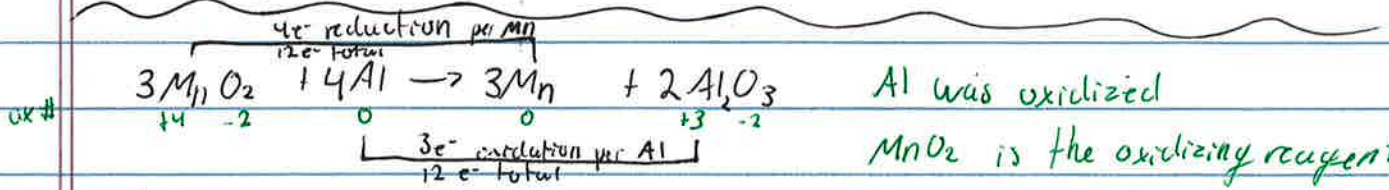
3/23

Today: Sections 18.1 - 18.4 (Ch 4) - will not be on the next test

Sunday + Tuesday - Problem Club with Ali

Monday: 3/26 Review for Ch 3

Wednesday Ch 3 (good luck!)



Al was oxidized

MnO_2 is the oxidizing reagent

Mn is reduced

Al was the reducing reagent

Assigning oxidation numbers

Neutral elements Ox # = 0

Monatomic ions Ox# = charge on ion

Usually, O is -2, group 1 is +1, group 2 is +2, H is +1

Sum of Ox numbers have to add up to the charge on ion or 0 for neutral

Balancing Redox equations

1. Assign ox # to every atom
2. Determine what was oxidized ^ and reduced and by how much
   LEO ≠ GER
3. Connecting atoms by "link lines", balance the linked atoms as you go
4. Use the least common multiple to balance oxid and reduction parts
5. Balance the oxygen atoms with H_2O molecules
6. Balance Hydrogen atoms with H^+ molecules
7. Balance "stray dogs"

5e⁻ reduction per Mn
10e⁻ total

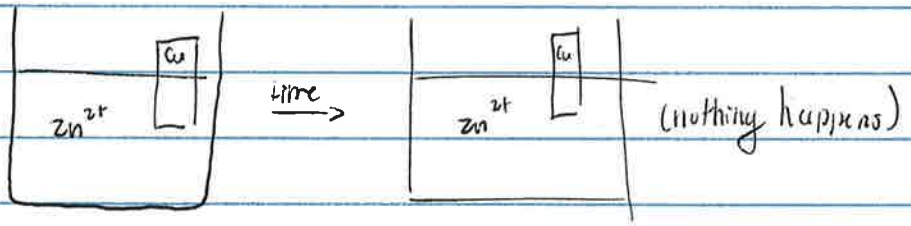
$16H^+ + 2MnO_4^- + 10Cl^- \longrightarrow 2Mn^{2+} + 5Cl_2 + 8H_2O$

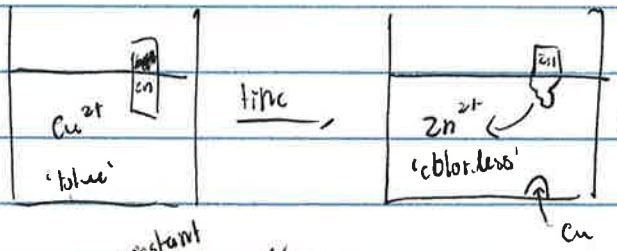
(+7 −2) (−1) (+2) (0)

1e⁻ oxidation per Cl
10e⁻ total

check:

16	H	16	✓
2	Mn	2	✓
8	O	8	✓
10	Cl	10	✓
+4	charge	+4	✓





Red: $Cu^{2+} + 2e^- \rightarrow Cu$

Ox: $Zn \rightarrow Zn^{2+} + 2e^-$

$Cu^{2+} + Zn \rightarrow Cu + Zn^{2+}$

} half reactions

$\Delta G < 0$ spontaneous

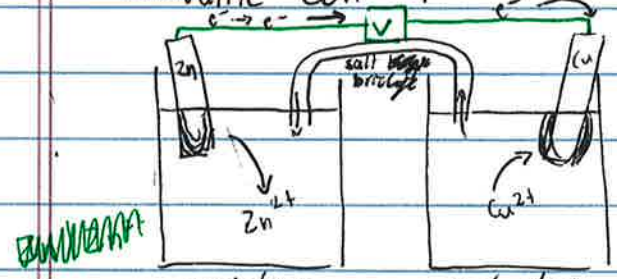
$E > 0$

$\Delta G = -nFE$

n = constant, E = voltage

↑ least common multiple

Galvanic cell = spontaneous cell



$Zn \rightarrow Zn^{2+} + 2e^-$ oxidation (anode)

$Cu^{2+} + 2e^- \rightarrow Cu$ reduction (cathode)

Cu electrode gets bigger

Zn electrode gets smaller

cell notation: $Zn|Zn^{2+}||Cu^{2+}|Cu$

overall: $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$

$E = +1.10V$

25°, 1 atm, 1.0 M

spontaneous

$Cu^{2+} + Zn \rightarrow Cu + Zn^{2+}$ $E^\circ = +1.10\,V$

$Cu^{2+} + Pb \rightarrow Cu + Pb^{2+}$ $E^\circ = +0.47\,V$

$Cu^{2+} + H_2 \rightarrow Cu + 2H^+$ $E^\circ = +0.34\,V$

$Cu^{2+} + 2e^- \rightarrow Cu$ $E^\circ_{red} = +0.34\,V$

$H_2(g) \rightarrow 2H^+ + 2e^-$ $E^\circ_{ox} = 0.00\,V$ (by convention)

$Cu^{2+} + H_2 \rightarrow Cu + 2H^+$ $E^\circ = +0.34\,V$

Table of reduction potentials

$Cu^{2+} + 2e^- \rightarrow Cu$ $E^\circ_{red} = +0.34\,V$

$2H^+ + 2e^- \rightarrow H_2$ $E^\circ_{red} = 0.00\,V$

$Pb^{2+} + 2e^- \rightarrow Pb$ $E^\circ_{red} = -0.13\,V$

$Zn^{2+} + 2e^- \rightarrow Zn$ $E^\circ_{red} = -0.76\,V$

$Cu^{2+} + 2e^- \rightarrow Cu$ $E^\circ_{red} = 0.34\,V$

$Pb \rightarrow Pb^{2+} + 2e^-$ $E^\circ_{ox} = 0.13\,V$

$Cu^{2+} + Pb \rightarrow Pb^{2+} + Cu$ $E^\circ = 0.47\,V$

$Cu^{2+} + 2e^- \rightarrow Cu$ $E^\circ_{red} = 0.34\,V$

$Zn \rightarrow Zn^{2+} + 2e^-$ $E^\circ_{ox} = 0.76\,V$

$Cu^{2+} + Zn \rightarrow Cu + Zn^{2+}$ $E^\circ = 1.10\,V$