South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

4 • Chemical Equations and Stoichiometry

Station 1 – COMBUSTION EQUATIONS

Write balanced equations for the complete combustion of the following fuels:

Fuel	Combustion Equation
C_3H_8	
C_6H_{14}	
CH_3OCH_3	

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Station 2 – BALANCING EQUATIONS

Balance the following chemical equations:

$\_\_KClO_3(s) \rightarrow \_\_KCl(s) + \_\_O_2(g)$
$\_\_Fe(s) + \_\_Cl_2(g) \rightarrow \_\_FeCl_3(s)$
$\_\_Pb(NO_3)_2(aq) + \_\_AlCl_3(aq) \rightarrow \_\_PbCl_2(aq) + \_\_Al(NO_3)_3(aq)$

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Station 3 – PHASES

From the statement, decide whether each substance should be labeled with (s), (l), (g), or (aq):

Pure rubbing alcohol is C_3H_7OH( ).
Copper metal is Cu( ).
A solution of cupric chloride is $CuCl_2$( ).
Melted iron is Fe( ).
Salt water is NaCl( ).
Helium is He( ).
Dry ice is CO_2( ).
Steam is H_2O( ).

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Station 4 – EMPIRICAL FORMULAS

Determine the molecular formula given the following information:

Empirical Formula	Molecular Formula	Molar Mass
CH_2		84.18 $g \cdot mol^{-1}$
NO_2		92.02 $g \cdot mol^{-1}$
$NaSO_2$		174.14 $g \cdot mol^{-1}$
PCl_3		137.32 $g \cdot mol^{-1}$

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Station 5 – STOICHIOMETRY

Solve the following general stoichiometry problems: ***(Show work beautifully.)***

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

[Molar Masses: 28.02 $g \cdot mol^{-1}$ 2.02 $g \cdot mol^{-1}$ 17.04 $g \cdot mol^{-1}$]

Calculate the mass of ammonia, NH_3, formed when 45.0 L $N_2(g)$ reacts with excess $H_2(g)$ at STP.

What mass of H_2 is needed to completely react with 10.0 grams of N_2?

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Station 6 – LIMITING REACTANT PROBLEMS

Solve the following problem:

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

[Molar Masses: 28.02 $g \cdot mol^{-1}$ 2.02 $g \cdot mol^{-1}$ 17.04 $g \cdot mol^{-1}$]

What mass of NH_3 is formed when 135.00 g N_2 reacts with 32.00 g H_2?

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Station 7 – LABORATORY PROBLEM

Using the following data, determine the best ratio of the chemical reaction:

$$\_\_\_X + \_\_\_Y \rightarrow Z + \text{heat}$$

Various mixtures of X and Y were mixed. A thermometer was used to record the temperature of the mixture.
The **highest temperature reached** for each mixture was recorded in the table below.
Circle the mixture in the data table that released the **most** heat.
Determine the **stoichiometric ratio** for X and Y (write in the coefficients in the equation above).

Volume X (mL)	Volume Y (mL)	Max Temp Measured (°C)
0	100	20.0°C
20	80	25.0°C
40	60	30.0°C
60	40	35.0°C
80	20	27.5°C
100	0	20.0°C

In the mixture of 20 mL X and 80 mL Y, _____ was the limiting reactant.

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Station 8 – PERCENT YIELD

Solve the following problem:

Hydrogen gas was generated according to the equation: $Zn(s) + 2HCl(aq) \rightarrow H_2(g) + ZnCl_2(aq)$

When 25.00 grams of Zn metal reacted with excess HCl 7.50 L $H_2(g)$ was collected at STP.

The **theoretical yield** of $H_2(g)$ for this reaction is: (show work)

The **percentage yield** for this reaction is: (show set-up)

4 • Chemical Equations and Stoichiometry

Station 9 – CHEMICAL ANALYSIS

Solve the following problem:

A compound composed of carbon and hydrogen is analyzed by combustion.
When a 4.297 g sample of the compound is burned, 12.57 g CO_2 and 7.72 g H_2O are formed.
What is the **empirical formula** of the compound? _____

The molar mass of the compound is found to be about 30 $g \cdot mol^{-1}$.
The **molecular formula** for the compound is _____

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