Determining Empirical Formulas for Ionic Compounds
Naming Ionic Compounds

Name_____

Please do your work on another piece of paper and show your work so that you can refer to it later to check for mistakes and use for review.

1. One compound of platinum and chlorine is known to consist of 42.1 % chlorine. Another consists of 26.7% chlorine.
    1. Determine the empirical formulas for each compound.
    2. Name each compound.

2. Consider compound made of silver and fluorine that is 85 % silver?
    a. What is the empirical formula?
    b. Name this compound.

3. An ionic compound was found to be 24.58 % potassium, 34.81 % manganese, and the remainder is oxygen.
    a. Determine the empirical formula of this compound.
    b. Name this compound.

4. 6.840 g of an aluminum compound was analyzed. The polyatomic ion portion of the compound was made of 1.922 g of sulfur and 3.837 g of oxygen. The remainder of the compound was made of aluminum.
    a. Determine the empirical formula of this compound.
    b. Name this compound.

5. An ionic compound was analyzed and determined to be 37.70 % sodium, 22.95 % silicon, and 39.34 % oxygen.
    a. Determine the empirical formula of this compound.
    b. Name this compound.

6. Analysis of an ionic compound was found to be 21.20 % nitrogen, 6.06 % hydrogen, 24.3 % sulfur, and 48.45 % oxygen.
    a. Determine the empirical formula of this compound.
    b. Name this compound. (Hint: This compound is made of two polyatomic ions.)

7. A 10.00 g sample of an ionic compound is composed of 4.94 g of potassium, 2.03 g of sulfur, and the remainder is oxygen.
    a. Determine the empirical formula of this compound.
    b. Name this compound.

8. Analysis of an iron, carbon, oxygen ionic compound was determined to be 48.2 % iron, 10.4 % carbon, and 41.4 % oxygen. Determine the empirical formula of this compound.
    a. Name this compound.

9. An iron oxide compound was analyzed and determined to be 69.9 % iron.
    a. Determine the empirical formula of this compound.
    b. Name this compound.

10. An ionic compound made of iron and a polyatomic ion was determined to be 14.70 % iron, 41.07 % chromium, and 44.23 % oxygen.
    a. Determine the empirical formula of this compound.
    b. Name this compound. (Hint: To get the correct ratios, be careful about not rounding off your molar masses or the calculated mole values.)

11. In an experiment, a student obtained 1.24 g of potassium and then burned it in air. The product was a potassium oxide compound which had a total mass of 1.49 g. Determine the empirical formula of this ionic compound.

12. A solid sample was determined to be 38.6 % potassium, 13.9 % nitrogen and the remainder was oxygen.
    a. Determine the empirical formula of this ionic compound.
    b. What is the name of this salt?

 Determining Empirical Formulas for Ionic Compounds - *ANSWERS*

1 a $PtCl_4$ $PtCl_2$

b platinum(IV) chloride platinum(II) chloride

If you know the percentage of one element, the other element must be 100% − 42.1% = 57.9 % Pt

When given percentages, you can assume 100g total, and thus turn the percentage in to mass.

$57.9gPt \times \frac{1mol}{195.08g} = 0.297 \quad \frac{0.297}{0.297} = 1$ $73.3gPt \times \frac{1mol}{195.08g} = 0.376 \quad \frac{0.376}{0.376} = 1$

$42.1gCl \times \frac{1mol}{35.45g} = 1.19 \quad \frac{1.19}{0.297} = 3.99$ $26.7gCl \times \frac{1mol}{35.45g} = 0.753 \quad \frac{0.753}{0.376} = 2$

2 a AgF

b silver fluoride (You should remember that there are 3 transition metals that do NOT get a Roman number because they only ever have one charge option. Ag^+ Zn^{2+} Cd^{2+} You should memorize these ion charges.)

