

Chemistry 1154 Fall 2011 test 1

Thursday, September 29, 2011

Time: 1 hour 50 minutes

Name: _____

Student number: _____

*This test consists of **seven** pages of questions, a page of useful constants, and a periodic table. Please ensure that you have a complete paper and, if you do not, obtain one from me **immediately**. There are **30** marks available. Good luck!*

1) **[4 marks]** "Compound X" is known to be 7.74 percent hydrogen by mass, and the rest carbon.

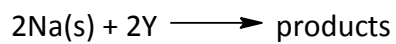
a) What is the empirical formula of "Compound X"?

b) As a gas, "Compound X" has a density of 1.276 g/L at 0.500 atm pressure and 100.0°C. What is the molecular formula of "Compound X"?

2) **[5 marks total]** A 310.3-mg sample of “Compound Y” (known to contain C, H, and O) was burned and 440.1 mg of CO₂ (44.01 g/mol) and 270.3 mg of H₂O (18.02 g/mol) were collected.

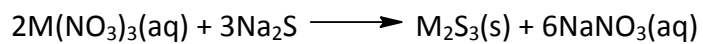
a) **[3 marks]** What is the empirical formula of “Compound Y”?

b) **[2 marks]** “Compound Y” reacts with elemental sodium:

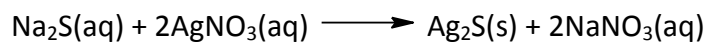


In one experiment, 124.1 mg of “Compound Y” required 46.0 mg of Na for complete reaction. What is the molecular formula of “Compound Y”?

- 3) **[4 marks]** A 902.5-mg sample of a compound of formula $M(\text{NO}_3)_3$, (where M is an unknown element) was dissolved in enough water to make 200.0 mL of solution. A 20.0-mL aliquot was taken and reacted with 20.0 mL of 0.0300 M Na_2S :

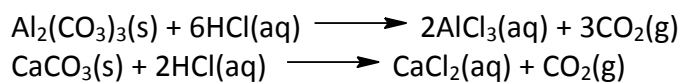


The excess Na_2S was titrated with 15.0 mL of 0.0200 M AgNO_3 :



What is the metal, M?

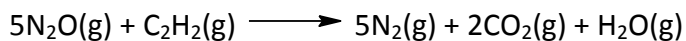
- 4) **[4 marks]** A 1570-mg mixture of $\text{Al}_2(\text{CO}_3)_3$ (234 g/mol) and CaCO_3 (100 g/mol) was reacted with excess aqueous HCl:



The partial pressure of the CO_2 was found to be 0.914 atm when collected in a 0.500-L flask at 20.0°C. What was the percent by mass of the CaCO_3 in the original mixture?

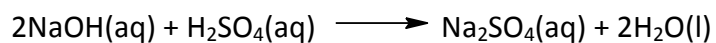
5) **[2 marks]** Vinegar is actually a dilute solution of acetic acid. A certain vinegar solution has a density of 1.00 g/mL and a concentration of 0.8493 M. If the solution is known to be 5.10 percent acetic acid by mass, what is the molar mass of acetic acid?

6) **[3 marks]** Suppose the reaction:



proceeded with a 75.00-percent yield. How many grams of 90.00-percent pure N_2O (44.01 g/mol) would be necessary to guarantee collection of exactly 88.02 grams of CO_2 (44.01 g/mol)?

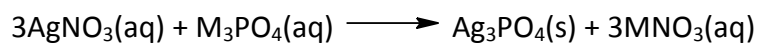
- 7) **[5 marks total]** In one experiment, 20.00 mL of 0.0500 M NaOH was mixed with 30.00 mL of 0.0200 M H₂SO₄:



- a) **[3 marks]** What would be the concentration of the Na₂SO₄ in moles/L after the reaction?

- b) **[2 marks]** What would be the concentration of the excess reagent in moles/L after the reaction?

- 8) **[3 marks]** In another experiment, 1639 mg of M_3PO_4 (M is an unknown metal) were mixed with excess $AgNO_3$ and 2549.7 mg of MNO_3 were isolated:



What is the metal, M?