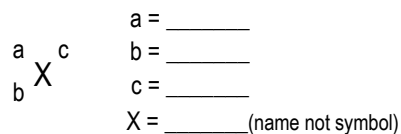


Chem 121 Midterm 1

Sept 28, 2012

Show all work for full marks (sig. figs.) unless otherwise stated.

- (2) 1) A monocation contains 118 neutrons and 78 electrons. Fill in the information below. No work need be shown.



- (3) 2) The latest measurements estimate ^{14}C to be 0.000000001% abundant and therefore we shall neglect its effects. The atomic mass of ^{13}C = 13.003354 amu and the periodic table says the atomic mass of carbon = 12.01115 amu. Calculate the % abundance of the ^{12}C and ^{13}C isotopes.

- (3) 3) When a radioisotope emits a beta particle, the atomic number remains the same. Discuss with an example. Discuss means you can agree or disagree with the statement!

- (4) 4) Complete the following with the correct name or formula.

Cobalt (II) acetate = _____

Beryllium hypobromite = _____

N_3C_3 = _____

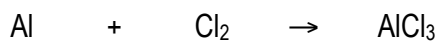
H_2CO_3 (aq.) = _____

(4) 5) Calculate the molarity of Na^+ if 35.0 mL of 0.250 M sodium thiosulphate ($\text{Na}_2\text{S}_2\text{O}_3(\text{aq.})$) is mixed with 80.0 mL of 0.420 M sodium pyrophosphate ($\text{Na}_4\text{P}_2\text{O}_7(\text{aq.})$). Everything is completely soluble in water.

(5) 6) A 1.586 g of a compound, containing only carbon, hydrogen and oxygen, is burned completely in excess O_2 to produce 2.333 g of CO_2 and 0.9501 g of H_2O . The molecular mass as determined by mass spectrometry is 90.08 g mol^{-1} . What are the empirical and molecular formulas of the compound? Data (g mol^{-1}): C 12.01; H 1.008; O 16.00; CO_2 44.01; H_2O 18.02.

7) Aluminum chloride can be prepared by reacting aluminum with chlorine.

(3) a) What mass of aluminum chloride can be formed from 20.0 g of aluminum and 60.0 g of chlorine? Indicate the limiting reactant and how you arrived at this conclusion. Data (g mol^{-1}): Al 26.98; Cl_2 70.91; AlCl_3 133.34.



(2) **b)** What mass of the reagent in excess will remain unused?

(2) **c)** If 25.6 g of product were obtained when this reaction was run, what was the percent yield?

(5) **8)** A mixture of iron oxides, Fe_2O_3 and Fe_3O_4 , weighs 2.42 grams. The iron oxide mixture is reduced with aluminum to exothermically yield molten iron (plus other unimportant products) in a thermite reaction. The iron weighed 1.722 grams. Calculate each mass of Fe_2O_3 and Fe_3O_4 in the mixture. Data (g mol^{-1}): Fe_2O_3 159.69; Fe_3O_4 231.54.