Atoms, Elements, Compounds & Mixtures

Pure substances are made up of one type of **atom**

Atoms of the **same element** are exactly alike

Atoms cannot be created, destroyed, or divided into smaller particles

An **element** is a pure substance that cannot decompose into simpler substances

Compounds are formed by joining 2 or more elements e.g. water; they can be broken down into simpler substances

Mixtures are two are more elements or compounds which are not chemically combined

Mixtures can be **homogeneous** (uniform) e.g. sugar + water or **heterogeneous** (non-uniform) dirt + water

Physical Separation Techniques

SEPARATING SOLIDS	
Sieving (density)	Separating solid particles according to particle size by passing them through a perforated barrier
Sedimentation	Process in which solids settle to the bottom of a container
SEPARATING SOLIDS FROM LIQUIDS	
Filtration (solubility, particle sizes)	Process of separating undissolved solid from a liquid or gas by passing the mixture through a filter
Decanting	Process of carefully pouring out the liquid and leaving the solid undisturbed at the bottom of the container
SEPARATING DISSOLVED SOLIDS AND LIQUIDS	

Physical Separation Techniques (cont)

Evaporation (boiling point)	Process of separating a dissolved solid from a solution by vaporising the liquid
Crystallisation	Process of forming crystals from a solution
SEPARATING LIQUIDS	
Separating funnel (miscibility)	Placing mixture in a separating funnel and opening the tap to let out the lower layer into a clean vessel below
Distillation (boiling point)	Process of separating the liquid by boiling the solution and condensing the resulting vapour back to a liquid (big difference in boiling points)
SEPARATING GASES	
Fractional Distillation	Similar to distillation, but performed under colder conditions instead of at room temperature (small difference in boiling points)
OTHER SEPARATION METHODS	
Centrifugation	Process of spinning molecules with different densities around an axis at high speed

Physical Separation Techniques (cont)

Magnetic Separation (magnetism)	Process of passing a mixture through a magnetic field to separate the magnetic field and non-magnetic components
Chromatography	Process whereby mixture is dissolved in a solvent (called the mobile phase), which carries it through a second substance called the stationary phase

Atoms

An **atom** is the smallest particle of an element that is still recognisable as that element

Atoms are made up of three sub atomic particles: **electrons** (-1), **protons** (+1) and **neutrons** (0)

An atom consists of an extremely **small, dense, and positively charged nucleus** or core, which contains the **bulk of the mass of the atom**

This nucleus is surrounded by an **electron cloud** of rapidly moving and extremely **light negatively charged particles** (electrons).

Atomic number, **Z**, of an element is the **number of protons** in the nucleus of an atom of that element.

The **mass number**, **A**, is the number of **protons plus neutrons in the nucleus** of an atom

Number of electrons in the electron cloud is *equal* to the **number of protons** in the nucleus

Table of Transition Metal and Metal Cations:

+1 Charge	+2 Charge	+3 Charge	+4 Charge
Copper(I): Cu^{+}	Copper(II): Cu^{2+}	Aluminum: Al^{3+}	Lead(IV): Pb^{4+}
Silver: Ag^{+}	Iron(II): Fe^{2+}	Iron(III): Fe^{3+}	Tin(IV): Sn^{4+}
	Cobalt(II): Co^{2+}	Cobalt(III): Co^{3+}	
	Tin(II): Sn^{2+}		
	Lead(II): Pb^{2+}		
	Nickel: Ni^{2+}		
	Zinc: Zn^{2+}		

By **ducky**
cheatography.com/ducky/

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Naming Inorganic Compounds

There are two types of inorganic compounds that can be formed: **ionic compounds** and **molecular compounds**.

COMPOUNDS BETWEEN METALS AND NON-METALS

When an atom **loses** one or more electrons, it becomes a **positively-charged** ion (cations)	The **cation** (metal) is always named first with its name unchanged
When an atom gains one or more **electrons**, it becomes a **negatively-charged** ion (anions)	The **anion** (non-metal) is written after the cation, modified to end in *–ide*

Transition metals may form **more than one ion**

Example of Compounds Between Metals and Non-metals

$Na^+ + Cl^- = NaCl$; $Ca^{2+} + 2Br^- = CaBr_2$

Sodium + Chlorine = Sodium Chlor**ide;** Calcium + Bromine = Calcium Brom**ide**

More Than One Ion Example

Ions:	$Fe^{2+} + 2Cl^-$	$Fe^{3+} + 3Cl^-$
Compound:	$FeCl_2$	$FeCl_3$
Nomenclature	Iron (II) Chloride	Iron (III) Chloride

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