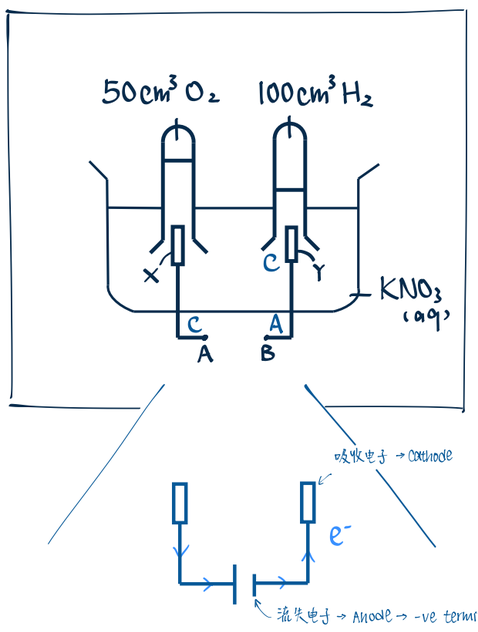
Electrolysis: more examples

1 Electrolysis of weak O.A./R.A.



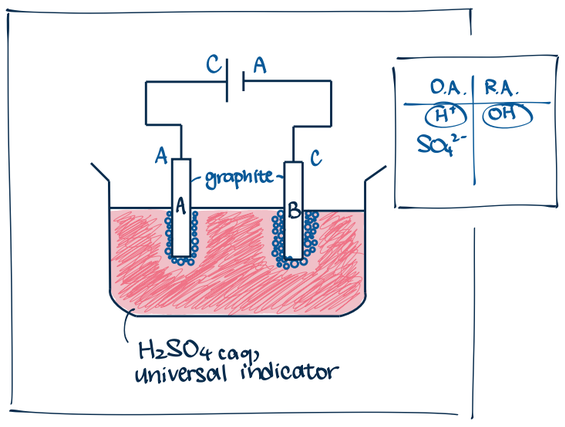
State & explain which terminal, A or B, is positive terminal.

- H_2 vol : O_2 vol = 100 : 50 = 2 : 1
- $2H_2O \rightarrow 2H_2 + O_2$ → vol. ratio
- ∴ electrolysis of water is performed
- H^+ is stronger O.A. than K^+, undergoes reduction and form H_2 at Y.
- electrode Y is cathode → B is anode
- ∴ A is +ve terminal

From the experiment, prove the chemical formula of water is H_2O.

- $H_2 : O_2 = 2 : 1$ (mol ratio)
  $H : O = 4 : 2$ (atom ratio)

→ Empirical formula of water = H_2O



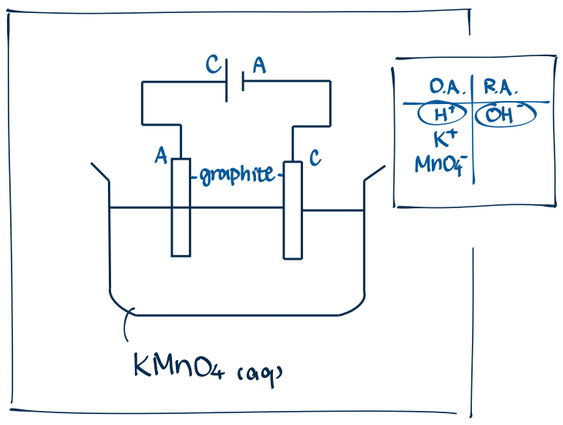
State and explain observable changes at electrode B.

Cathode electrode

- colourless gas bubbles evolve
  > H^+ is stronger O.A. than Na^+
  > preferentially discharges
  > undergoes reduction → H_2
- sol^n around electrode: remains red
  > $[H^+_{(aq)}]$ in H_2SO_4 >> $[OH^-_{(aq)}]$ (much larger than; 10^{-7} mol dm^{-3} in H_2O)

∵ consumed H_2O
∴ $[H_2SO_{4\,(aq)}]$ ↑
→ sol^n becomes more acidic

题外话：可以电解 $H_2SO_{4(l)}$ 吗？
- No.
- $H_2SO_{4(l)}$ 只有少量 mobile ion，难通电
- 会与 carbon electrode react → 产生 CO_2 + SO_2



State & explain observable changes at both electrodes.

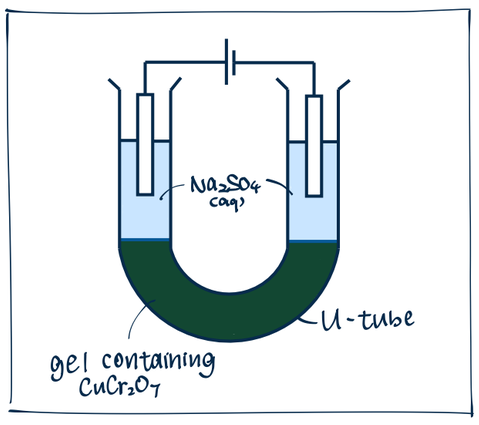
Cathode electrode

- colourless gas bubbles evolve
  > MnO_4^- is strongest O.A.
  > but MnO_4^- has -ve charge, X migrate to -ve cathode electrode to gain e^- for reduction (负负相吸)
  > H^+ is only positive O.A. stronger than K^+
  > preferentially discharges
  > undergoes reduction → H_2

Anode electrode

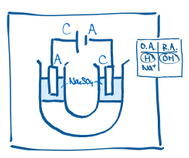
- colourless gas bubbles evolve
  > OH^- is the only R.A.
  > preferentially discharges
  > undergoes oxidation → O_2

2 Migration of ions + electrolysis



① Electrolysis of $Na_2SO_{4\,(aq)}$

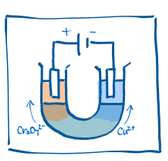
Na_2SO_4 = 废柴，电解 Na_2SO_4 = 电解水 ($2H_2O \rightarrow 2H_2 + O_2$)



Cathode: H^+ is stronger O.A. than Na^+
→ preferentially discharges to form H_2
→ colourless gas bubbles

Anode: OH^- is only R.A.
→ preferentially discharges to form O_2
→ colourless gas bubbles

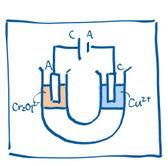
② After a while... migration of ions



+ve electrode: orange colour
→ $Cr_2O_7^{2-}$ is orange in colour, negatively charged
→ attracted to +ve electrode

-ve electrode: blue colour
→ Cu^{2+} is blue in colour, positively charged
→ attracted to -ve electrode

③ Redox reactions of migrated ions



Cathode: Cu^{2+} is stronger O.A. than H^+
→ preferentially discharge to form Cu
→ reddish brown solid deposits

Anode: OH^- continues to be only R.A.
→ 有 $Cr_2O_7^{2-}$ 小但为 O.A.
→ anode 先进行 oxidation ⇒ $Cr_2O_7^{2-}$ X ra
→ OH^- preferentially discharges to form O_2
→ colourless gas bubbles