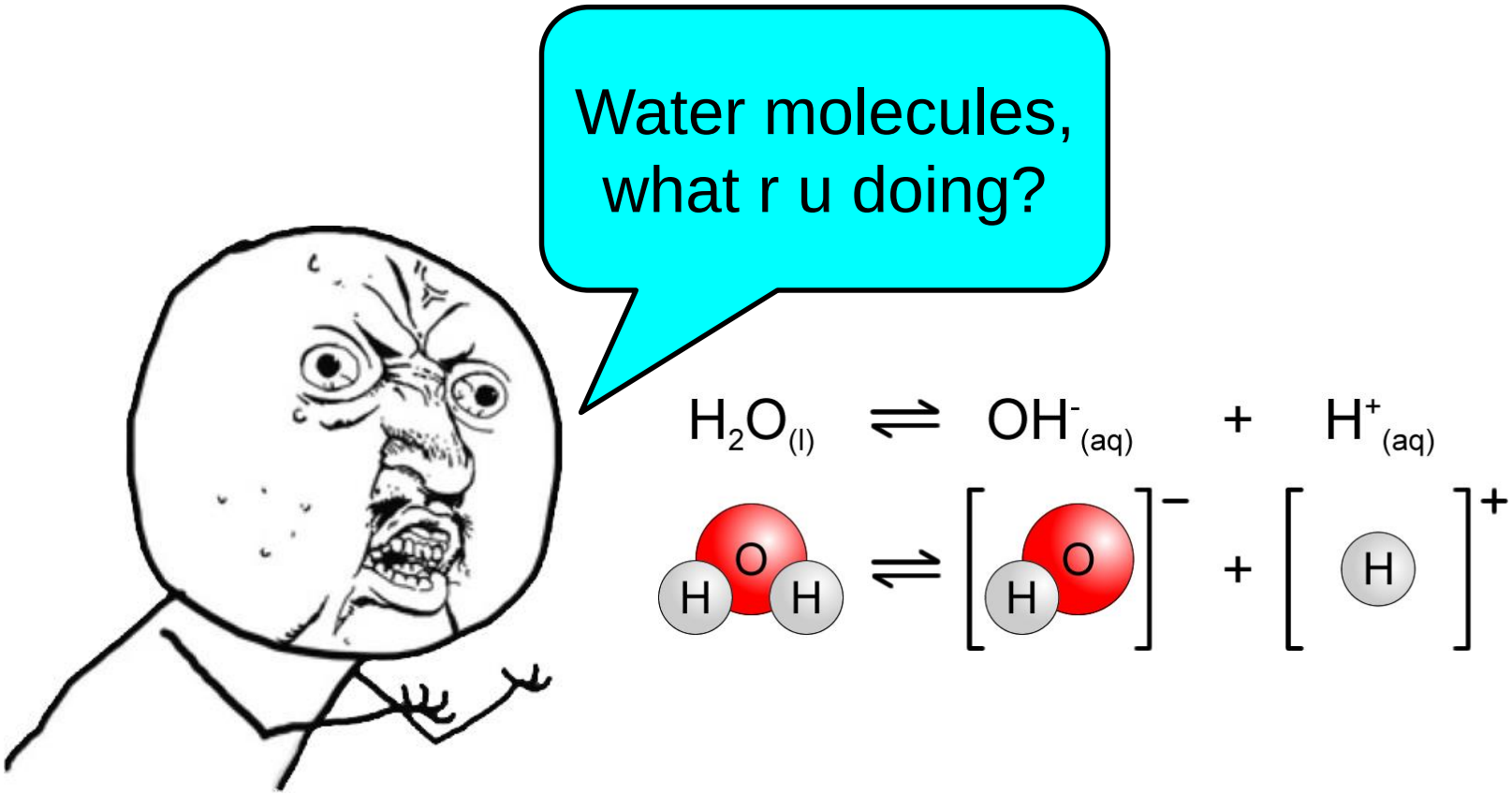
Problem…

…with the Electrolysis of Aqueous Salts?

Electrolysis Rage

Spontaneous Ionization of Water

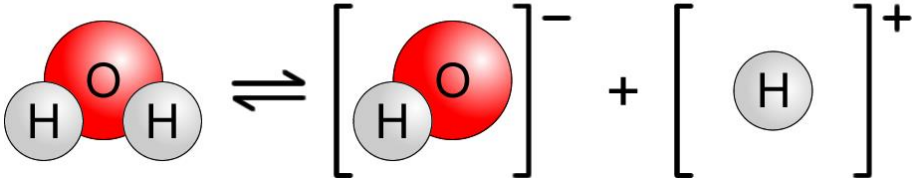


Electrolysis Rage

Spontaneous Ionization of Water

Water molecules spontaneously ionizes to form *OH^-* and *H^+*!

$$H_2O_{(l)} \rightleftharpoons OH^-_{(aq)} + H^+_{(aq)}$$

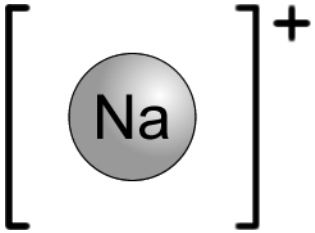


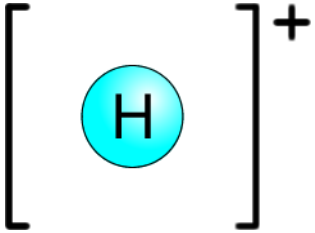
- The aqueous solution of a salt will contain *four ions*:
  - **1)** H^+ from water.
  - **2)** cation from salt.
  - **3)** OH^- from water.
  - **4)** anion from salt.

Electrolysis Rage

Electrolysis of Dilute Aqueous Sodium Chloride

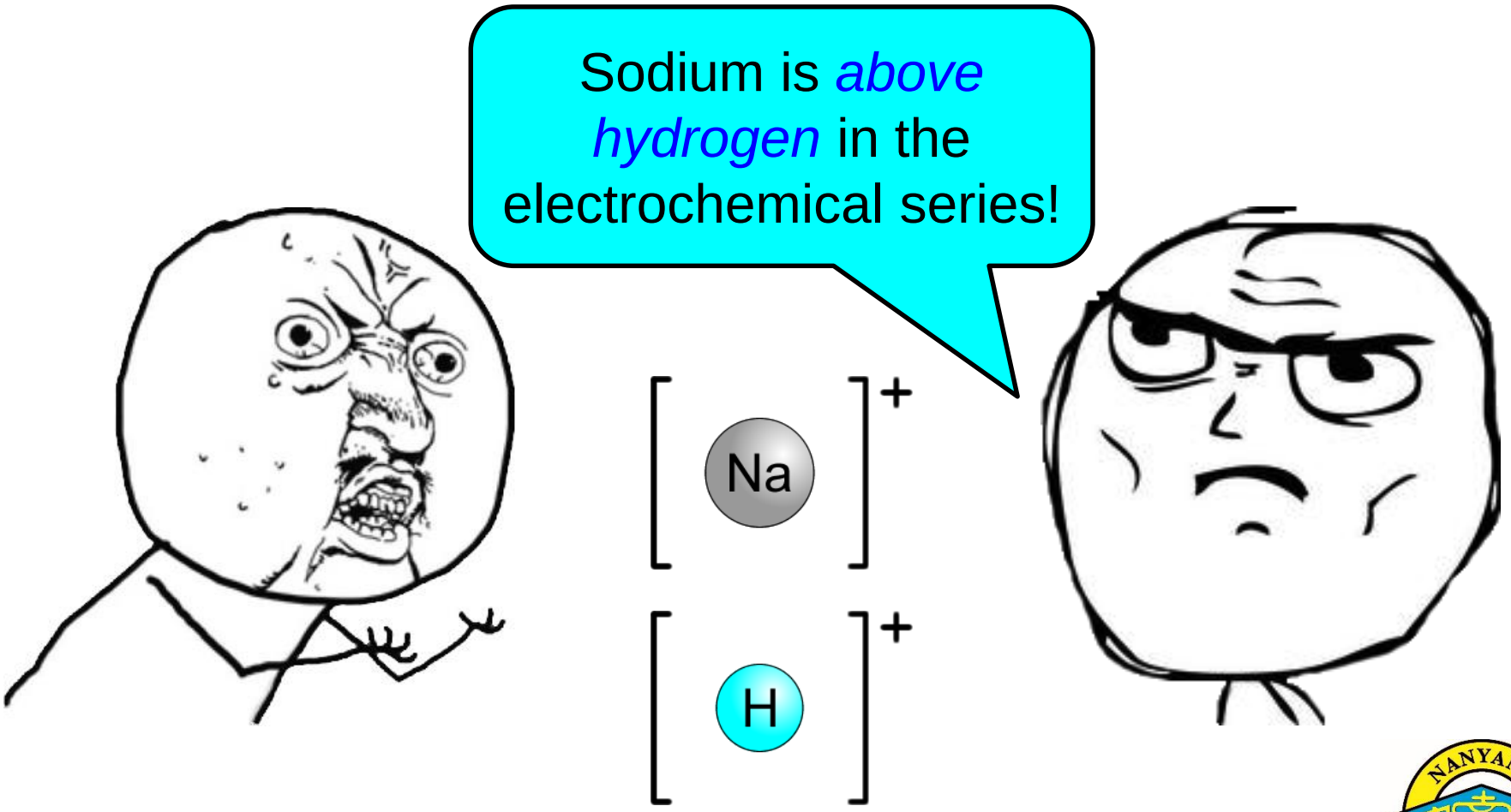
Sodium ions, y u no discharge?





