Review moles, stoichiometry, exothermic and endothermic reactions

1. How many moles are in 12 g of H_2O?

$n = \frac{m}{mm}$ $\frac{12}{18.02}$ 0.67 mol

2. How many molecules are in 99 g of $CaCO_3$?

$n = \frac{m}{mm}$ $\frac{99}{100.09} = .989109801$ $\frac{1\ mol}{6.023\times10^{23}\ molecules} = \frac{.989...}{x}$ 6.0×10^{23} molecules

3. How many hydrogen atoms are in 24.5 g of $Ca(OH)_2$?

$n = \frac{m}{mm}$ $\frac{24.5}{74.10} = .330634278$ $\frac{1\ mol}{6.02\times10^{23}} = \frac{.330...}{x} = 1.990418354\times10^{23} \times 2$ 3.98×10^{23} atoms

4. Calculate the molarity of a solution by dissolving 250 g of NaCl in water to make a 400.0 mL solution.

$n = \frac{m}{mm}$ $\frac{250}{58.44} = 4.277891855$ $\frac{4.277...}{.4000} = \frac{x}{1L} =$ 11 mol/L

5. There are 10.0 g/ 6.0 L of salt NaCl in a Gatorade drink. What is the molar concentration of the drink?

$\frac{10.0g}{6.0L} = \frac{x}{1L} = 1.666666667g$ $n = \frac{m}{mm}$ $\frac{1.66...}{58.44} =$ 0.029 mol/L

6. How many moles of P_2O_5 are in 600.0 mL of a 2.2 M solution?

$\frac{2.2\ mol}{L} = \frac{x}{.6L} =$ 1.3 mol

7. How many grams of NaCl are in 3.00 L of a 6.2 M solution?

$m = n \times mm$

$18,6 \times 58.44 =$ 1100 g

$\frac{6.2\ mol}{L} = \frac{x}{3.00}$ 18.6 mol

8. How would you prepare 5.5 L of 4.5 M solution of KBr?

$m = n \times mm$

24.75×119.00

2900g

$\frac{4.5\ mol}{L}$ $\frac{x}{5.5L} = 24.75$

5 steps 1) weigh 2) Put 3) stir 4) add 5) Cm.

9. What volume of a 7.0 mol/L solution of H_2O contains 25 g of solute?

$n = \frac{m}{mm}$ $\frac{25}{18.02} = 1.387547392$ $\frac{7.0\ mol}{L} = \frac{1.38...}{x} =$ .20L

10. To neutralize hydrochloric acid (HCl), magnesium hydroxide ($Mg(OH)_2$), a base is added. The neutralization reaction is represented by the following equation:

$$2\,HCl + Mg(OH)_2 \rightarrow MgCl_2 + 2\,H_2O$$

a- What mass of the $Mg(OH)_2$ is required to neutralize 9.0 g of HCl?

Given: $9.0\,g\,HCl \times \frac{1\,mol\,HCl}{36.46\,g\,HCl} \times \frac{1\,mol\,Mg(OH)_2}{2\,mol\,HCl} \times \frac{58.33\,g\,Mg(OH)_2}{1\,mol\,Mg(OH)_2} = 7.2\,g$

b- How many moles of the $Mg(OH)_2$ is required to neutralize 7.5 g of H_2O?

Given: $7.5\,g\,H_2O \times \frac{1\,mol\,H_2O}{18.02\,g\,H_2O} \times \frac{1\,mol\,Mg(OH)_2}{2\,mol\,H_2O} = 0.21\,mol$

c- You have 6.0 moles of HCl, what mass of $MgCl_2$ is required to neutralize the 6.0 moles of HCl?

Given: $6.0\,mol\,HCl \times \frac{1\,mol\,MgCl_2}{2\,mol\,HCl} \times \frac{95.21\,g\,MgCl_2}{1\,mol\,MgCl_2} = 290\,g$

d- You have 7.0 moles of HCl, how many moles of $Mg(OH)_2$ is required to neutralize the 4 moles of HCl?

