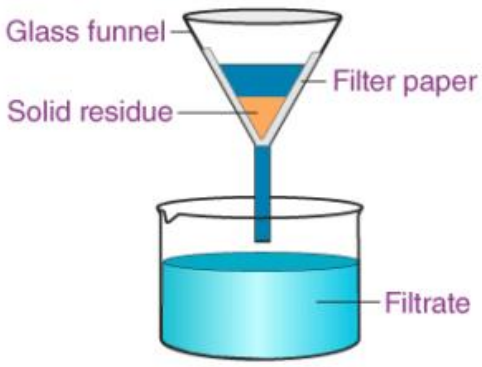
A mixture of iron filings and sulfur can be separated by using a magnet.

You used the difference in the properties of iron and sulfur to separate them. Iron is magnetic; sulfur is not magnetic.

There are common separation techniques such as:

Technique	Separated Materials	Used device
Magnetic attraction	Two solids, one of them is a magnetic material	Magnet
Sieving	Two solids, one of them is bigger than the other in size	Sieve
Filtration	Insoluble solid in a liquid	Filter paper, Funnel and Conical flask
Evaporation	Soluble solid in a liquid	Evaporating dish
Condensation	2 Mixed liquids / a soluble solid in a liquid	Condenser

- Sometimes we can use more than one technique to separate a mixture of 2 substances or more.



Filtration process

Examples:

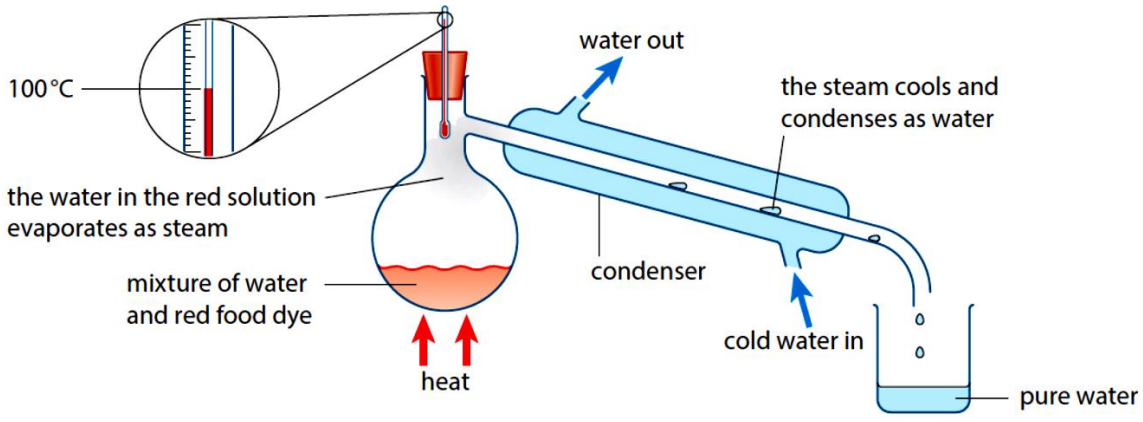
Food dye and water

A mixture of food dye and water can be separated by using a piece of apparatus called a **condenser**. It is used to separate mixtures of two liquids.

The water and food dye mixture is heated and boils. The liquid water reaches the temperature where it changes state and becomes a gas.

Water that is in the gas state is called steam when it has been formed by boiling the water. The gas travels along the tube into the condenser. The cold water that is circulating around the outside of the condenser cools the gas down. This makes the gas condense back into liquid water. The liquid water collects in the beaker. The food dye remains in the heated container.

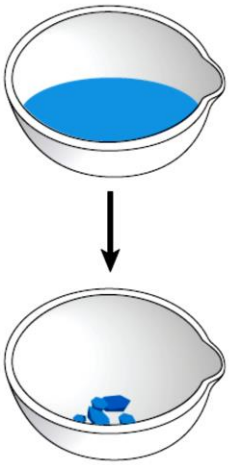
The food dye and water have different properties that allow you to separate them – they have different boiling points.