Electrolysis Rage

Electrolysis of Dilute Aqueous Sodium Chloride



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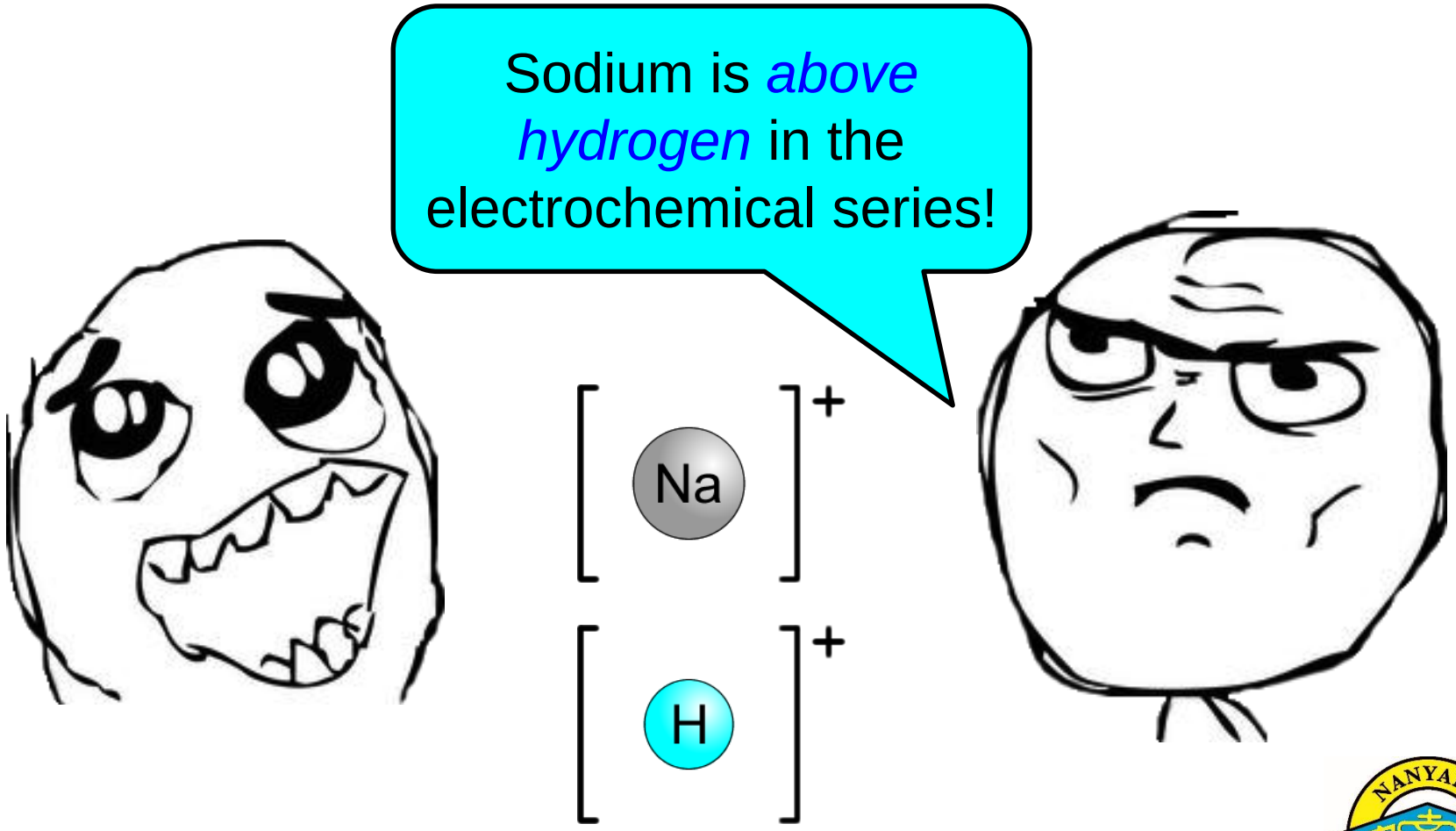
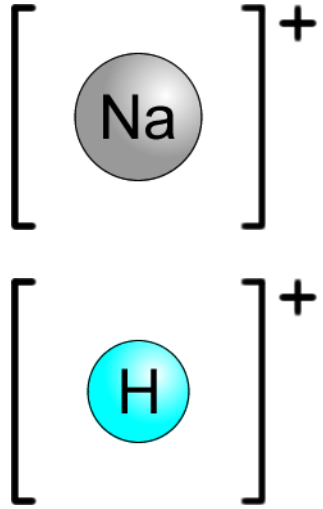


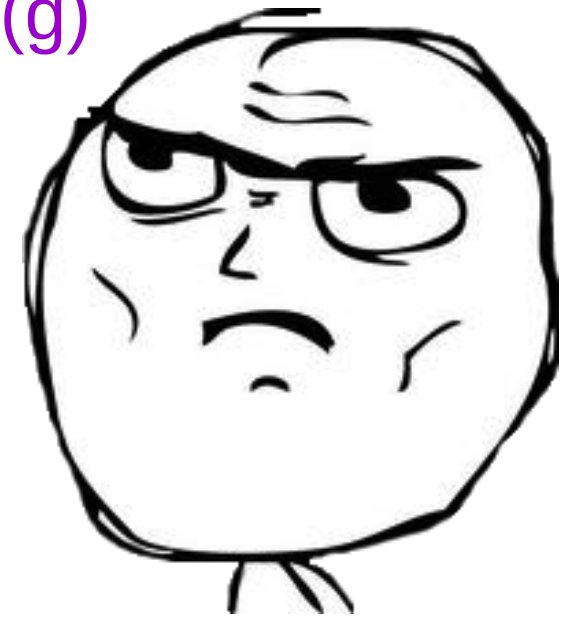
Electrolysis Rage

Electrolysis of Dilute Aqueous Sodium Chloride

Ions of the less reactive element (hydrogen) are preferentially reduced at the cathode:

$$2H^+(aq) + 2e^- \rightarrow H_2(g)$$





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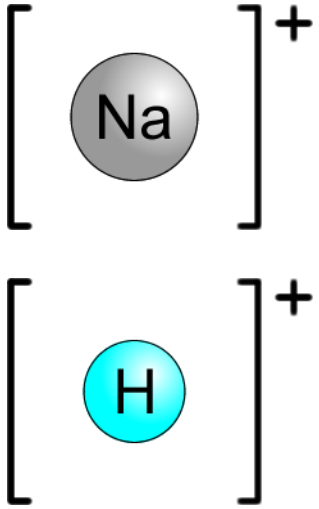

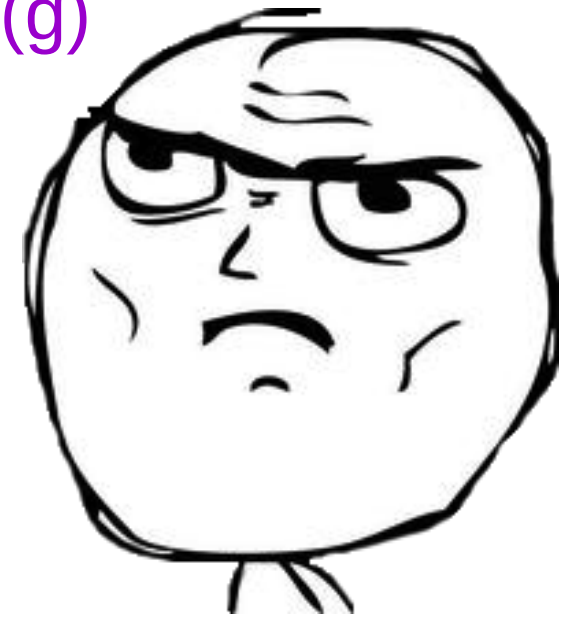

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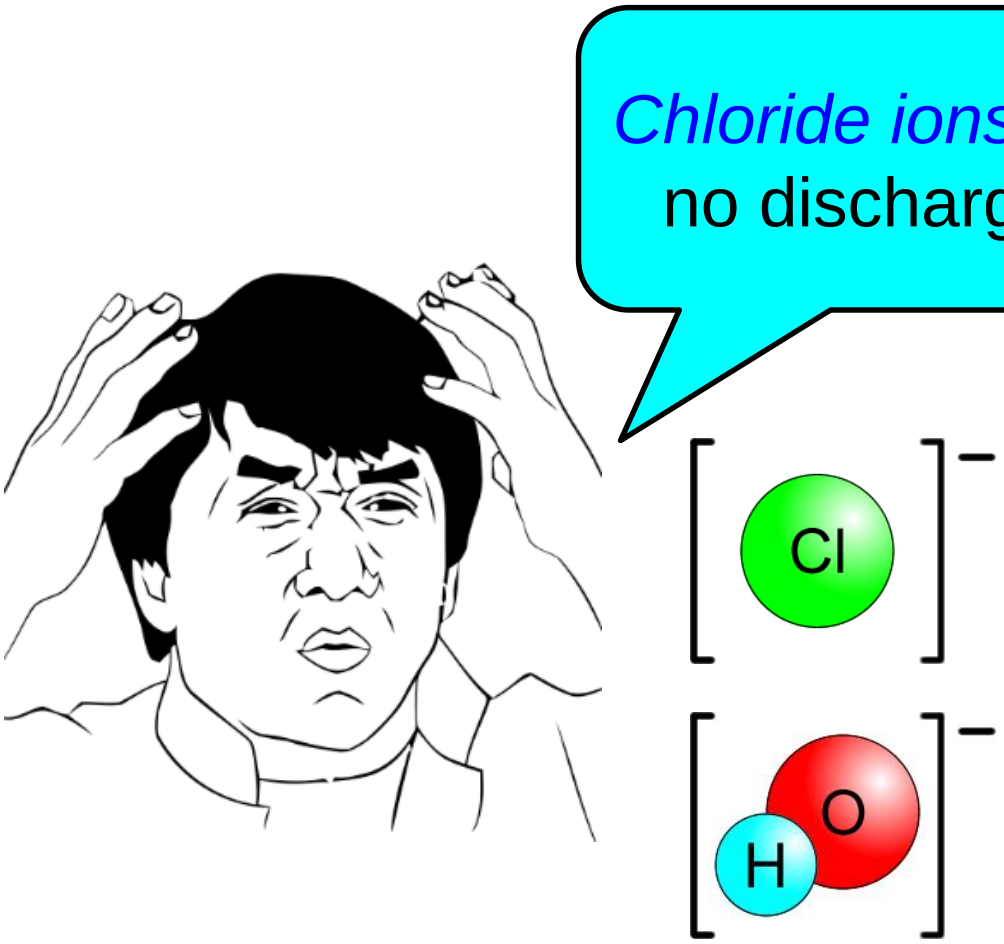
Electrolysis of Dilute Aqueous Sodium Chloride



