Honors Chemistry
Exam 2 Study Guide

Exam Date:
Wednesday, October 22

Content:
Chapter 3 (excluding section 3.5) and Chapter 4 sections 4.1 and 4.2
Format:
Multiple choice, short answer, problem solving, and one essay

Time allotted:
87 minutes

YOU MUST BRING A CALCULATOR TO THE EXAM. IF YOU DO NOT HAVE ACCESS TO ONE, PLEASE LET ME KNOW TWO DAYS PRIOR TO THE EXAM.

Topics

Chapter 3: Stoichiometry

Chemical equations

Reactants

Products

Law of Conservation of Mass

Balanced chemical equation

Synthesis/Combination reactions

Decomposition reactions

Single replacement reactions

Double replacement reactions

Combustion reactions

Formula weight

Molecular weight

Percent composition

Avogadro's number

Mole

Molar mass

Limiting reactant

Theoretical yield

Actual yield

Percent yield

Chapter 4: Sections 4.1 and 4.2

Aqueous solutions

Solvent

Solute

Electrolyte

Nonelectrolyte

Strong electrolyte

Weak electrolyte

Solvation

Chemical equilibrium

Precipitation reactions

Precipitate

Solubility

Exchange reactions/ metathesis reactions

Complete ionic equations

Molecular equations

Net ionic equations

Spectator ions

COMMON POLYATOMIC IONS:

Hydroxide OH^-

Carbonate CO_3^{2-}

Ammonium NH_4^+

Sulfate SO_4^{2-}

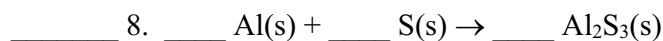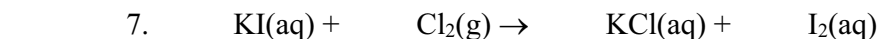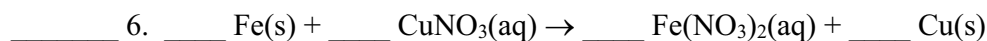Nitrate NO_3^-

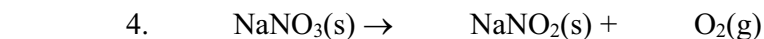Phosphate PO_4^{3-}

Chromate CrO_4^{2-}

Sample Problems

Balancing equations

1	$H_2 + O_2 \Rightarrow H_2O$
2	$H_3PO_4 + KOH \Rightarrow K_3PO_4 + H_2O$
3	$K + B_2O_3 \Rightarrow K_2O + B$
4	$HCl + NaOH \Rightarrow NaCl + H_2O$
5	$Na + NaNO_3 \Rightarrow Na_2O + N_2$
6	$C + S_8 \Rightarrow CS_2$
7	$Na + O_2 \Rightarrow Na_2O_2$
8	$N_2 + O_2 \Rightarrow N_2O_5$
9	$H_3PO_4 + Mg(OH)_2 \Rightarrow Mg_3(PO_4)_2 + H_2O$
10	$NaOH + H_2CO_3 \Rightarrow Na_2CO_3 + H_2O$
11	$KOH + HBr \Rightarrow KBr + H_2O$
12	$H_2 + O_2 \Rightarrow H_2O_2$
13	$Na + O_2 \Rightarrow Na_2O$
14	$Al(OH)_3 + H_2CO_3 \Rightarrow Al_2(CO_3)_3 + H_2O$
15	$Al + S_8 \Rightarrow Al_2S_3$

Types of reactions

Write a balanced equation for each of the following reactions. Then classify each as: synthesis (S), decomposition (D), combustion (C), single displacement (SD), or double displacement (DD).

_____ 1. ____ $Na(s) +$____ $H_2O(l) \rightarrow$ ____ $NaOH(aq) +$ ____ $H_2(g)$

_____ 2. ____ $CO(g) +$ ____ $O_2(g) \rightarrow$ ____ $CO_2(g)$

_____ 3. ____ $FeS(s) +$ ____ $HCl(aq) \rightarrow$ ____ $FeCl_2(aq) +$ ____ $H_2S(g)$

_____ 4. ____ $NaNO_3(s) \rightarrow$ ____ $NaNO_2(s) +$ ____ $O_2(g)$

_____ 5. ____ $CH_4(g) +$____ $O_2(g) \rightarrow$ ____ $CO_2 +$ ____ H_2O

_____ 6. ____ $Fe(s) +$ ____ $CuNO_3(aq) \rightarrow$ ____ $Fe(NO_3)_2(aq) +$ ____ $Cu(s)$

_____ 7. ____ $KI(aq) +$ ____ $Cl_2(g) \rightarrow$ ____ $KCl(aq) +$ ____ $I_2(aq)$

_____ 8. ____ $Al(s) +$ ____ $S(s) \rightarrow$ ____ $Al_2S_3(s)$
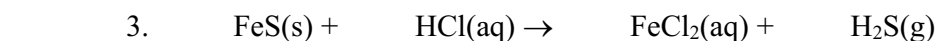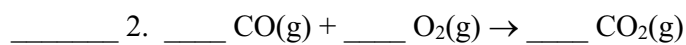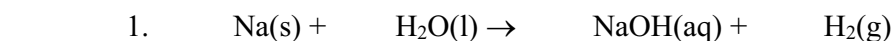
Molecular weight: *Calculate the molecular weight of:*