Separating water from a mixture of food dye and water.

Copper sulfate and water

The evaporating dish contains a mixture of water and copper sulfate.
If it is left in a warm room, the water evaporates and leaves the copper sulfate behind in the dish.



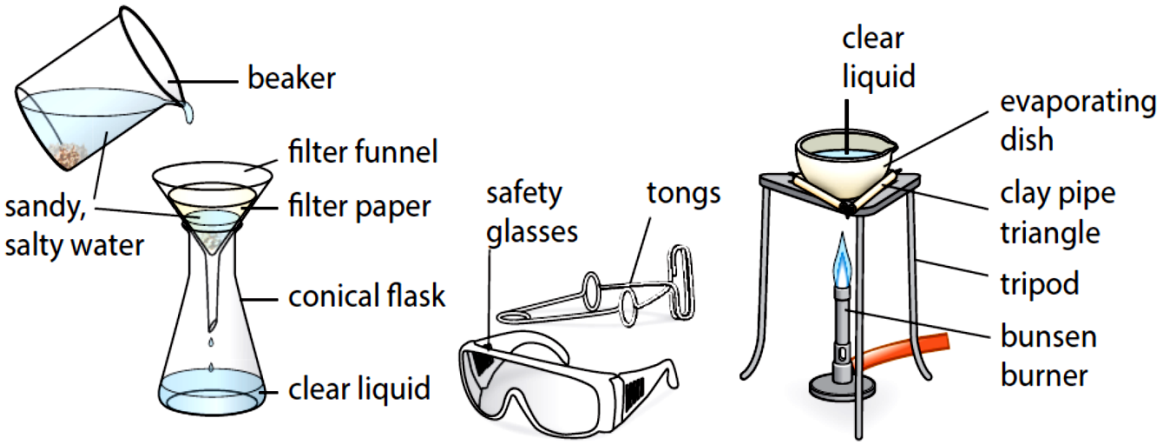
The water evaporates and leaves the copper sulfate in the evaporating dish.

Note that:

You can increase the rate of evaporation by heating the solution

- We can use more than one method to separate a mixture of different components.

Some tools for separating materials



5.5 Acids and alkalis

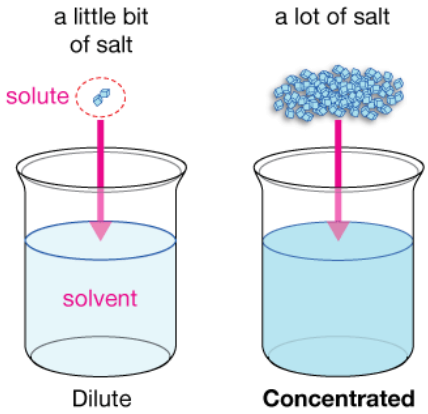
Acids

The foods have a sour, sharp tangy taste and contain acid.
Lemons and limes taste sour as they contain citric acid which is a weak acid.

Common acids in the laboratory are hydrochloric acid, sulfuric acid and nitric acid.

Concentrated acids contain less solvents (water)

Diluted acids contain more water



Alkalis

Many cleaning products contain alkalis such as sodium hydroxide, which is a compound of sodium, hydrogen and oxygen. Sodium hydroxide is a strong alkali.
Common alkalis found in the laboratory are sodium hydroxide, potassium hydroxide and calcium hydroxide.

Property	Acid	Alkali
Contains	H ions	OH ions
Taste	Sour	Bitter
Safety	Dangerous and harmful	Dangerous and harmful
Effect of strong ones	Corrosive	Corrosive
Effect of concentrated	dissolve the skin (makes chemical burn)	dissolve the skin (makes chemical burn)
Effect of diluted	irritate skin and eyes	irritate skin and eyes
Protection	use eye protection and gloves	use eye protection and gloves

Acids and alkalis are chemical opposites, (they cancel each other out when mixed together to produce water and salt) which is called a Neutralization reaction.
The acidity or alkalinity of a substance is a chemical property of that substance.

