AP Chemistry
Reaction Practice
Day 1

Name Key - 2011
Date _____ **Period** _____

For each of the following three reactions, in part (i) write a BALANCED equation and in part (ii) answer the question about the reaction. In part (i), coefficients should be in terms of lowest whole numbers. Assume that solutions are aqueous unless otherwise indicated. Represent substances in solutions as ions if the substances are extensively ionized. Omit formulas for any ions or molecules that are unchanged by the reaction.

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1. A reaction occurs when 82.0 grams of sodium hydroxide is added to 1.00 moles of a copper(II) nitate solution

(i) $2OH^- + Cu^{2+} \rightarrow Cu(OH)_2$

2.05 moles 1.00 mol

(ii) Determine the substance that is in excess and the amount in grams of the excess reagent..

$82.0\text{ g NaOH} \left| \frac{\text{mol}}{40\text{ g NaOH}} \right| = 2.05\text{ mol}$

Cu^{2+} is the L.R; OH^- is in Excess

There are 2.0g NaOH left

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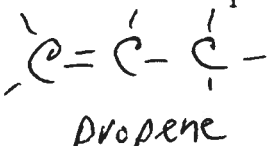
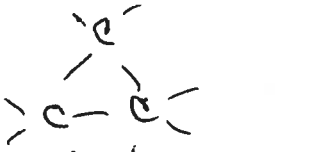
2. Propene is burned in excess oxygen

(i) $2C_3H_6 + 9O_2 \rightarrow 6CO_2 + 6H_2O$

(ii) Draw and name both of the isomers of propene.



propene



Cyclopropane

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3. 1.0 L of ~~0.2 M~~ barium nitrate ~~solution~~ is added to 2.0 L an alkaline 0.2 M potassium chromate solution. .067M .133M

(i) $Ba^{2+} + CrO_4^{2-} \rightarrow BaCrO_4$

$\frac{.20\text{ mol}}{3.0\text{ L}}$ $\frac{.40\text{ moles}}{3\text{ L}}$

(ii) List all of the ions that you have a significant amount left in solution after the reaction takes place.

$[Ba^{2+}] = 0$

$[NO_3^-] = 2(.067M) = .133M$

$[K^+] = 2(.133M) = .266M$

$[CrO_4^{2-}] = .133M - .067M = .067M$

Stoich

(1)

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Question 3

3. Answer the following questions that relate to the analysis of chemical compounds.

(a) A compound containing the elements C, H, N, and O is analyzed. When a 1.2359 g sample is burned in excess oxygen, 2.241 g of $CO_2(g)$ is formed. The combustion analysis also showed that the sample contained 0.0648 g of H.

$CHNO + O_2 \rightarrow CO_2 + H_2O + N_2$

(i) Determine the mass, in grams, of C in the 1.2359 g sample of the compound.

$2.241\ g\ CO_2(g) \times \frac{1\ mol\ CO_2}{44.01\ g\ CO_2} \times \frac{1\ mol\ C}{1\ mol\ CO_2} \times \frac{12.011\ g\ C}{1\ mol\ C}$ $= 0.6116\ g\ C$	One point is earned for the correct answer.

(ii) When the compound is analyzed for N content only, the mass percent of N is found to be 28.84 percent. Determine the mass, in grams, of N in the original 1.2359 g sample of the compound.

$1.2359\ g\ sample \times 0.2884 = 0.3564\ g\ N$	One point is earned for the correct answer.

(iii) Determine the mass, in grams, of O in the original 1.2359 g sample of the compound.

Because the compound contains only C, H, N, and O, mass of O = g sample − (g H + g C + g N) = 1.2359 − (0.0648 + 0.6116 + 0.3564) = 0.2031 g	One point is earned for the answer consistent with the answers in parts (a)(i) and (a)(ii).

(iv) Determine the empirical formula of the compound.

Converting all masses to moles, $0.6116\ g\ C \times \frac{1\ mol\ C}{12.011\ g\ C} = 0.05092\ mol\ C$ $0.0648\ g\ H \times \frac{1\ mol\ H}{1.0079\ g\ H} = 0.06429\ mol\ H$ $0.3564\ g\ N \times \frac{1\ mol\ N}{14.007\ g\ N} = 0.02544\ mol\ N$ $0.2031\ g\ O \times \frac{1\ mol\ O}{16.00\ g\ O} = 0.01269\ mol\ O$	One point is earned for all masses converted to moles. Note: Moles of C may be shown in part (a)(i).

Question 3 (continued)

Divide all mole quantities by the smallest number of moles: 0.05092 mol ÷ 0.01269 mol = 4.013 0.06429 mol ÷ 0.01269 mol = 5.066 0.02544 mol ÷ 0.01269 mol = 2.005 0.01269 mol ÷ 0.01269 mol = 1.000 ⇒ Empirical formula is $C_4H_5N_2O$	One point is earned for dividing by the smallest number of moles. One point is earned for the empirical formula consistent with the ratio of moles calculated.

(b) A different compound, which has the empirical formula CH_2Br, has a vapor density of 6.00 g L^{-1} at 375 K and 0.983 atm. Using these data, determine the following.

$MM = \frac{dRT}{P}$

(i) The molar mass of the compound

$PV = nRT \Rightarrow \frac{PV}{RT} = n$ $\frac{(0.983\text{ atm})(1.00\text{ L})}{(0.0821\text{ L atm mol}^{-1}\text{K}^{-1})(375\text{ K})} = 0.0319\text{ mol}$ molar mass of gas (M) = $\frac{6.00\text{ g}}{0.0319\text{ mol}} = 188\text{ g mol}^{-1}$ *OR* $M = \frac{DRT}{P} = \frac{6.00\text{ g L}^{-1} \times 0.0821\text{ L atm mol}^{-1}\text{ K}^{-1} \times 375\text{ K}}{0.983\text{ atm}}$ $= 188\text{ g mol}^{-1}$	One point is earned for applying the gas law to calculate n. One point is earned for calculating the molar mass. *OR* Two points are earned for calculating the molar mass using $M = \frac{DRT}{P}$

(ii) The molecular formula of the compound

Each CH_2Br unit has mass of 12.011 + 2(1.0079) + 79.90 = 93.9 g, and $\frac{188\text{ g}}{93.9\text{ g}} = 2.00$, so there must be two CH_2Br units per molecule. Therefore, the molecular formula of the compound is $C_2H_4Br_2$.	One point is earned for the molecular formula that is consistent with the molar mass calculated in part (b)(i).