CHEMISTRY UNIT 3 REVIEW **Name _____KEY_____**

Part One – Multiple Choice

1) Mixtures can be separated into simpler substances with a _____ change, and compounds can be separated into their elements with a _____ change.
   a. physical, physical
   b. physical, chemical
   c. chemical, physical
   d. chemical, chemical

2) All chemical changes involve the formation of
   a. a gas
   b. heat
   c. a new substance
   d. a color change

3) Which of the following is classified as a physical change?
   a. decomposing sugar into carbon and water
   b. forming sodium chloride from sodium and chlorine
   c. distilling saltwater into salt and water
   d. rusting of iron to form iron oxide

4) Which process represents a chemical change?
   a. melting of ice
   b. corrosion of copper
   c. evaporation of water
   d. crystallization of sugar

5) When dry ice (solid carbon dioxide) undergoes sublimation, this would be classified as
   a. a physical change, because the chemical identity of the CO_2 is unchanged
   b. a physical change, because carbon dioxide is being separated into carbon and oxygen
   c. a chemical change, because a gas is being produced
   d. a chemical change, because carbon dioxide is being decomposed

6) Which of the following processes would be classified as a physical change?
   a. $Zn(s) + CuSO_4(aq) \rightarrow Cu(s) + ZnSO_4(aq)$
   b. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
   c. $NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$
   d. $C_{12}H_{26}O(s) \rightarrow C_{12}H_{26}O(l)$

7) Which statement describes a chemical change?
   a. Alcohol evaporates.
   b. Water vapor forms snowflakes.
   c. Table salt (NaCl) is crushed into powder.
   d. Glucose ($C_6H_{12}O_6$) and oxygen produce CO_2 and H_2O

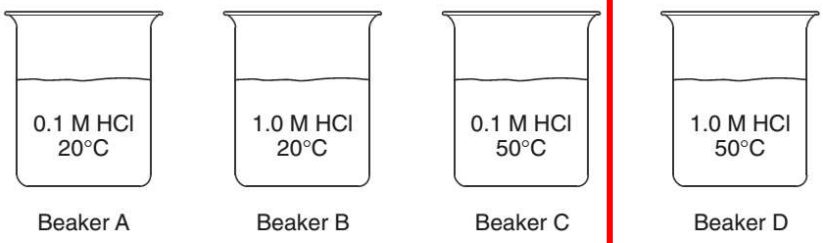
8) Given the balanced equation representing a reaction: $2H_2 + O_2 \rightarrow 2H_2O$
   What is the mass of H_2O produced when 10.0 grams of H_2 reacts completely with 80.0 grams of O_2?
   a. 70.0 g
   b. 90.0 g
   c. 180 g
   d. 800 g

9) Given the incomplete equation: $4Fe + 3O_2 \rightarrow 2X$
   Which compound is represented by X?
   a. FeO
   b. Fe_2O_3
   c. Fe_3O_2
   d. Fe_3O_4

CHEMISTRY UNIT 3 REVIEW **Name _____KEY_____**

10) Given the reaction: $Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$
The reaction occurs more slowly when a single piece of zinc is used than when the same mass of powdered zinc is used. Why does this occur?
a. The powdered zinc is more concentrated
b. The powdered zinc has greater surface area
c. The powder zinc requires less activation energy
d. The powdered zinc generates more heat energy

11) In each of the four beakers shown below, a 2.0-centimeter strip of magnesium ribbon reacts with 100 milliliters of HCl(aq) under the conditions shown. In which beaker will the reaction occur at the fastest rate?