Working safely with acids and alkalis

When you handle chemicals, you should:
• Stand up to work, so that if you spill something it does not spill onto you
• Wear safety glasses, so nothing gets into your eyes
• Take the top of the bottle and place it upside down on the work surface, so that it does not get acid onto the surface or dirt into the acid
• Replace the bottle top as soon as you have finished using the bottle. This prevents spills and reduces the risk of replacing the wrong top on the wrong bottle.

Hazard warning labels

Many chemicals are hazardous. Their bottles are clearly labelled with hazard warning symbols, so you must handle them carefully.

Explosive		A substance that can explode if it comes into contact with a flame or heat.
Flammable		A substance that can catch fire easily.
Oxidising		A substance that gives off a large amount of heat when in contact with other substances.
Corrosive		A substance that can destroy living tissue. It can cause burns.

Toxic		A substance that can poison you.
Hazardous to the environment		A substance that can kill or damage living things in the environment.
Health hazard		A substance that can cause harm such as irritating your skin and eyes.
Serious health hazard		A substance that can cause a serious problem to your health.

5.6 Indicators and the pH scale

To differentiate between an acidic and an alkaline substance, we need to use an indicator and the PH scale that shows whether it is:

- Acid or alkali
- Concentrated or diluted

An indicator is a substance that turns one colour in an acid and a different colour in an alkali.

Indicators can be made from brightly coloured berries, flowers and other parts of plants. These include:

- red cabbage
- blackcurrant
- beetroot.

We use two main indicators in the Science Lab:

1- Litmus: is a very common indicator. It is a dye, which is made by soaking absorbent paper in a litmus solution.

Litmus turns red in acids. Litmus turns blue in alkalis. Litmus turns purple when it is in a neutral substance.

A neutral substance is neither acid nor alkali.

Examples:

Substance	Litmus colour	Type of substance
hydrochloric acid	red	acid
sodium hydroxide	blue	alkali
water	purple	neutral
lemon juice	red	acid
calcium hydroxide	blue	alkali

Litmus and other simple indicators just show if a substance is an acid or an alkali.

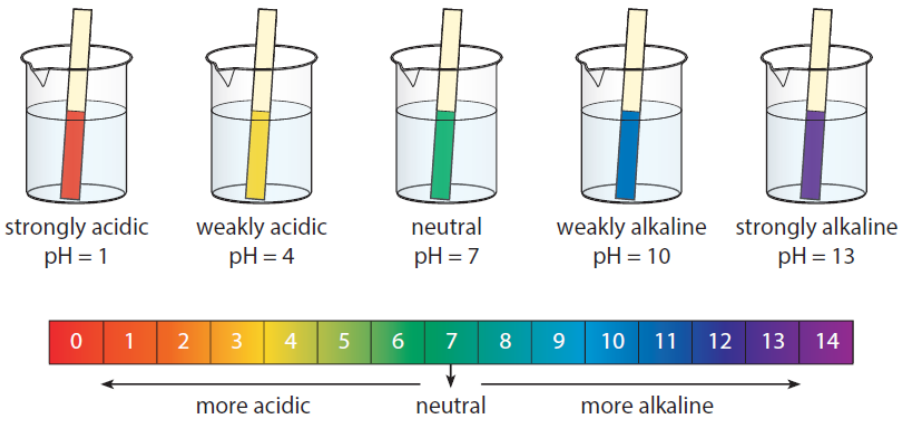
2- Universal indicator shows how acidic or alkaline a substance is.

- The acidity or alkalinity of a substance is one of its chemical properties.
- Universal indicator can change to many different colours, as it is made up of a mixture of different indicators.

Type of substance	Colour of universal indicator
strongly acid	red
weakly acid	yellow
neutral	green
weakly alkaline	blue
strongly alkaline	purple

These strips of paper were soaked in universal indicator solution and then dried. The papers were then dipped into different liquids.

The strength of acids and alkalis is measured on the pH scale.
The universal indicator changes colour and shows the pH of a substance, which is one of the chemical properties of that substance.



A colour chart for universal indicator showing the pH scale.