Electrochemistry

November 26, 2024 4:51 PM

Section 13:

R ? Q: Yes on my notes it was Section 12: "...this chapter is terrible" - so yes it is Section 12
And for Section 13: "I'm so funny... to discuss a few things... before we can drive into electrochemistry" ... so sorry I was thinking of that note I had on hand to be related to electrochemistry - but here is the true comments of Section 12 and Section 13....

Splitting up oxidation and reduction

The aluminothermic reduction of iron reaction (Reaction 10) is a nice stepping stone to transition into the business that this chapter is supposed to be about: electrochemistry! You see, as the name implies, iron is being *reduced*. This means that iron is gaining electrons (perhaps you've heard that LEO the lion says, "GER," reminding us that we **L**ose **E**lectrons in **O**xidation and **G**ain **E**lectrons in **R**eduction). We can write out just the most simple thing that is happening to iron in the reaction

$Fe_2O_3 + 2Al^0 \longrightarrow Al_2O_3 + Fe^0$ is thermodynamic!

(Fe_2O_3: $2\times3^+$, 6^-; Al_2O_3: $2\times3^+$)

$Al^0 \longrightarrow Al^{3+} + 3e^-$ "oxidation"

$[Ne]\,3s^2 3p^1 = 1s^2 2s^2 2p^6 3s^2 3p^1$

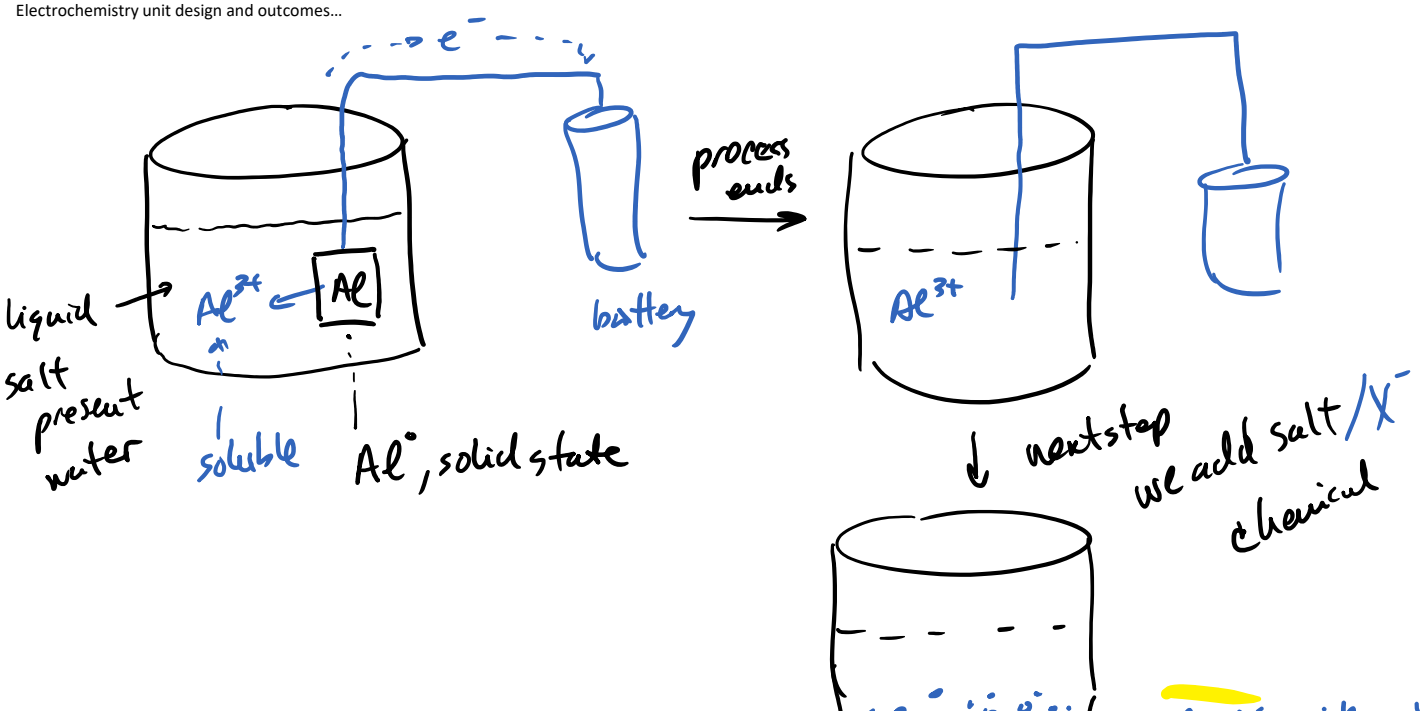
Electrochemistry

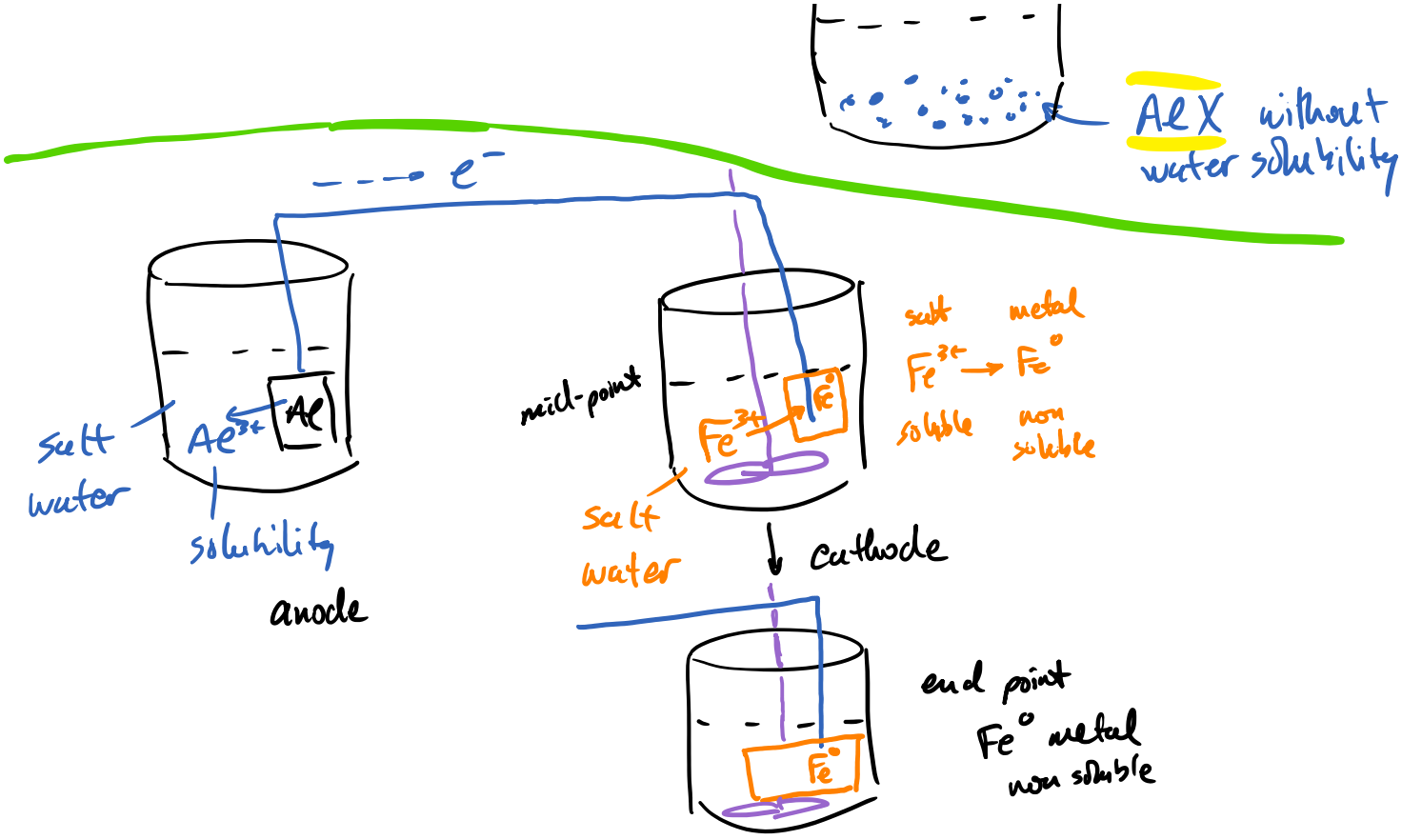
$Fe^{3+} \xrightarrow{+3e^-} Fe^0$ "reduction"