$85gAg \times \frac{1mol}{107.87g} = 0.788 \quad \frac{0.789}{0.789} = 1$

$15gF \times \frac{1mol}{19g} = 0.789 \quad \frac{0.789}{0.789} = 1$

3 a $KMnO_4$

b potassium permanganate

$24.58gK \times \frac{1mol}{39.1g} = 0.623 \quad \frac{0.623}{0.623} = 1$

$34.81gMn \times \frac{1mol}{54.94g} = 0.634 \quad \frac{0.634}{0.623} = 1.01$

$40.61gO \times \frac{1mol}{16g} = 2.54 \quad \frac{2.54}{0.623} = 4.08$

4 a $Al_2S_3O_{12}$ should be written as $Al_2(SO_4)_3$

b aluminum sulfate

Remember that if one of the elements comes out to #.5, you need to multiply all the moles by 2

$1.081gK \times \frac{1mol}{26.98g} = 0.0401 \quad \frac{0.0401}{0.0401} = 1 \times 2 = 2$

$1.922gS \times \frac{1mol}{32.07g} = 0.0599 \quad \frac{0.0599}{0.0401} = 1.49 \times 2 = 3$

$3.837gO \times \frac{1mol}{16g} = 0.240 \quad \frac{0.24}{0.0401} = 5.99 \times 2 = 12$

5 a Na_2SiO_3

b sodium silicate

$37.7gNa \times \frac{1mol}{22.99g} = 1.64 \quad \frac{1.64}{0.817} = 2$

$22.95gSi \times \frac{1mol}{28.09g} = 0.817 \quad \frac{0.817}{0.817} = 1$

$39.34gO \times \frac{1mol}{16g} = 2.46 \quad \frac{2.46}{0.817} = 3$

6 a $N_2H_8SO_4$ should be written as $(NH_4)_2SO_4$
b ammonium sulfate

$21.20gN \times \frac{1mol}{14.01g} = 1.51 \quad \frac{1.51}{0.758} = 2$

$6.06gH \times \frac{1mol}{1.01g} = 6 \quad \frac{6}{0.758} = 7.92$

$24.3gS \times \frac{1mol}{32.07g} = 0.758 \quad \frac{0.758}{0.758} = 1$

$48.45gO \times \frac{1mol}{16g} = 3.03 \quad \frac{3.03}{0.758} = 3.99$

7 a K_2SO_3
b potassium sulfite

$4.94gK \times \frac{1mol}{39.1g} = 0.126 \quad \frac{0.126}{0.0633} = 1.99$

$2.03gS \times \frac{1mol}{32.07g} = 0.0633 \quad \frac{0.0633}{0.0633} = 1$

$3.03gO \times \frac{1mol}{16g} = 0.189 \quad \frac{0.189}{0.0633} = 2.99$

8 a $FeCO_3$
b iron(II) carbonate

$48.2gFe \times \frac{1mol}{55.85g} = 0.863 \quad \frac{0.863}{0.863} = 1$

$10.4gC \times \frac{1mol}{12.01g} = 0.866 \quad \frac{0.866}{0.863} = 1$

$41.4gO \times \frac{1mol}{16g} = 2.59 \quad \frac{2.59}{0.863} = 3$

9 Fe_2O_3
b iron(III) oxide

$69.9gFe \times \frac{1mol}{55.85g} = 1.25 \quad \frac{1.25}{1.25} = 1 \times 2 = 2$

$30.1gO \times \frac{1mol}{16g} = 1.88 \quad \frac{1.88}{1.25} = 1.5 \times 2 = 3$

10 a $Fe_2Cr_6O_{21}$ should be written as $Fe_2(Cr_2O_7)_3$
b iron(III) dichromate

$14.7gFe \times \frac{1mol}{55.85g} = 0.263 \quad \frac{0.263}{0.263} = 1 \times 2 = 2$

$41.07gCr \times \frac{1mol}{52g} = 0.790 \quad \frac{0.79}{0.263} = 3 \times 2 = 6$

$44.23gO \times \frac{1mol}{16g} = 2.76 \quad \frac{2.76}{0.263} = 10.5 \times 2 = 21$

11 K_2O

In this problem, you must realize that you can subtract the mass of potassium from the resulting mass of potassium oxide, to acquire the mass of oxygen that combines with the original amount of potassium.

$1.24gK \times \frac{1mol}{39.1g} = 0.0317 \quad \frac{0.0317}{0.0156} = 2.03$

$0.25gO \times \frac{1mol}{16g} = 0.0156 \quad \frac{0.0156}{0.0156} = 1$

12 a KNO_3

b potassium nitrate

$38.6gK \times \frac{1mol}{39.1g} = 0.987 \quad \frac{0.987}{0.987} = 1$

$13.9gN \times \frac{1mol}{14.01g} = 0.992 \quad \frac{0.992}{0.987} = 1.01$

$47.5gO \times \frac{1mol}{16g} = 2.97 \quad \frac{2.97}{0.987} = 3.01$