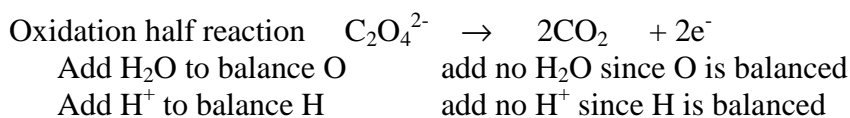
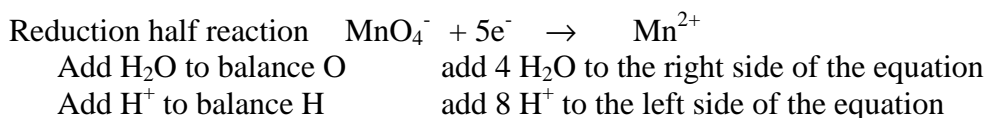
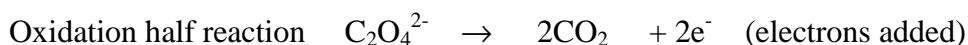
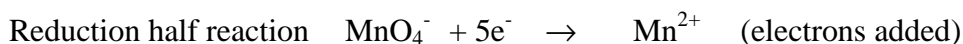
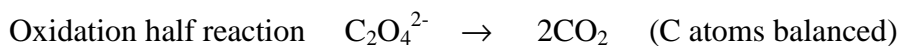
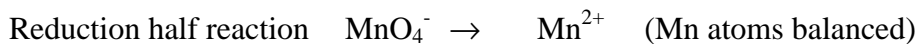
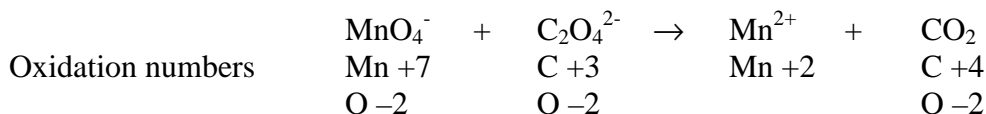
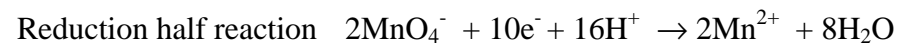


Balancing Redox Equations

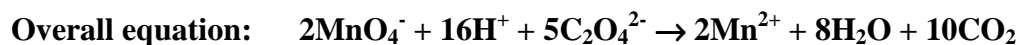
1. Determine the oxidation numbers for all atoms in the reaction.
2. Determine which atom is being oxidized and which is being reduced.
3. Write a half reaction for the reduction process, showing the species with the atom being reduced and the product containing that atom.
4. Write a half reaction for the oxidation process, showing the species with the atom being oxidized and the product containing that atom.
5. If the atoms being oxidized and reduced are not already balanced, balance them.
6. Add the appropriate number of electrons to each half reaction needed to bring about the reduction and oxidation.
7. Balance all other atoms in each half reaction **except** H and O.
8. Balance the H and O atoms as shown below:
 - a. If the reaction is **acidic**, add H^+ and H_2O . Balance O first by adding H_2O , then balance H by adding H^+ . Charge should now be balanced.
 - b. If the reaction is **basic**, add OH^- and H_2O . Balance charge first by adding OH^- , then O by adding H_2O . The H should now be balanced.
9. Once the half reactions are balanced, find the lowest common denominator (LCD) for the electrons in the two half reactions.
10. Multiply each half reaction by a whole number so that the total number of electrons in the reduction half reaction equals the total number of electrons in the oxidation half reaction (and they each equal the LCD).
11. Add the two half reactions together and cancel those things that are common to both sides.
12. Check the equation to be sure that the equation is balanced by atoms and by charge.

Example of an acidic redox reaction:

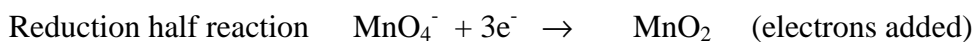
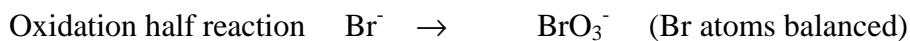
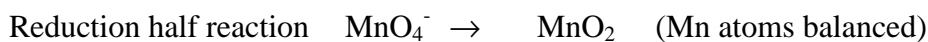
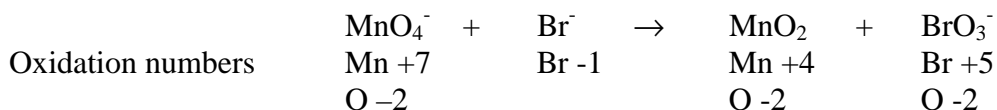
The lowest common denominator for the 2 reactions is 10. Multiply the reduction equation by 2 and the oxidation equation by 5.



Cancel electrons since they are on both sides of the equation.