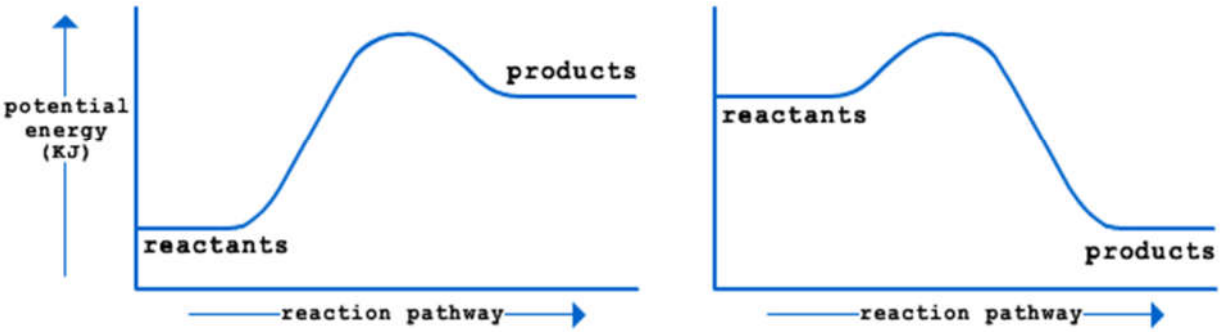


Part Two – Short Answer

1) Suppose you have a homogeneous mixture of ethyl alcohol (boiling point = 78°C) and water (boiling point = 100°C).
a. Could you separate this mixture by pouring it through filter paper? _____
b. These two substances have different boiling points, so they could be separated with the technique known as distillation. This technique is classified as a _____ change, because the chemical identity of the substances involved are _____

2) Suppose you have a sample of pure water. Your task is to decompose it into hydrogen and oxygen.
a. Could you decompose the water by heating it to its boiling point? _____
b. If you use electricity, the water could be separated into its elements. This is classified as a_____ _____ change, because the chemical identity of the substances involved are _____.

3) Label the following diagrams as either an exothermic or endothermic reaction.



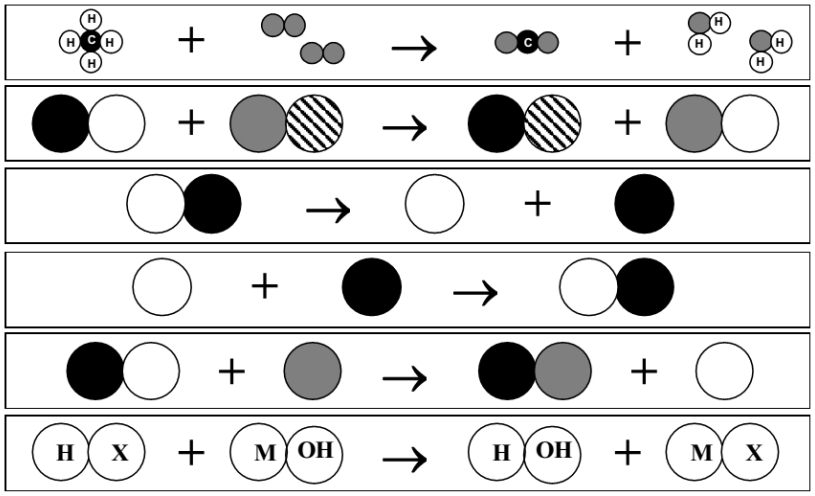
ENDOTHERMIC EXOTHERMIC

4) What is the difference between endothermic and exothermic change? Give examples of each.

CHEMISTRY UNIT 3 REVIEW **Name _____KEY_____**

5) Identify the TYPE of reaction that is represented in each diagram. Use the following choices:

synthesis = S | single replacement = SR | combustion = C
decomposition = D | double replacement = DR | neutralization = N



C

DR

D

S

SR

N

6) Write the balanced equation from the sentence and identify the type of reaction.

synthesis = S | single replacement = SR | combustion = C
decomposition = D | double replacement = DR | neutralization = N

D a. Solid Nickel (III) Hydroxide, $Ni(OH)_3$, was broken down to Nickel (III) oxide powder (Ni_2O_3) and water. The temperature of the flask where the reaction took place changed from 25°C to 35°C

$2\ Ni(OH)_3\ (s) \rightarrow 1\ Ni_2O_3\ (s) + 3\ H_2O\ (l) + heat$

SR b. Chlorine gas (Cl_2) and aqueous Scandium Bromide ($ScBr_2$) reacted to form Bromine gas (Br_2) and aqueous Scandium Chloride ($ScCl_2$) in an exothermic reaction.