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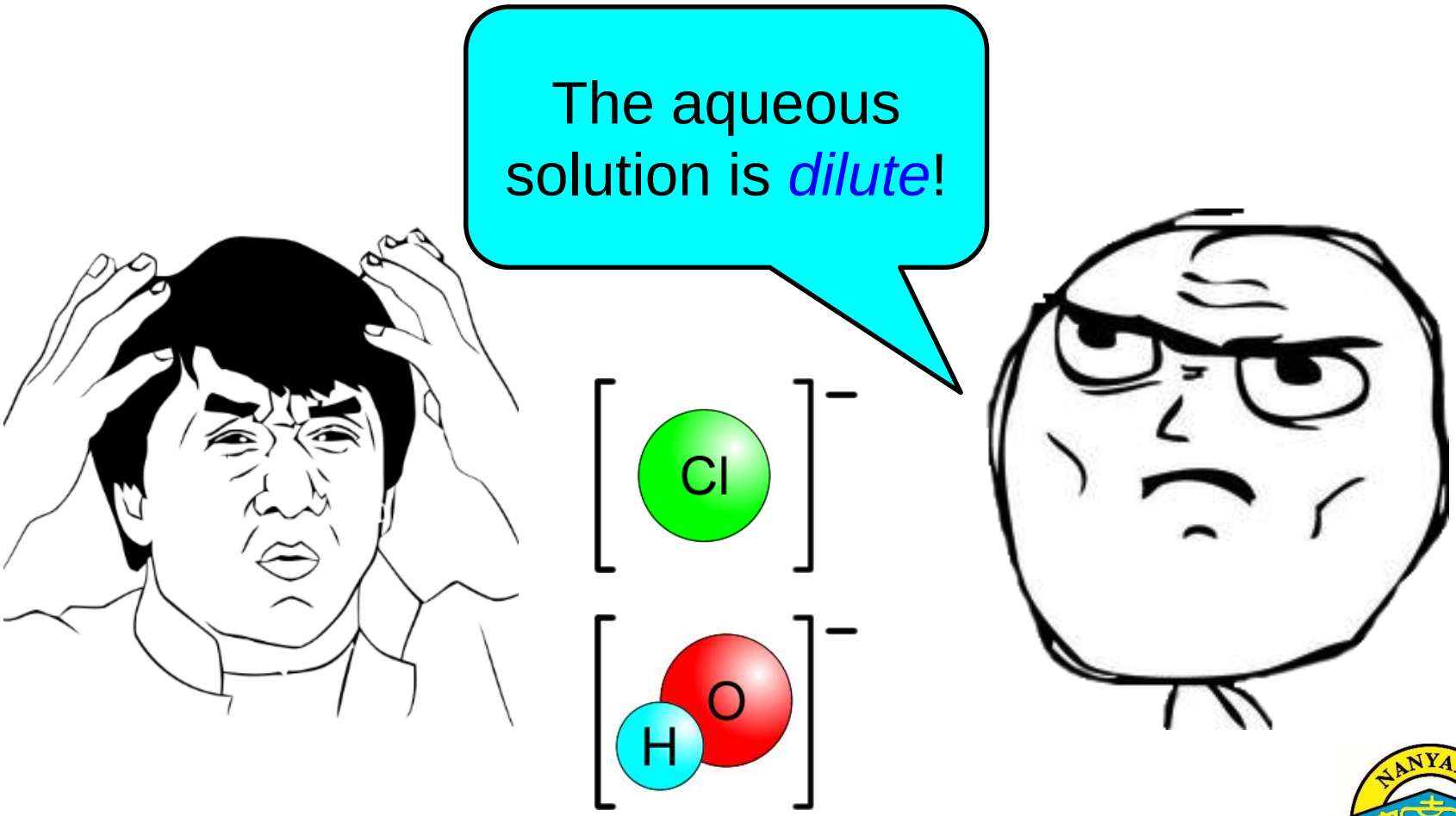

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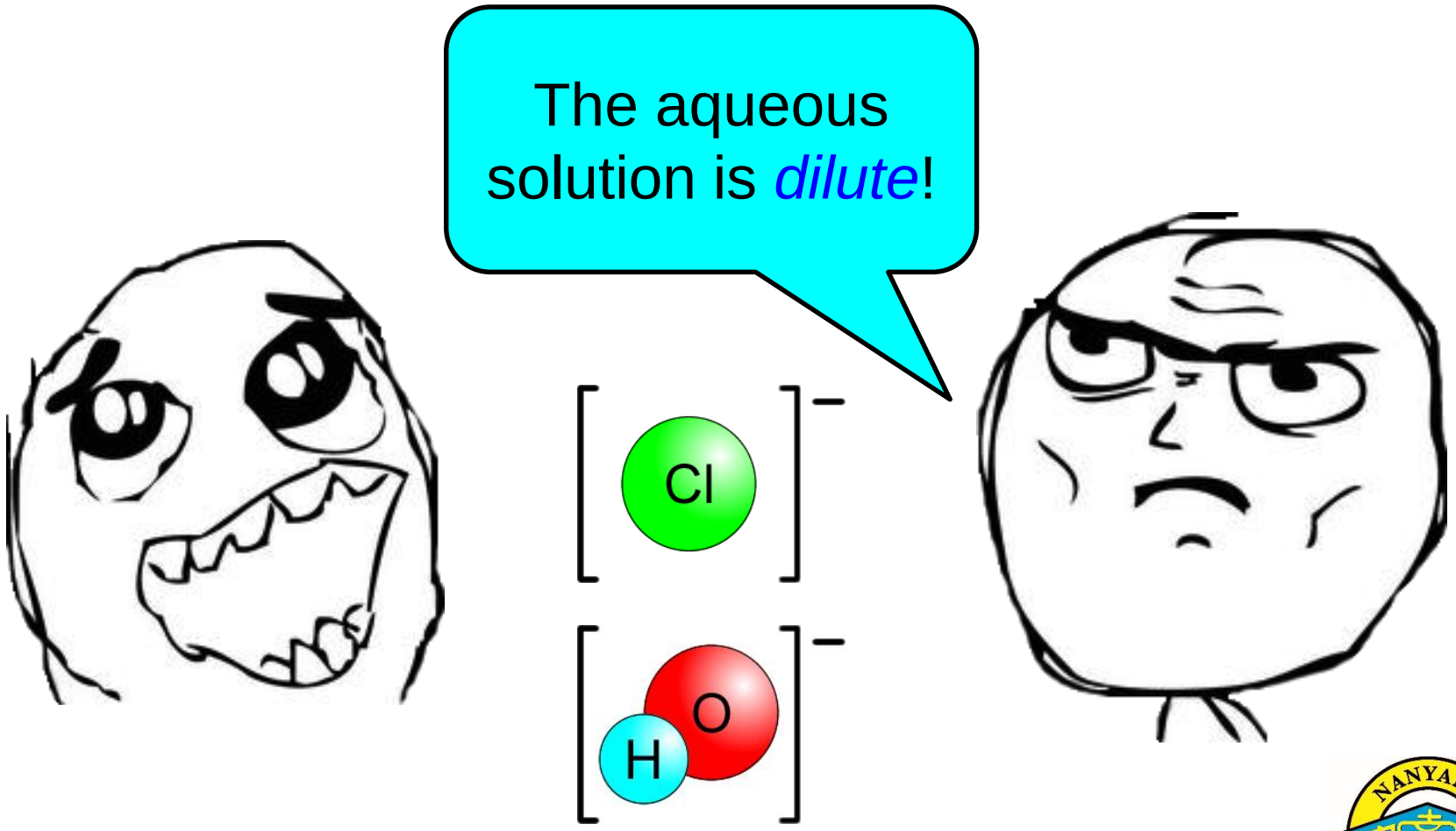
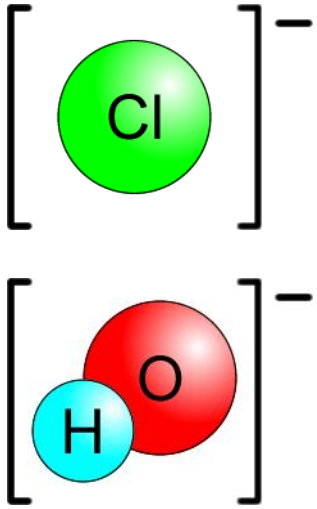


