Section 15 – Redox Reactions

1) Define the following terms, succinctly but without copying a definition:

a) Reduction b) Oxidation c) Reducing Agent d) Oxidizing Agent

2) Write the oxidation number for each element in the following species:

Oxidation Practice

Determine the oxidation numbers for each element in the following compounds.			
1) $\mathbf{H_2CO_3}$	**2)** $\mathbf{MnO_4^-}$	**3)** $\mathbf{CrO_4^{2-}}$	**4)** $\mathbf{Cr_2O_7^{2-}}$
5) SF_2	**6)** $\mathbf{SF_4}$	**7)** $\mathbf{SF_6}$	**8)** $\mathbf{Cu(NO_3)_2}$
9) NaClO	**10)** $\mathbf{H_2O_2}$	**11)** $Na_2C_2O_4$	**12)** $\mathbf{N_2F_2}$
13) NH_2OH	**14)** $\mathbf{NO_3^-}$	**15)** $\mathbf{Cr_2(SO_4)_3}$	**16)** $\mathbf{HIO_4}$

3) Identify what element(s) are oxidized and which element(s) are reduced.

$$5H_2C_2O_{4(aq)} + 2MnO_4^- + 6H^+_{(aq)} \rightarrow 2Mn^{+2}_{(aq)} + 10CO_{2(g)} + 8H_2O_{(L)}$$

$$3Cu_{(s)} + 8H^+_{(aq)} + 2NO_3^- \rightarrow 3Cu^{2+}_{(aq)} + 2NO_{(g)} + 4H_2O_{(L)}$$

$$2H^+_{(aq)} + H_2O_{2(aq)} + 2Fe^{+2}_{(aq)} \rightarrow 2Fe^{+3}_{(aq)} + 2H_2O_{(L)}$$

$$2MnO^-_{4(aq)} + 10Cl^-_{(aq)} + 16H^+_{(aq)} \rightarrow 5Cl_{2(g)} + 2Mn^{+2}_{(aq)} + 8H_2O_{(L)}$$

$$8H^+_{(aq)} + Cr_2O_7^{-2} + 3SO_3^{-2} \rightarrow 2Cr^{+3}_{(aq)} + 3SO_4^{-2} + 4H_2O_{(L)}$$

$$NO_3^- + 4Zn_{(s)} + 7OH^-_{(aq)} + 6H_2O_{(L)} \rightarrow 4Zn(OH)^-_{4(aq)} + NH_{3(aq)}$$

Combination Reactions

4) Predict the products and balance the reactions below

$Sr_{(s)} + Br_{2(L)} \rightarrow$	$C_{(graphite)} + O_{2(g)} \rightarrow$
$H_{2(g)} + I_{2(s)} \rightarrow$	$PF_{3(g)} + F_{2(g)} \rightarrow$
$Fe_{(s)} + O_{2(g)} \rightarrow$	$Na_{(s)} + O_{2(g)} \rightarrow$
$S_{(s)} + O_{2(g)} \rightarrow$	$N_{2(g)} + H_{2(g)} \rightarrow$

Decomposition Reactions

5) Predict the products and balance the reactions below

$H_2O_{(L)} \rightarrow$	$NaCl_{(s)} \rightarrow$
$KClO_{3(s)} \rightarrow$	$CaCO_{3(s)} \rightarrow$
$NaClO_{3(s)} \rightarrow$	$C_{12}H_{22}O_{11(s)} \rightarrow$

Combustion Reactions

6) Predict the products and balance the reactions below	
$CH_{4(g)} + O_{2(g)} \rightarrow$	$H_2C_{2(g)} + O_{2(g)} \rightarrow$
$C_3H_{8(g)} + O_{2(g)} \rightarrow$	$C_4H_{10(g)} + O_{2(g)} \rightarrow$
$C_7H_{16(g)} + O_{2(g)} \rightarrow$	$C_8H_{18(L)} + O_{2(g)} \rightarrow$
$C_6H_{12}O_{6(s)} + O_{2(g)} \rightarrow$	$CH_3CH_2OH_{(L)} + O_{2(g)} \rightarrow$

Displacement Reactions

7) Predict the products and balance the reactions below	
$Zn_{(s)} + Fe(NO_3)_{2(aq)} \rightarrow$	$Zn_{(s)} + AgNO_{3(aq)} \rightarrow$
$Cr(NO_3)_{3(aq)} + Al_{(s)} \rightarrow$	$Mg_{(s)} + HCl_{(aq)} \rightarrow$
$Ag_{(s)} + HCl_{(aq)} \rightarrow$	$Zn_{(s)} + HNO_{3(aq)} \rightarrow$
$Mg_{(s)} + Pb(NO_3)_{4(aq)} \rightarrow$	

