

Metal reactions

1 Metal reactivity series

	K ₂ O	←	K (钾)	→	K ⁺	
	Na ₂ O	←	Na (钠)	→	Na ⁺	
白	CaO	←	Ca (钙)	→	Ca ²⁺	water
	MgO	←	Mg (镁)	→	Mg ²⁺	
白或黄热	Al ₂ O ₃	←	Al (铝)	→	Al ³⁺	steam
	ZnO	←	Zn (锌)	→	Zn ²⁺	
iron (II, III) oxide = mixture of FeO & Fe ₂ O ₃	Fe ₃ O ₄	←	Fe (铁)	→	Fe ²⁺	very pale green
黑	SnO ₂	←	Sn (锡)	→	Sn ²⁺ / Sn ⁴⁺	
黄绿橙热	PbO	←	Pb (铅)	→	Pb ²⁺ / Pb ⁴⁺	dilute acid
黑	CuO	←	Cu (铜)	→	Cu ²⁺	rare but possible, 看题目找线索
红 (稀有)	HgO	←	Hg (汞)	→	Hg ²⁺	
黑	Ag ₂ O	←	Ag (银)	→	Ag ⁺	reddish brown

2 Reactions

WITH OXYGEN



mostly require heat, 但比 Mg reactive 的 (ie 钾钠钙) 不用加热

- eg. $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$
- eg. $3\text{Fe} + 2\text{O}_2 \rightarrow \text{Fe}_3\text{O}_4$ ← mixture of ① iron (II) oxide FeO ② iron (III) oxide Fe₂O₃
- Observable changes
 - > change in colour (metal colour → oxide colour)
 - > change in shininess (metal: shiny → oxide: dull)
 - > flame colour (for Cu, Ca, Na, K, Fe, Mg)

变成 oxide 后的 flame colour: 加热金属的 flame colour

WITH NON-METAL ELEMENTS



- 不 reactive 的 (eg. N₂) 要加热
- 注意 non-metal 通常是两颗 atom 组成一个 molecule
- $6\text{Na} + \text{N}_2 \xrightarrow{\Delta} 2\text{Na}_3\text{N}$
- $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$

WITH WATER & ACIDS

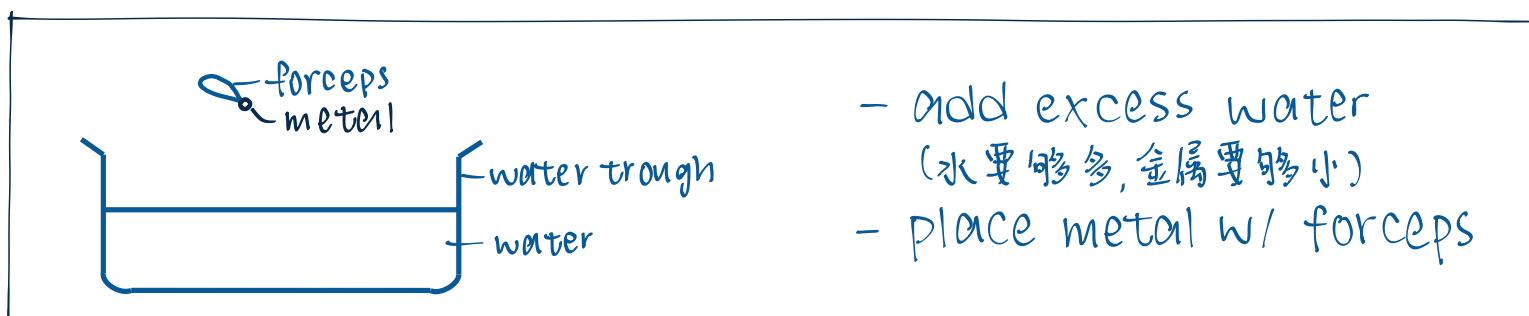
a. liquid water



假设 metal 的 ion 是 1+

- K Na Ca Mg Al Zn Fe ...

