Chapter 6 – More Review

Name___________________

1. Calculate the number of moles in 4.87×10^{27} units (molecules, ionicules) of calcium chloride.

2. Calculate the number of moles in 76.89 g of fluorine gas.

3. Calculate the % by mass of hydrogen in ammonium sulfide.

4. Determine the mass of the oxygen in 8.56 g of chromium(VI) sulfate.

5. Analysis of a molecular compound made of iodine and oxygen determined it to be 76.0 % iodine. The molar mass of this compound is 668 g/mole. Determine the molecular formula and the name of this compound.

6. Determine the empirical formula of a nitrogen oxygen compound made of 1.53×10^{22} nitrogen atoms and 7.63×10^{21} oxygen atoms.

Chapter 6 – More Review

Name___________________

7. Calculate the % of water in magnesium sulfate heptahydrate.

8. Calculate how many atoms of oxygen are in 25.78 g of iron(II) nitrate.

9. Determine the formula for 7.65 g of a hydrate that was heated until it had a mass of 5.14 g. The anhydrate was further analyzed and determined to be 32.2 % cobalt, 15.3 % nitrogen, and 52.5 % oxygen.

10. Determine the empirical formula for chromium oxide if 0.5152 g of chromium was burned and the product had a mass of 0.7530 g.

11. Determine the identity of 5.63×10^{22} molecules of gaseous element that weighs 2.99 g.

12. Determine the mass of 1 aluminum atom.

1. In this problem, you simple need to convert moles to items.

$$4.87\times10^{27}\,units\left(\frac{1mol}{6.02\times10^{23}\,units}\right)$$ = **8,090 moles**

2. In this problem, you need to know that fluorine is a diatomic element, F_2, which has a mass of 2(19) = 38 g/mol

$$76.89g\left(\frac{1mol}{38.00g}\right)$$ = **2.023 moles**

3. In this problem, you need to write the formula for ammonium sulfide, and calculate the molar mass.

$(NH_4)_2S$ 2(14) + 8(1) + 32 = 68 g/mol

$$\frac{8g\text{ of H}}{68g\text{ total}}\times100$$ = **11.8%**

4. You need write the formula $Cr(SO_4)_3$ then calculate the % of oxygen in this compound. 12(16)/(52 + 3(32) + 12(16) = 56%
Since 56 % is 0.56 × 8.56 g = **4.83 g**

5. $76.g\left(\frac{1mol}{127g}\right)$ = 0.598 mol $\left(\frac{0.0598}{0.0598}\right)$ = 1 × 2 = 2

$24g\left(\frac{1mol}{16g}\right)$ = 1.5 $\left(\frac{1.5}{0.0598}\right)$ = 2.5 × 2 = 5 I_2O_5 2(127) + 5(16) = 334 $\left(\frac{668}{334}\right)$ = 2 Voila **I_4O_{10}**

6. This problem may seem dramatically different, however, it is just another empirical formula problem, however, in this case, you need to convert items − instead of grams or percentages − to moles

$1.53\times10^{22}\,atoms\left(\frac{1mol}{6.02\times10^{23}\,atoms}\right)$ = 0.0254 $\left(\frac{0.0254}{0.01267}\right)$ = 2

$7.63\times10^{21}\,atoms\left(\frac{1mol}{6.02\times10^{23}\,atoms}\right)$ = 0.01267 $\left(\frac{0.01267}{0.01267}\right)$ = 1 Voila **N_2O**

7. The name of the hydrate given in thei problem allows you to write out the chemical formula for it. $MgSO_4 \bullet 7H_2O$

from which you can calculate the molar mass; 24.3 + 32 + 4 (16) + 7(18) = 104.3

from this you simply calculate the percent of water out of the toal molar mass of the hydrate compound.

$$\left(\frac{7\times18}{(7\times18)+32.06+(4\times16)}\right)\times100$$ = **51.2%**

8. First you must write out the chemical formula of the compound and calculate its molar mass

$Fe(NO_3)_2$ 55.85 + 2(14) + 6(16) = 179.85

With the molar mass, you can calculate the number of moles of the compound, then convert to the number of "ionicules" (aka formula units) of the compound, and then by knowing that there are 6 oxygen atoms in each formula unit, you can convert to the number of oxygen atoms.

$$25.78g\left(\frac{1mol}{179.85g}\right)\left(\frac{6.02\times10^{23}\,units}{1mol}\right)\left(\frac{6OxyAtoms}{1Fe(NO_3)_2\,ionicule}\right)$$ = **5.18 × 10^23 atoms of O**

9. First determine the empirical formula of the anhydrate part of this ionic compound

Cobalt $29.5g\left(\frac{1mol}{58.93g}\right)$= 0.5673 mole $\left(\frac{1.0929}{0.5006}\right)=1$

Nitrogen $15.3g\left(\frac{1mol}{14.0g}\right)$ = 1.0929 moles $\left(\frac{1.0929}{0.5006}\right)=2$

Oxygen $52.5g\left(\frac{1mol}{16.0g}\right)$ = 3.281 moles $\left(\frac{3.281}{0.5006}\right)=6$ Voila **$Co(NO_3)_2$**

Next determine the molar mass of the anhydrate $Co(NO_3)_2$ 52 + + 2(14) + 6(16) = 182.93

Calculate the mass of the compound that is water: 7.65 g – 5.14 g = 2.51 g water

and the calculate moles of anhydrate and moles of water

$5.14g\left(\frac{1mol}{182.93g}\right)$ = 0.0281 mole $\left(\frac{0.0281}{0.0281}\right)=1$

$2.51g\left(\frac{1mol}{18g}\right)$ = 0.139 $\left(\frac{0.139}{0.0281}\right)=5$ **$Co(NO_3)_2 \bullet 5H_2O$**

10. Since you know the tarting mass of chromium, and the final mass of the chromium oxide, you can calculate the mass of oxygen that would be present in this compound

0.7530 g – 0.5152 g = 0.2378 g Then change the mass of each element into moles.

$0.2378g\left(\frac{1mol}{16g}\right)=0.0149mol$ $\left(\frac{0.0149}{0.0099}\right)=1.5 \quad \times 2 = 3$

$0.5152g\left(\frac{1mol}{52g}\right)=0.0099mol$ $\left(\frac{0.0099}{0.0099}\right)=1 \quad \times 2 = 2$ Voila. **Cr_2O_3**

11. In this problem you are told that 5.63×10^{22} molecules have a mass of 2.99 g.

Set this up as a ratio to start your dimensional analysis.

$$\left(\frac{2.99g}{5.63\times10^{22}molecules}\right)\left(\frac{6.02\times10^{23}molecules}{1mol}\right)=32g/mol$$

because the problem tells you that this substance is an element of which the particles are molecules, then you know the substance must be one of the diatomic gases with a molar mass of 32 g/mol. Thus it must be **O_2**

12. For the substance aluminum, you know that the molar mass is 27 g/1mole. Use this to start your dimensional analysis.

$$\left(\frac{27g}{1mol}\right)\left(\frac{1mol}{6.02\times10^{23}atoms}\right)=4.5\times10^{-23}g/atom$$