

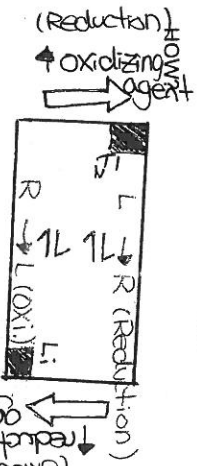
SPONTANEOUS

REDOX RXN

Name: _____
Blk: C Date: _____

Chemistry 12
Electrochemistry Lesson #3
Predicting the spontaneity of a REDOX reaction!!!

Turn to pg 336 in Hebden "Standard Reduction Potentials of Half-Cells"
This table is constructed similarly to the Relative Strengths of Acids table



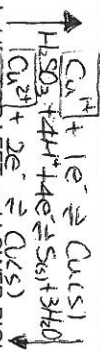
- isolated half-RXN
(can be read in either direc.)

IMPORTANT TO NOTE IN GENERAL:

- a. METALS are found at the bottom right hand side
exceptions include: Cu(s), Ag(s), Au(s), Hg(l)
- b. HALOGENS + OXYANIONS (COMMON OXYGEN) are found at the top left hand side

c. METALS such as Fe(s), Sn(s), Cr(s), Hg(l), Cu(s) have more than one common oxidation number, therefore, they have 2 half-RXN

example:



d. H_2O_2 is found at the TOP LEFT and LOWER RIGHT of the table
(hydrogen peroxide) (Both undergo Oxi & Redu)

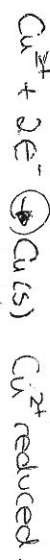
HOW TO READ THE HALF-REactions in the table:
Species in upper left "GO FORWARD", while species in bottom right "GO BACKWARD". Although each reaction can go either forward or backward.

USE Equilibrium arrows when referring to an isolated half-reaction
USE the specific direction for the half-reaction involved in a redox reaction
IMPT!!! YOU MUST GET USED TO THE FOLLOWING IDEA:

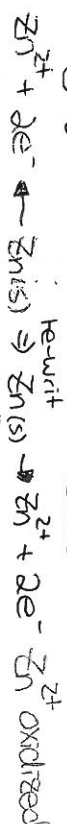


NOW, consider the following situation:
 $\text{Cu}^{2+} + 2e^- \rightleftharpoons \text{Cu}$ *Add together
 $\text{Zn}^{2+} + 2e^- \rightleftharpoons \text{Zn}$ \downarrow
 $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu(s)}$
 $\text{Zn} + 2e^- \rightarrow \text{Zn}^{2+}$
+ Zn(s) \rightarrow Zn²⁺ + 2e⁻
Cu²⁺ + Zn(s) \rightarrow Cu(s) + Zn²⁺

The compound that is HIGHER ON THE LEFT SIDE has greater tendency to be oxidizing agent. Therefore Cu undergoes reduction.



The compound that is LOWER ON THE RIGHT SIDE has greater tendency to be reducing agent. Therefore Zn undergoes oxidation:



****re-writing the oxidation reaction places the Zn(s) on the reactant side****

The overall reaction that SPONTANEOUSLY OCCURS is found by

For example:



WHEN THE TWO HALF-CELLS ARE JOINED, THE HIGHER HALF-REACTION ON THE TABLE WILL UNDERGO Reduction AND THE LOWER ONE WILL UNDERGO oxidation.

PROBLEM: what if you are given two POTENTIAL reactants and asked to determine whether or not a reaction will occur?

1. LOCATE each reactant on the TABLE!
- a. if the BOTH appear on the same side... (NO) REACTION OCCURS

for example:

- b. If one is on the left and the other is on the right, there are two possibilities:
 - i. If the species to be reduced (on the left hand side) is HIGHER than the species to be oxidized (on the right hand side)... A SPONTANEOUS RXN OCCURS!

for example:



YES! Spontaneous RXN.

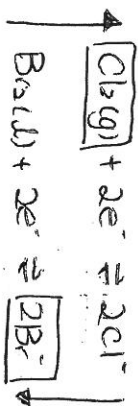
ii. If the species to be reduced (on the left hand side) is LOWER than the species to be oxidized (on the right hand side) ... NO RXN OCCURS!

for example:



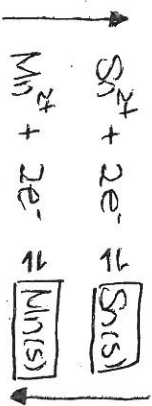
NO! SPONTANEOUS RXN

Example 1: (except adding energy)
Predict whether or not a reaction will occur when the following are mixed:
a. Cl_2 with Br^-



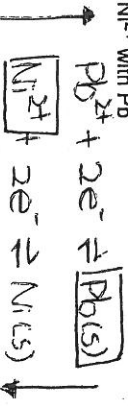
YES! \checkmark \Downarrow

b. Sn with Mn^{2+}



NO! X \Downarrow

c. Ni^{2+} with Pb



NO! X \Downarrow

For HOMEWORK do Exercises pg 199 - 200 7-18 odd letters only (i.e. a, c, e)
PLOS 54 - 58

★ Criteria ★

→ understand structure of standard reduction potential of $1/2$ cell.

→ know the use of equilibrium / specific direction) arrow.

→ determine if the ~~redox~~ ^{2 $1/2$ cell RXN} is spontaneous RXN.

(using \rightleftharpoons)

→ Balancing (redox) RXN by ~~MANIPULATING~~ SBMAC

→ determine the order (tendency to be reduced)

→ list out the spontaneous eq.

* non-metal anions - reducing agent (oxidation)
anions - oxidizing agent (REDUCTION)

* metal cations - OA (Reduction)
RA (oxidation)