Electrolysis Rage

Electrolysis of Dilute Aqueous Sodium Chloride

Hydroxide ions are preferentially oxidised at the anode during the electrolysis of a dilute aqueous solution:

$$4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$$



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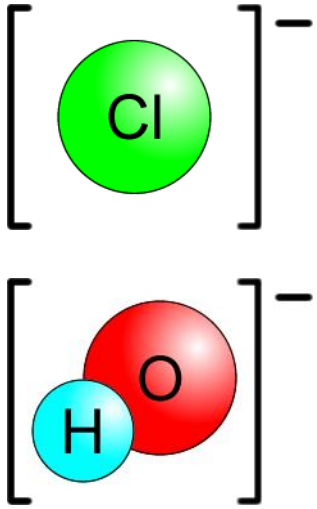
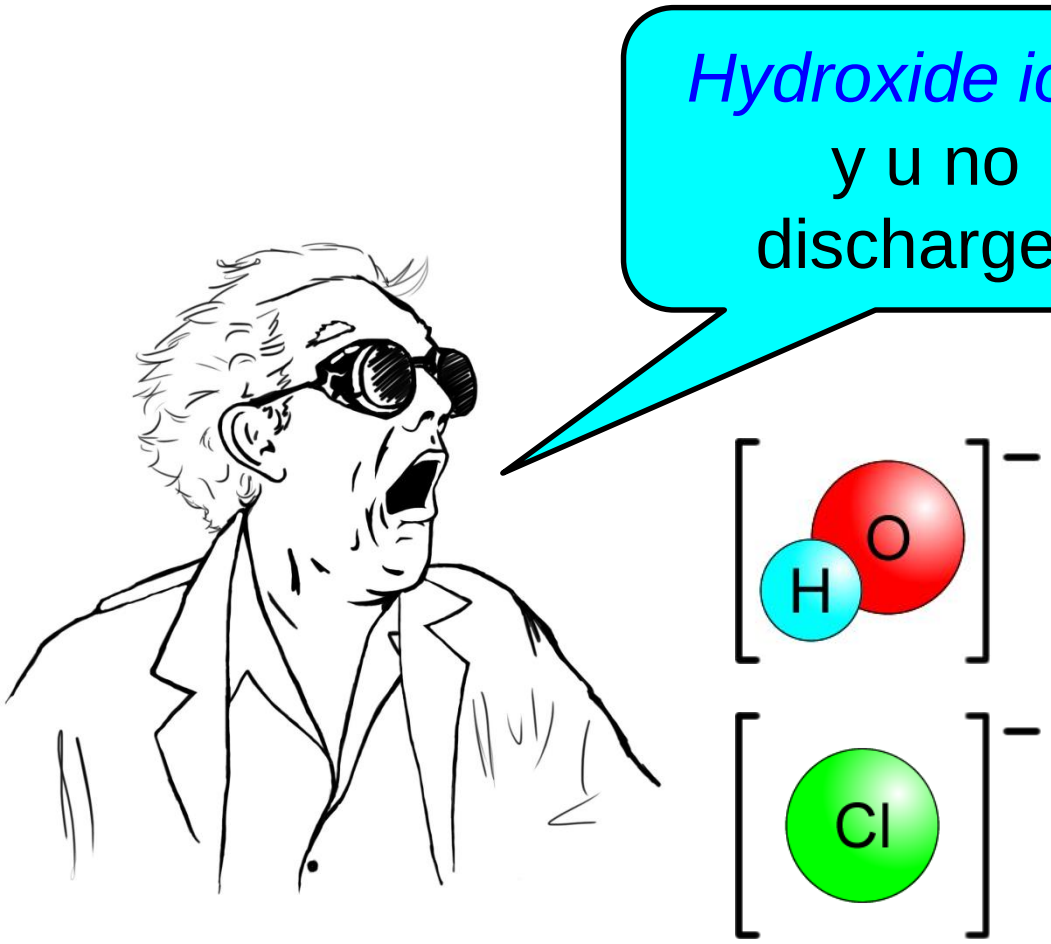


Electrolysis Rage

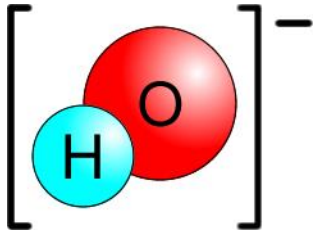
Electrolysis of Concentrated Aqueous Sodium Chloride

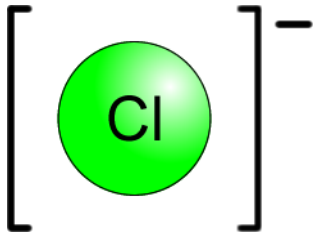


Electrolysis Rage

Electrolysis of Concentrated Aqueous Sodium Chloride

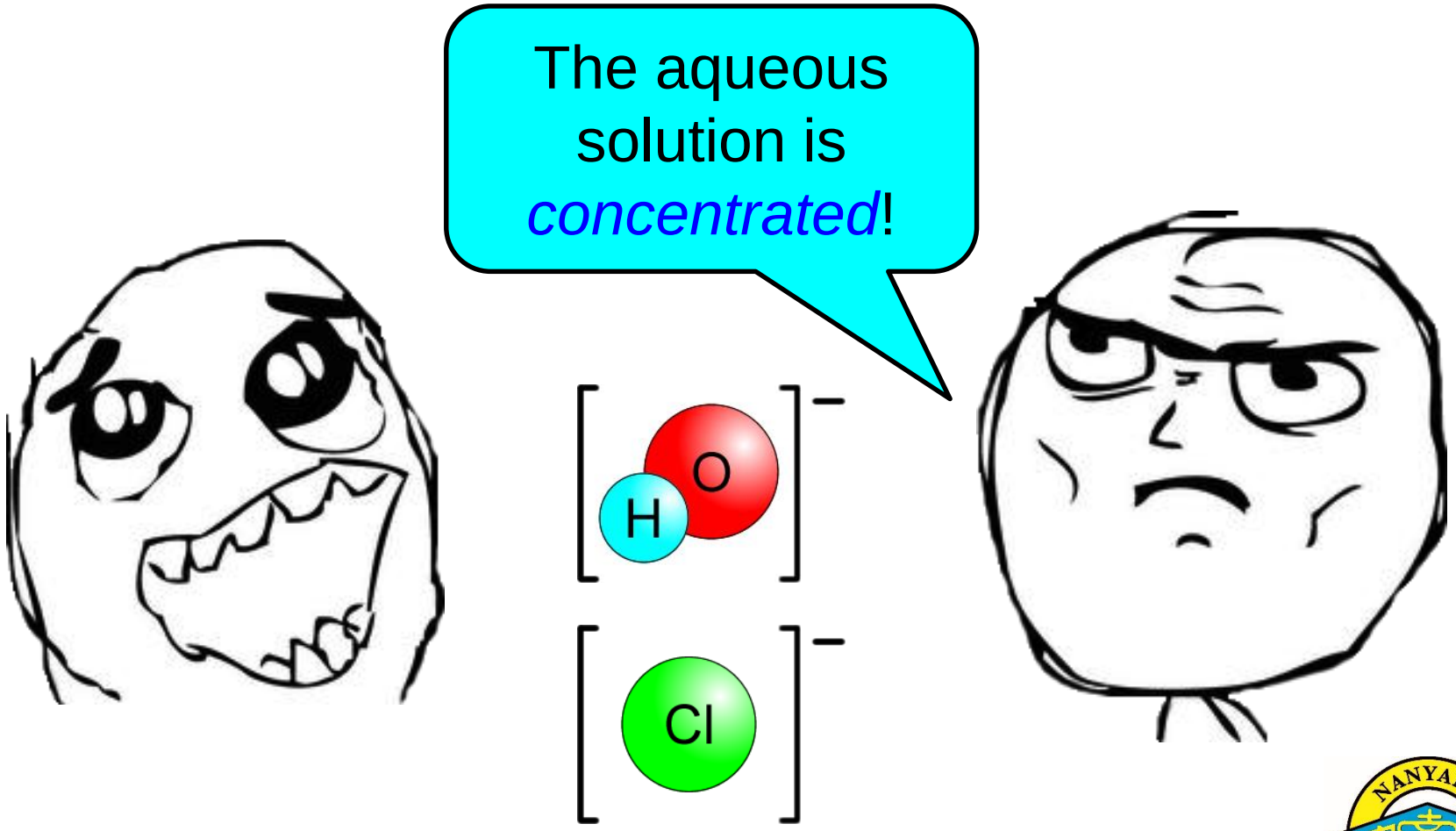
The aqueous solution is *concentrated*!





Electrolysis Rage

Electrolysis of Concentrated Aqueous Sodium Chloride

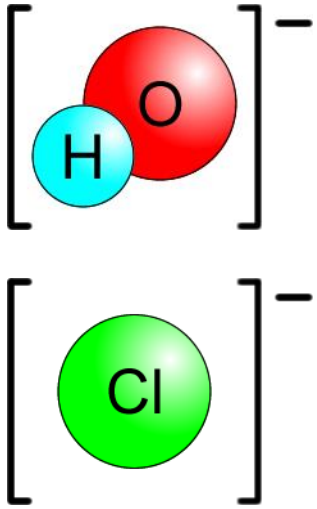


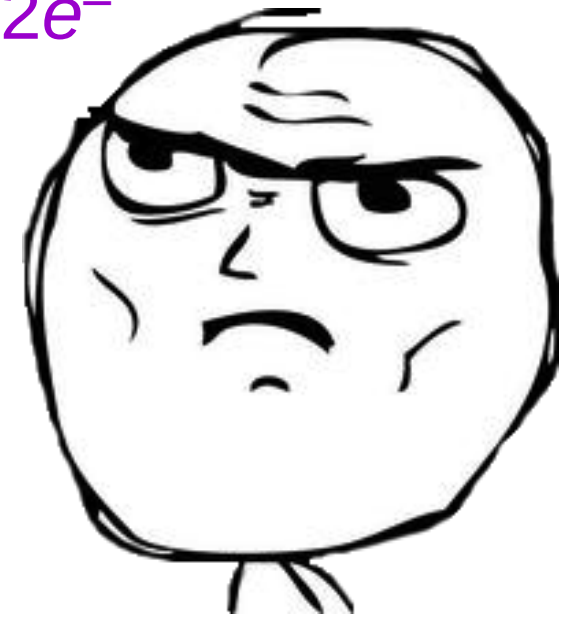
Electrolysis Rage

Electrolysis of Concentrated Aqueous Sodium Chloride

Chloride ions are preferentially oxidised at the anode to produce molecular chlorine:

