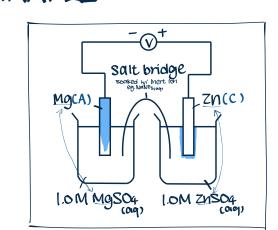# Simple chemical cells: examples (2 electrolyte)

1 Metal-metal ion cells

EXAMPLE

Metal-metal ion cell = 2× metal-metal ion half cell + 1× salt bridge
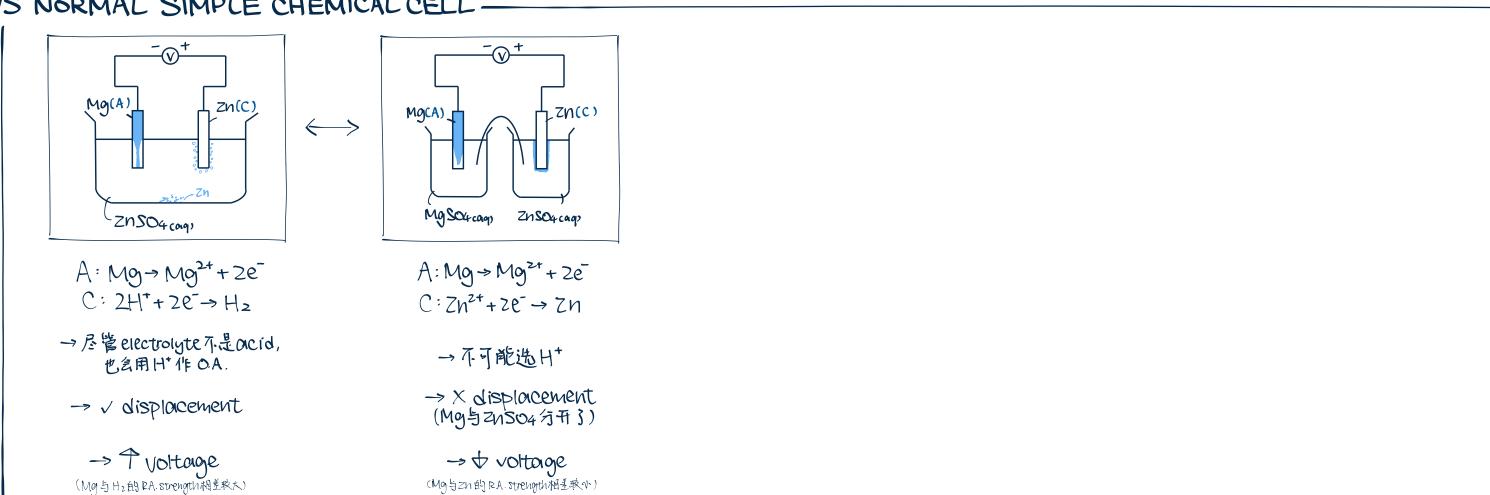
C: $Zn^{2+} + 2e^- \rightarrow Zn$ → 两个sol^n分开,
A: $Mg \rightarrow Mg^{2+} + 2e^-$ electrode = metal, electrolyte = 那种金属的ion
⇒ 肥Cat瘦An ⇒ 不可能选H^+为O.A.
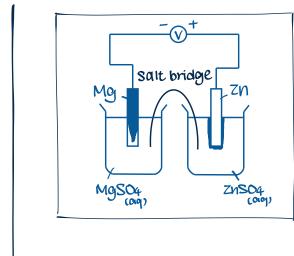
VS NORMAL SIMPLE CHEMICAL CELL

A: $Mg \rightarrow Mg^{2+} + 2e^-$
C: $2H^+ + 2e^- \rightarrow H_2$

→ 尽管electrolyte不是acid, 也么用H^+作 O.A.

→ ✓ displacement

→ ↑ voltage
(Mg与H_2的 R.A. strength的相差较大)

A: $Mg \rightarrow Mg^{2+} + 2e^-$
C: $Zn^{2+} + 2e^- \rightarrow Zn$

→ 不可能选H^+

→ ✗ displacement
(Mg与$ZnSO_4$分开了)

→ ↓ voltage
(Mg与Zn的 R.A. strength的相差较小)

SALT BRIDGE
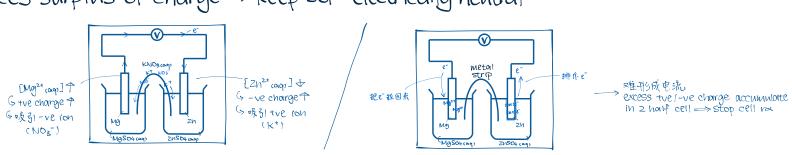
What is it?
- Strip of filter paper soaked w/ saturated sol^n of salt

