Worksheet 30: Mass Stoichiometry
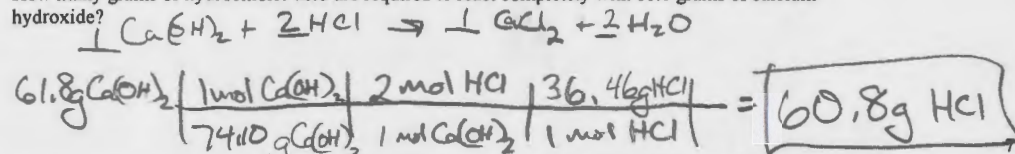
Name: _____ **Key**
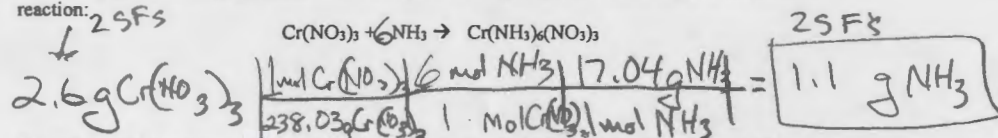
Period: _____
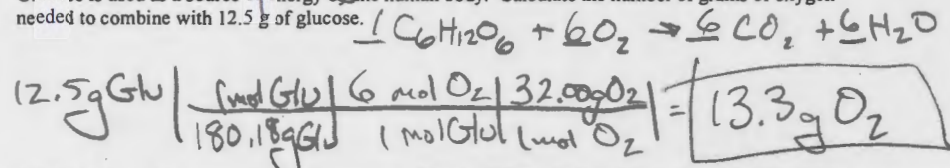
1. How many grams of hydrochloric acid are required to react completely with 61.8 grams of calcium hydroxide?

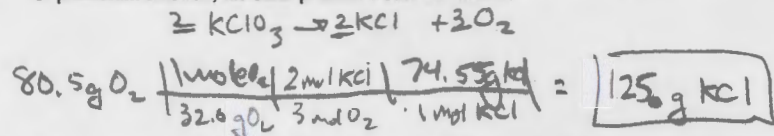$1 \ Ca(OH)_2 + 2 HCl \rightarrow 1 \ CaCl_2 + 2 H_2O$

$$61.8g \ Ca(OH)_2 \left| \frac{1 \ mol \ Ca(OH)_2}{74.10 g \ Ca(OH)_2} \right| \frac{2 \ mol \ HCl}{1 \ mol \ Ca(OH)_2} \left| \frac{36.46g \ HCl}{1 \ mol \ HCl} \right| = \boxed{60.8g \ HCl}$$

2. How many grams of NH_3 are needed when 2.6 grams of $Cr(NO_3)_3$ react according to this synthesis reaction:

2 SF's

$Cr(NO_3)_3 + 6NH_3 \rightarrow Cr(NH_3)_6(NO_3)_3$

2 SF's

$$2.6g \ Cr(NO_3)_3 \left| \frac{1 \ mol \ Cr(NO_3)_3}{238.03 g \ Cr(NO_3)_3} \right| \frac{6 \ mol \ NH_3}{1 \ mol \ Cr(NO_3)_3} \left| \frac{17.04 g \ NH_3}{1 \ mol \ NH_3} \right| = \boxed{1.1 \ g \ NH_3}$$
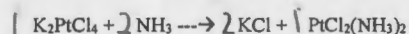
3. Glucose is used as a source of energy by the human body. Calculate the number of grams of oxygen needed to combine with 12.5 g of glucose.
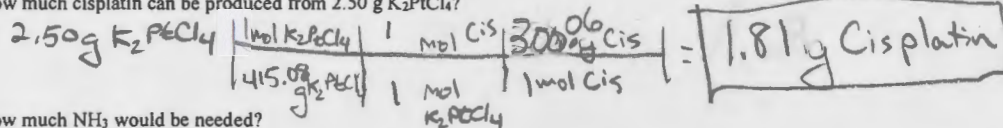
$1 \ C_6H_{12}O_6 + 6O_2 \rightarrow 6 CO_2 + 6 H_2O$

$$12.5g \ Glu \left| \frac{1 \ mol \ Glu}{180.18 g \ Glu} \right| \frac{6 \ mol \ O_2}{1 \ mol \ Glu} \left| \frac{32.00 g \ O_2}{1 \ mol \ O_2} \right| = \boxed{13.3g \ O_2}$$

4. Assume that in the decomposition of potassium chlorate, $KClO_3$, 80.5 g of O_2 form. How many grams of potassium chloride, the other product would be formed?

