

The Periodic Table

Learning Objective	Red	Yellow	Green	Date Completed
OC3 understand what an element is and recall that all known elements are listed in the Periodic Table; (also know how to use the Table; know what a Period and a Group are)				
<i><u>OC48 describe the general properties of the alkali metals and understand that alkali metals are in Group I of the Periodic Table and have similar properties.</u></i>				
<i><u>OC49 describe the reactions of the alkali metals with air and water (word equations for reaction with water).</u></i>				
OC50 understand that Group II elements are the alkaline earth metals.				

Key Points

The Periodic Table

The periodic table is an arrangement of elements in order of increasing atomic number. Dmitri Mendeleev was the first to draw up a periodic table.

All elements in the same group of the Periodic Table have similar chemical properties.

Group 1 are called the Alkali metals – because they form alkalis when added to water.

Sodium + water → Sodium Hydroxide + Hydrogen.

Potassium + water → Potassium Hydroxide + Hydrogen.

Group II = alkaline earth metals – because many of them are found as minerals in the earth.

Group 3 = halogens – these are commonly found in salts.

Group 0 = noble (inert) gases – because they are unreactive gases.

The block of elements at the centre are called the transition metals.

Some metals are well known, often because they are lustrous, ductile or malleable.

Electron configuration shows the arrangement of electrons in an atom.

Isotopes – are atoms of the same elements that have different mass numbers due to different numbers of neutrons in the nucleus.

There are 3 isotopes of carbon – Carbon –12, Carbon –13 and Carbon –14. Carbon –14 is used in carbon dating.

ATOMIC STRUCTURE

Atom: the smallest part of an element that still has the characteristics/ properties of that element.

The atoms of each of the elements that exist and are found on the PERIODIC TABLE are different. For example an atom of hydrogen has completely different properties to that of sodium.

ATOM STRUCTURE

Made up of smaller particles called sub-atomic particles.

3 types: the proton – which has a positive charge
 the electron – which has a negative charge
 the neutron – which has no charge (is neutral).

These particles are so small we can't find their mass using conventional measurement units.

Atomic mass unit (a.m.u.)

Neutrons have a mass of 1 a.m.u.

Protons have a mass of 1 a.m.u.

Electrons have a mass of $1/1840$ a.m.u.

Structure of the Atom – The Bohr Model

Protons and neutrons are at the very centre of the atom, the nucleus.

The electrons are found in orbits or shells surrounding the nucleus.

Metals and Non-Metals

Learning Objective	Red	Yellow	Green	Date Completed
OC4 examine a variety of substances and classify these as metals or non-metals.				
OC5 list the physical properties (state and colour only) of two examples of metallic and two examples of non-metallic elements.				
OC6 recall that metals conduct electricity and heat.				
OC7 identify everyday applications of metals, for example in industry, in the making of jewellery.				
OC8 recall the symbols of the metallic elements Cu, Zn, Al, Fe, Ag, and Au.				
OC9 recall the symbols of the non-metallic elements C, O, S, H and N.				
OC10 understand that metals are shiny (lustrous), can be beaten into shape (malleable) and can be stretched (ductile).				
OC11 understand that solder, steel, brass and bronze are alloys, and state one use of each alloy.				
OC13 and understand that an alloy is a mixture				
OC52 investigate the relative reactivities of Ca, Mg, Zn, and Cu based on their reactions with water and acid (equations not required)				
OC51 investigate the reaction between zinc and HCl, and test for hydrogen (word equation and chemical equation)				
OC45 understand that rusting is a chemical process that changes iron into a new substance				
OC46 carry out an experiment to demonstrate that oxygen and water are necessary for rusting				
OC47 list three examples of methods of rust prevention: paint, oil, galvanizing				

Some properties of Metals

- Metals are lustrous: All metals are shiny
- Metals are malleable: Metals can be hammered and shaped
- Metals are ductile: Metals can be stretched
- Metals are usually strong, hard solids: Most metals are hard and strong. Sodium and the other alkali metals are soft.
- Metals are good conductors of heat and electricity: Heat energy and electrons can easily move through metals.

Alloys are mixtures of metals – some alloys contain the non-metal carbon.

Alloy	Mixtures of elements	Uses
Steel	Iron, carbon and other elements	Construction, machinery, motor vehicles, etc.
Brass	Copper and zinc	Door handles, musical instruments, etc
Bronze	Copper and tin	Statues
Solder	Lead and Tin	Joining connections together in electrical circuits

Corrosion and Rusting

- When metals react with oxygen and water, they corrode. This chemical reaction is an oxidation reaction.
- Rusting is iron corrosion. Water and oxygen are necessary for rusting.
- Corrosion returns metals to their ore, e.g. iron is changed into iron oxide.

Painting, electroplating, greasing, galvanising, anodising and alloying can all be used to prevent corrosion.

The Alkali Metals

- The Alkali metals are in Group 1 of the periodic table
- Lithium, sodium, potassium, rubidium and caesium are called the alkali metals because they react with water to form alkaline (basic) solutions.
- They have similar physical and chemical properties because they each have one electron in their outer shell.
- They are soft, shiny metals that are stored in oil because they react with air and water.

Reaction with Air (oxygen)

The alkali metals react with oxygen to form metal oxides. They lose their shiny appearance when they are exposed to air.

Lithium + oxygen = Lithium oxide

Sodium + oxygen = Sodium oxide

Potassium + oxygen = Potassium oxide

Reaction with water

Metals like potassium and sodium react violently with cold water. Lithium is the least reactive of the alkali metals.

Potassium floats and fizzes on water. A gas hydrogen is released which catches fire. A white trail of potassium hydroxide forms in the water. If red litmus paper is added to the water, the paper turns blue.

Potassium + water = potassium hydroxide + hydrogen

Sodium + water = sodium hydroxide + hydrogen

Lithium + water = lithium hydroxide + hydrogen

The Alkaline Earth Metals

- The alkaline earth metals are in group 2 of the periodic table
- They are less reactive than the alkali metals
- The best known alkaline earth metals are magnesium and calcium
- Magnesium alloys are used in building aircraft and ships
- Calcium is the main element in bones, teeth and shells
- They have similar physical and chemical properties because they each have two electrons in their outer shell.

Relative Reactivities of Metals (Ca, Mg, Zn and Cu)

Reaction with water

When metals react with water, they release hydrogen gas.

Calcium reacts vigorously with cold water while magnesium takes several days to react with cold water. Zinc does not react with cold water (when zinc is heated, it reacts with steam) Copper does not react with water.

Reactions with dilute acids

When metals react with dilute hydrochloric acid, they form salts and release hydrogen gas

- Calcium reacts the quickest with dilute hydrochloric acid
- Magnesium reacts less quickly than calcium
- Zinc reacts slowly
- Copper does not react.

Order of Reactivity

Calcium Magnesium Zinc Copper
 <_____ Increasing

When testing reactions of metals in water and dilute hydrochloric acid:

- The metals should be approximately the same size
- The concentration of the acid used must be the same in each experiment
- The experiments must be done at the same temperature

Summary of the reactions of Metals (Ca, Mg, Zn and Cu)

Metal	Reaction with water	Reaction with dilute hydrochloric acid
Calcium	Forms calcium hydroxide and releases hydrogen gas	Produces calcium chloride and releases hydrogen gas
Magnesium	Forms metal oxide and releases hydrogen gas	Produces magnesium chloride and releases hydrogen gas
Zinc	Forms zinc hydroxide and releases hydrogen gas	
Copper	No Reaction	No Reaction