

Determining Empirical Formulas for Ionic Compounds Naming Ionic Compounds

Name _____ Per _____

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. *Hint: To get the correct ratios, be careful about not rounding off your molar masses or the calculated mole values.*

1. One compound of platinum and chlorine is known to consist of 42.1 % chlorine. Another consists of 26.7% chlorine. Determine the empirical formulas for each compound.
2. Consider compound made of silver and fluorine that is 85 % silver? What is the empirical formula?
3. An ionic compound was found to be 24.58 % potassium, 34.81 % manganese, and the remainder is oxygen. Determine the empirical formula of 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. Determine the empirical formula of this compound.
5. An ionic compound was analyzed and determined to be 37.70 % sodium, 22.95 % silicon, and 39.34 % oxygen. Determine the empirical formula of 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. Determine the empirical formula of this compound.
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. Determine the empirical formula of 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.
9. An iron oxide compound was analyzed and determined to be 69.9 % iron. Determine the empirical formula of 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. Determine the empirical formula of this compound.
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. Determine the empirical formula of this ionic compound.

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Determining Empirical Formulas for Ionic Compounds - ANSWERS



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.

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

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



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

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



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

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

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

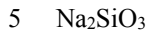


Remember that if one of the elements comes out to #.5, you need to multiply all the moles by 2

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

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

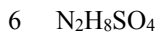
$$3.837gO \times \frac{1mol}{16g} = 0.240 \quad \frac{0.24}{0.0401} = 5.99 \times 2 = 12$$



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

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

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



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

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

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

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

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7 K_2SO_3

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

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

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

8 FeCO_3

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

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

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

9 Fe_2O_3

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

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

10 $\text{Fe}_2\text{Cr}_6\text{O}_{21}$

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

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

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

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.

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

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

12 KNO_3

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

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

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