

Chemistry in Society

Worksheet 5 REDOX



1. The highest oxidation state of chlorine is present in:

A HClO

B HClO2

C HClO3

D HClO4

1. Determine the oxidation number of the elements in each of the following compounds:  
     
   a. H2CO3  
   **H: +1, O: -2, C: +4**  
     
   b. N2   
   **N: 0**  
     
   c. Zn(OH)42-   
   **Zn: 2+, H: +1, O: -2**  
     
   d. NO2-   
   **N: +3, O: -2**  
     
   e. LiH   
   **Li: +1, H: -1**  
     
   Identify the species being oxidized and reduced in each of the following reactions:   
     
     
   a. Cr+ + Sn4+ http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif Cr3+ + Sn2+   
   **Cr+: oxidized, Sn4+: reduced**  
     
   b. 3 Hg2+ + 2 Fe (s) http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif 3 Hg2 + 2 Fe3+   
   **Hg2+: reduced, Fe: oxidized**  
     
   c. 2 As (s) + 3 Cl2 (g) http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif 2 AsCl3   
   **As: oxidized, Cl2: reduced**
2. Correctly identify which reagent is being oxidised and which is being reduced in the following reaction.   
     
     
   Show answer through writing out half-reactions including electrons.

oxidation: reduction:

1. Ammonia reacts with magnesium as shown.

3Mg(s) +2NH3(g) ⭢ (Mg2+)3(N3-)2(s) + 3H2(g)

In this reaction, ammonia is acting as:

A a reducing agent

B an oxidising agent

C a base

D an acid

1. State the substance that is the oxidising agent and which is the reducing agent in the following reaction:  
     
   Mn + Pb(NO3)2 🡪 Mn(NO3)2 + Pb  
     
     
   Mn = reducing agent

Pb(NO3)2 = oxidizing agent

1. During a redox process in acid solution, iodate ions, IO3 − (aq), are converted into iodine, I2(aq).   
     
    IO3 − (aq) → I2(aq)   
     
   The numbers of H+ (aq) and H2O(l) required to balance the ion-electron equation for the formation of I2(aq) are, respectively   
     
   A 3 and 6   
   B 6 and 3   
   C 6 and 12   
   D 12 and 6.  
    12H+ + 2IO3 − (aq) → I2(aq) + 6H2O

1. During a redox process in acid solution, nitrate ions, NO3-(aq), are converted into nitrite ions, NO2-(aq).

NO3- (aq) ⭢ NO2- (aq)

The numbers of H+(aq) and H2O(l) required to balance the ion-electron equation for the formation of 1 mol of NO2-(aq) are, respectively

A 2 and 1

B 1 and 3

C 1 and 1

D 3 and 2

1. Balance the full redox equation:  
     
    ClO3- + I2 🡪 Cl- + IO3- Acid Conditions
2. **ClO3- + I2** 🡪 **Cl- + IO3-oxidation numbers: +5 -2**  0 -1 +5 -2   
     
   **ClO3- + 6e-** 🡪 **Cl-   
    I2** 🡪 **2IO3- + 10e-Multiply equations to cancel out electrons.  
     
   5ClO3- + 30e-** 🡪 **5Cl-   
    3I2** 🡪 **6IO3- + 30e-add equations together and cancel out electrons**  
   **5ClO3- + 3I2** 🡪 **5Cl- + 6IO3-  
     
   Add H2O to whichever side doesn’t have enough oxygen**  
   **15 oxygens on left** 🡪 **18 oxygens on right**  
     
   **need 3 on the left hand side  
     
   3H2O + 5ClO3- + 3I2** 🡪 **5Cl- + 6IO3-**  
   **Balance the hydrogen by adding H+**   
     
   **3H2O + 5ClO3- + 3I2** 🡪 **5Cl- + 6IO3-  + 6H+**  
   **Check that the charges balance on each side. -5 on each side. Balanced!**

1. Balance the full redox equation:   
     
   Cr(OH)3 + Br2 http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif CrO42- + Br- in basic solution

Cr(OH)3 + Br2 http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif CrO42- + 2Br-

 +3 (-2:+1) 0 +6 -8 -1  
  
oxidation: Cr(OH)3  http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif CrO42 + 3e-  
reduction: Br2 + 2e- http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif  2Br-   
  
2Cr(OH)3  http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif 2CrO42 + 6e-  
3Br2 + 6e- http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif  6Br- 

Cancel electrons and add up  
  
2Cr(OH)3  + 3Br2 http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif2CrO42 + 6Br-   
  
add water   
  
2H2O + 2Cr(OH)3  + 3Br2 http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif2CrO42 + 6Br-   
balance with H+  
  
2H2O + 2Cr(OH)3  + 3Br2 http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif2CrO42 + 6Br- + 10H+  
  
add OH- to neutralise the acid  
10 OH- + 2H2O + 2Cr(OH)3  + 3Br2 http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif2CrO42 + 6Br- + 10H+ + 10 OH-  
  
H+ + OH- = H2O  
  
10 OH- + 2H2O + 2Cr(OH)3  + 3Br2 http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif2CrO42 + 6Br- + 10H2O

Cancel waters on either side  
  
**10 OH- + 2 Cr(OH)3 + 3 Br2**http://www.chemistry.wustl.edu/~coursedev/Online%20tutorials/arrow.gif**2 CrO42- + 8 H2O + 6 Br-**