

BIG CHEM: Unit 6 - Chemical Reactions

Problem Set #6

Due: Wednesday, January 16th
Mr. Darlington

- Write a summary paragraph on the article: "How Gasoline Becomes CO₂."
- In terms of gasoline burning, explain why when bonds are broken energy is absorbed, and when bonds are formed, energy is released.
- State whether each of the following represents a Physical Change, or a Chemical Change. If it is a chemical change, state the evidence of the chemical reaction.
Breaking glass, Dissolving sugar, Rusting iron, Boiling water, Digesting sugar, Burning gasoline, Respiration
- Determine the formula masses of each of the substances below.
 - CaCl₂
 - NH₄OH
 - AgCH₃COO
 - Ba₃(PO₄)₂
 - Al₂(CO₃)₃
 - Zn(NO₃)₂
- Determine the empirical formula, for each of the following molecular formulas. Some compounds may have the same empirical and molecular formulas.
 - C₅H₁₈
 - H₂O₂
 - Hg₂Cl₂
 - C₃H₆O₃
 - Na₂C₂O₄
 - H₂O
- Find the molecular formula for a compound with
 - a mass of 78 amu and the empirical formula CH.
 - a mass of 82 amu and the empirical formula C₃H₅.
 - a mass of 90 amu and the empirical formula HCO₂.
 - a mass of 112 amu and the empirical formula CH₂.
- For the following percent composition problems
 - What is the percentage composition of: Na, O, and H in the compound NaOH?
 - Calculate the percentage composition of baking soda (NaHCO₃).
 - Calculate the percentage of each of the elements within acetic acid (HC₂H₃O₂), the substance found in vinegar
 - What is the percentage composition of a soap (C₁₇H₃₅COONa)?.
- Make a table with 5 columns labeled, Identity of Reactants, Phase of Reactants, Identity of Products, Phase of Products, and finally, Ratio. Using your table, identify the reactants and the products, state what phase each is in, and state the ratios of all the products and reactants.
 - $3\text{Ca}(\text{NO}_3)_2(\text{aq}) + 2\text{Na}_3\text{PO}_4(\text{aq}) \rightarrow 6\text{NaNO}_3(\text{aq}) + \text{Ca}_3(\text{PO}_4)_2(\text{s})$
 - $\text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{liq}) \rightarrow \text{H}_2\text{CO}_3(\text{aq})$
 - $\text{Zn}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{ZnCl}_2(\text{aq}) + \text{H}_2(\text{g})$
 - $\text{Cu}(\text{s}) + 2\text{AgNO}_3(\text{aq}) \rightarrow 2\text{Ag}(\text{s}) + \text{Cu}(\text{NO}_3)_2(\text{aq})$
 - $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{MgO}(\text{s})$
 - $2\text{Fe}(\text{OH})_2(\text{s}) + \text{H}_2\text{O}_2(\text{aq}) \rightarrow 2\text{Fe}(\text{OH})_3(\text{s})$
- For each of the reactions shown below, identify the type of reaction.
 - $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$
 - $\text{Zn}(\text{s}) + \text{CuSO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu}(\text{s})$
 - $\text{FeCl}_3(\text{aq}) + 3\text{NaOH}(\text{aq}) \rightarrow \text{Fe}(\text{OH})_3(\text{s}) + 3\text{NaCl}(\text{aq})$
 - $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{MgO}(\text{s})$
 - $\text{H}_2\text{CO}_3(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{liq}) + \text{CO}_2(\text{g})$
 - $\text{H}_2\text{O}(\text{liq}) + \text{N}_2\text{O}_5(\text{g}) \rightarrow 2\text{HNO}_3(\text{aq})$
 - $\text{Cl}_2(\text{g}) + 2\text{NaBr}(\text{aq}) \rightarrow 2\text{NaCl}(\text{aq}) + \text{Br}_2(\text{liq})$
 - $2\text{KClO}_3(\text{s}) \rightarrow 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$
 - $2\text{K}(\text{s}) + 2\text{H}_2\text{O}(\text{liq}) \rightarrow 2\text{KOH}(\text{aq}) + \text{H}_2(\text{g})$
- Balance the equations below by writing the correct coefficient in the space before each formula. Coefficient "1" need not be written.
 - $\text{H}_2 + \text{Cl}_2 \rightarrow \text{HCl}$
 - $\text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{HNO}_3$
 - $\text{Fe} + \text{Cl}_2 \rightarrow \text{FeCl}_3$
 - $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$
 - $\text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$
 - $\text{Cu} + \text{AgCH}_3\text{COO} \rightarrow \text{Cu}(\text{CH}_3\text{COO})_2 + \text{Ag}$
 - $\text{H}_2\text{SO}_4 + \text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
 - $\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3$
 - $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
 - $\text{S} + \text{O}_2 \rightarrow \text{SO}_3$
- Balance the equations below by writing coefficients greater than one in front of the formulas where needed. Identify the reaction type as Synthesis (S), Decomposition (D), Single Replacement (SR), or Double Replacement (DR).
 - $\text{Al} + \text{HCl} \rightarrow \text{AlCl}_3 + \text{H}_2$
 - $\text{Fe}_2\text{O}_3 + \text{C} \rightarrow \text{Fe} + \text{CO}_2$