$1\ Cl_2\ (g) + 1\ ScBr_2\ (aq) \rightarrow 1\ Br_2\ (g) + 1\ ScCl_2\ (aq) + heat$

C c. Liquid heptanol ($C_7H_{14}O$) was burned in the presence of oxygen gas (O_2) to produce carbon dioxide (CO_2) and water vapor in an exothermic reaction.

$1\ C_7H_{14}O\ (l) + 10\ O_2\ (g) \rightarrow 7\ CO_2\ (g) + 7\ H_2O\ (g) + heat$

N d. Aqueous Sulfuric Acid (H_2SO_4) reacted with aqueous sodium hydroxide (NaOH) to produce aqueous Sodium Sulfate (Na_2SO_4) and water in an exothermic reaction.

$1\ H_2SO_4\ (aq) + 2\ NaOH\ (aq) \rightarrow 1\ Na_2SO_4\ (aq) + 2\ H_2O\ (l) + heat$

S e. Heat was added to a flask containing Aluminum metal and Sulfur powder (S_8) in order to form solid Aluminum Sulfide (Al_2S_3)

$16\ Al\ (s) + 3\ S_8\ (s) + heat \rightarrow 8\ Al_2S_3\ (s)$

DR f. Aqueous Calcium nitrate, $Ca(NO_3)_2$, reacts with dissolved sodium carbonate, Na_2CO_3, to yield solid Calcium Carbonate, $CaCO_3$, and aqueous Sodium Nitrate, $NaNO_3$.

$1\ Ca(NO_3)_2\ (aq) + 1\ Na_2CO_3\ (aq) \rightarrow 1\ CaCO_3\ (s) + 2\ NaNO_3\ (aq)$

CHEMISTRY UNIT 3 REVIEW **Name _____KEY_____**

7) Balance and identify the following reactions

D 1) $2\ AlCl_3 \rightarrow 2\ Al + 3\ Cl_2$

SR 2) $2\ K + 2\ H_2O \rightarrow 2\ KOH + 1\ H_2$

C 3) $1\ C_5H_{12} + 8\ O_2 \rightarrow 5\ CO_2 + 6\ H_2O$

N 4) $2\ HCl + 1\ Mg(OH)_2 \rightarrow 2\ H_2O + 1\ MgCl_2$

S 5) $4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$

DR 6) $2\ Fe(NO_3)_3 + 3\ Ca(OH)_2 \rightarrow 2\ Fe(OH)_3 + 3\ Ca(NO_3)_2$

8) Stoichiometry Problems: Balance the equation then solve the stoichiometry problem

1. $1\ N_2 + 3\ H_2 \rightarrow 2\ NH_3$

How many moles of hydrogen are needed to completely react with 2.5 moles of nitrogen?

7.5 mol H_2

2. $2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$

How many moles of oxygen are produced by the decomposition of 0.67 moles of $KClO_3$?

1.005 mol O_2

3. $1\ Zn + 2\ HCl \rightarrow 1\ ZnCl_2 + 1\ H_2$

How many grams of hydrogen are produced from the reaction of 3.14 moles of zinc with excess HCl?

6.34 g H_2

4. $1\ C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$

How many moles of oxygen are necessary to react completley with 4.25 grams of propane (C_3H_8)?

0.48 mol O_2

5. $1\ K_3PO_4 + 1\ Al(NO_3)_3 \rightarrow 3\ KNO_3 + 1\ AlPO_4$

How many grams of KNO_3 are produced when 5.32 grams of K_3PO_4 are completely reacted?

7.6 g KNO_3