

Alkaline Earth Metals (AEM)

Pragati Education

Atomic size Be nS^2

Mg

Ca

Sr

Ba

Ra.

Atomic size increases down the group.

as new shell gets added up.

* AEM has higher nuclear charge due to which the electrons are more strongly attracted towards the nucleus causing a decrease in atomic size.

Ionization Energy

Be

Mg

Ca

Sr

Ba

Ra

I.E decreases. but in comparison to alkali metals

$$\text{I.E}_{\text{I(AEM)}} > \text{I.E}_{\text{I(AM)}}$$

$$\text{I.E}_{\text{II(AEM)}} < \text{I.E}_{\text{II(AM)}}$$

* I.E decreases because of increase in atomic size due to ① addition of new shells and increase in the ② magnitude of screening effect of the electrons in inner shells.

* Alkaline earth metals are fairly electropositive due to low I.E but less electropositive than alkali metals.

** $\text{I.E}_{\text{I(AEM)}} > \text{I.E}_{\text{I(AM)}}$ but $\text{I.E}_{\text{II(AEM)}} < \text{I.E}_{\text{II(AM)}}$

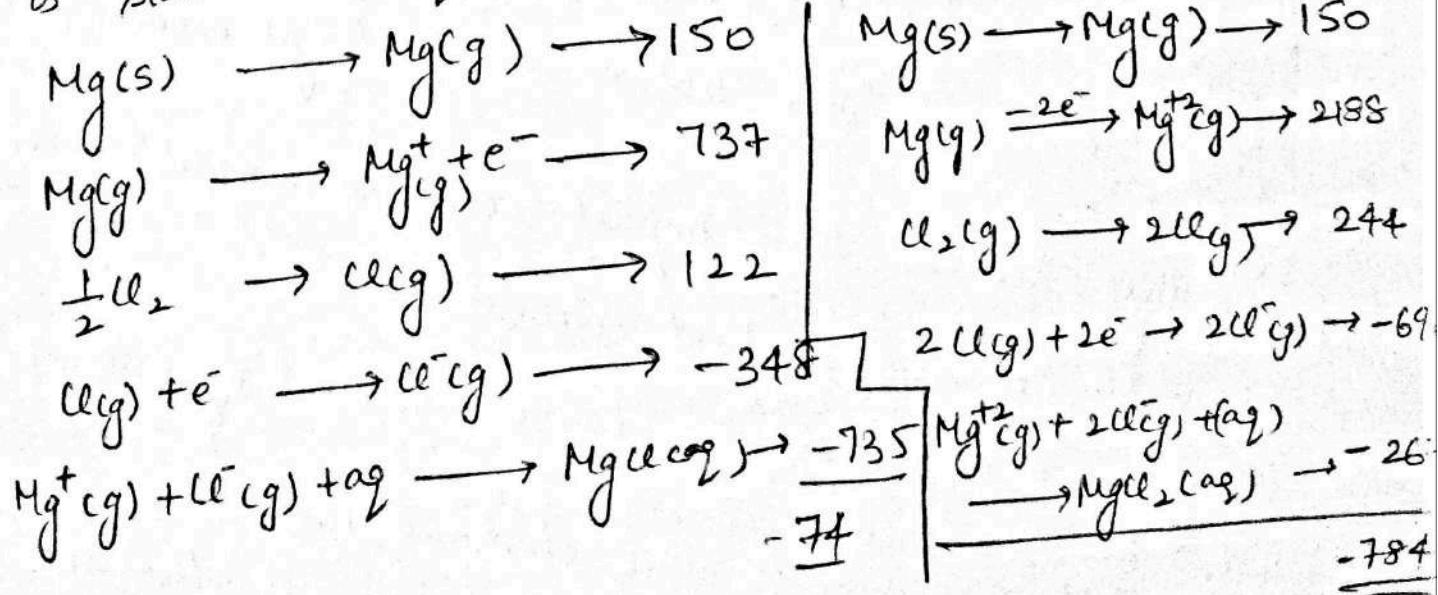
Ans: After removal of valence electron from alkali metal it acquire noble gas configuration, so it is difficult to remove next electron, so $\text{I.E}_{\text{II(AM)}} > \text{I.E}_{\text{II(AEM)}}$. While in alkaline earth metals, second electron is to be removed from monovalent cation which is yet to acquire noble gas configuration.

Hydration Enthalpy

- * H.E(AEM) > H.E(AM) because of larger size.
- * Alkaline earth metals are more hydrated.
e.g. MgCl₂.6H₂O & CaCl₂.6H₂O while for alkali metals.
LiCl.2H₂O.
- * Down the group hydration enthalpies decreases.
 $\text{Be}^{+2} > \text{Mg}^{+2} > \text{Ca}^{+2} > \text{Sr}^{+2} > \text{Ba}^{+2}$ ----- hydration enthalpy.

Oxidation State $\underline{\text{ns}^2}$

- * 2 electrons in outermost orbit.
- * So, will loose electrons, give rise to oxidation state $\underline{+2}$.
- * Divalent cation has stable noble gas configuration.
- * Divalent cation form strong lattice, so, a strong lattice energy is released which easily compensates for 2nd ionization energy. So, it is stable in solid state.
- * Divalent cation due to smaller size gets hydrated in water to a greater extent and thus hydration enthalpy released compensates for 2nd ionization enthalpy. So, it is stable in aq. state .



Reducing Properties

Weaker reducing agents than AM due to higher I.E.

Nature of Bonds Formed

* Ionic bond due to low I.E.

* Down the group, tendency of forming ionic bond ↑.

* Except Be → it forms covalent bond because of small size & high I.E. forms covalent compounds.

Metallic Bond

* AEM possess strong metallic bond due to presence of two electrons & small size.

It results in to

- a) Higher melting point
- b) Higher boiling pt.
- c) Higher densities
- d) are harder than corresponding alkali metals.

Characteristic Flame Colouration

Be
↓
X

Mg
↓
X

Ca
↓
B sick Red

Sr
↓
Crimson

Ba
↓

Grossy Green

- * It is due to electrons absorb energy & get excited to higher energy state.
- * When they return they impart colour in visible range.

Qn Be & Mg do not impart colour?

Ans. They have very I.E. So large amount of energy is required to excite their electrons. This energy is not available from flame & hence electrons are not mixed.

Density More closely packed, as they have smaller size & held by stronger forces of attraction. so they are tightly packed. so density is high.

- Melting & Boiling pt's
- * Due to close packing, they have high melting & boiling point than alkali metals.
 - * M.P. first decreases from Be \rightarrow Mg then \uparrow from Mg \rightarrow Ca & finally \downarrow Ca to Ra.