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

$$80.5g \ O_2 \left| \frac{1 \ mol \ O_2}{32.0 g \ O_2} \right| \frac{2 \ mol \ KCl}{3 \ mol \ O_2} \left| \frac{74.55 g \ KCl}{1 \ mol \ KCl} \right| = \boxed{125g \ KCl}$$
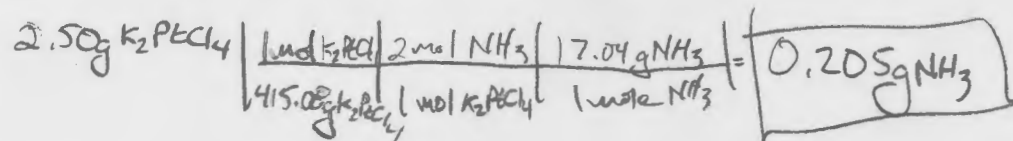
5. The compound cisplatin $PtCl_2(NH_3)_2$, has been found to be effective in treating some types of cancer. A typical dose can be between 20 – 600 mg at a cost of up to $100 per gram. It can be synthesized using the following reaction.
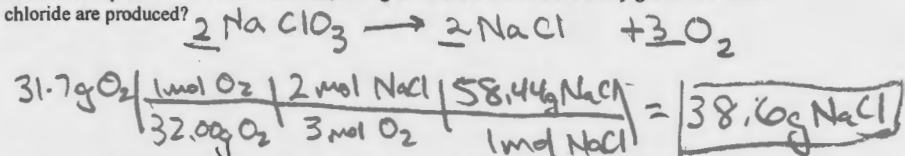
$1 \ K_2PtCl_4 + 2 NH_3 \dashrightarrow 2 KCl + 1 \ PtCl_2(NH_3)_2$

a. How much cisplatin can be produced from 2.50 g K_2PtCl_4?

$$2.50g \ K_2PtCl_4 \left| \frac{1 \ mol \ K_2PtCl_4}{415.08 g \ K_2PtCl_4} \right| \frac{1 \ mol \ Cis}{1 \ mol \ K_2PtCl_4} \left| \frac{300.06 g \ Cis}{1 \ mol \ Cis} \right| = \boxed{1.81 g \ Cisplatin}$$

b. How much NH_3 would be needed?

$$2.50g \ K_2PtCl_4 \left| \frac{1 \ mol \ K_2PtCl_4}{415.08 g \ K_2PtCl_4} \right| \frac{2 \ mol \ NH_3}{1 \ mol \ K_2PtCl_4} \left| \frac{17.04 g \ NH_3}{1 \ mol \ NH_3} \right| = \boxed{0.205 g \ NH_3}$$
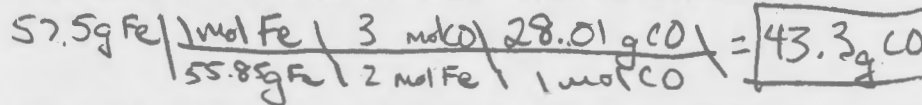
6. In the decomposition of sodium chlorate, 31.7 g of O_2 are formed. How many grams of sodium chloride are produced?

$2 \ NaClO_3 \rightarrow 2 NaCl + 3 O_2$

$$31.7g \ O_2 \left| \frac{1 \ mol \ O_2}{32.00 g \ O_2} \right| \frac{2 \ mol \ NaCl}{3 \ mol \ O_2} \left| \frac{58.44 g \ NaCl}{1 \ mol \ NaCl} \right| = \boxed{38.6g \ NaCl}$$

7. The action of carbon monoxide on iron(III) oxide can be represented by the equation

$1 \ Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$
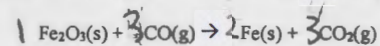
What is the minimum amount of carbon monoxide used if 57.5 grams of iron were produced?

$$57.5g \ Fe \left| \frac{1 \ mol \ Fe}{55.85 g \ Fe} \right| \frac{3 \ mol \ CO}{2 \ mol \ Fe} \left| \frac{28.01 g \ CO}{1 \ mol \ CO} \right| = \boxed{43.3g \ CO}$$

8. Claude-Louis Berthollet first prepared ethyne (acetylene) by sparking carbon electrodes in hydrogen gas.

$2 C + 1H_2 \rightarrow 1 C_2H_2$
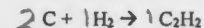
How many grams of carbon electrode will be consumed when 59.8 grams of acetylene are produced?

$$59.8g \ C_2H_2 \left| \frac{1 \ mol \ C_2H_2}{26.04 g \ C_2H_2} \right| \frac{2 \ mol \ C}{1 \ mol \ C_2H_2} \left| \frac{12.01 g \ C}{1 \ mol \ C} \right| = \boxed{55.2g \ C}$$
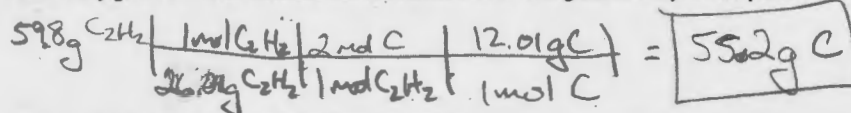
9. In space vehicles, air purification for the crew is partly accomplished with the use of lithium peroxide, Li_2O_2. It reacts with waste CO_2 in the air according to the reaction

$2 Li_2O_2 + 2 CO_2 \rightarrow 2 Li_2CO_3 + 1 O_2$
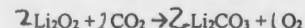
How many grams of oxygen are released by the reaction of 0.905 g of carbon dioxide?

$$0.905g \ CO_2 \left| \frac{1 \ mol \ CO_2}{44.0 g \ CO_2} \right| \frac{1 \ mol \ O_2}{2 \ mol \ CO_2} \left| \frac{32.00 g \ O_2}{1 \ mol \ O_2} \right|$$

$$= \boxed{0.329g \ O_2}$$