

COMMENTS:

- Heavy content chapter
- 5 key concepts
- 2 advanced concepts
- Always tested in exams, MCQ and FRQ
- Require knowledge from chapters like Periodic table, Oxidation & Reduction
- Heavy-medium overall weightage

Order of Reactivity ★★ ★ MUST KNOW ★★ ★

Please - Potassium (K) most reactive

Stop - Sodium (Na)

Calling - Calcium (Ca)

me - magnesium (Mg)

Cute - Carbon (C)

Zombie - Zinc (Zn)

I - Iron (Fe)

Like - Lead (Pb)

Hwa - Hydrogen (H)

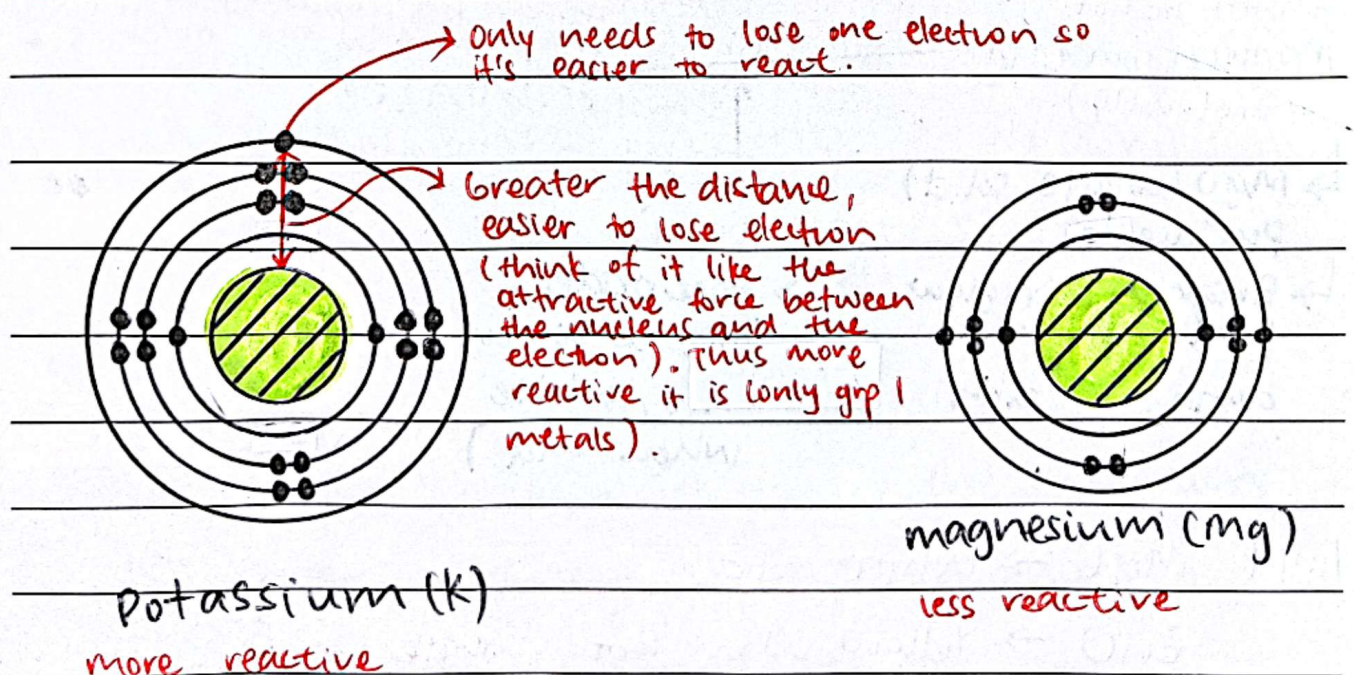
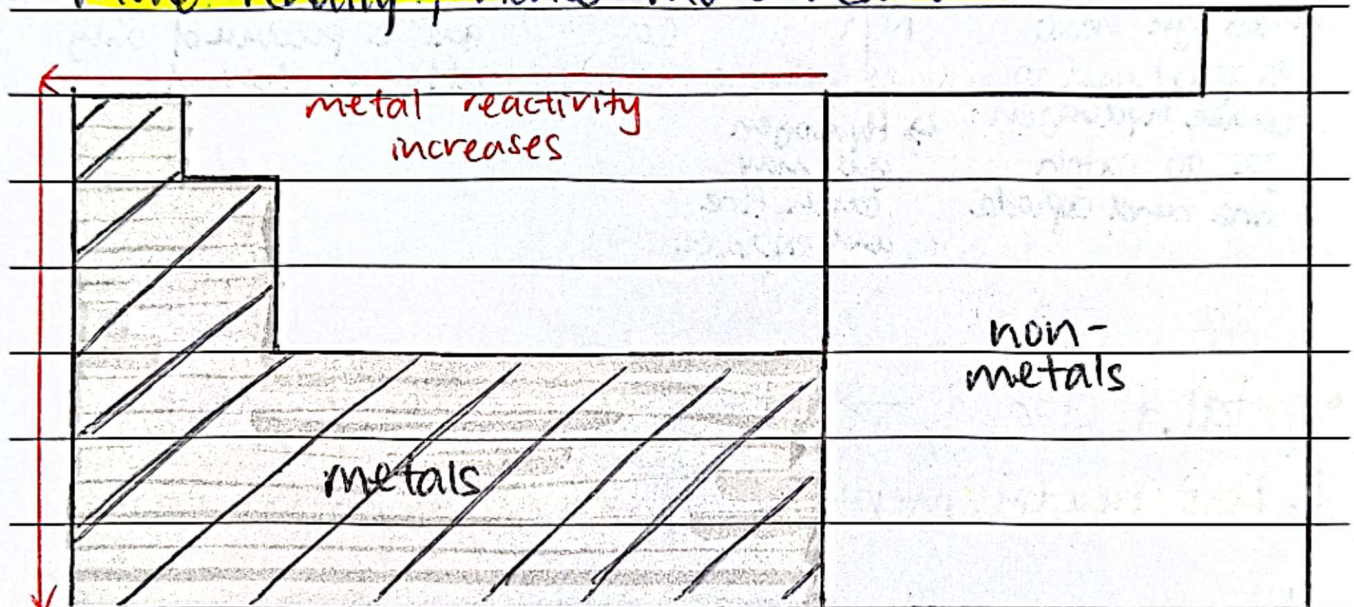
Chong - Copper (Cu)

