1st November, 2023 C.W Wednesday

Periodic Table

Group 1 Elements.

Alkali Metals

Lithium	Li
Sodium	Na
Potassium	K
Rubidium	Rb
Ceasium	Cs
Francium	Fr

Alkali metals
Since they produce alkalis when dissolved in water.

Physical Properties of Alkali Metals.

i) They are soft and can be cut with knife like hard butter.
ii) Have low melting and boiling point.
iii) Have low densities. Lithium, Sodium, and potassium float on water.

Trend of these properties across the group

Going down the group,
i) The melting and boiling points would decrease.
ii) The densities of alkali metals generally increase.

Element	Melting point	Boiling point	Density g/cm^3
Li	180°C	1347 C°	0.53
Na	98°C	853 C°	0.97
K	63°C	774 C°	0.83
Rb	39°C	688 C°	1.53

Chemical Properties of Alkali metals

→ Alkali metals are highly reactive metals. They are stored in oil to prevent them from reacting with air and water.

→ Each alkali metal has one valence electron.

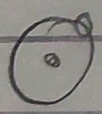
→ By losing this valence electron alkaline metal attains the electronic configuration of a noble gas.

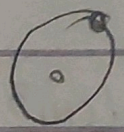
Do all alkali metals have same reactivity?

As we move down in group 1, the size of alkali metal increases. Its easier to remove electron from the valence shell of bigger atoms. Hence reactivity increases down the group in alkali metals.

Li  Difficult to remove, less reactive

Na 

K 

Rb  Easy to remove, most reactive.

Reaction with Water

Alkali metals react with cold water to form.

i) Lithium:

$$2Li_{(s)} + 2H_2O_{(l)} \longrightarrow 2LiOH_{(aq)} + H_{2(g)}\uparrow$$

"reacts quickly"

ii) Sodium:

$$2Na_{(s)} + 2H_2O_{(l)} \longrightarrow 2NaOH_{(aq)} + H_{2(g)}$$

"Reacts violently". Sodium darts around the surface of water.

iii) Potassium

Reacts very violently. Reaction is explosive

$$2K_{(s)} + 2H_2O_{(l)} \longrightarrow 2KOH_{(l)} + H_{2(g)}$$

Alkali metals form Ionic compounds

	CO_3^{2-}	Nitrates NO_3^{1-}	SO_4^{2-} Sulfate
Li	Li_2CO_3	$LiNO_3$	Li_2SO_4
Na	Na_2CO_3	$NaNO_3$	Na_2SO_4
K	K_2CO_3	KNO_3	K_2SO_4

$$2Rb_{(s)} + 2H_2O_{(l)} \longrightarrow 2RbOH_{(aq)} + H_{2(g)}$$

$$2Rb + Cl_2 \longrightarrow 2RbCl.$$

GROUP VII ELEMENTS
HALOGENS

Halous - Salt
Gen - Formers
(Salt formers).

Flourine F
Chlorine Cl
Bromine Br
Iodine I
Astatine At

Physical Properties of Halogens

→ Halogens are non-metals.
→ Exist as diatomic covalent molecules.
- Pale yellow F_2 → reddish brown
- Greenish Yellow Cl_2 Br_2 → Purplish black
- I_2

→ Halogens are coloured.
→ They have low melting and boiling points.

Halogen	M.P	B.P
Cl_2	-101	-34
Br_2	-7	59
I_2	114	184

Trends of physical properties

Going down the group.

→ The melting and boiling points of halogens increase.

→ The colours of halogens become darker.

Prediction of the properties of halogens

→ Since the melting points of halogens increase going down the group, we should expect the melting of element below Iodine greater than 114°C.

→ We can also deduce that Astatine is black as the colour intensities of halogens increases down the group.

Chemical Properties of halogens

→ Halogens are reactive non-metals.

→ Why are they so reactive?

→ Halogens have seven valence electrons. This means that only one more electron is needed to achieve the electronic configuration of ~~nearest~~ noble gas.

Halogen react with metals to form salts called halides.

F^- Flouride
Cl^- Chloride.
Br^- Bromide
I^- Iodide

} Halide ions.

Displacement Reactions

These are the reactions in which one element takes the place of another element in a compound.

"A more reactive halogen will displace a less reactive halogen from its solution".

