

and BaO_2 powder. Aluminium itself attracts oxygen from the metal oxide and forms aluminium oxide and metal.

~~B 20/7/19/20~~

ALKALI Metals

The elements of Group IA is Alkali metals.
They are:-

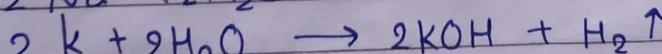
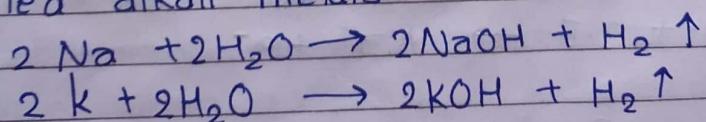
| | | |
|---------|-------------|------------------------|
| 3 - Li | → Lithium | - [He] 2s ¹ |
| 11 - Na | → Sodium | - [Ne] 3s ¹ |
| 19 - K | → Potassium | - [Ar] 4s ¹ |
| 37 - Rb | → Rubidium | - [Kr] 5s ¹ |
| 55 - Cs | → Caesium | - [Xe] 6s ¹ |
| 87 - Fr | → Francium | - [Rn] 7s ¹ |

NOTE: Magic numbers 2, 8, 8, 18, 18, 32

The electronic configuration of Alkali metal is nearer next gas + ns¹ [∴ where n is principle quantum]

IA elements are called alkali metals, why they are called so?

Ans IA elements when dissolves in water form hydroxide which is basic in nature. So, they are called alkali metals.



Physical characteristics of Alkali metals:

1. Physical appearance.

→ They are silvery white when freshly cut but tarnish in moist air.

2. Physical state

→ They are soft solid and softness increases from top to bottom in a group is due to weak metallic bonding in them because of large atomic size.

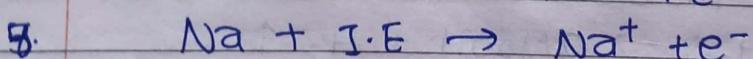
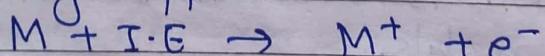
3. Atomic and ionic size

→ Atomic and ionic size of Alkali metals are the largest in the corresponding period due to the presence of weak metallic bond.

4. Ionization energy. (I.E)

→ The energy required to loose valence electron from gaseous atom to form ion is called Ionization energy also known as Ionization Potential.

Alkali metals has low ionization energy because of their big atomic size. However, I.E of alkali metal within the group decreases as we move down the group due to increase in size and screening effect.



5. Boiling Point and Melting Point

→ They have low B.P and M.P due to low Ionization energy.

6. Conductivity.

- They are good / super conductor of heat and electricity because the ^{sea} of mobile electrons is not strongly held by the kernels and the electrons are moving much freely.

7. Density.

- They have low density due to larger atomic size.

8. Flame test / coloration.

- Alkali metals impart characteristics colour when introduced in the flame of a bunsen burner.
for eg: Lithium imparts crimson red.

Sodium imparts golden yellow.

Potassium imparts pale violet.

Rubidium imparts reddish violet.

Cesium imparts sky blue on the flame.

The reason is when the alkali metal or any of its compound is introduced into a flame, the electron absorb energy from flame and get excited to higher energy levels. When these electrons come to ground state, the absorbed energy is given out in the form of radiations in the visible region.

9. Photoelectric effect.

Alkali metals, especially potassium, rubidium and cesium when exposed to light emit electrons because of their low ionization energy. This phenomena is called photoelectric effect and is used in photoelectric cells.

10. Oxidation

IA metal exhibit ± 1 oxidation state in their compounds.

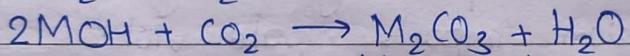
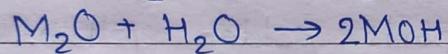
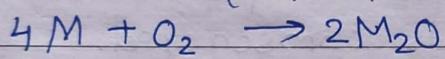
11. Reduction.

Due to low ionization energy, alkali metals have larger tendency to lose their outermost s-electron and hence, behave as strong reducing agents.

Chemical Properties.

1. Action with moist air.

\rightarrow IA Metals = (Li, Na, K ...)



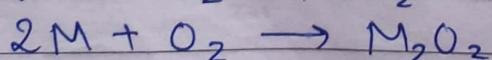
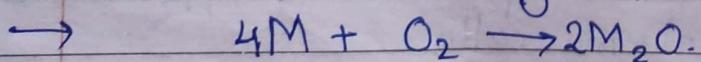
(tarnish layer of Metal carbonate)

Alkali metals form tarnish layer of metal carbonate when they are exposed to moist air.