"salt" "metal"

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

Electrochemistry unit design and outcomes...




AlX without water solubility
e⁻
salt water
Al³⁺
Al
solubility
anode
mid-point
Fe³⁺
Fe°
salt water
salt
metal
Fe³⁺ → Fe°
soluble
non soluble
cathode
end point
Fe° metal
non soluble

Re: slide 11 from November 25: https://www.svpscentre.utoronto.ca/2024/11/12/december-6-2024/

Electrochemistry → Mineral Process

$Zn^{2+} Fe^{2+} (S_2)^{(2+2^-)}$

zinc - iron - sulfur

oxygen water

mass balance ⇒ $4\,ZnFeS_2 + 19\,O_2 + 4\,H_2O$

how to mix?
require heat?

$4\,Zn^{2+} + 2\,Fe_2O_3 + 8\,H_2SO_4$

iron oxo sulfuric acid

water add

$S^{2-} \rightarrow S^{2+} \rightarrow S^{4+} \rightarrow S^{6+}$

$S^0\ 1s^2 2s^2 2p^6 3s^2 3p^4$

solubility - $4\,Zn^{2+} + 8\,H_2SO_4$ "separated" $2\,Fe_2O_3$ - low solubility

electrochemistry 0.763V

water still present.

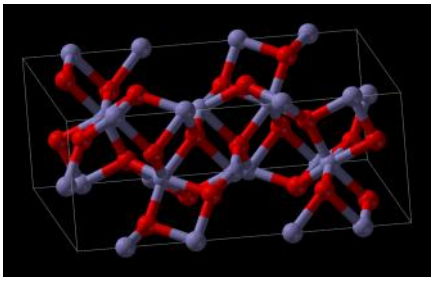
$4\,Zn^0 + 8\,H_2SO_4$

electro chemistry

maybe solubilize it?

