Dr. Grandinetti

Chemistry 121
Fall Quarter 2007
Quiz 3

Monday
Oct. 15, 2007

Name KEY Rec. Instr. _____

Two-Digit Section No. _____ Lab. Instr. _____

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1. [6 points] Balance the following equations:

$$\underline{3}\ Ca(OH)_2(aq) + \underline{2}\ H_3PO_4(aq) \longrightarrow \underline{1}\ Ca_3(PO_4)_2(s) + \underline{6}\ H_2O(l)$$

$$\underline{2}\ AgNO_3(aq) + \underline{1}\ Na_2SO_4(aq) \longrightarrow \underline{1}\ Ag_2SO_4(s) + \underline{2}\ NaNO_3(aq)$$

2. [5 points] Classify each of the following aqueous solutions as a nonelectrolyte, weak electrolyte, or strong electrolyte:

$HClO_4$	HNO_3	NH_4Cl	CH_3COCH_3 (acetone)	$CoSO_4$
strong	strong	strong	non-electrolyte	strong

3. [19 points] Hydrofluoric acid, $HF(aq)$, cannot be stored in glass bottles because the silicate in the glass is attacked by the $HF(aq)$. Sodium silicate (Na_2SiO_3), for example, reacts as follows:

$$Na_2SiO_3(s) + 8\ HF(aq) \longrightarrow H_2SiF_6(aq) + 2\ NaF(aq) + 3\ H_2O(l)$$

(a) How many moles of HF are needed to react with 0.300 moles of Na_2SiO_3?

(b) How many grams of NaF form when 0.500 moles of HF reacts with excess Na_2SiO_3?

(c) How many grams of Na_2SiO_3 can react with 0.800 g of HF?

(a) $0.300\ \text{moles } Na_2SiO_3 \left| \frac{8\ \text{moles HF}}{1\ \text{mole } Na_2SiO_3} \right. = 2.4\ \text{moles HF}$

Chem. Eq.

(b) $0.500\ \text{moles HF} \left| \frac{2\ \text{moles NaF}}{8\ \text{moles HF}} \right| \frac{41.9878\ g}{\text{mole NaF}} = 5.25\ g\ HF$

(c) $0.800\ g\ HF \left| \frac{\text{mole HF}}{20.006\ g} \right| \frac{1\ \text{mole } Na_2SiO_3}{8\ \text{moles HF}} \left| \frac{122.0679\ g}{\text{mole } Na_2SiO_3} \right. = 0.610\ g\ Na_2SiO_3$

Dr. Grandinetti

Chemistry 121
Fall Quarter 2007
Quiz 3

Wednesday
~~April~~ Oct. 17, 2007

Name KEY Rec. Instr. _____

Two-Digit Section No. _____ Lab. Instr. _____

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1. [6 points] Balance the following equations:

$$\underline{6}\ Li(s) + \underline{1}\ N_2(g) \longrightarrow \underline{2}\ Li_3N(s)$$

$$\underline{1}\ La_2O_3(s) + \underline{3}\ H_2O(l) \longrightarrow \underline{2}\ La(OH)_3(aq)$$

2. [5 points] Classify each of the following substances as a nonelectrolyte, weak electrolyte, or strong electrolyte in water:

H_2SO_3	C_2H_5OH (ethanol)	NH_3	$KClO_3$	$Cu(NO_3)_2$
weak	non-electrolyte	weak	strong	strong

3. [19 points] Several brands of antacids use $Al(OH)_3$ to react with stomach acid, which contains primarily HCl:

$$\underline{1}\ Al(OH)_3(s) + \underline{3}\ HCl(aq) \longrightarrow \underline{1}\ AlCl_3(aq) + \underline{3}\ H_2O(l)$$

(a) Balance this equation.

(b) Calculate the number of grams of HCl that can react with 0.500 g of $Al(OH)_3$.

(c) Calculate the number of grams of $AlCl_3$ and the number of grams of H_2O formed when 0.500 g of $Al(OH)_3$ reacts.

