

Exam 4 starts here.

Electromagnetic Chemistry.

4/11/13

Macroscopic Look Chemical Change.

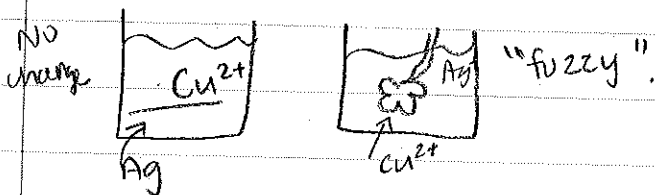
- Silver/copper ions & Copper

Solution: Copper 2 sulfate.

powder in silver nitrate! - in beaker → it turned into ^{Silver metal.} algae.
in blue water put in silver wire.

- Aluminium foil pipe; Copper 2 chloride, powder in beaker,
the foil started to shrink and gas is coming out.

color was green → now it's black. at the bottom
its copper.



Microscopic Thought Chemical Change.

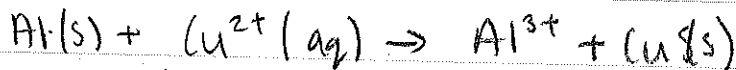
Pol1

The electrons are lower in energy in:

Silver metal because: → (redox reaction caused becaz electrons moving in lower energy.)

Copper metal → cu have multiple oxidation states.

→ copper normally has +1 or +2. Metals form cation.



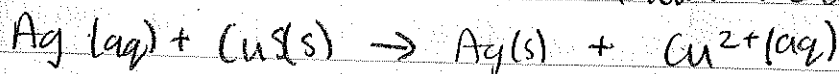
Al "dissolved"

Aluminum give off electron to form Aluminum.

Pol1

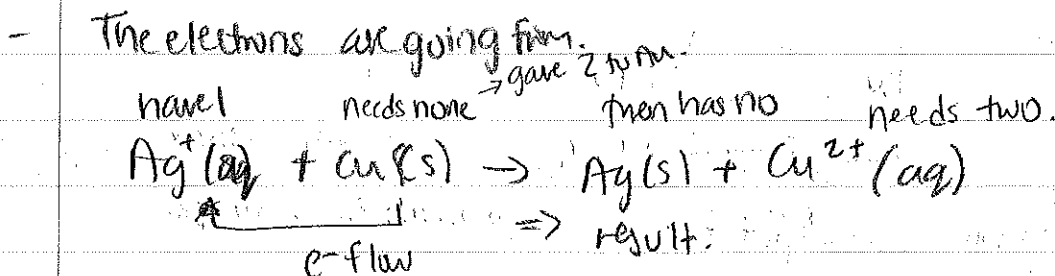
Copper: because the e- left Al(s) moved to Cu²⁺
to make Cu(s) (more stable & lower in energy).

Pol1



The electrons are moving from where to where? →

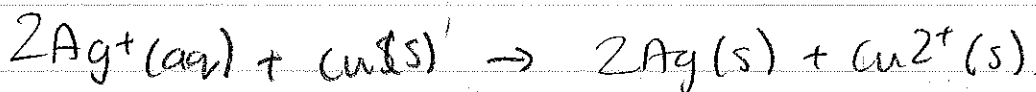
Is this reaction balanced? → **NO**



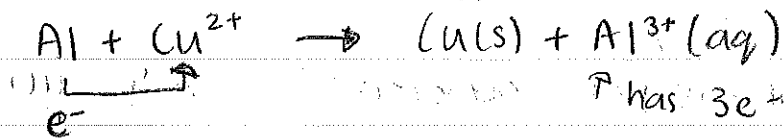
The electrons are moving between reactants.

Moving from reactant to reactant.

Mass is balanced. but charge is not balanced.

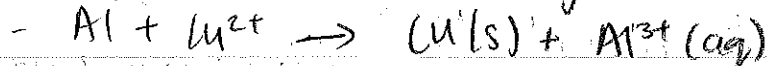
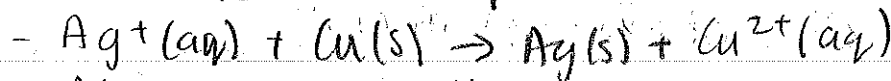


- Model movement of electrons:



Is this reaction balanced - **NO**

Poll • When will these reactions stop?



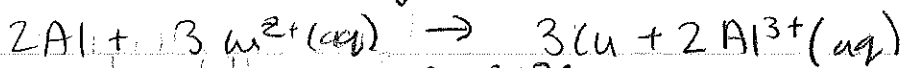
• When the systems come to equilibrium.