Sexies - Silver (Ag) least reactive

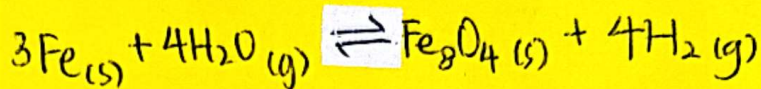
In order of
reactivity

Reactivity of metals

- Reactivity **increases** going down the group and from the **right to left** in the **periodic table**.
- **Group 1 metals** have the best reactivity
- going down the group, there is **more valence shells**, so it **loses its valence electrons more readily**, hence **more reactive**.



Iron's reaction:



Equations of metals

• metal + water → metal hydroxide + hydrogen

↳ more reactive metals react violently with cold

water → forms hydroxide with metals

Potassium (K) to Magnesium (Mg)
(explosively) (slowly)

↳ Enough heat is produced to cause hydrogen gas to catch fire and explode

Na

(violently)

↳ Hydrogen gas may catch fire and explode

Ca

(readily)

↳ A test tube of hydrogen gas is produced only after a few days.

• metal + steam → metal oxide + hydrogen

↳ less reactive metals react violently with steam

forms oxides with metals

* must be hot
Magnesium (Mg)
(violently)

to

* must be constantly heated & maintained as red-hot.

* must be hot

Iron (Fe)
(slowly)

↳ MgO (white solid) produced

Zn

(readily)

↳ Bright white glow produced during reaction

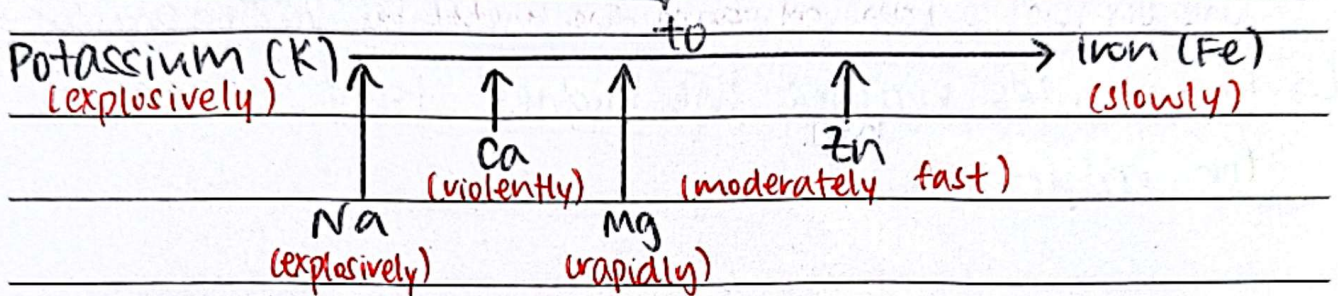
↳ Zinc oxide (yellow when hot, white when cold)

Imp't: MgO → white solid

ZnO → yellow when hot, white when cold.

• metal + dilute hydrochloric acid $\rightarrow$ metal chloride + $H_2(g)$

$\rightarrow$ metals above hydrogen in reactivity series react with dilute HCl $\rightarrow$ forms chloride with metals.



★ Why does lead show little to no reaction at all even though it is above hydrogen?

$\rightarrow$ The initial reaction between lead and HCl forms an insoluble layer of lead(II)chloride which coats the lead, preventing further reaction.

Reduction of metal oxides

• metal oxide + carbon $\xrightarrow{\text{heat}}$ metal + $CO_2(g)$

$\rightarrow$ only metal oxides below carbon in reactivity series can be reduced by carbon.

The oxygen is removed from the metal by the carbon, $CO_2(g)$ formed.

$\rightarrow$ The lower the metal is in the reactivity series from carbon, the more readily the reduction.

Zinc oxides require highest temperature for reduction.

E.g. $2CuO(s) + C(s) \xrightarrow{\text{heat}} 2Cu(s) + CO_2(g)$
(black solid)

• metal oxide + hydrogen $\xrightarrow{\text{heat}}$ metal + steam

↳ only metal oxides below carbon (except zinc) can be reduced by hydrogen

The oxygen is removed from the metal by hydrogen, ^{H₂O(g)} formed

↳ iron oxides require the highest temperature for reduction.