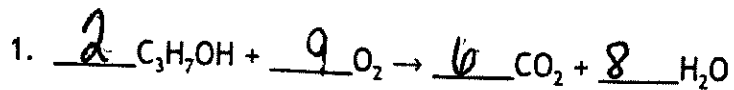


Key

Date: _____

Class Pd. _____

HONORS CHEMISTRY: Unit 5 Moles & Stoichiometry Test Review

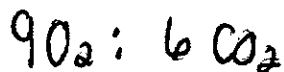


$$12 + 8 = 20$$

$$-2$$

$$\frac{18}{18}$$

a. What is the mole ratio of oxygen to carbon dioxide?



b. How many moles of carbon dioxide are produced when 4.6 mol of oxygen react?

Stoichiometry

$$\frac{4.6 \text{ mol O}_2}{9 \text{ mol O}_2} \times \frac{6 \text{ mol CO}_2}{6 \text{ mol CO}_2} = 3.1 \text{ mol CO}_2$$

c. How many molecules of C₃H₇OH will react with 4.6 L of oxygen?

Stoich

$$\frac{4.6 \text{ L O}_2}{22.4 \text{ L O}_2} \times \frac{1 \text{ mol O}_2}{1 \text{ mol O}_2} \times \frac{2 \text{ mol C}_3\text{H}_7\text{OH}}{9 \text{ mol O}_2} \times \frac{6.022 \times 10^{23} \text{ molecules C}_3\text{H}_7\text{OH}}{1 \text{ mol C}_3\text{H}_7\text{OH}} = 2.7 \times 10^{22} \text{ molecules C}_3\text{H}_7\text{OH}$$

2. Lithium nitride reacts with water to form ammonia (NH₃) and lithium hydroxide.



a. How many grams of lithium nitride will react with 40.0 g of water?

Stoich

$$\frac{40.0 \text{ g H}_2\text{O}}{18.016 \text{ g H}_2\text{O}} \times \frac{1 \text{ mol H}_2\text{O}}{3 \text{ mol H}_2\text{O}} \times \frac{1 \text{ mol Li}_3\text{N}}{1 \text{ mol Li}_3\text{N}} \times \frac{34.833 \text{ g Li}_3\text{N}}{1 \text{ mol Li}_3\text{N}} = 25.8 \text{ g Li}_3\text{N}$$

b. What mass of lithium hydroxide is produced from 6.75 mol of lithium nitride?

Stoich

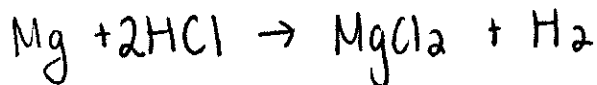
$$6.75 \text{ mol Li}_3\text{N} \times \frac{3 \text{ mol LiOH}}{1 \text{ mol Li}_3\text{N}} \times \frac{23.949 \text{ g LiOH}}{1 \text{ mol LiOH}} = 485 \text{ g LiOH}$$

3. A student made $\overset{P}{75.94 \text{ g}}$ of magnesium chloride by reacting $\overset{R}{30.00 \text{ g}}$ of Magnesium with $\overset{R}{60.00 \text{ g}}$ of hydrochloric acid.

R

Limiting reactant and percent yield

a. Write the balanced equation.



b. What is the limiting reactant?

Excess reactant?

$$\frac{30.00 \text{ g Mg}}{24.31 \text{ g Mg}} \times \frac{1 \text{ mol Mg}}{1 \text{ mol Mg}} \times \frac{1 \text{ mol MgCl}_2}{1 \text{ mol Mg}} \times 95.24 \text{ g MgCl}_2 = 117.5 \text{ g MgCl}_2$$

$$\frac{60.00 \text{ g HCl}}{36.458 \text{ g HCl}} \times \frac{1 \text{ mol HCl}}{2 \text{ mol HCl}} \times \frac{1 \text{ mol MgCl}_2}{1 \text{ mol MgCl}_2} \times 95.24 \text{ g MgCl}_2 = 78.37 \text{ g MgCl}_2$$

LR = HCl

ER = Mg

Theoretical yield = 78.37 g MgCl₂

c. What is the percent yield?

$$\frac{75.94 \text{ g MgCl}_2}{78.37 \text{ g MgCl}_2} \times 100 = 96.90\%$$

d. Determine the amount of excess reactant remaining.