$$2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$$





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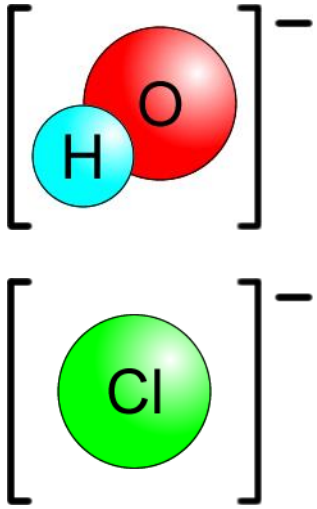
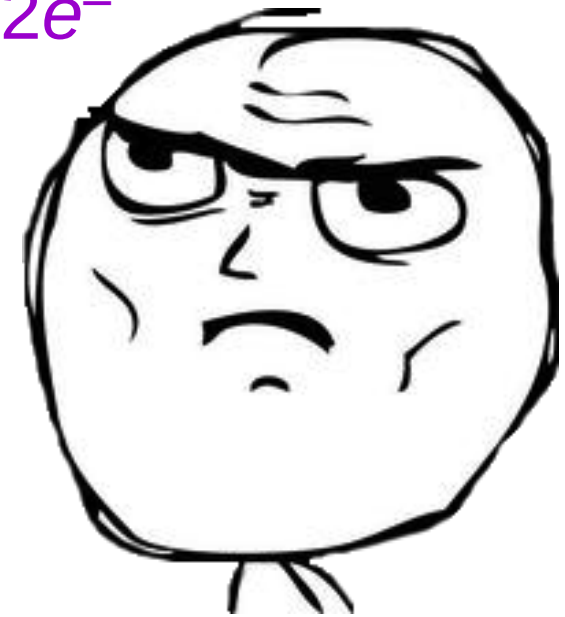
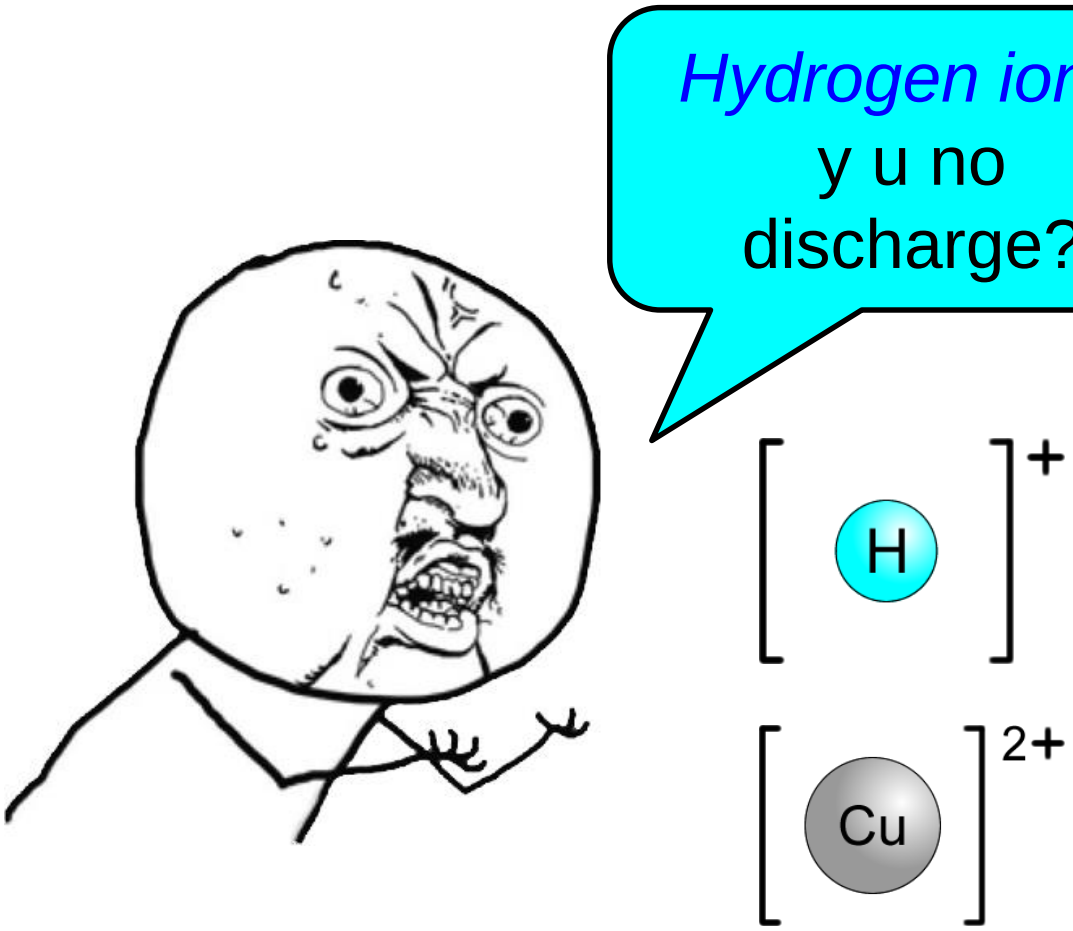




Electrolysis Rage

Electrolysis of Aqueous Copper(II) Sulfate



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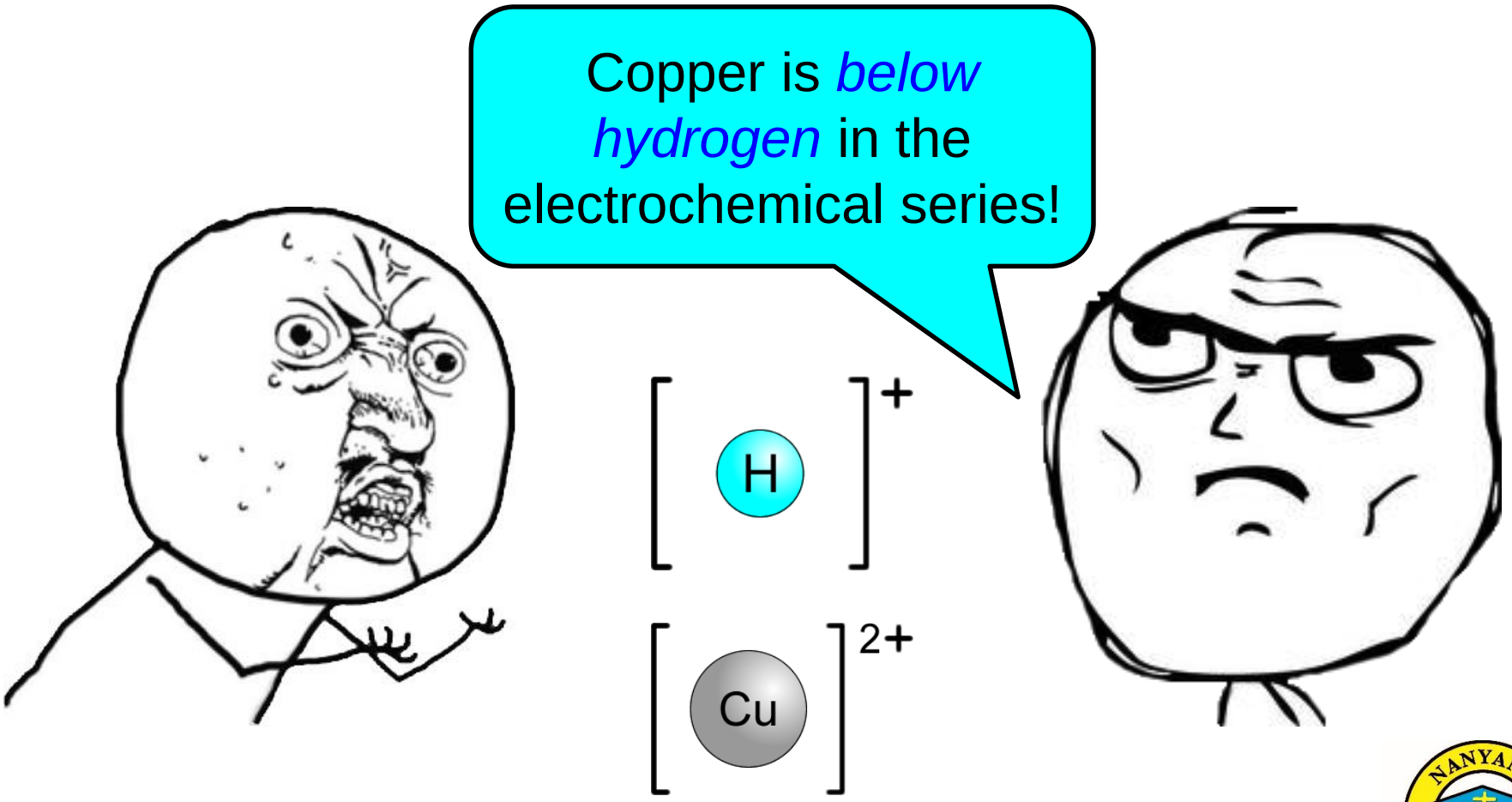

