

Reactions: acid - R.A.s

1 Redox reactions

For more info on redox reactions, see
7) Redox reactions, chemical cells & electrolysis

★ transfer of electrons

→ forming of ionic compounds

→ acid-metal reactions

→ acid-base reactions (这是 transfer of H^+ — $NaOH + HCl \rightarrow NaCl + H_2O \Rightarrow H^+ + OH^- \rightarrow H_2O$)

左吸右甩

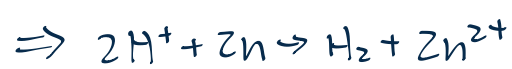
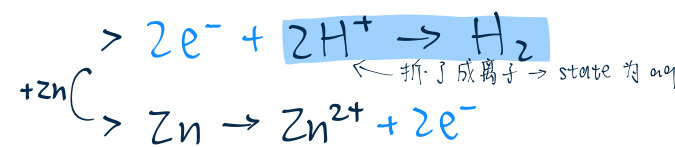
R.A. $\xrightarrow{\text{电子}}$ O.A.
reducing agent, 还原剂 oxidising agent, 氧化剂

2 Acid-metal reactions

HCl

★ HCl 不管是 dilute 还是 conc., reaction 也是一样的 (只是 rate 不同)

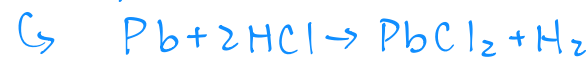
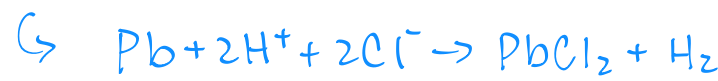
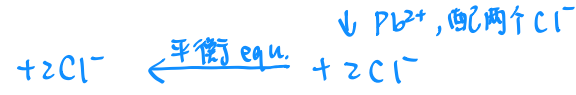
- Dilute / conc. HCl (K → Pb)



(ionic equ., full equ. 为 $2HCl + Zn \rightarrow H_2 + ZnCl_2$)

★ 这还是写 full equ. 比较好 (不知道 salt 溶不溶于水, 不溶于水不能写成 ion)

eg. $Pb + 2H^+ \rightarrow Pb^{2+} + H_2 \rightarrow$ salt 为 $AgCl$, 不落水!



H₂SO₄

- Dilute H₂SO₄ (K → Pb)

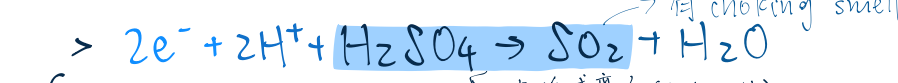


★ 这还是写 full equ. 比较好 (不知道 salt 溶不溶于水, 不溶于水不能写成 ion)

eg. $2H^+ + Pb(s) + H_2SO_4(aq) \rightarrow Pb^{2+} + SO_4^{2-} + 2H_2O \rightarrow$ 某盐 salt 是 $PbSO_4$, 不落水!

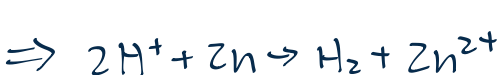


- CONC. H₂SO₄ (all metals)

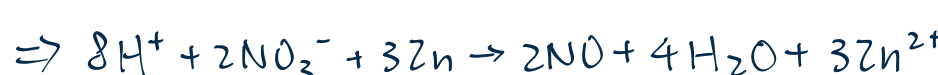
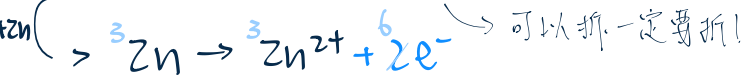
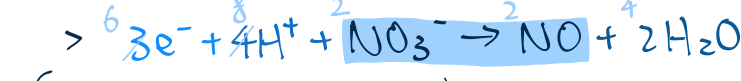


HNO₃

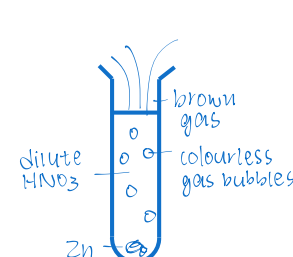
- Very dilute HNO₃ (K → Pb)



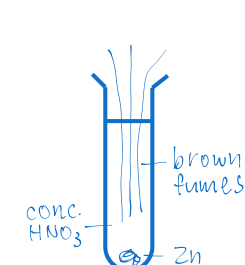
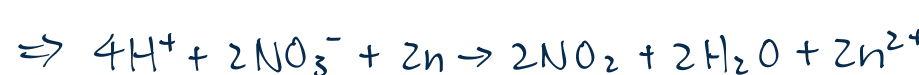
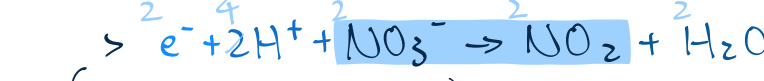
- dilute HNO₃ (aq) (all metals)