$2\,Fe^0 + 3\,O_2$

solid

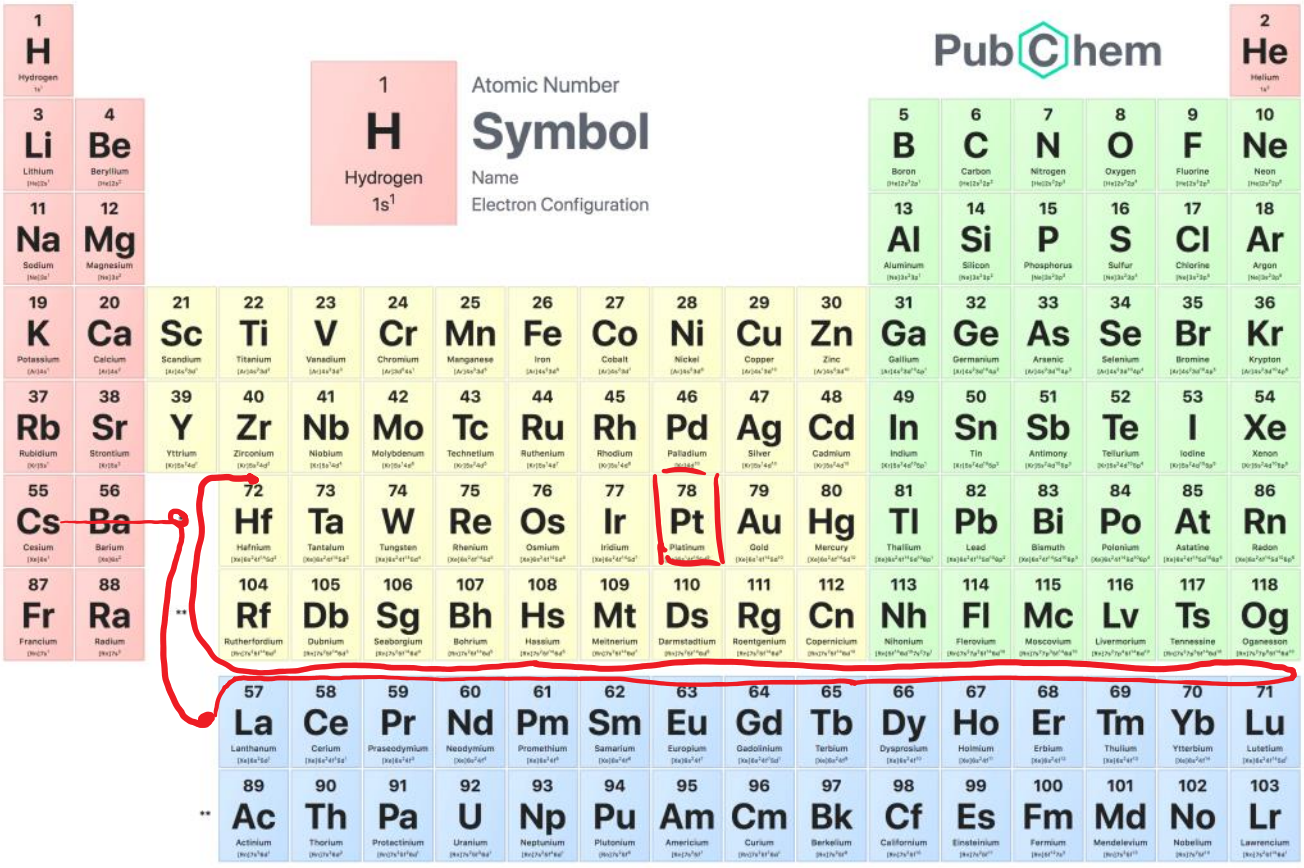


3D

Reduction Reaction	E° (V)
$Li^+_{(aq)} + e^- \rightarrow Li_{(s)}$	- 3.045
$Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn_{(s)}$	- 0.763
$Fe^{2+}_{(aq)} + 2e^- \rightarrow Fe_{(s)}$	- 0.44
$2H^+_{(aq)} + 2e^- \rightarrow H_{2(g)}$	0.000
$Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(s)}$ Copper	+ 0.337
$Pt^{2+}_{(aq)} + 2e^- \rightarrow Pt_{(s)}$ platium	+ 1.2

Table 1. Standard reduction potentials for a few half-cell reactions.

PERIODIC TABLE OF ELEMENTS



December 2, 2024 8:05 AM

Re-Introduction

Metals → Cu°, Fe°, Al° etc.

Ceramics → Al_2O_3, SiO_2, CuO "non-salts"

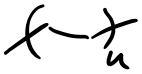
"salts" → $NaCl$, LiF, CaF_2 etc

Polymers →

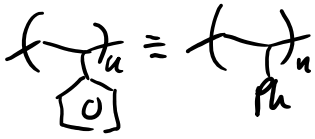
(1) poly ethylene terephthalate  not APS110.

(2) low density poly(ethylene) 

(3) poly(vinyl chloride) 

(4) high density poly(ethylene) 

(5) poly(propylene) 

(6) poly(styrene) 

n - length of a polymer

Chemicals