**Units 8 & 9 Test Review**

Topics Covered on the Test:

* Balancing Equations
* Types of Reactions
* Single Replacement Prediction
* Stoichiometry
* Percent Yield
* Limiting Reactant

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1.) ___ $CaCl_2$ + _2_ $AgNO_3$ → ___ $Ca(NO_3)_2$ + _2_ AgCl

50.0 g ? g

(A) Balance the equation.

(B) Type of reaction? Double replacement

(C) If 50.0 grams of calcium chloride are reacted with excess silver nitrate, how many grams of silver chloride can be produced?

$50.0\text{ g } CaCl_2 \times \frac{1\text{ mole}}{110.98\text{ g}} = 0.451\text{ moles } CaCl_2$

$\frac{0.451\text{ moles } CaCl_2}{1} = \frac{x\text{ moles AgCl}}{2}$ x = 0.902 moles AgCl

$0.902\text{ moles AgCl} \times \frac{143.32\text{ g}}{1\text{ mole}} =$ **129 g AgCl**

(D) What is the percent yield if a student makes 118 grams of silver chloride in this experiment?

$\frac{118\text{ g}}{129\text{ g}} \times 100 =$ **91.5 % yield**

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2.) _2_ $Fe(HCO_3)_3$ → ___ $Fe_2O_3$ + _3_ $H_2O$ + _6_ $CO_2$

15.0 g ? g

(A) Balance the equation.

(B) Type of reaction? Decomposition

(C) A lab group decomposed 15.0 grams of $Fe(HCO_3)_3$. What is the theoretical yield of iron (III) oxide?

$15.0\text{ g } Fe(HCO_3)_3 \times \frac{1\text{ mole}}{238.904\text{ g}} = 0.0628\text{ moles } Fe(HCO_3)_3$

$\frac{0.0628\text{ moles } Fe(HCO_3)_3}{2} = \frac{x\text{ moles } Fe_2O_3}{1}$ x = 0.0314 moles $Fe_2O_3$

$0.0314\text{ moles } Fe_2O_3 \times \frac{159.7\text{ g}}{1\text{ mole}} =$ **5.01 g $Fe_2O_3$**

(D) If the lab group produced 4.63 grams of iron (III) oxide, what is their percent yield?

$\frac{4.63\text{ g}}{5.01\text{ g}} \times 100 =$ **92.4 % yield**

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3.) ___ Au + ___$HNO_3$ + _3_HCl → ___ $AuCl_3$ + ___NO + _2_ $H_2O$

1.25 moles ? g

(A) How many grams of hydrochloric acid (HCl) are needed to completely react 1.25 moles of gold metal?

$\frac{1.25\text{ moles Au}}{1} = \frac{x\text{ moles HCl}}{3}$ x = 3.75 moles HCl

$3.75\text{ moles HCl} \times \frac{36.458\text{ g}}{1\text{ mole}} =$ **137 g HCl**

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4.) ___ Fe + _2_ $CuNO_3$ → ___ $Fe(NO_3)_2$ + _2_ Cu

3.7 moles ? moles

(A) How do we know that this reaction actually happens?

Iron (Fe) is higher on the Activity Series than copper (Cu).

(B) When 3.7 moles of iron are reacted with excess copper (I) nitrate, how many moles of copper are produced?

$\frac{3.7 \text{ moles Fe}}{1} = \frac{x \text{ moles Cu}}{2}$ x = **7.4 moles Cu**

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5.) ___ $Ca_3(PO_4)_2$ + _3_ $SiO_2$ + _5_ C → _2_ P + _3_ $CaSiO_3$ + _5_ CO

225.5 g ? moles

(A) How many moles of $CaSiO_3$ would be produced by the complete reaction of 225.5 grams of calcium phosphate?

$225.5 \text{ g } Ca_3(PO_4)_2 \times \frac{1 \text{ mole}}{310.18 \text{ g}} = 0.7270 \text{ moles } Ca_3(PO_4)_2$

$\frac{0.7270 \text{ moles } Ca_3(PO_4)_2}{1} = \frac{x \text{ moles } CaSiO_3}{3}$ x = **2.181 moles $Ca_3(PO_4)_2$**

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6.) ___ Ca + ___ $H_2O$ → ___ $Ca(OH)_2$ + ___ $H_2$

(A) How many molecules of water would be needed to react completely with 34.2 grams of calcium?

