Problems

1. MnO_4^- **(aq) +** SO_3^{2-} **(aq) →** MnO_2 **(s) +** SO_4^{2-} **(aq)** in basic solution
2. NO_2^- **(aq) + Al (s) →** NH_3 **(aq) +** $Al(OH)_4^-$ **(aq)** in basic solution
3. Mn^{2+} **(aq) +** $NaBiO_3$ **(s) →** Bi^{3+} **(aq) +** MnO_4^- **(aq) +** Na^+ **(aq)** in acidic solution
4. As_2O_3 **(s) +** NO_3^- **(aq) →** H_3AsO_4 **(aq) +** N_2O_3 **(aq)** in acidic solution
5. **Pb (s) +** PbO_2 **(s) +** H_2SO_4 **(aq) →** $PbSO_4$ **(s)** in acidic solution

to state changes

Model 2

What if we switched reaction 1 between zinc solid with copper ions to be:

$$Zn^{2+} (aq) + Cu (s) \rightarrow Zn (s) + Cu^{2+} (aq).$$

Will this reaction proceed?

How do we know?

Alkali metals

aq

Activity Series of Metals

Li (s) → Li^+ (aq) + e^-	Most Reactive Most easily oxidized Strongest tendency to lose electrons
K (s) → K^+ (aq) + e^-	
Ca (s) → Ca^{2+} (aq) + $2e^-$	
Na (s) → Na^+ (aq) + e^-	
Mg (s) → Mg^{2+} (aq) + $2e^-$	
Al (s) → Al^{3+} (aq) + $3e^-$	
Mn (s) → Mn^{2+} (aq) + $2e^-$	
Zn (s) → Zn^{2+} (aq) + $2e^-$	
Cr (s) → Cr^{3+} (aq) + $2e^-$	
Fe (s) → Fe^{2+} (aq) + $2e^-$	
Ni (s) → Ni^{2+} (aq) + $2e^-$	
Sn (s) → Sn^{2+} (aq) + $2e^-$	
Pb (s) → Pb^{2+} (aq) + $2e^-$	
H_2 (g) → $2H^+$ (aq) + $2e^-$	
Cu (s) → Cu^{2+} (aq) + $2e^-$	Least Reactive Most difficult to oxidize Least tendency to lose electrons
Ag (s) → Ag^+ (aq) + e^-	
Au (s) → Au^{3+} (aq) + $3e^-$	

solid

Single displacement

According to the activity series, zinc is more reactive than copper, and is more easily oxidized than copper because it is higher up on the series. Therefore, reaction 1 will proceed, but reaction 2 will not.

Besides REDOX, what other type of reaction is this? Single displacement - net equation

Problems

Predict whether each reaction will occur. If it does, write and balance the reaction.

6. Mn (s) + Ni^{2+} (aq) →
7. manganese + nickel bromide →
8. Ni (s) + Mn^{2+} (aq) →
9. Fe (s) + Mn^{2+} (aq) →
10. Zn (s) + HCl (aq) →
11. Cu (s) + H^+ (aq) →
12. aluminum + tin (II) bromide →
13. tin + aluminum bromide →
14. calcium + zinc acetate →
15. zinc + calcium acetate →

1. Assign oxidation numbers to all elements. Determine which is oxidation and which is reduction.
2. Write the two half-reactions. Circle the charges.
3. **Do each half-reaction separately.** Balance elements, other than O and H, by adding coefficients.
4. Balance O by adding H_2O to one of the sides of the reaction.
5. Balance H by adding H^+ to one of the sides of the reaction.
*6. If in "basic" solution, add OH^- to the side with H^+ to form water. Add the same amount of OH^- to the other side.
7. Add e^- to balance the charges. Add e^- to the right side for oxidation and the left side for reduction. Make sure this balances with regards to oxidation numbers.
8. Check to see if the half-reactions are balanced in terms of charges and number of atoms.
9. Multiply the two half reactions by coefficients such that the overall electron loss equals the overall electrons gained.
10. Add the two half-reactions together.
11. **CHECK TO SEE THE THAT NUMBER OF <u>ATOMS AND CHARGES</u> ARE EQUAL on both sides.**