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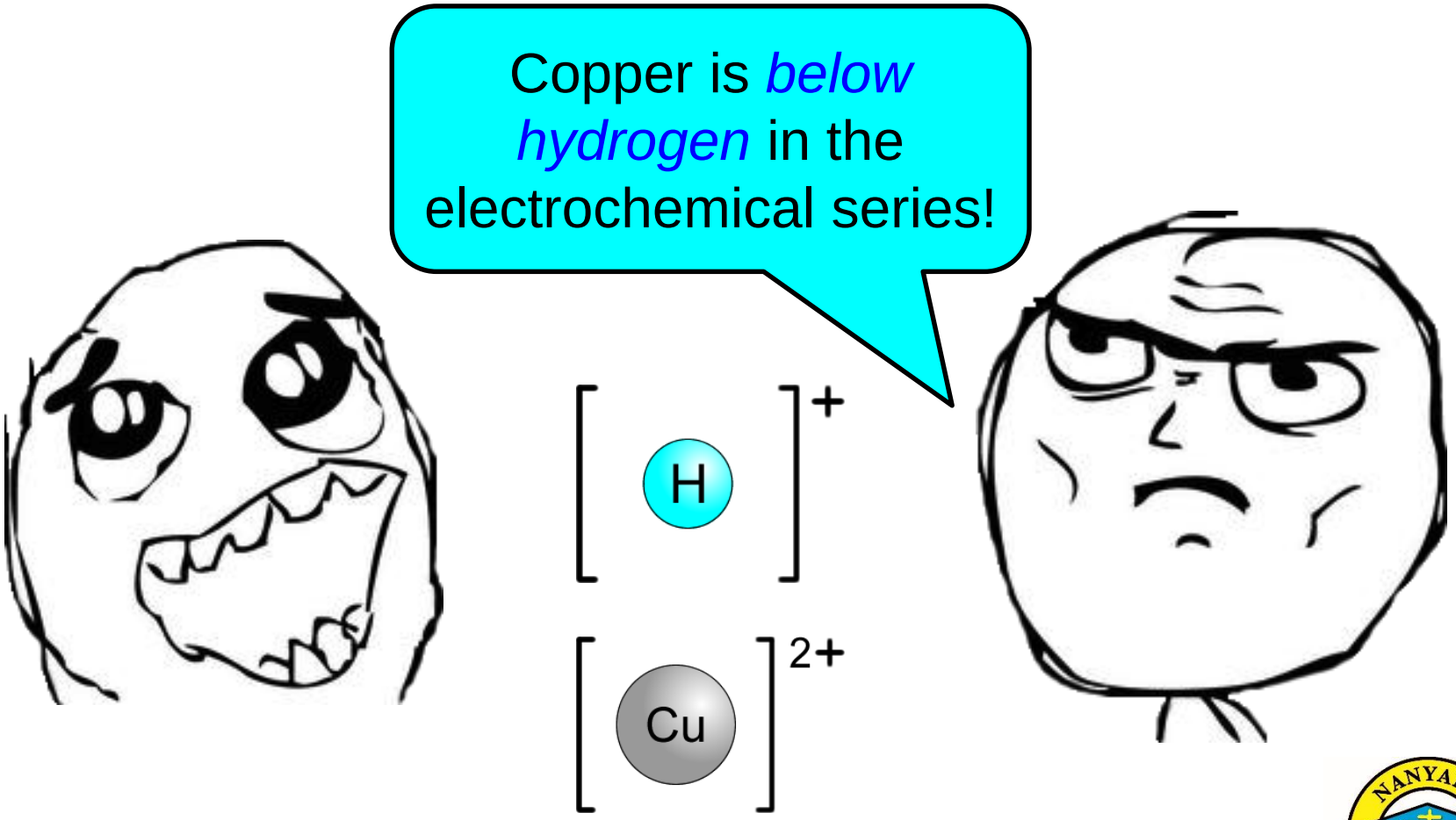

Electrolysis Rage

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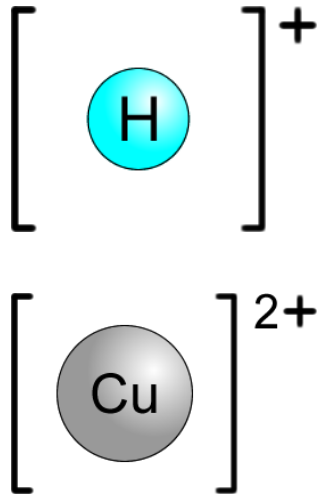
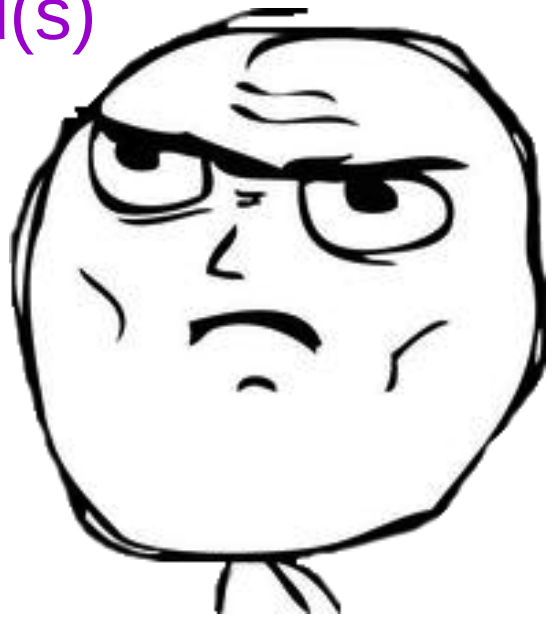
Ions of the less reactive element (copper) are preferentially reduced at the cathode:

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$





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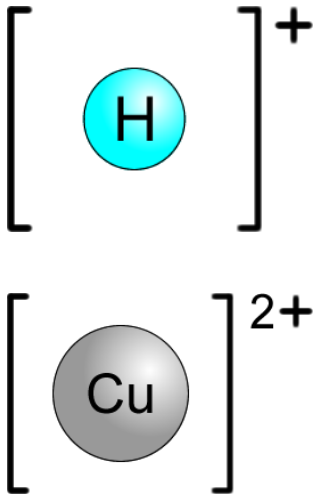
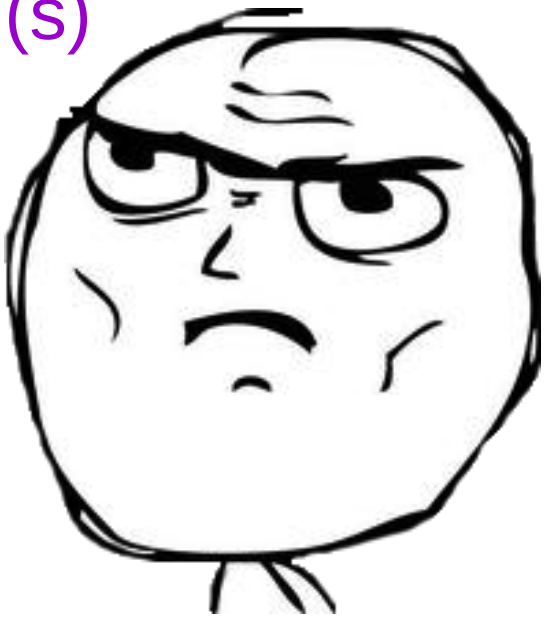
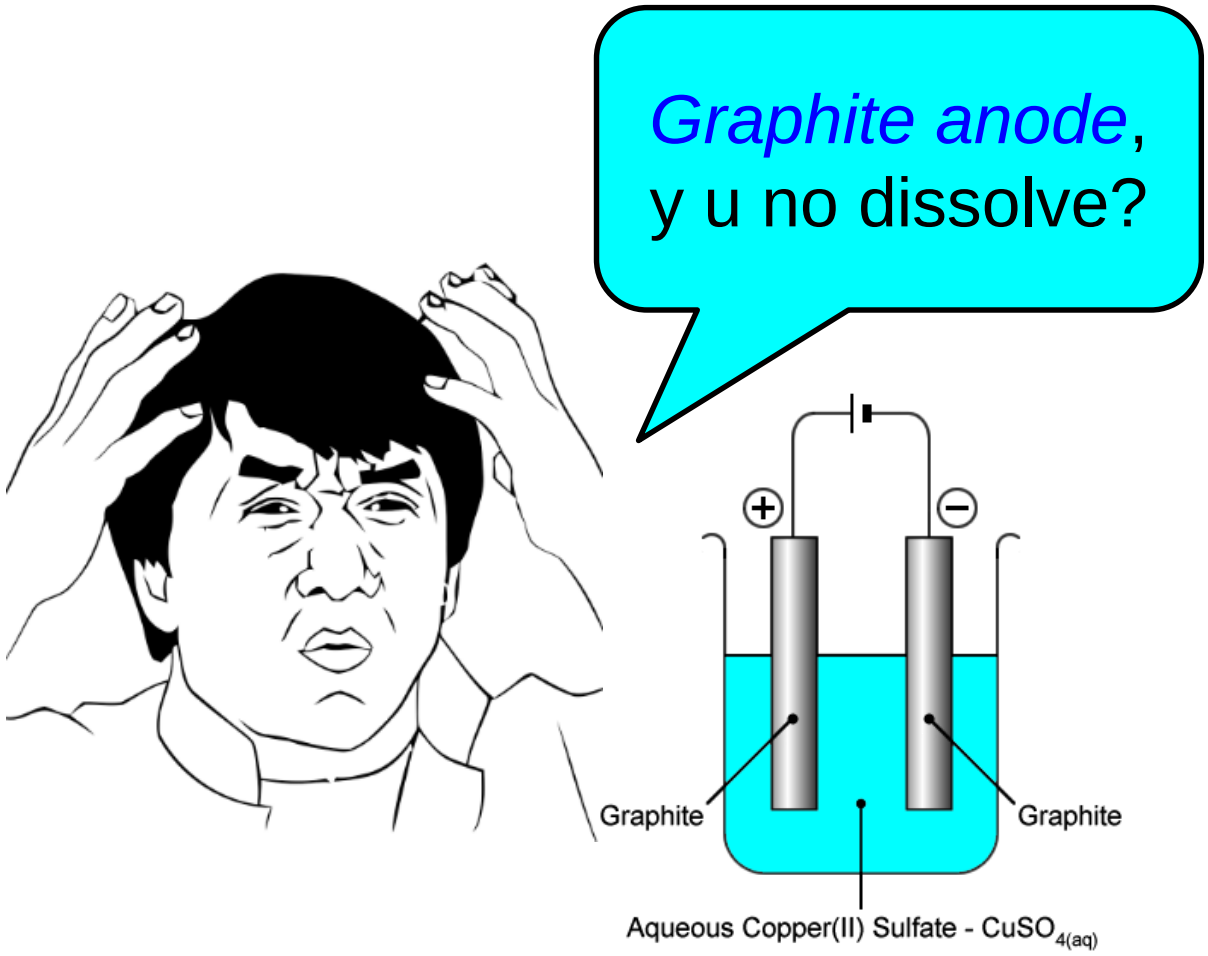