Given: $7.0\,mol\,HCl \times \frac{1\,mol\,Mg(OH)_2}{2\,mol\,HCl} = 3.5\,mol$

e- If 700.0 g of water was produced, how many molecules of magnesium chloride ($MgCl_2$) must have reacted with the ~~oxygen~~?

Given: $700.0\,g\,H_2O \times \frac{1\,mol\,H_2O}{18.02\,g\,H_2O} \times \frac{1\,mol\,MgCl_2}{2\,mol\,H_2O} \times \frac{6.02\times10^{23}\,molecule\,MgCl_2}{1\,mol\,MgCl_2} = 1.169\times10^{25}\,molec$

f- If 3.00×10^9 molecules of HCl are available, how many moles of water would react with it?

Given: $3.00\times10^{9}\,molec\,HCl \times \frac{1\,mol\,HCl}{6.02\times10^{23}\,molec\,HCl} \times \frac{2\,mol\,H_2O}{2\,mol\,HCl} = 4.98\times10^{-15}\,mol$

g- If 10.5×10^7 molecules of HCl are available, how many grams of $MgCl_2$ would react with it?

Given: $10.5\times10^{7}\,molec\,HCl \times \frac{1\,mol\,HCl}{6.02\times10^{23}\,molec\,HCl} \times \frac{1\,mol\,MgCl_2}{2\,mol\,HCl} \times \frac{95.21\,g\,MgCl_2}{1\,mol\,MgCl_2}$

$= 8.30\times10^{-15}\,g$

11. 100mL of $BaCl_2$ is used to produce $BaCrO_4$. If 5.0 g of $BaCrO_4$ is made, what is the concentration of the $BaCl_2$ used? The following equation represents the reaction:

$$K_2CrO_{4\,(aq)} + BaCl_{2(aq)} \rightarrow BaCrO_{4(s)} + 2KCl_{(aq)}$$

Given

$5.0\,g\,BaCrO_4 \times \frac{1\,mol\,BaCrO_4}{253.33\,g\,BaCrO_4} \times \frac{1\,mol\,BaCl_2}{1\,mol\,BaCrO_4} = \frac{0.019737102}{.1\,L} = \frac{.2\,mol}{L}$

12. How many mL of a 9.0M solution of HCl are needed to react with 3.5 g of $NaHCO_3$? The equation that represents the reaction follows.

$$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$$

Given

$3.5\,g\,NaHCO_3 \times \frac{1\,mol\,NaHCO_3}{84.01\,g\,NaHCO_3} \times \frac{1\,mol\,HCl}{1\,mol\,NaHCO_3} = \frac{.04166707}{x} = \frac{9.0\,mol}{L}$

$.0046 \times 1000$

4.6mL

13. Sandy neutralizes 700.0 mL of HCL at a concentration of 5.5mol/L using $Ca(OH)_2$ according to the following equation:

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

After the neutralization, she allows the water from the beaker to evaporate. What is the mass of the $CaCl_2$ that will be left in the beaker?

$\frac{5.5\,mol}{L} = \frac{x}{.7L}$

Given

$3.85\,mol\,HCl \times \frac{1\,mol\,CaCl_2}{2\,mol\,HCl} \times \frac{110.97\,g\,CaCl_2}{1\,mol\,CaCl_2} = 210g$

14. When 900mL of HCl is mixed with $NaHCO_3$, 16 gg of CO_2 is produced. What was the concentration of the HCl solution used to produce this much gas?

$$HCl_{(aq)} + NaHCO_{3(s)} \rightarrow NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$$

given

$16\,g\,CO_2 \times \frac{1\,mol\,CO_2}{44.01\,g\,CO_2} \times \frac{1\,mol\,HCl}{1\,mol\,CO_2} = \frac{.36355\,3738}{.9} = \frac{x}{1L}$

$\frac{.4\,mol}{L}$

15. Label each example as endothermic or exothermic.

a- Energy is released Exo
b- Environment becomes colder endo
c- Energy is on the reactant side Endo
d- Melting ice-cream - Endo
e- A bon-fire - Exo
f- Making ice - Endo
g- Molecules having more energy - Exo
h- Combustion - Exo