Name _____

1. When aluminum is heated in oxygen, aluminum oxide is formed. What weight of the oxide can be obtained from 25.0 g of the metal?

2. When steam (hot water) is passed over iron, hydrogen gas and iron (III) oxide are formed. What weight of steam would be needed to react completely with 100.0 g of iron?

3. How much ammonium hydroxide is needed to react completely with 75.0 g of copper (II) nitrate in a double replacement reaction?

4. When ammonia is burned in oxygen, free nitrogen gas and water are produced. What volume of ammonia will react completely with 25.0 L of oxygen? What volume of nitrogen gas is formed?

5. When sodium carbonate reacts with hydrochloric acid, the carbonic acid that is formed immediately breaks down into carbon dioxide and water. What weight of sodium carbonate would have been present originally if 5.0 L of carbon dioxide were obtained in this way?

6. How much copper metal can be obtained by the single replacement reaction between copper (I) nitrate and 30.0 g of iron metal? (Iron [II] nitrate is formed.)

7. What weight of sulfuric acid will be needed to react completely with 35.5 g of ammonia in the production of ammonium sulfate?

8. What weight of chlorine gas will be needed to react completely with 85.8 g of potassium iodide in a single replacement reaction?

9. In the neutralization reaction between sulfuric acid and potassium hydroxide, how much potassium sulfate can be produced if you have 150.0 g of sulfuric acid to begin with?

10. What volume of nitrogen gas is needed to react completely with 150.0 L of hydrogen in the production of ammonia?

1) $4\,Al + 3\,O_2 \rightarrow 2\,Al_2O_3$

25.0 g Al, x g Al_2O_3

$25.0\text{ g Al} \times \frac{1\text{ mole Al}}{26.98\text{ g Al}} \times \frac{2\text{ mole } Al_2O_3}{4\text{ mole Al}} \times \frac{101.9\text{ g } Al_2O_3}{1\text{ mole } Al_2O_3} = 47.2\text{ g } Al_2O_3$

2) $3\,H_2O + 2\,Fe \rightarrow 3\,H_2 + Fe_2O_3$

x g, 100.0 g Fe

$100.0\text{ g Fe} \times \frac{1\text{ mole Fe}}{55.85\text{ g Fe}} \times \frac{3\text{ mole } H_2O}{2\text{ mole Fe}} \times \frac{18.02\text{ g } H_2O}{1\text{ mole } H_2O} =$

$48.4\text{ g } H_2O$

3) $2(NH_4)(OH) + Cu(NO_3)_2 \rightarrow 2(NH_4)(NO_3) + Cu(OH)_2$

x g, 75.0 g

$75.0\text{ g } Cu(NO_3)_2 \times \frac{1\text{ mole } Cu(NO_3)_2}{187.57\text{ g } Cu(NO_3)_2} \times \frac{2\text{ mole } (NH_4)(OH)}{1\text{ mole } Cu(NO_3)_2} \times \frac{35.0\text{ g } (NH_4)(OH)}{1\text{ mole } (NH_4)(OH)} = 28.0\text{ g } (NH_4)(OH)$

4) $4\,NH_3 + 3\,O_2 \rightarrow 2\,N_2 + 6\,H_2O$

x L, 25.0 L

$25.0\text{ L } O_2 \times \frac{1\text{ mole } O_2}{22.4\text{ L } O_2} \times \frac{4\text{ mole } NH_3}{3\text{ mole } O_2} \times \frac{22.4\text{ L } NH_3}{1\text{ mole } NH_3} = 33.3\text{ L } NH_3$

5) $Na_2CO_3 + 2HCl \rightarrow H_2CO_3 + 2NaCl$

$H_2CO_3 \rightarrow H_2O + CO_2$

x g → 5.0 L

$5.0\ L\ CO_2 \left|\frac{1\ mole\ CO_2}{22.4\ L\ CO_2}\right|\frac{1\ mole\ Na_2CO_3}{1\ mole\ CO_2}\left|\frac{105.99\ g\ Na_2CO_3}{1\ mole\ Na_2CO_3}\right| =$

$23.7\ g\ Na_2CO_3$

6) $2Cu(NO_3) + Fe \rightarrow 2Cu + Fe(NO_3)_2$

30.0 g → x g

$30.0\ g\ Fe \left|\frac{1\ mole\ Fe}{55.85\ g\ Fe}\right|\frac{2\ mole\ Cu}{1\ mole\ Fe}\left|\frac{63.55\ g\ Cu}{1\ mole\ Cu}\right| =$

$68.3\ g\ Cu$

7) $H_2SO_4 + 2NH_3 \rightarrow (NH_4)_2SO_4$

x g → 35.5 g

$35.5\ g\ NH_3 \left|\frac{1\ mole\ NH_3}{17.04\ g\ NH_3}\right|\frac{1\ mole\ H_2SO_4}{2\ mole\ NH_3}\left|\frac{98.08\ g\ H_2SO_4}{1\ mole\ H_2SO_4}\right| =$

$102.2\ g\ H_2SO_4$

8) $Cl_2 + 2KI \rightarrow 2KCl + I_2$

x g → 85.8 g

$85.8\ g\ KI \left|\frac{1\ mole\ KI}{166.01\ g\ KI}\right|\frac{1\ mole\ Cl_2}{2\ mole\ KI}\left|\frac{70.90\ g\ Cl_2}{1\ mole\ Cl_2}\right| =$

$18.3\ g\ Cl_2$

a) H_2SO_4 + 2KOH → K_2SO_4 + H_2O

150.0g H_2SO_4 → xg K_2SO_4

$$150.0\text{g } H_2SO_4 \left|\frac{1\text{ mole } H_2SO_4}{98.0\text{g } H_2SO_4}\right|\frac{1\text{ mole } K_2SO_4}{1\text{ mole } H_2SO_4}\left|\frac{174.2\text{g } K_2SO_4}{1\text{ mole } K_2SO_4}\right| =$$

266.5g K_2SO_4

b) N_2 + $3H_2$ → $2NH_3$

X L 150.0 L

$$150.0\text{L } H_2 \left|\frac{1\text{ mole } H_2}{22.4\text{L } H_2}\right|\frac{1\text{ mole } N_2}{3\text{ mole } H_2}\left|\frac{22.4\text{L } N_2}{1\text{ mole } N_2}\right| =$$

50.0L N_2