Electrolysis Rage

Electrolysis with Inert Graphite Electrodes



Electrolysis Rage

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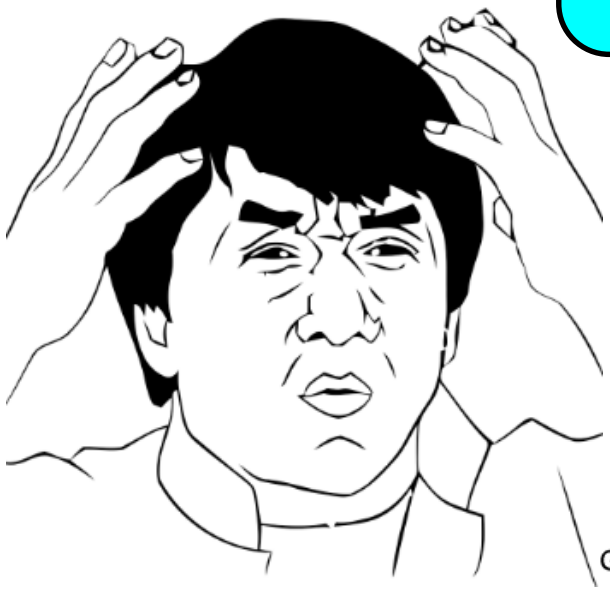
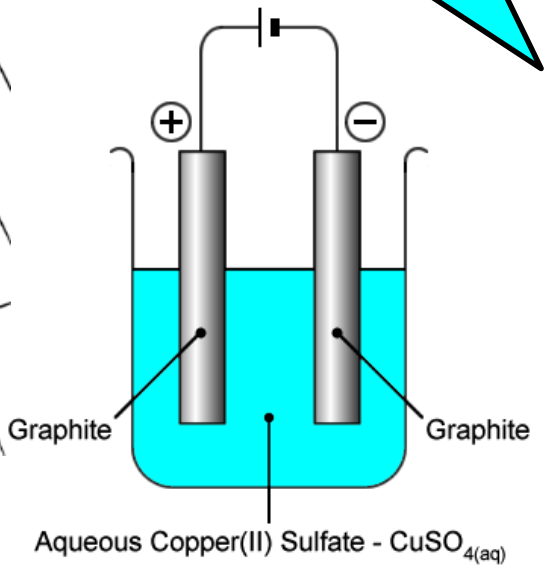


Graphite is *inert* and will *not react* during the electrolysis!



NANYANG GIRLS' HIGH

Electrolysis Rage

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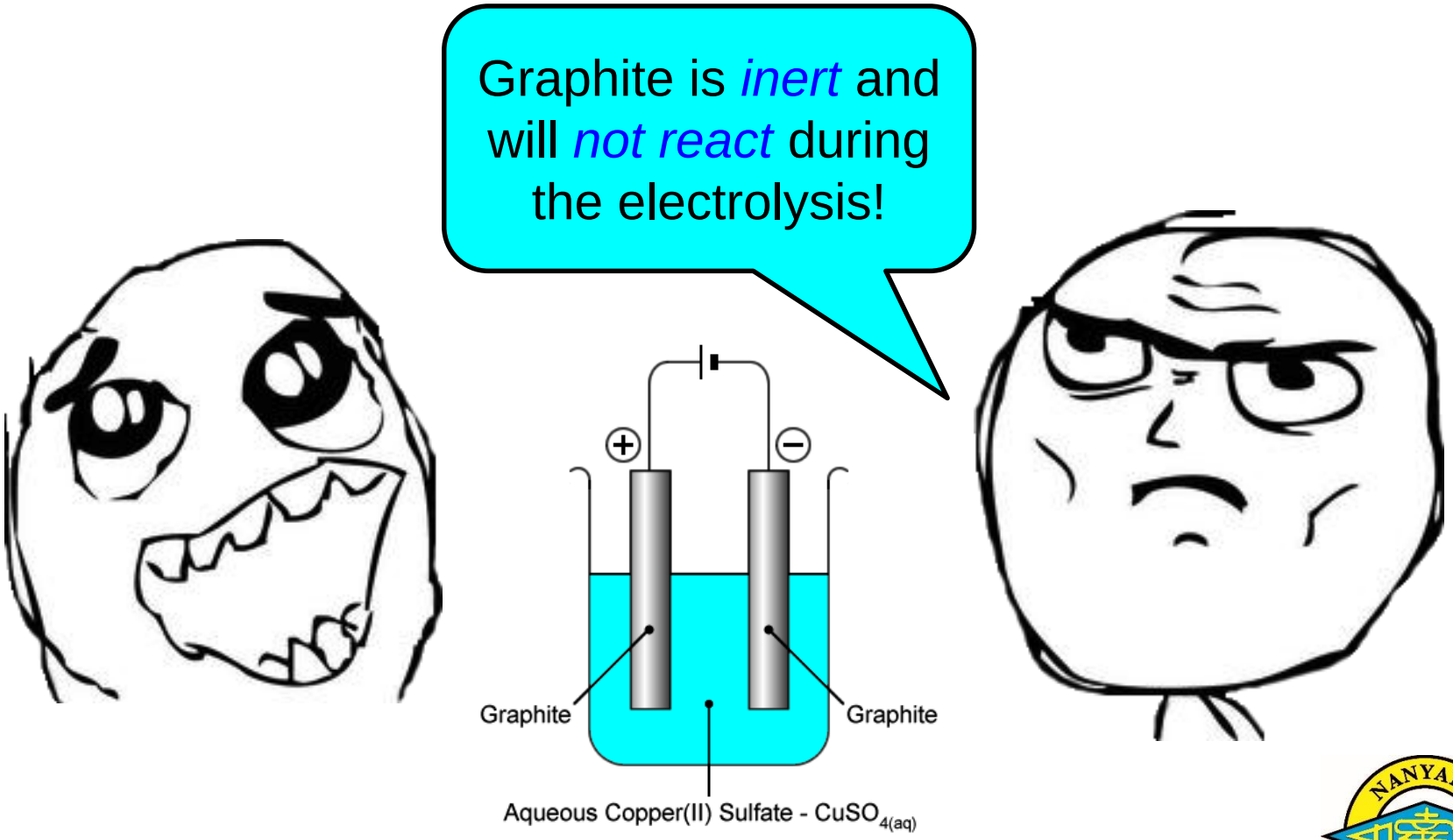
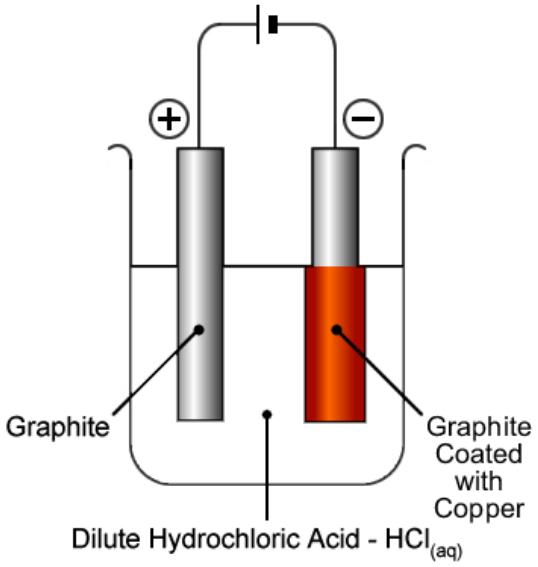


Electrolysis Rage

Electrolysis with Inert Graphite Electrodes

Graphite and platinum can both be used as inert electrodes.