8) Predict the products and balance the following reactions, put oxidation number of each element above it.

a) ____ $C_{(graph)}$ + ____ $O_{2(g)} \rightarrow$

b) ____ $Al_2O_{3(s)} \rightarrow$

c) ____ $NaClO_{3(s)} \rightarrow$

d) ____ $Na_{(s)}$ + ____ $Br_{2(L)} \rightarrow$

e) ____ $Cu_{(s)}$ + ____ $O_{2(g)} \rightarrow$

f) ____ $ZnCl_{2(s)} \rightarrow$

g) ____ $Ca_{(s)}$ + ____ $Br_{2(L)} \rightarrow$

h) ____ $Mg(ClO_3)_{2(s)} \rightarrow$

i) ____ $Fe_{(s)}$ + ____ $O_{2(g)} \rightarrow$

j) ____ $Si_{(s)}$ + ____ $O_{2(g)} \rightarrow$

9) Predict the products for the following replacement reactions, remember states of matter. Place the oxidation # for each element above it in the reaction:

a) ____ $Ca_{(s)}$ + ____ $Cd(NO_3)_{2(aq)} \rightarrow$

b) ____ $F_{2(g)}$ + ____ $LiI_{(aq)} \rightarrow$

c) ____ $Al_{(s)}$ + ____ $HNO_{3(aq)} \rightarrow$

d) ____ $Ag_{(s)}$ + ____ $FeCl_{2(aq)} \rightarrow$

e) ____ $Cr_{(s)}$ + ____ $Ni(NO_3)_{2(aq)} \rightarrow$

f) ____ $Au_{(s)}$ + ____ $HCl_{(aq)} \rightarrow$

g) ____ $Sn_{(s)}$ + ____ $H_2SO_{4(aq)} \rightarrow$

h) ____ $Br_{2(g)}$ + ____ $NaCl_{(aq)} \rightarrow$

i) ____ $Cu_{(s)}$ + ____ $AgNO_{3(aq)} \rightarrow$

j) ____ $Co_{(s)}$ + ____ $HClO_{4(aq)} \rightarrow$

Lab

Combination Chemistry

Procedure

1) Obtain approximately 5 cm of magnesium ribbon.

2) Mass the magnesium

3) Obtain a crucible and mass the crucible with the lid on.

4) Place magnesium in crucible and heat until the magnesium ignites.

5) Once the reaction has come to completion remove heat.

6) After crucible has cooled, mass the crucible and product

Questions

1) Make a data table for the demonstration

2) How many moles of magnesium were started with?

3) What did the magnesium react with?

4) What was the mass of the product?

5) What mass was added to the magnesium and how many moles of that stuff was added to the magnesium?

6) What is the theoretical formula of your product?

7) Write a balanced reaction for the lab.

8) What was the percent yield of the reaction?

Decomposition Chemistry

Procedure

1) Setup experiment like Mr. Beck showed at the front of the class room.

2) Obtain approximately 1 g of copper (II) oxide. Be careful, the substance behaves like baby powder and can spread easily.

3) Mass the large test tube that will be used.

4) Add the copper (II) oxide to the test tube, be sure to spread out the powder, if it is in clumps the reaction will take longer.

5) Setup experiment and see Mr. Beck to make sure the setup is okay.

6) Ignite flame and start heating the copper (II) oxide. Move the flame along the test tube so the test tube does not melt, and no we do not want that to happen.

7) Once you have determined that the reaction is finished, remove the test tube from the flame.

8) Allow the test tube to cool for a moment then mass the test tube and the product.

Questions

1) Create a data table indicating all the measurements that were taken.

2) How many moles of copper (II) oxide did you start with?

3) What does the color change tell you about one of the products in this reaction?

4) Write a balanced reaction for the decomposition of copper (II) oxide.

5) What should the theoretical yield be for the reaction?

6) What was the percent yield for the reaction?

7) Why was the lab setup the way it was? Why did we have methane gas running through the test tube?

Single Replacement

Procedure

1) **Obtain approximately 12.5 g of copper (II) sulfate pentahydrate**

2) **Dissolve the copper (II) sulfate pentahydrate in 200 mL of water. What do you notice about the color?**

3) **Add a piece of zinc that is *at least* 3.3 g, but please do not put in a huge amount.**

4) **Allow the solution to sit for 30 minutes and then record observations.**

Questions

1) **How many moles of copper (II) sulfate pentahydrate were used in the demonstration?**

2) **What was the concentration of copper (II) sulfate used?**

3) **How many moles of Zn were used?**

4) **What do you think the products were?**

5) **Write a balanced equation for the reaction.**

6) **What is theoretical mass of the solid formed?**

7) **What is the concentration of the other product?**

8) **What is being transferred between the two metals? How can these reactions be used?**