USES
- provides complete circuit ← 电子并不会经过 salt bridge (电子行电路,离行sol^n)
- balances surplus of charge → keep sol^n electrically neutral

$[Mg^{2+}(aq)]$↑
⊕ +ve charge ↑
→ 吸引 -ve ion
(NO_3^-)

$[Zn^{2+}(aq)]$↓
⊖ -ve charge↑
→ 吸引 +ve ion
(K^+)

metal
strip
比C更弱

嗯形成电流,
excess +ve/-ve charge accumulates
in 2 half cell → stop cell rx

- prevents direct mixing of sol^n
  - direct mixing → mixed molecules have stronger VDW force % them (ie enthalpy ↓)
  → release heat
  ⇒ sol^n: loses heat
  ⇒ chemical energy ↓
  ⇒ produced electrical energy ↓
  ⇒ voltage ↓

Choice of ion in salt bridge
- inert ions (does not react w/ substances in half cells/ become O.A., R.A.)
  > can coloured ions be used?
    - No.
    - coloured ions are reactive
- no ppt reactions
  > insoluble precipitate → clogs passage of ion → incomplete circuit
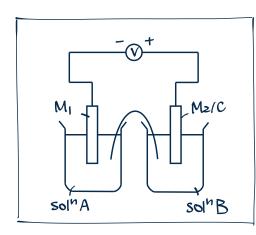 > Zn/Mg cell → can KOH, NaOH be used?
    - No.
    - $Zn^{2+} + 2OH^- \rightarrow Zn(OH)_2$, $Mg^{2+} + 2OH^- \rightarrow Mg(OH)_2$
  > Zn/Pb cell → can K_2SO_4 be used?
    - No.
    - $Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4$
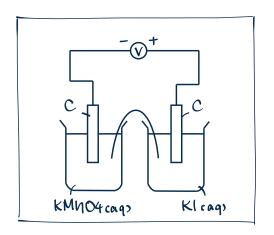
2 Examples (2 electrolyte)

EXAMPLES

If O.A. is found in sol^n B / ⓥ reading is +ve
→ R.A. strength: $M_1 > M_2$ / $M_1 > C$
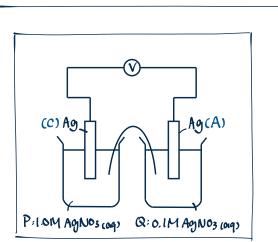
☆ sol^n A, B不能放 H_2O
→ mobile ions 浓度太低, 不通电

C: $5e^- + 8H^+ + MnO_4^- \rightarrow Mn^{2+} + 4H_2O$
A: $2I^- \rightarrow I_2 + 2e^-$

☆ 永远最白才考虑H^+为O.A. (OH^-不用考虑)

∵ P: $1.0M\ Ag^+(aq)$ gains e^- more readily than Q: $0.1M\ Ag^+(aq)$
∴ undergoes reduction → Ag

- C(P): $Ag^+ + e^- \rightarrow Ag$
  A(Q): $Ag \rightarrow Ag^+ + e^-$

☆ As cell rx continue, P: $[Ag^+(aq)]$↓, Q: $[Ag^+(aq)]$↑
finally: $P[Ag^+(aq)] = Q[Ag^+(aq)]$
⇒ rx stops ⇒ ⓥ: 0V

∵ difference in conc ↓ → voltage ↓
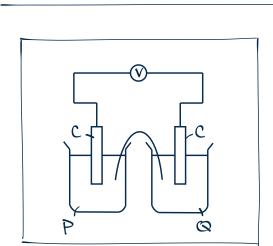
Given P: $[K^+(aq)]$↑, which metal is stronger R.A.?
- P: $[K^+(aq)]$↑ → -ve sol^n (字荚收蚀,所以吸到的K^+多)
→ Q: +ve sol^n → At Q: $M_2 \rightarrow M_2 + e^-$
⇒ R.A. strength: $M_2 > M_1$

Given: resulting $[X^-(aq)] = 0.7M$, which halogen is stronger O.A.?
- original $[X^-(aq)] = \frac{1.0}{2} = 0.5M < 0.7M$ → $[X^-(aq)]$↑ ← 1.0M $X_2(aq)$稀释到原来, 浓度=字表全稀

⇒ $X_2 + 2e^- \rightarrow 2X^-$, X_2 gains e^- more readily, undergoes reduction ⇒ X^-
∴ X_2 is stronger O.A.

Find resulting $[Y^-(aq)]$

- $X_2 + 2Y^- \rightarrow 2X^- + Y_2$

∴ $[Y^-(aq)] = 0.24M$

P: $1.0M\ 40cm^3\ X_2(aq)$ mixed w/ $1.0M\ 40cm^3\ KX(aq)$
Q: $0.8M\ 50cm^3\ Y_2(aq)$ mixed w/ $0.8M\ 50cm^3\ KY(aq)$