$34.2 \text{ g Ca} \times \frac{1 \text{ mole}}{40.08 \text{ g}} = 0.853 \text{ moles Ca}$

$\frac{0.853 \text{ moles Ca}}{1} = \frac{x \text{ moles } H_2O}{2}$ x = 1.706 moles $H_2O$

$1.706 \text{ moles } H_2O \times \frac{6.022 \times 10^{23} \text{ mcs}}{1 \text{ mole}} =$ **$1.03 \times 10^{24}$ mcs $H_2O$**

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7.) _2_ $K_3PO_4$ + _3_ $MgCl_2$ → ___ $Mg_3(PO_4)_2$ + _6_ KCl

25.4 g 21.7 g ? g

(A) What is the theoretical yield of potassium chloride if 21.7 grams of magnesium chloride are reacted with 25.4 grams of potassium phosphate?

*First, find the limiting reactant (LR).*

$25.4 \text{ g } K_3PO_4 \times \frac{1 \text{ mole}}{212.27 \text{ g}} = \frac{0.1197 \text{ moles } K_3PO_4}{2} = 0.05985^*$ - smaller # = LR

$25.4 \text{ g } MgCl_2 \times \frac{1 \text{ mole}}{95.21 \text{ g}} = \frac{0.2668 \text{ moles } MgCl_2}{3} = 0.0889$

$\frac{0.1197 \text{ moles } K_3PO_4}{2} = \frac{x \text{ moles KCl}}{6}$ x = 0.3591 moles KCl

$0.3591 \text{ moles KCl} \times \frac{74.55 \text{ g}}{1 \text{ mole}} =$ **26.8 g KCl**

(B) How many grams of excess reactant remain after the reaction is complete?

$\frac{0.1197 \text{ moles } K_3PO_4}{2} = \frac{x \text{ moles } MgCl_2}{3}$ x = 0.1796 moles $MgCl_2$

0.1796 moles $MgCl_2$ x $\frac{95.21\ g}{1\ mole}$ = 17.1 g $MgCl_2$ used

21.7 g $MgCl_2$ at start

- 17.1 g $MgCl_2$ used

**4.6 g remaining**

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8.) Al + $NiCl_2$ →

Compare Al to Ni because both are metals.
Al (element by itself) is higher on Activity Series than Ni (in compound), so reaction happens.
Al replaces Ni ~~> Ni ends up by itself
Al ends up in a compound with Cl
*Must use oxidation #s to write formulas for cmpds!*

$Al^{+3} \cdots Cl^{-1}$

8.) **2** Al + **3** $NiCl_2$ → **2 $AlCl_3$ + 3 Ni**

9.) $Zn(NO_3)_2$ + Mg →

Compare Zn to Mg because both are metals.
Mg (element by itself) is higher on Activity Series than Zn (in compound), so reaction happens.
Mg replaces Zn ~~>Zn ends up by itself
Mg ends up in a compound with $NO_3$
*Must use oxidation #s to write formulas for cmpds!*

$Mg^{+2} \cdots NO_3^{-1}$

9.) $Zn(NO_3)_2$ + Mg → **Zn + $Mg(NO_3)_2$**

10.) $Cu + K_2SO_4 \rightarrow$

Compare Cu to K because both are metals.
Cu (element by itself) is NOT higher on Activity Series than K (in compound), so reaction does not happen.

10.) $Cu + K_2SO_4 \rightarrow$ **no reaction**

11.) $CsF + I_2 \rightarrow$

Compare $F_2$ to $I_2$ because both are nonmetals.
$I_2$ (element by itself) is NOT higher on Activity Series than $F_2$ (in compound), so reaction does not happen.

11.) $CsF + I_2 \rightarrow$ **no reaction**

12.) $Cl_2 + NaBr \rightarrow$

Compare $Cl_2$ to $Br_2$ because both are nonmetals.
$Cl_2$ (element by itself) is higher on Activity Series than $Br_2$ (in compound), so reaction happens.
Cl replaces Br ~~>Br ends up by itself (as $Br_2$)
Cl ends up in a compound with Na
*Must use oxidation #s to write formulas for cmpds!*

$Na^{+1}Cl^{-1}$

12.) $Cl_2 + 2\ NaBr \rightarrow$ **$Br_2 + 2\ NaCl$**

13.) $Pb(ClO_3)_2 + K \rightarrow$

Compare Pb to K because both are metals.
K (element by itself) is higher on Activity Series than Pb (in compound), so reaction happens.
K replaces Pb ~~>Pb ends up by itself
K ends up in a compound with $ClO_3$
*Must use oxidation #s to write formulas for cmpds!*

$K^{+1}$ ..... $ClO_3^{-1}$

13.) $Pb(ClO_3)_2 + 2\ K \rightarrow$ **$Pb + 2\ KClO_3$**

14.) $Mn + LiOH \rightarrow$

Compare Mn to Li because both are metals.
Mn (element by itself) is NOT higher on Activity Series than Li (in compound), so reaction does not happen.

14.) $Mn + LiOH \rightarrow$ **no reaction**