Questions:- Alkali metals should be preserved in closed vessel have kerosene / parafin oil?

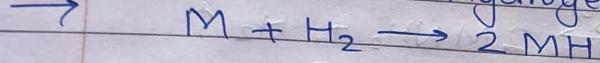
Ans Alkali metals are very reactive in nature when kept free reacts with surrounding forming oxide, Hydroxide and carbonates. So, to prevent this situation Alkali metals is kept in inert environment in a vessel filled with kerosene / parafin oil.

2. Action with dry air. [M = Li, Na, K ...]

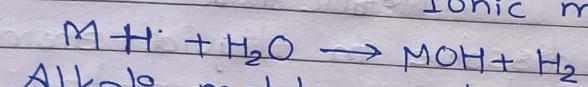


$M + O_2 \rightarrow MO_2$
Alkali metals form different types of oxide when they are treated with dry air.

3. Action with Hydrogen.



Ionic metallic hydride.



Alkali metals react with hydrogen to form ionic metallic hydride. Thus formed ionic hydride further reacted with water to form Metallic hydroxide and Hydrogen is regenerated.

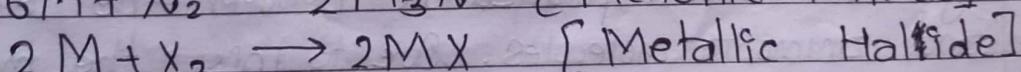
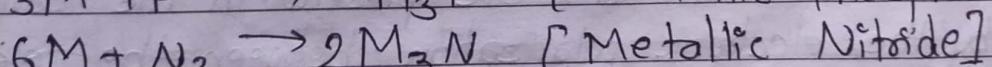
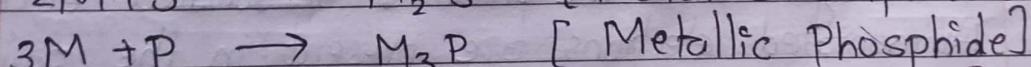
4. Action with H_2O . ($M = Li, Na, K, Rb, Cs$)



Alkali metals react with water to form metallic hydroxide and hydrogen gas. It is exothermic reaction. The reactivity of this reaction increases from lithium to caesium.

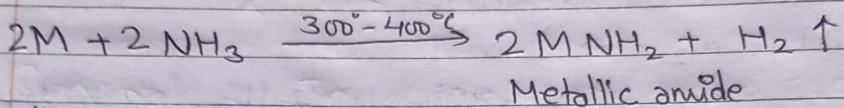
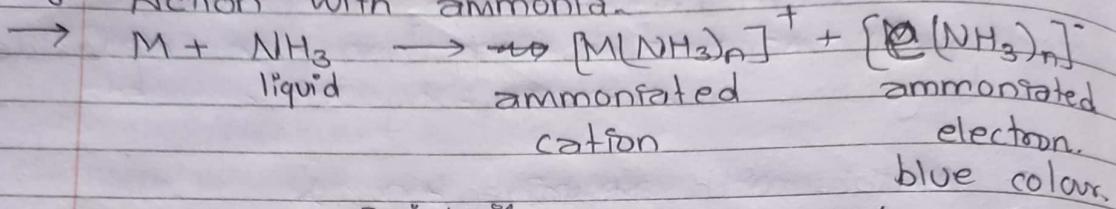
5. Action with non-metals

\rightarrow Non-metals like, S, P, N, X (Halogen).



Alkali metals react with sulphur, phosphorus, Nitrogen and Halogen to form metallic sulphides, phosphides, Nitrides and Halides respectively.

6. Action with ammonia.



Alkali metals dissolve in liquid ammonia to form blue coloration of ammoniated electron which has high conductivity but it gives Metallic amide and Hydrogen gas at high temperature.

* Question

- Ammoniated solution has high conductivity. Give reason.
- What will happen when alkali metals are dissolved in liquid ammonia at low temperature?
- What will happen when alkali metal react with ammonia?

i. Ans Solution of alkali metals in liquid ammonia conducts electricity due to the presence of solvated electrons. Ammoniated electrons are present in the cavities formed by the electronic polarization between the electrons and ammonia molecules. Due to this, the metal solution occupies larger volume and has lower density than solvent itself.