Chapter 4 Review

1. How many grams of carbon dioxide should form if a student heats 50.00 grams of Aluminum carbonate and it decomposes?

___$Al_2(CO_3)_3$ (s) → ___Al_2O_3 (s) + 3 CO_2(g)

a. Balance the equation.

b. Find the grams of CO_2.

g CO_2 = 50.00 g $Al_2(CO_3)_3$ × $\frac{1\text{ mol } Al_2(CO_3)_3}{234\text{g}}$ × $\frac{3\text{ mol } CO_2}{1\text{ mol } Al_2(CO_3)_3}$ × $\frac{44\text{ g } CO_2}{1\text{ mol } CO_2}$ = 28.2g CO_2

c. If the actual lab value of CO_2 is 25.0 grams, what is the %yield?

$\frac{25.0}{28.2}$ × 100% = 88.7%

2. ___$Pb(NO_3)_{2(aq)}$ + 2 NaOH(aq) → 2 $NaNO_3$ (aq) + ___$Pb(OH)_2$(s)

343g 80g 241g

mass

9. A reaction combines 133.484 g of lead (II) nitrate with 45.010 g of sodium hydroxide.

a. Which reactant is limiting? $Pb(NO_3)_2$ limits NaOH

$Pb(NO_3)_2$: $\frac{133.484\text{g } Pb(NO_3)_2}{343\text{g}} = \frac{x\text{ g } Pb(OH)_2}{241\text{g}}$ x = 93.8 g $Pb(NO_3)_2$

NaOH: $\frac{45.010\text{g NaOH}}{80\text{g}} = \frac{x\text{ g } Pb(OH)_2}{241\text{g}}$ x = 135.6 g $Pb(OH)_2$

3. What is the molarity of a solution that contains 8.00 grams of Na_2SO_4 in 500 mL of solution?

What is the molarity of Na^{+1} ions in the above solution?

mole Na_2SO_4 = 8.00 g Na_2SO_4 × $\frac{1\text{ mol}}{142\text{ g}}$ = $\frac{.0563\text{ mole } Na_2SO_4}{.500\text{ L}}$ = .113 M Na_2SO_4

Molarity Na^+ ion = .113 M Na_2SO_4 × $\frac{2\text{ Na}^+}{1\text{ } Na_2SO_4}$ = .226 M Na^+ ions

4. How would you prepare 150 mL of a 2.00 M of HCl if you have a 12.0 M solution?

$M_1V_1 = M_2V_2$

(12.0)(x) = (2.00)(.150)

x = .025

add .025 L of 12 M HCl to .125 L of H_2O

5. How would you prepare 250 mL of a 3.00 M solutions of NaOH?

g = (3.00)(.250)(40) = 30 g NaOH

40 mL of a .500 M solution of calcium chloride reacts completely with 30.0 mL of a solution of sodium phosphate to form a precipitate of calcium phosphate Stoichiometrically equal

6. Write the balanced equation. $3CaCl_2 + 2Na_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6NaCl$

mole $CaCl_2$ = (.500 M × .040 L) = .02 mole

7. What is the molarity of the sodium phosphate solution?

mole Na_3PO_4 = .02 mol $CaCl_2$ × $\frac{2\text{ mol } Na_3PO_4}{3\text{ mol } CaCl_2}$ = $\frac{.0133\text{ mol } Na_3PO_4}{.03\text{ L}}$ = .44 M

8. What is the number of grams of precipitate formed? Choose either reactant, they both limit

g $Ca_3(PO_4)_2$ = .02 mol $CaCl_2$ × $\frac{1\text{ mol } Ca_3(PO_4)_2}{3\text{ mol } CaCl_2}$ × $\frac{310\text{g}}{1\text{ mol } Ca_3(PO_4)_2}$ = 2.06 g $Ca_3(PO_4)_2$

1996 B

Concentrated sulfuric acid (18.4-molar H_2SO_4) has a density of 1.84 grams per milliliter. After dilution with water to 5.20-molar, the solution has a density of 1.38 grams per milliliter and can be used as an electrolyte in lead storage batteries for automobiles.

9. (a) Calculate the volume of concentrated acid required to prepare 1.00 liter of 5.20-molar H_2SO_4.

$M_1V_1 = M_2V_2$

(18.4)(x) = (5.20)(1.00)

x = .283 L 18.4 M H_2SO_4

In a reaction vessel, 0.600 mol of $Ba(NO_3)_2$ and 0.300 mol of H_3PO_4 (aq) are combined with deionized water to a final volume of 2.00 L. The reaction represented below occurs.

,600 mol ,300 mol

$$3Ba(NO_3)_2(aq) + 2H_3PO_4(aq) \rightarrow Ba_3(PO_4)_3(s) + 6HNO_3(aq)$$

3 2

10. Calculate the mass of $Ba_3(PO4)_2$ formed.

#g $Ba_3(PO_4)_2$ = ,15 mol x $\frac{696g}{1mol}$ = 104.4g $Ba_3(PO_4)_2$

$Ba(NO_3)_2$: $\frac{,600\ mol\ Ba(NO_3)_2}{3\ mol} = \frac{x\ mol\ Ba_3(PO_4)_2}{1\ mol}$ $x = ,2\ mol$

H_3PO_4: $\frac{,300\ mol\ H_3PO_4}{2\ mol} = \frac{x\ mol\ Ba_3(PO_4)_2}{1\ mol}$ $x = ,15\ mol\ Ba_3(PO_4)_2$ limits

11. What is the concentration, in mol L^{-1}, of the nitrate ion, NO_3(aq) after the reaction reaches completion?

Conservation of mass

#ions NO_3^- = ,600 mol $Ba(NO_3)_2$ x $\frac{2\ mol\ NO_3^-}{1\ mol\ Ba(NO_3)_2}$ = 1,2 mol NO_3^-

Total volume solution = 2.00L $\frac{1,2\ mol\ NO_3}{2.00L} = ,600M$

b. How much precipitate formed?

#g $Ba_3(PO_4)_2$ = ,15 mol Ba_3PO_4 x $\frac{696g}{1mol}$ = 104.4g $Ba_3(PO_4)_2$