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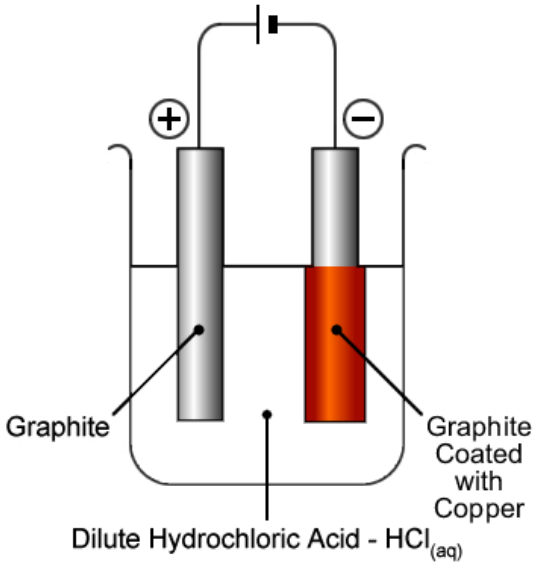
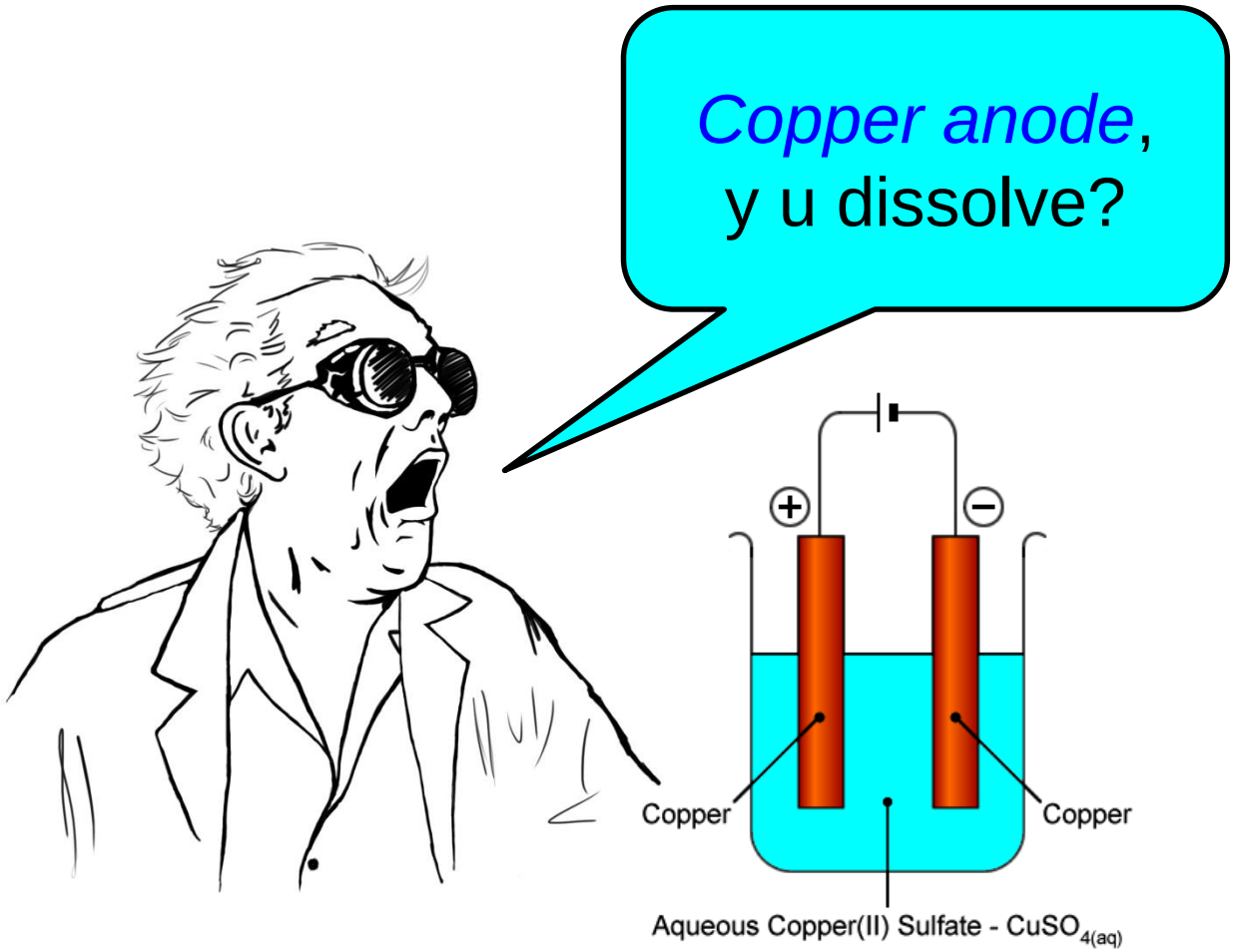


Electrolysis Rage

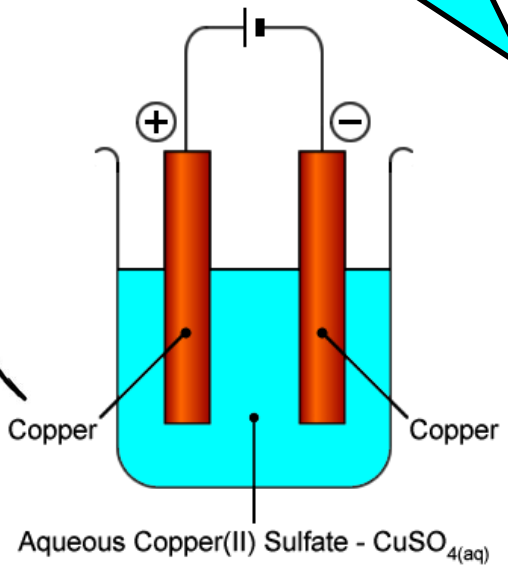
Electrolysis with Active Copper Electrodes



Electrolysis Rage

Electrolysis with Active Copper Electrodes

If the *anode* is made of *copper*, then it will be *oxidised* during electrolysis!



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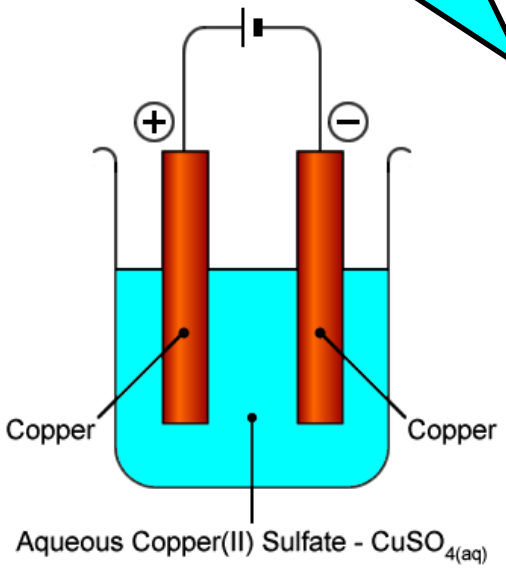
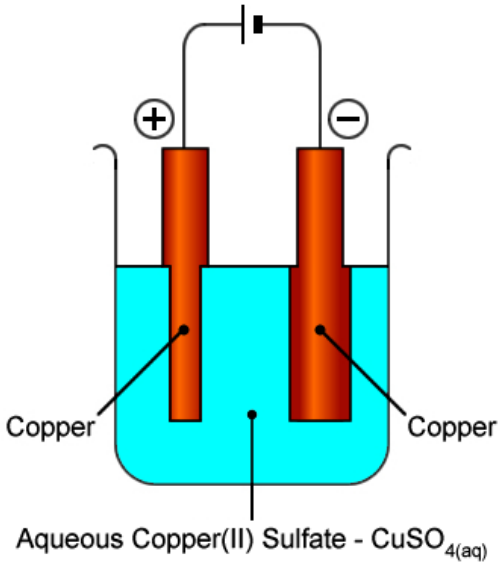


Electrolysis Rage

Electrolysis with Active Copper Electrodes

If the anode is made of metal, then atoms of the metal can be oxidised to metal cations which dissolve into the solution:

e.g. $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$



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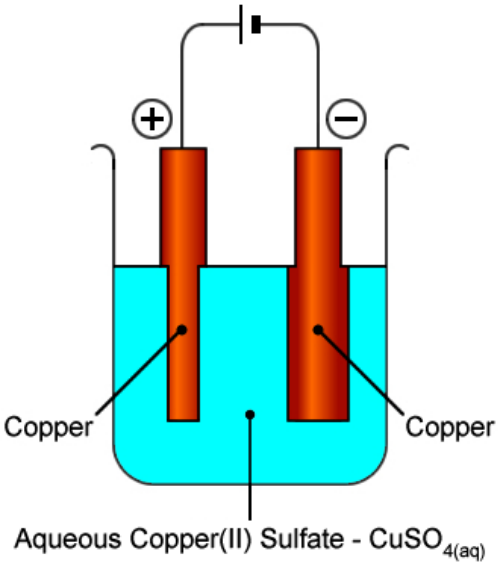

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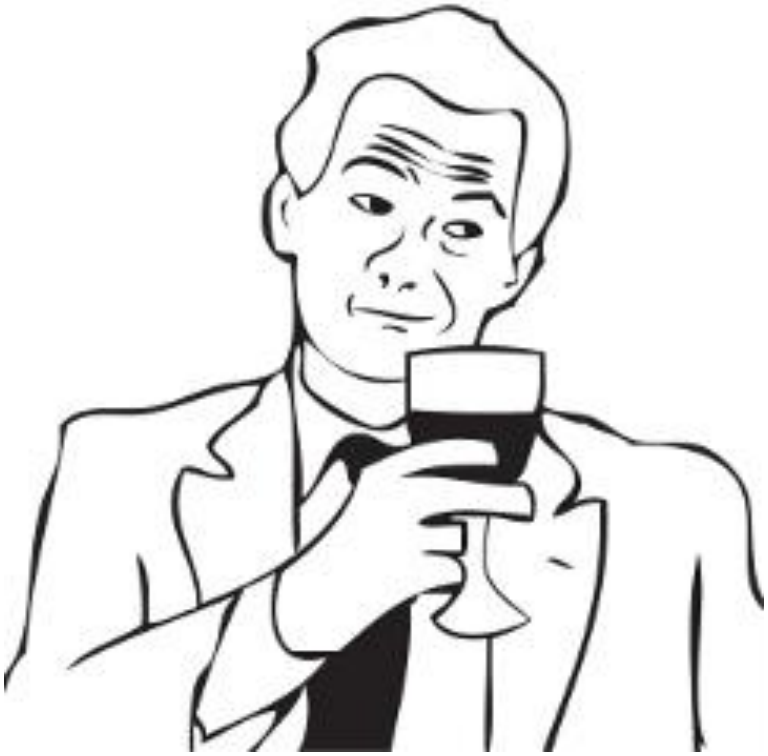

True Story

Told by Dr. Chris Slatter
Nanyang Girls' High School
8th February 2016