Example of a basic redox reaction:



Add OH^- to balance charge add 4 OH^- to the right side of the equation

Add H_2O to balance O add 2 H_2O to the left side of the equation

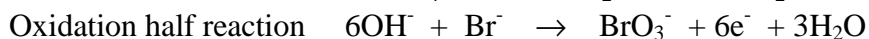
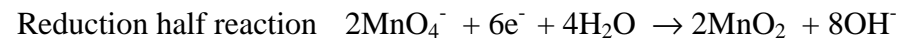


Add OH^- to balance charge add 6 OH^- to the left side of the equation

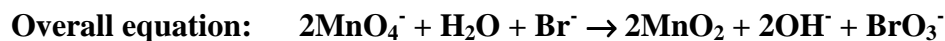
Add H_2O to balance O add 3 H_2O to the right side of the equation



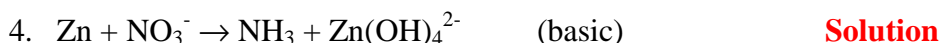
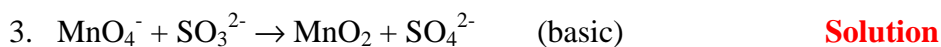
The lowest common denominator for the 2 reactions is 6. Multiply the reduction equation by 2 and the oxidation equation by 1.

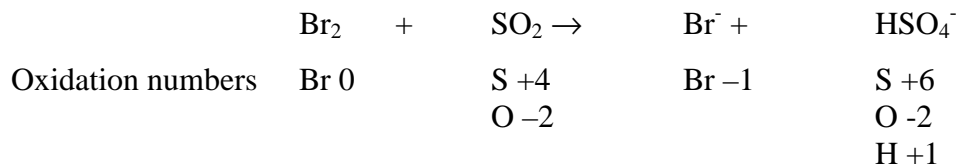


Cancel electrons H^+ and H_2O since they are on both sides of the equation.



Problems:

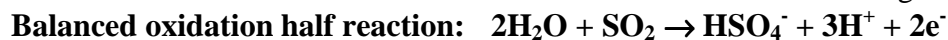


Solutions:

This equation is balanced for Br, electrons are included and no addition of H^+ or H_2O is needed since there are no H or O in the equation.



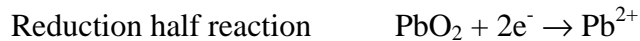
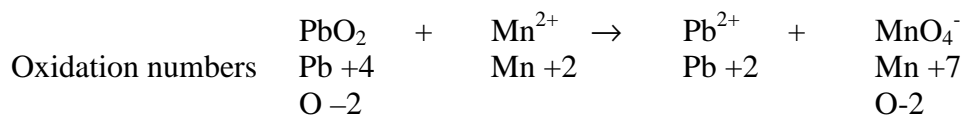
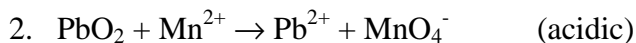
Add 2 H_2O to the left side to balance the O and 3 H^+ to the right side to balance H.



Both equations have 2e^- so there is no need to find a LCD. The only thing that cancels will be the electrons.



Return to Problems



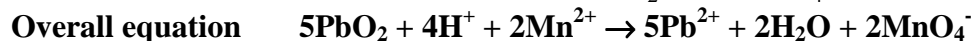
Add 2 H_2O to the right side to balance O, add 4 H^+ to the left side to balance H



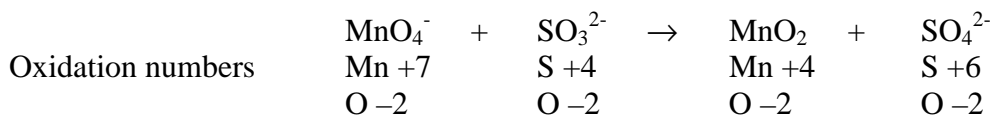
Add 4 H_2O to the left side to balance O, add 8 H^+ to the right side to balance H



LCD is 10 so we need to multiply the reduction half reaction by 5 and the oxidation half reaction by 2.



Return to Problems



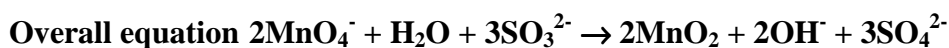
Add 4 OH^- to the right side to balance charge, add 2 H_2O to the left side to balance O



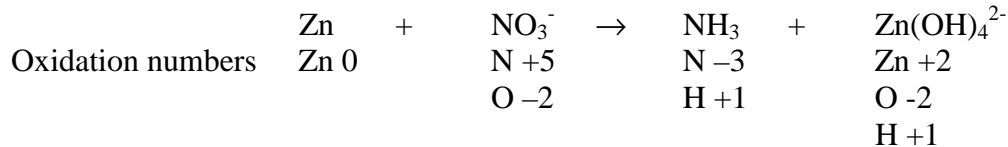
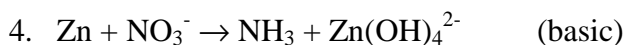
Add 2 OH^- to the left side to balance charge, add 1 H_2O to the right side to balance O



LCD is 6 so we need to multiply the reduction half reaction by 2 and the oxidation half reaction by 3.



Return to Problems



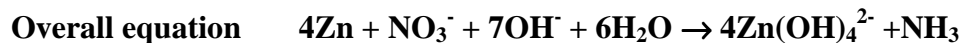
Add 9 OH^- to the right side to balance charge, add 6 H_2O to the left side to balance O.



Add 4 OH^- to the left side to balance charge, no addition of H_2O needed.



LCD is 8 so multiply the oxidation half reaction by 4 (no need to alter the reduction half reaction)



Return to Problems