★ 附加一条公式: $2NO + O_2 \rightarrow 2NO_2$



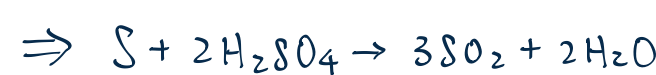
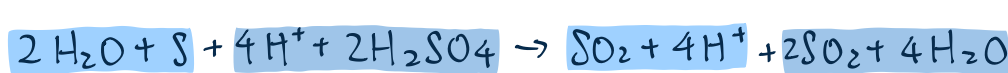
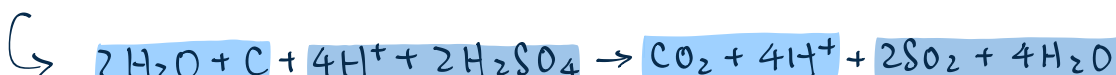
- CONC. HNO₃ (aq) (all metals)



4 Acid - non-metal reactions

- R.A. $\begin{cases} \text{Carbon} \rightarrow 2H_2O + C \rightarrow CO_2 + 4H^+ + 4e^- \\ \text{Sulphur} \rightarrow 2H_2O + S \rightarrow SO_2 + 4H^+ + 4e^- \end{cases}$

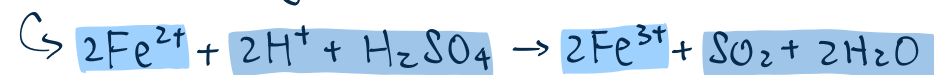
- O.A. (only conc. H₂SO₄) $\rightarrow 2e^- + 2H^+ + H_2SO_4 \rightarrow SO_2 + 2H_2O$



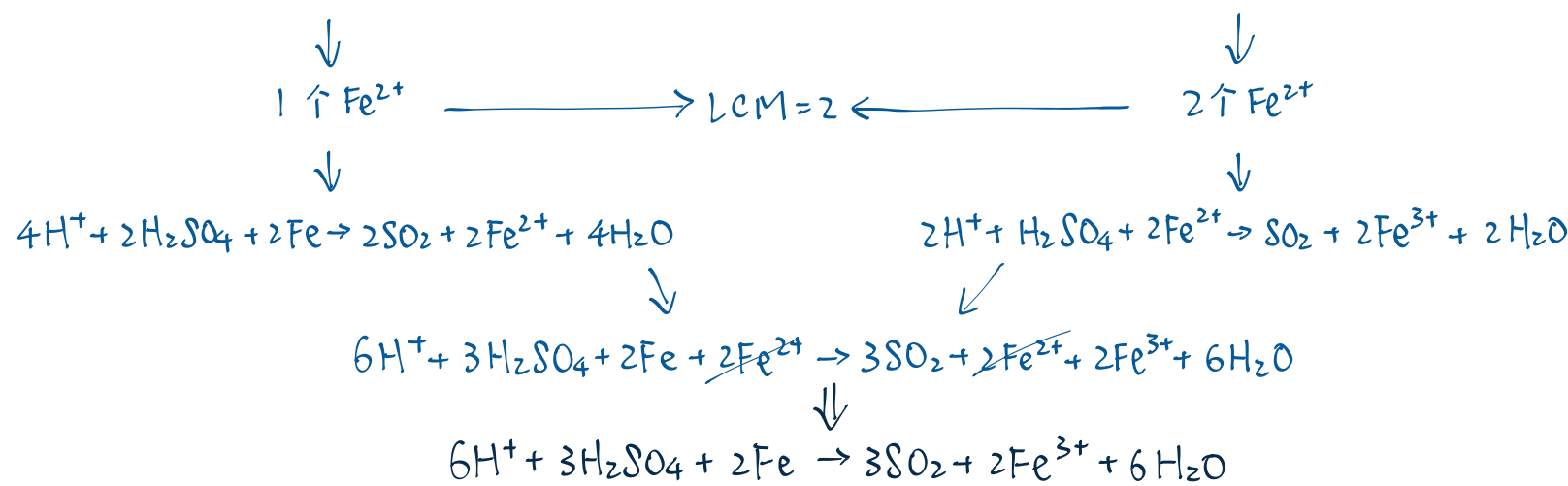
5 Acid-metal ion reaction

- R.A. — metal ions — especially $\rightarrow Fe^{2+} \rightarrow Fe^{3+} + e^-$

- O.A. — only conc. H₂SO₄ $\rightarrow 2e^- + 2H^+ + H_2SO_4 \rightarrow SO_2 + 2H_2O$



∴ H₂SO₄ (c) + Fe will undergo 2 reactions



6 Differentiating conc. / dilute acids

分辨 conc. / dilute acid — chemical equ. — 别用 base! (conc. 与 dilute acid 也是一样)
— reaction rate — metals — Pb / Cu / Ag
— base — CO₃²⁻ / HCO₃⁻ — 这两个才有 colourless gas bubbles

	dilute HCl (aq)	conc. H ₂ SO ₄ (c)	conc. HNO ₃ (aq)
Pb	$Pb + 2HCl \rightarrow PbCl_2 + H_2$ ↳ white precipitate	$Pb + 2H_2SO_4 \rightarrow PbSO_4 + SO_2 + 2H_2O$ ↳ white precipitate ↳ choking smell	$4H^+ + Pb + 2HNO_3 \rightarrow Pb^{2+} + 2NO_2 + 4H_2O$ ↳ brown fumes
Cu	X Reaction	$2H^+ + Cu + H_2SO_4 \rightarrow Cu^{2+} + SO_2 + 2H_2O$ ↳ colourless solution → blue ↳ choking smell	$4H^+ + Cu + 2NO_3^- \rightarrow Cu^{2+} + 2NO_2 + 2H_2O$ ↳ colourless solution → blue ↳ brown fumes