1) Ammonium sulfide

2) Fe_2O_3

3) Potassium carbonate

4) SF_6

5) Ammonium sulfate

Percent composition: *Determine the percent by mass of the indicated element in each compound:*

1) Magnesium in magnesium oxide

2) Sodium in sodium sulfide

3) Oxygen in Lithium Nitrate

4) Hydrogen in potassium hydroxide

5) Sulfur in hydrogen sulfate

Mole conversions

1. There are _____ sulfur atoms in 25 molecules of $C_4H_4S_2$.

2. A sample of C_3H_8O that contains 200 molecules contains _____ carbon atoms.

3. There are _____ molecules of methane in 0.123 mol of methane (CH_4).

Stoichiometry

1. Under appropriate conditions, nitrogen and hydrogen undergo a combination reaction to yield

ammonia:

$$N_2 \text{ (g)} + 3H_2 \text{ (g)} \rightarrow 2NH_3 \text{ (g)}$$
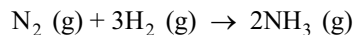
A 7.1-g sample of N_2 requires _____ g of H_2 for complete reaction.

2. Calcium carbide (CaC_2) reacts with water to produce acetylene (C_2H_2) and calcium hydroxide.

Production of 13g of C_2H_2 requires consumption of _____ g of H_2O.

Limiting reactant/Percent yield

1. $NaCl + H_2SO_4$ → $NaHSO_4 + HCl$

If a reaction vessel contains 10.0 g of sodium chloride and 12.0 g of sulfuric acid, what is the limiting reactant? What is the theoretical yield of hydrochloric acid? How many grams of excess reactant are left unconsumed?
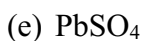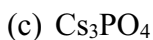
2.   A 3.82-g sample of magnesium nitride is reacted with 7.73 g of water.
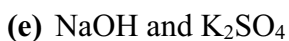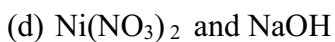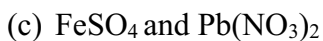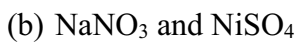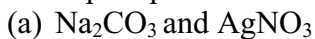
$$Mg_3N_2 + 3H_2O \rightarrow 2NH_3 + 3MgO$$
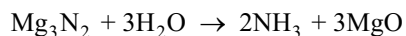
The actual yield of MgO is 3.60 g. What is the percent yield in the reaction?

Precipitation reactions/ Metathesis reactions

1. Predict whether each of the following compounds is soluble or insoluble in water:
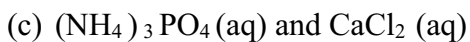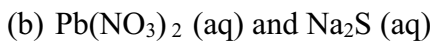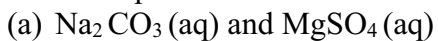
(a) $NiCl_2$

(b) Ag_2S

(c) Cs_3PO_4

(d) $SrCO_3$

(e) $PbSO_4$

2. Will a precipitate form if the following solutions are mixed? If so, write a balanced equation.
   (a) Na_2CO_3 and $AgNO_3$

   (b) $NaNO_3$ and $NiSO_4$

   (c) $FeSO_4$ and $Pb(NO_3)_2$

   (d) $Ni(NO_3)_2$ and $NaOH$

   (e) $NaOH$ and K_2SO_4

Ionic equations
1. Name the spectator ions in the following reactions:
   (a) $Na_2 CO_3$ (aq) and $MgSO_4$ (aq)

   (b) $Pb(NO_3)_2$ (aq) and Na_2S (aq)

   (c) $(NH_4)_3 PO_4$ (aq) and $CaCl_2$ (aq)

2. Write the balanced net ionic equations for the reactions that occur in each of the following. Identify spectator ion (s).

   (a) $Cr_2 (SO_4)_3$ (aq) + $(NH_4)_2 CO_3$ (aq) →

   (b) $Ba(NO_3)_2$ (aq) + $K_2 SO_4$ (aq) →

   (c) $Fe(NO_3)_2$ (aq) + KOH (aq) →