For example, when chlorine is added to aqueous solution of sodium or potassium bromide, a reddish brown solution is obtained.

$$Cl_2 + 2NaBr \longrightarrow 2NaCl + Br_2$$

(g) yellow; (aq) colourless; (colorless); (Reddish brown)

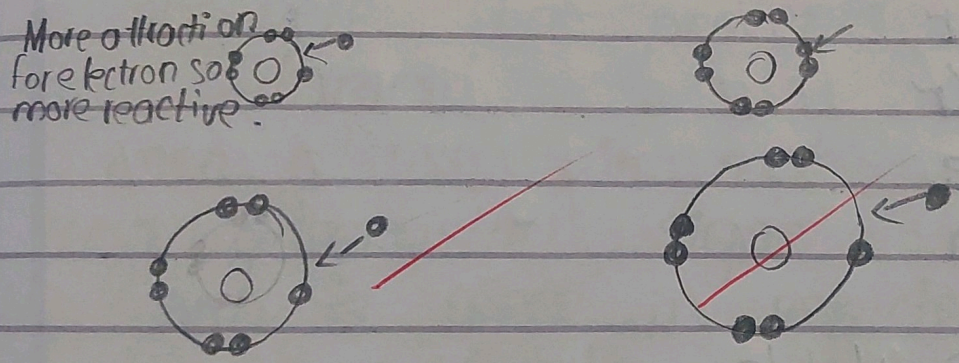
Order of reactivity of halogens

We can reduce the order of reactivity of halogens from their displacement reaction.

Unlike alkali metals, the reactivity of halogens decreases down the group.

This is because size of the atoms increases down the group making it more difficult for the nucleus to attract one more electron.

Chlorine > Bromine > Iodine



Chemical Properties of Halogens:

→ Halogens are reactive non-metal.

→ Why are they so reactive?

→ Halogens have 7 valence electrons.

Group Zero Elements
Noble Gases

other names:

→ Inert gases
→ Rare gases
→ Trace gases
→ VIIIA group element
→ Zero group

Helium	He
Neon	Ne
Argon	Ar
Krypton	Kr
Xenon	Xe
Radon	Rn

Properties of Noble Gases

→ Monoatomic Gases (Exist in form of individual atoms).
→ Colourless gases at room temperature.
→ Low melting and boiling points.
→ Insoluble in water.
→ Unreative

Reason for unreactivity of noble gases

→ Exept helium all other atoms have 8 electrons in their valence shells.

→ Their full electronic structure makes them unreactive.
→ They do not lose, gain, or share their electrons. Hence they are unreactive.

Uses of Noble Gases

i.) Helium is used for filling weather or advertisement balloons and airships.
ii) Argon is used to fill tungsten bulbs. It provides an inert (unreactive) atmosphere that prevents oxidation of the filament.
iii) Neon is used in making lights and and advertising signs.
iv) Xenon is used in vehicle head lamps.
v) Argon is also used to provide an inert atmosphere in certain processes such as welding stainless steel.

Transition Elements

These are the block of elements found between group II and III in the periodic table.

→ These are also called transition metals.

→ Some examples are

Copper - Cu
Iron - Fe
Chromium - Cr
Zinc - Zn

Properties of transition metals

① "Have high melting and boiling points and densities."

	Group 1 Metals	Group II metals	Transition elements.			
Element	K	Ca	Cr	Mn	Fe	Cu
Melting Point	63	839	1857	1244	1538	1084
Boiling Point	774	1484	2672	1962	2750	2567
Density	0.86	1.55	7.19	7.21	7.86	8.92

Good

Glans 4/12/2023

continued PTO

Notice that the melting points, boiling point, and densities of the transition metals are higher than those of the Group I and Group II metals.

② Transition metals have variable oxidation states

Metals of group I and II form only one type of postive ions, for example, Group I metals form an ion with oxidation state of 1+.

Unlike metals in group I and II transition metals form ions with different oxidation states

Compound of

Chromium (Cr)		Magnese (Mn)		Iron (Fe)		Copper (Cu)	
common oxidation state	Example	common oxidation state	Example	common oxidation state	Example	common oxidation state	Example
+3	$CrCl_3$	+2	$MnCl_2$	+2	$FeCl_2$	+1	Cu_2O
+6	$K_2Cr_2O_7$	+4	MnO_2	+3	$FeCl_3$	+2	$CuSO_4$
		+7	$KMnO_4$				

③ Transition metals form coloured compounds

One of the most significant features of the transition metals is that they form coloured compounds. For example, aqueous Iron(III) chloride is yellow while aqueous Iron(II) chloride is green.

The colours of the compounds of a transition metals are different at different oxidation states.

④ Transition metals and their compounds are good catalysts.

Catalyst: Catalyst is a substance that increases the rate/speed of reaction and remains chemically unchanged at the end of chemical reaction.

Transition elements and their compounds are important catalysts for many reactions both in laboratory and in industry.

Catalyst	Industrial Process
Iron :	In Haber process for the manufacture of Ammonia (NH_3)
Nickel :	Manufacture of margarine from vegetable oil.