

Reference Sheet for Properties of Matter

Properties of Metals

Physical

High melting points and boiling points

-solids at room temperature

-exceptions:

mercury (only liquid metal at room temperature)

Alkali Metals have untypical low melting points.

Good conductors of heat and electricity.

Most have a high density

-exceptions: Alkali Metals have low densities

Shiny appearance (luster)

They are easily beaten into shape (malleable) or drawn into wire (ductile)

Chemical

They tend to form basic oxides that react with acids to form salts

Most metals react with acids to form a salt and hydrogen.

Metals readily form positive ions

Properties of Nonmetals

Physical

Low melting points and boiling points

-gases, liquids or solids at room temperature

-exceptions: silicon, and carbon

Poor conductors of heat and electricity

-exception carbon in the form of graphite

Low density.

Varied appearance - tend to be dull if solid.

Often weak materials e.g. soft or brittle solids

-exceptions: silicon, and carbon as diamond

Neither malleable nor ductile

Chemical

They form acidic oxides when burned in air or oxygen,

They do not usually react with acids e.g. to produce a salt and hydrogen like most metals do.

Non-metals readily form negative ions

Metalloids

Possess some physical characteristics of metals/some of nonmetals
For example, silicon is lustrous but brittle as a solid

Reactivity depends on properties of other elements in reaction
Behave like metals when they react with nonmetals
Behave like nonmetals when they react with metals

Often make good semiconductors

Electronegativities between those of metals and nonmetals

Ionization energies between those of metals and nonmetals

Notable families of the Periodic Table and some important members:

Alkali Metals

Very reactive – only found in compounds in nature

They readily react with non-metals to form ionic compounds

These are colourless crystals or white solids, soluble in water to give colourless solutions

The metals react rapidly, maybe violently, with water to form alkaline hydroxides and hydrogen gas.

Down the group, the metals get more reactive, and the melting points and boiling points decrease.

Alkaline Earth Metals

Metals with a shiny, silvery-white colour.

Not quite as reactive as the Alkali Metals for the same period.

Harder and denser than sodium and potassium, and have higher melting points.

Halogens

Coloured non-metals with low melting points and boiling points.

Brittle when solid e.g. iodine and poor conductors of heat and electricity when liquid or solid.

Halogens exist as molecules of pairs of atoms, X_2 (diatomic molecules), form ionic salts with metals e.g. KBr or $MgCl_2$, but form covalent molecular compounds with other non-metallic elements e.g. HCl , CBr_4 .

Down the group the melting points and boiling points increase and the reactivity decreases.

Chalcogens

Form covalent small molecule compounds with other non-metallic elements e.g. H_2O or CS_2 .

Oxygen and sulfur are nonmetals,

Polonium, selenium and tellurium are metalloid semiconductors

Common as minerals. (FeS_2 (pyrite) is an iron ore and AuTe_2 gave its name to the gold rush town of Telluride, Colorado

Transition Metals

Typical metals - good conductors of heat and electricity, malleable and ductile.

Compared to the Alkali Metals,

- higher melting points (except mercury - a liquid at room temperature);

- harder, tougher and stronger;

- much less reactive and so do not react (corrode) as quickly with oxygen or water.

Form coloured compounds (e.g. blue copper salt solutions)

Noble Gases

Colourless non-metals with very low melting and boiling points

They exist as individual atoms (NOT diatomic molecules) and are very unreactive chemically

Their lack of chemical reactivity makes them useful to provide an 'inert' atmosphere to prevent oxidation e.g. argon in filament bulbs and in arc welding.