Review of Chem 170

1. Report the answer for to the correct number of significant figures.

For multiplication or division, we round the answer to the same number of significant figures as the measurement with the fewest significant figures; thus, when we divide 21.15 by 3.46, we round the answer of 6.1127… to 6.11. For addition and subtraction, we round the answer to the last decimal place that is significant for each measurement in the calculation; thus, when we add 5.7 to 6.11, we round the answer of 11.81 to 11.8. Note: When completing a multistep calculation, we often carry an extra signficant figure through the calculation, rounding to the correct number of significant figures at the end.

2. A portable radiator provides 2050 BTUs of energy per hour. Given that 1 BTU is equivalent to 1.055 kJ, how many megajoules are produced if the radiator is operated 24 hours per day for 90 days?

3. How many hydrogen atoms are in 5.10 mol of NH4S?

4. A 30.6 g sample of the compound X2O3 contains 14.4 g of oxygen atoms. What is the identity of the element X?

To determine the identity of X, we need to determine its atomic mass. We know the compound contains 30.6 g – 14.4 g = 16.2 g of X. The moles of X in the 30.6 g sample is

The atomic mass for X, therefore, is 16.2 g/0.600 mol, or 27.0 g/mol, which corresponds to aluminum.

5. A compound is 54.33% C, 9.15% H, and 36.32% O by mass. What is its empirical formula?

If we assume a 100.0 g sample of the compound, then it contains 54.33 g C, 9.15 g H, and 36.32 g O. If we convert each mass to the equivalent number of moles, then we can find the simplest mole ratio between the elements.

There are fewer moles of oxygen than of carbon or oxygen, so we use oxygen to establish the ratios. The ratio of carbon to oxygen is 4.524/2.270 = 2, and the ratio of hydrogen to oxygen is 9.08/2.270 = 4; thus, the compound’s empirical formula is C2H4O.

6. When heated, KClO3 decomposes to form KCl and O2. Write a balanced chemical reaction for this process and report the mass of O2 produced by the reaction of 20.5 g of KClO3.

The balanced chemical reaction is 2KClO3*(s)* " 2KCl*(s)* + 3O2*(g)*; thus

7. Zinc reacts with hydrochloric acid to form a solution of zinc chloride and hydrogen gas. Write a balanced chemical reaction for this process and report the mL of 4.50 M HCl needed to react with 3.45 g Zn.

The balanced chemical reaction is Zn*(s)* + 2HCl*(aq)* " ZnCl2*(aq)* + H2*(g)*; thus

8. Write a balanced reaction showing the precipitation of PbI2 upon combining separate solutions of Pb(NO3)2 and NaI. What mass of PbI2 forms when mixing 1.50 L of 0.0400 M Pb(NO3)2 and 0.600 L of 0.140 M NaI.

The balanced reaction is Pb(NO3)2*(aq)* + 2NaI*(aq)* " PbI2*(s)* + 2NaNO3*(aq)*. To determine the mass of PbI2 we first need to determine the limiting reagent. We have

Given the 2:1 stoichiometry between NaI and Pb(NO3)2, we see that NaI is the limiting reagent because the 0.084 mol available is less than the 0.120 mol needed to react completing with the Pb(NO3)2; thus