- c $S + O_2 \rightarrow SO_3$
- d $N_2 + H_2 \rightarrow NH_3$
- e $H_2O + P_2O_5 \rightarrow H_3PO_4$
- f $NH_4NO_2 \rightarrow H_2O + N_2$
- g $Ba(NO_3)_2 + Fe_2(SO_4)_3 \rightarrow BaSO_4 + Fe(NO_3)_3$
- h $ZnCl_2 + AgNO_3 \rightarrow Zn(NO_3)_2 + AgCl$
- i $Na_2O + H_2O \rightarrow NaOH$
- j $NiCO_3 + Al(OH)_3 \rightarrow Ni(OH)_2 + Al_2(CO_3)_3$
- k $Ca(ClO_3)_2 \rightarrow CaCl_2 + O_2$
- l $Mg + H_2O \rightarrow Mg(OH)_2 + H_2$

12 Perform the following calculations.

- a What is the mass of 3 moles of potassium nitrate?
- b What is the mass of 0.75 moles of aluminum oxide?
- c What is the mass of 3.5 moles of silver acetate?
- d What is the mass of 0.25 moles of calcium sulfate?
- e How many moles are in 484.25 g of ammonium phosphate?
- f How many moles are in 75.46 g of sulfuric acid?
- g How many moles are in 270. g of dinitrogen pentoxide?
- h How many moles are in 546 g of tin IV fluoride?

13 For each of the following, write a balanced equation based on the description of the reactions below and perform the calculation described.

- a How many moles of oxygen will be produced from the decomposition of 3 moles of $KClO_3$ into potassium chloride and oxygen gas?
- b In a single replacement reaction of Zinc and hydrogen chloride where zinc replaces hydrogen, how many moles of Zn are needed to completely react with 0.4 moles of HCl?
- c Methane (CH_4) reacts with oxygen to form carbon dioxide and water. How many moles of oxygen will be needed to completely react with 4 moles of CH_4 ?
- d How many moles of hydrogen will be needed to react with 2 moles of nitrogen to form ammonium (NH_3)?
- e Using the above reaction how many moles of NH_3 will be formed if 18 moles of H_2 is used?
- f How many moles of sulfur are needed to react 3 moles of zinc metal (Zn) to form zinc sulfide?
- g How many moles of silver chloride will be produced if 2 moles of silver is allowed to react with an unlimited amount of chlorine?

14 Calculate the amount of material asked for in each of the following. You will need to write a balanced equation.

- a How many grams of oxygen will be produced from the decomposition of 244 grams of $KClO_3$ into potassium chloride and oxygen gas?
- b How many grams of Zn will be needed to completely react with 72 g of HCl were zinc replaces hydrogen in a single replacement reaction?
- c How many moles of oxygen will be needed to completely react 64 g of CH_4 to form water and carbon dioxide gas?
- d How many grams of hydrogen will be needed to react with 56 g of nitrogen to form ammonium (NH_3)?
- e Using the above reaction how many grams of NH_3 will be formed if 36 grams of H_2 is used?
- f How many grams of sulfur will be needed to react 95 grams of zinc metal (Zn) to form zinc sulfide?
- g How many grams of silver chloride will be produced if 216 grams of silver is allowed to react with an unlimited amount of chlorine?