

Metal reactions

1 Metal reactivity series

	K_2O	←	K (钾)	→	K^+	
	Na_2O	←	Na (钠)	→	Na^+	
白	CaO	←	Ca (钙)	→	Ca^{2+}	water
	MgO	←	Mg (镁)	→	Mg^{2+}	
白或黄热	Al_2O_3	←	Al (铝)	→	Al^{3+}	steam
	ZnO	←	Zn (锌)	→	Zn^{2+}	
黑	Fe_3O_4	←	Fe (铁)	→	Fe^{2+}	very pale green
黄绿橙热	SnO_2	←	Sn (锡)	→	Sn^{2+}/Sn^{4+}	
	PbO	←	Pb (铅)	→	Pb^{2+}/Pb^{4+}	H_2
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_2O	←	Ag (银)	→	Ag^+	reddish brown

iron (II, III) oxide = mixture of FeO & Fe_2O_3

2 Reactions

WITH OXYGEN



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

- eg. $4Na + O_2 \rightarrow 2Na_2O$
- eg. $3Fe + 2O_2 \rightarrow Fe_3O_4$ ← mixture of ① iron (II) oxide FeO , ② iron (III) oxide Fe_2O_3 , ①:② = 1:1
- 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. N_2) 要加热
- 注意 non-metal 通常是两颗 atom 组成一个 molecule
- $6Na + N_2 \xrightarrow{\Delta} 2Na_3N$
- $2Na + Cl_2 \rightarrow 2NaCl$

WITH WATER & ACIDS

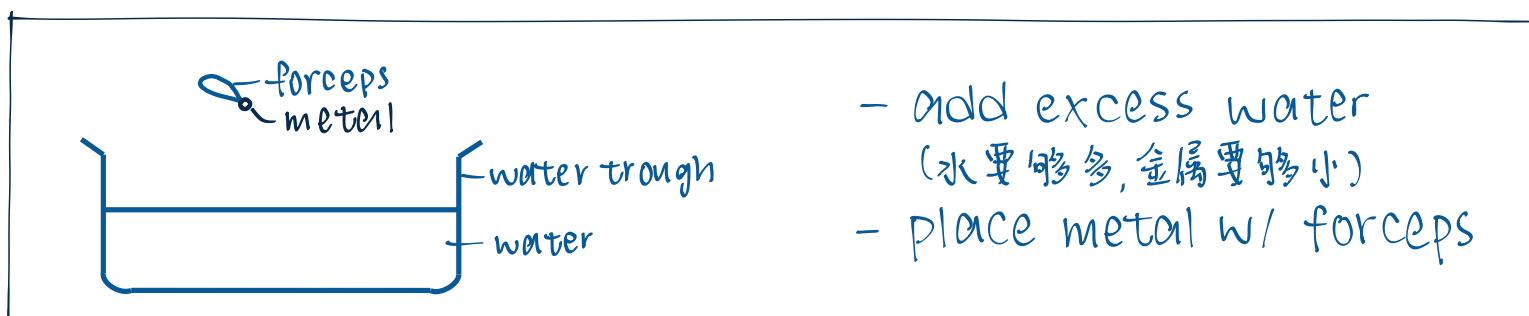
a. liquid water



假设 metal 的 ion 是 1+

- $\underline{K, Na, Ca, Mg, Al, Zn, Fe} \dots$

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



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

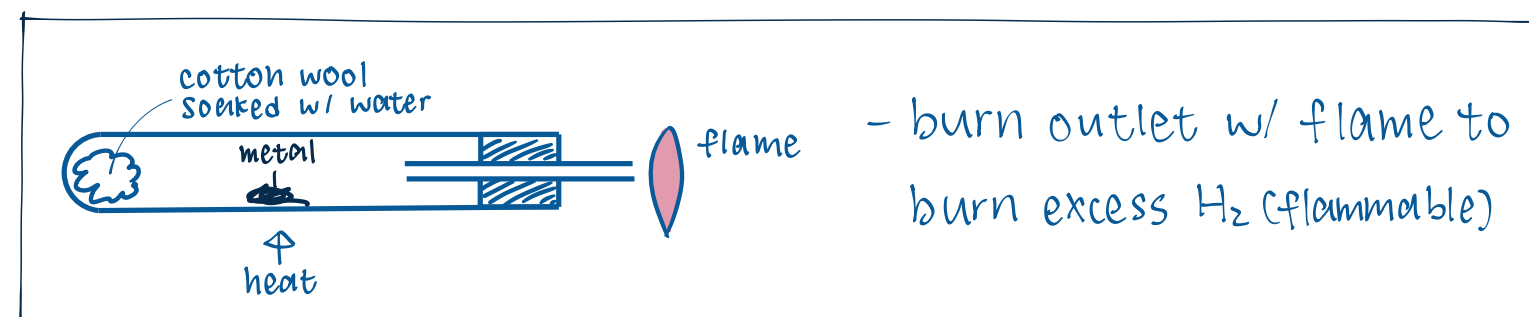
- observable changes
 - > <metal> dissolves
 - > insoluble salt: <colour> solid deposits
 - > soluble salt + coloured ion: solution changes from colourless to <colour>
 - > colourless gas bubbles evolve

b. water vapour



- $\underline{K, Na, Ca, Mg, Al, Zn, Fe, Sn, Pb, Cu} \dots$

✓ react ✗ react



- burn outlet w/ flame to burn excess H_2 (flammable)

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

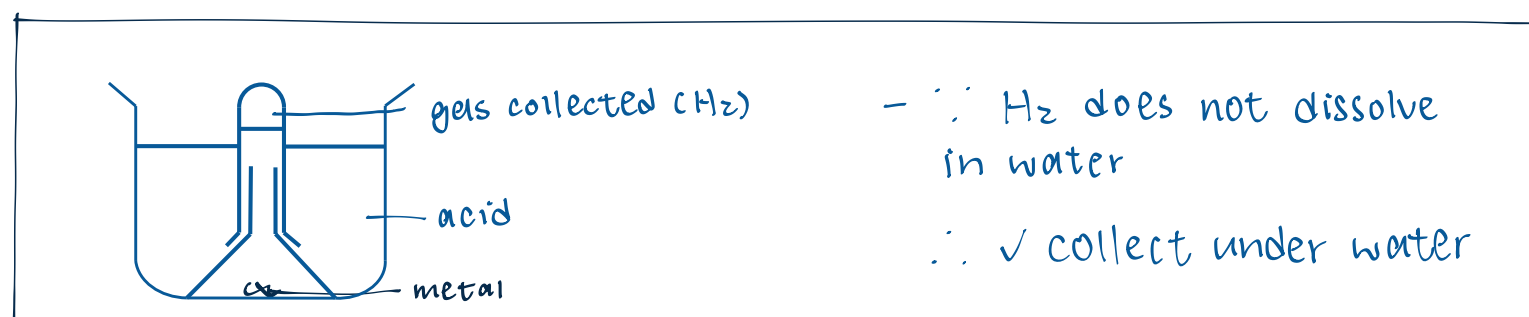
c. acids



acid: dilute/conc. HCl, dilute H_2SO_4 , very dilute HNO_3 , CH_3COOH (for rxn of metal & other acids see Acid and Bases topic)

- $\underline{K, Na, Ca, Mg, Al, Zn, Fe, Sn, Pb, Cu, Hg, Ag, Au}$

✓ react ✗ react



- $\therefore H_2$ does not dissolve in water
- \therefore ✓ 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