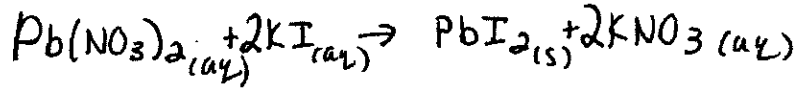
$$\frac{78.37 \text{ g MgCl}_2}{95.24 \text{ g MgCl}_2} \times \frac{1 \text{ mol MgCl}_2}{1 \text{ mol MgCl}_2} \times \frac{1 \text{ mol Mg}}{1 \text{ mol Mg}} \times 24.31 \text{ g Mg} = 20.00 \text{ g Mg}$$

↑
used up

$$30.00 \text{ g Mg} - 20.00 \text{ g Mg} = 10.00 \text{ g Mg}$$

4. A student reacts 2.00g of Lead (II) nitrate with 4.00g of potassium iodide. How much product in grams should she expect to collect? (Write a balanced reaction and determine the precipitate)

solid



$$\frac{2.00\text{g Pb}(\text{NO}_3)_2}{331.22\text{g Pb}(\text{NO}_3)_2} \times \frac{1\text{ mol Pb}(\text{NO}_3)_2}{1\text{ mol Pb}(\text{NO}_3)_2} \times \frac{1\text{ mol PbI}_2}{1\text{ mol Pb}(\text{NO}_3)_2} \times \frac{461\text{g PbI}_2}{1\text{ mol PbI}_2} = 2.78\text{g PbI}_2$$

$$\frac{4.00\text{g KI}}{166\text{g KI}} \times \frac{1\text{ mol KI}}{1\text{ mol KI}} \times \frac{1\text{ mol PbI}_2}{2\text{ mol KI}} \times \frac{461\text{g PbI}_2}{1\text{ mol PbI}_2} = 5.55\text{g PbI}_2$$

LR = $\text{Pb}(\text{NO}_3)_2$ ER = KI theoretical yield = 2.78g PbI_2

5. Find the percentage of nitrogen in ammonium nitrate, an important source of nitrogen in fertilizers.

$$\frac{28.02}{80.052} \times 100 = 35.00\%$$

NH₄NO₃
↳ 80.052

Name the following compounds and give the percent composition of each element.

6. Fe₂O₃ Name: Iron(III) oxide %Fe = 69.94
↳ 159.7 %O = 30.06

7. Ag₂O Name: Silver oxide %Ag = 93.10%
↳ 231.74 %O = 6.97%

8. Na₂SO₄ Name: Sodium sulfate %Na = 32.37%
↳ 142.05 %S = 22.58%
%O = 45.05%

9. What is the empirical formula of a compound that contains 53.73 % Fe and 46.27 % S?

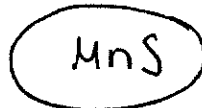
$$\frac{53.73 \text{ g Fe}}{55.85 \text{ g Fe}} \times \frac{1 \text{ mol Fe}}{1 \text{ mol Fe}} = 0.96204 / 0.96204 = 1 \times 2 = 2$$

$$\frac{46.27 \text{ g S}}{32.07 \text{ g S}} \times \frac{1 \text{ mol S}}{1 \text{ mol S}} = 1.443 / 0.96204 = 1.5 \times 2 = 3$$



10. What is the empirical formula of a compound that contains 63.1 % Mn and 36.9 % S?

$$\frac{63.1 \text{ g Mn}}{54.94 \text{ g Mn}} \times \frac{1 \text{ mol Mn}}{1 \text{ mol Mn}} = 1.1485 / 1.1485 = 1$$



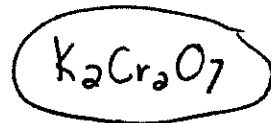
$$\frac{36.9 \text{ g S}}{32.07 \text{ g S}} \times \frac{1 \text{ mol S}}{1 \text{ mol S}} = 1.1506 / 1.1485 = 1$$

11. What is the empirical formula of a compound that contains 26.6 % K, 35.4 % Cr, and 38.0 % O?

$$\frac{26.6 \text{ g K}}{39.1 \text{ g K}} \times \frac{1 \text{ mol K}}{1 \text{ mol K}} = 0.68031 / 0.68031 = 1 \times 2 = 2$$

$$\frac{35.4 \text{ g Cr}}{51.99 \text{ g Cr}} \times \frac{1 \text{ mol Cr}}{1 \text{ mol Cr}} = 0.6809 / 0.68031 = 1 \times 2 = 2$$

$$\frac{38.0 \text{ g O}}{16 \text{ g O}} \times \frac{1 \text{ mol O}}{1 \text{ mol O}} = 2.375 / 0.68031 = 3.5 \times 2 = 7$$