(b) $0.500\text{ g } Al(OH)_3 \left|\frac{1\text{ mole } Al(OH)_3}{78.001\text{ g}}\right|\frac{3\text{ moles HCl}}{1\text{ mole } Al(OH)_3}\left|\frac{36.461\text{ g}}{\text{mole HCl}}\right. = 0.701\text{ g HCl}$

(c) $0.500\text{ g } Al(OH)_3 \left|\frac{1\text{ mole } Al(OH)_3}{78.001\text{ g}}\right|\frac{1\text{ mole } AlCl_3}{1\text{ mole } Al(OH)_3}\left|\frac{133.339\text{ g}}{\text{mole } AlCl_3}\right. = 0.855\text{ g } AlCl_3$

$0.500\text{ g } Al(OH)_3 \left|\frac{1\text{ mole } Al(OH)_3}{78.001\text{ g}}\right|\frac{3\text{ moles } H_2O}{1\text{ mole } Al(OH)_3}\left|\frac{18.015\text{ g}}{\text{mole } H_2O}\right. = 0.346\text{ g } H_2O$

Dr. Grandinetti

Chemistry 121
Fall Quarter 2007
Quiz 3

Friday
~~April~~ Oct. 19, 2007

Name KEY Rec. Instr. _____

Two-Digit Section No. _____ Lab. Instr. _____

1. [6 points] Balance the following equations:

$$\underline{2}\ NH_4NO_3(s) \longrightarrow \underline{2}\ N_2(g) + \underline{1}\ O_2(g) + \underline{4}\ H_2O(g)$$

$$\underline{1}\ Ca_3P_2(s) + \underline{6}\ H_2O(l) \longrightarrow \underline{3}\ Ca(OH)_2(aq) + \underline{2}\ PH_3(g)$$

2. [4 points] An aqueous solution of an unknown solute is tested with litmus paper and found to be acidic. The solution is weakly conducting compared with a solution of NaCl of the same concentration. Which of the following substances could the unknown be:

KOH NH_3 HNO_3 $KClO_2$ H_3PO_3 CH_3COCH_3 (acetone)

3. [20 points] Automotive air bags inflate when sodium azide, NaN_3, rapidly decomposes to its component elements:

(a) $\underline{2}\ NaN_3(s) \longrightarrow \underline{2}\ Na(s) + \underline{3}\ N_2(g)$

(a) Balance this equation.

(b) How many moles of N_2 are produced by the decomposition of 1.50 moles of NaN_3?

(c) How many grams of NaN_3 are required to form 10.0 g of nitrogen gas?

(d) How many grams of NaN_3 are required to produce 10.0 ft^3 of nitrogen gas if the gas has a density of 1.25 g/L? (1 liter = 0.035314 ft^3)

(b) $$1.50 \text{ moles } NaN_3 \left| \frac{3 \text{ moles } N_2}{2 \text{ moles } NaN_3} \right. = 2.25 \text{ moles } N_2$$
(2 moles NaN_3: chem eq)

(c) $$10.0 \text{ g } N_2 \left| \frac{\text{mole } N_2}{28.014 \text{ g}} \right| \frac{2 \text{ moles } NaN_3}{3 \text{ moles } N_2} \left| \frac{65.01 \text{ g}}{\text{mole } NaN_3} \right. = 16.9 \text{ g } NaN_3$$
(28.014 g: MW N_2; 3 moles N_2: chem eq.; mole NaN_3: MW NaN_3)

(d) $$10.0 \text{ ft}^3 N_2 \left| \frac{1 \text{ liter}}{0.035314 \text{ ft}^3} \right| \frac{1.25 \text{ g}}{\text{liter}} \left| \frac{\text{mole } N_2}{28.014 \text{ g}} \right| \frac{2 \text{ mole } NaN_3}{3 \text{ moles } N_2} \left| \frac{65.01 \text{ g}}{\text{mole } NaN_3} \right. =$$
(0.035314 ft^3: $Ft^3 \rightarrow$ liter; liter: density N_2; 28.014 g: MW N_2; 3 moles N_2: chem eq; mole NaN_3: MW NaN_3)

$$= 5.48 \times 10^2 \text{ g } NaN_3$$