✓ react at room temp. ✓ react (hot water) ✗ react



- add excess water (水要够多, 金属要够小)
- place metal w/ forceps

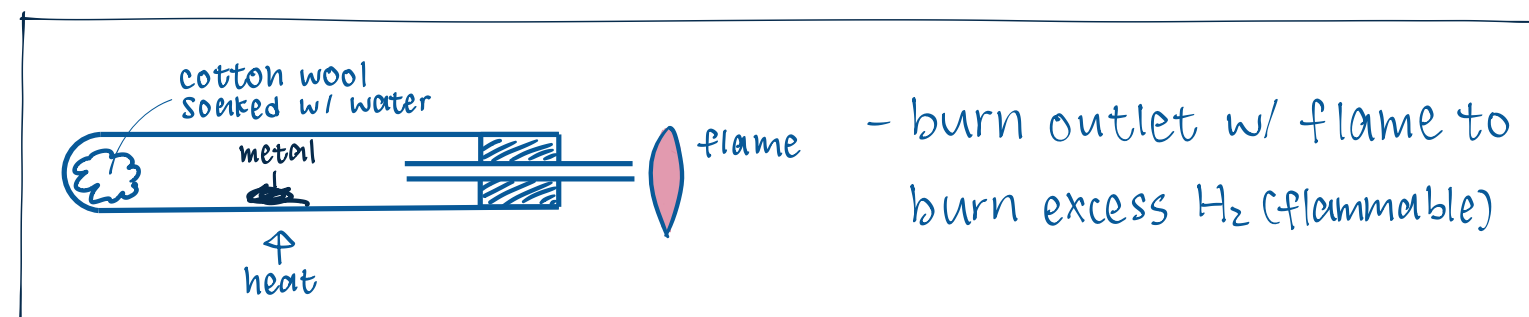
- observable changes
 - > <metal> dissolves
 - > insoluble salt: <colour> solid deposits
 - > soluble salt + coloured ion: solution changes from colourless to <colour>
 - > colourless gas bubbles evolve

b. water vapour



- K Na Ca Mg Al Zn Fe, Sn Pb Cu ...

✓ react ✗ react



- burn outlet w/ flame to burn excess H₂ (flammable)

- observable changes
 - > change in colour (metal colour → oxide colour)
 - > change in shininess (metal: shiny → oxide: dull)

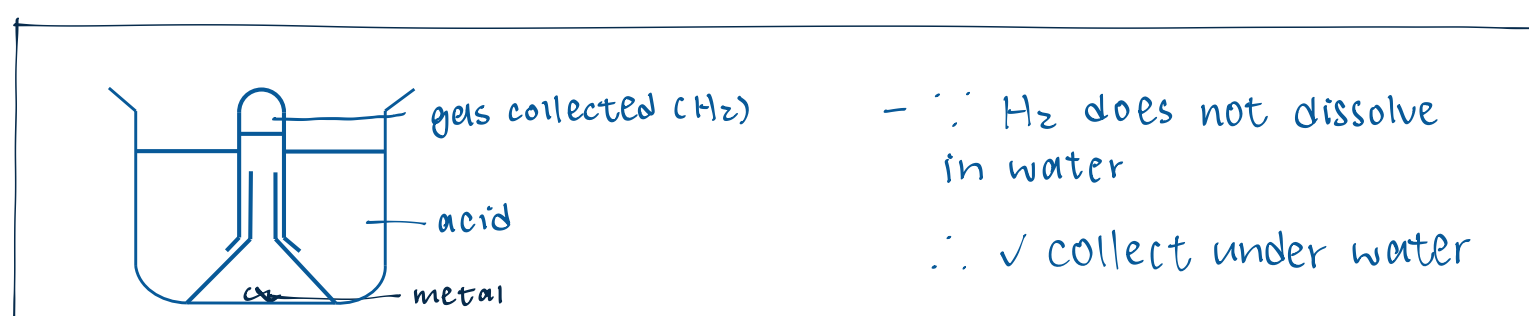
c. acids



acid: dilute / conc. HCl, dilute H₂SO₄, very dilute HNO₃, CH₃COOH (for rx of metal & other acids see Acid and Bases topic)

- K Na Ca Mg Al Zn Fe Sn Pb, Cu Hg Ag Au

✓ react ✗ react



- ∴ H₂ does not dissolve in water
- ∴ ✓ collect under water

- observable changes
 - > <metal> dissolves
 - > insoluble salt: <colour> solid deposits
 - > soluble salt + coloured metal ion: solution changes from colourless to <colour>
 - > colourless gas bubbles evolve