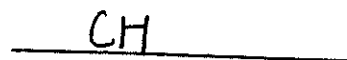


12. An organic compound is found to contain 92.25 % carbon and 7.75 % hydrogen. If the molecular mass is 78, calculate:

The empirical formula =

$$\frac{92.25 \text{ g C}}{12.01 \text{ g C}} \times \frac{1 \text{ mol C}}{1 \text{ mol C}} = 7.6811 / 7.6811 = 1$$

$$\frac{7.75 \text{ g H}}{1.008 \text{ g H}} \times \frac{1 \text{ mol H}}{1 \text{ mol H}} = 7.688 / 7.6811 = 1$$



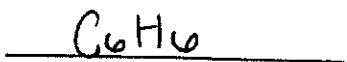
The empirical formula mass =

$$\text{CH} \rightarrow 12.01 + 1.008$$

13.018 g/mol

The molecular formula =

$$\frac{78}{13.018} = 6 \quad \text{CH} \times 6$$



13. In an experiment, a student gently heated a hydrated $\text{CuSO}_4 \cdot x \text{H}_2\text{O}$ to remove the water. The following data was recorded:

Mass of empty crucible	19.82 g
Mass of crucible & contents before heating	21.54 g.
Mass of crucible & contents after heating	20.94 g

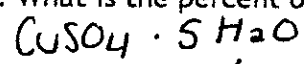
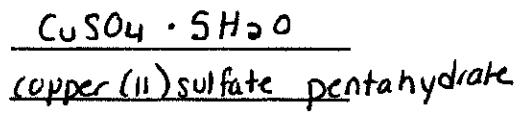
$$\begin{aligned} \text{Hydrate} &= 21.54 - 19.82 \\ &= 1.72 \text{ g} \\ \text{anhydrous salt} &= 20.94 - 19.82 \\ &= 1.12 \text{ g} \\ \text{water} &= 1.72 - 1.12 = \\ &= 0.60 \text{ g} \end{aligned}$$

a. Determine the formula of the hydrate.

$$\frac{1.12 \text{ g CuSO}_4}{159.62 \text{ g CuSO}_4} \Bigg| \frac{1 \text{ mol CuSO}_4}{159.62 \text{ g CuSO}_4} = 0.00702 / 0.00702 = 1$$

$$\frac{0.60 \text{ g H}_2\text{O}}{18.016 \text{ g H}_2\text{O}} \Bigg| \frac{1 \text{ mol H}_2\text{O}}{18.016 \text{ g H}_2\text{O}} = 0.0333 / 0.00702 = \text{about } 5$$

- b. The formula of the hydrate =
- c. What is the name of the hydrate?
- d. What is the percent of water in the hydrate



$$\frac{90.08}{249.7} \times 100 = 36.08\%$$

14. In an experiment, barium chloride ___ hydrate was heated to remove water. The following data was obtained:

Mass of empty crucible	20.286 g
Mass of crucible & contents before heating	21.673 g
Mass of crucible & contents after heating	21.461 g

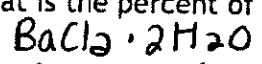
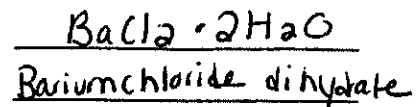
$$\begin{aligned} \text{hydrate} &= 21.673 - 20.286 \\ &= 1.387 \text{ g} \\ \text{anhydrous salt} &= 21.461 - 20.286 \\ &= 1.175 \text{ g} \\ \text{water} &= 1.387 - 1.175 \\ &= 0.212 \text{ g} \end{aligned}$$

a. Determine the formula of the hydrate.

$$\frac{1.175 \text{ g BaCl}_2}{208.28 \text{ g BaCl}_2} \Bigg| \frac{1 \text{ mol BaCl}_2}{208.28 \text{ g BaCl}_2} = 0.00564 / 0.00564 = 1$$

$$\frac{0.212 \text{ g H}_2\text{O}}{18.016 \text{ g H}_2\text{O}} \Bigg| \frac{1 \text{ mol H}_2\text{O}}{18.016 \text{ g H}_2\text{O}} = 0.01177 / 0.00564 = 2$$

- b. The formula of the hydrate =
- c. What is the name of the hydrate?
- d. What is the percent of water in the hydrate



$$\frac{36.032}{244.312} \times 100 = 14.75\%$$