What is the equilibrium constant?



$$K = \frac{[\text{Cu}^{2+}]}{[\text{Ag}^+]^2}$$

product favored



$$K = \frac{[\text{Al}^{3+}]^2}{[\text{Cu}^{2+}]^3}$$

product favored

The free energy should be negative.



is that reaction product favored or reactant favored?

$$K = \frac{[\text{Ag}]^2}{[\text{Cu}^{2+}]}$$

no detectable change
so reactant favored.

reactant favored (Ag wire just sits).

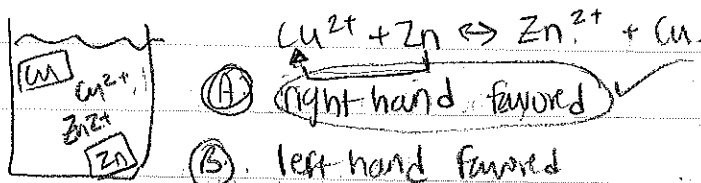
when free energy is positive.

ΔG & K ?

$$\Delta G = -RT \ln K$$

→ Oxidation loss of e^-

• work function - how much energy it takes to eject the electron from metal.



→ Copper is lower in energy - electrons go to side where lower in energy.

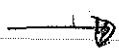
POU How many electrons are moving in this reaction?



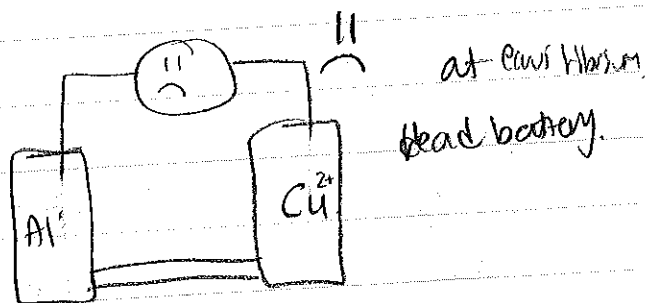
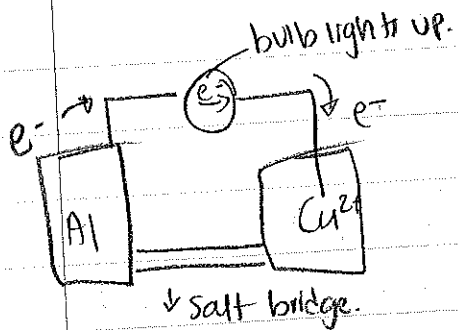
3 electrons given to Cu, and since we have 2 Al then $3 \times 2 = 6$

Free energy of $2\text{Al} + 3\text{Cu}^{2+} > 3\text{Cu} + 2\text{Al}^{3+}$

reactants

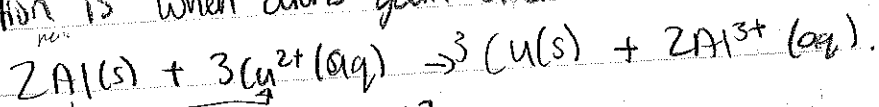


products.



Separate reactions physically into two compartments.

- Oxidation is when atoms loses electrons.
- reduction is when atoms gain electrons.



What is undergoing oxidized?

Ⓐ Aluminium is being oxidized.

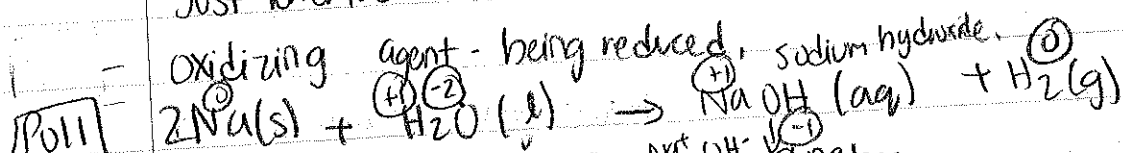
6 electrons being transferred.

OIL RIG Oxidation is lost reduction is gain.

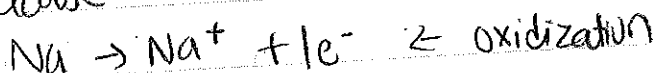
LEO says GER Loss of e⁻ oxidation, Gains of e⁻ reduction.

JREMIT GROR

Just remember it: Gain reduction / oxidation loss.



Ⓐ Na - because



pure metal, cation metal or anion → physically the charge.
is +1. OH⁻.

assign oxidation #.

H₂O has no charge, must add up to 0.
OH → add up to (-1). Oxygen has -1.