

Moles Review Sheet
Quantitative Chemistry

For the following problems, be sure to show your work and use significant figures!

1. Perform the following conversions.

a. 6.89 moles Al = _____ grams

$$6.89 \text{ mol Al} \times \frac{26.98 \text{ g Al}}{1 \text{ mol Al}} = 186 \text{ g Al}$$

b. 185 grams CrCl₃ = _____ moles

$$185 \text{ g CrCl}_3 \times \frac{1 \text{ mol CrCl}_3}{158.4 \text{ g CrCl}_3} = 1.17 \text{ mol CrCl}_3$$

c. 0.17 moles NaOH = _____ grams

$$0.17 \text{ mol NaOH} \times \frac{40.0 \text{ g NaOH}}{1 \text{ mol NaOH}} = 6.8 \text{ g NaOH}$$

2. What is the mass (in grams) of 5.8×10^{24} atoms of beryllium?

$$5.8 \times 10^{24} \text{ atoms Be} \times \frac{1 \text{ mol Be}}{6.02 \times 10^{23} \text{ atoms Be}} \times \frac{9.01 \text{ g Be}}{1 \text{ mol Be}} = 87 \text{ g Be}$$

3. A sample of water has a mass of 63.8 grams.

a. How many molecules of water are in the sample?

$$63.8 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} \times \frac{6.02 \times 10^{23} \text{ molecules H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 2.13 \times 10^{23} \text{ molecules H}_2\text{O}$$

b. How many atoms of H are in the sample?

$$2.13 \times 10^{23} \text{ molecules H}_2\text{O} \times \frac{2 \text{ atoms H}}{1 \text{ molecule H}_2\text{O}} = 4.26 \times 10^{23} \text{ atoms H}$$

c. How many atoms of O are in the sample?

$$2.13 \times 10^{23} \text{ molecules H}_2\text{O} \times \frac{1 \text{ atom O}}{1 \text{ molecule H}_2\text{O}} = 2.13 \times 10^{23} \text{ atoms O}$$

4. Calculate the mass percent of each element in the following compounds:

a) KF K 67.30 %

$$\frac{39.0983 \text{ g K}}{58.0967 \text{ g KF}} \times 100 = 67.30 \% \text{ K/KF}$$

$$\text{F } \underline{32.70} \%$$

b) Cu(NO₃)₂ Cu 33.88 %

$$\frac{63.546 \text{ g Cu}}{187.55588 \text{ g Cu(NO}_3)_2} \times 100 = 33.88 \% \text{ Cu/Cu(NO}_3)_2$$

$$\text{N } \underline{14.94} \%$$

$$\frac{28.0134 \text{ g N}}{187.55588 \text{ g Cu(NO}_3)_2} \times 100 = 14.94 \% \text{ N/Cu(NO}_3)_2$$

$$\text{O } \underline{51.18}$$

5. A sample of a certain compound contains 3.0 grams of carbon, 0.50 grams of hydrogen, and 4.0 grams of oxygen.

a. Determine its empirical formula.

$$3.0 \text{ g C} \times \frac{1 \text{ mol C}}{12.0 \text{ g C}} = 0.25 \text{ mol C} \qquad \frac{0.25 \text{ mol C}}{0.25 \text{ mol O}} = \frac{1 \text{ C}}{1 \text{ O}}$$

$$0.50 \text{ g H} \times \frac{1 \text{ mol H}}{1.01 \text{ g H}} = 0.50 \text{ mol H} \qquad \frac{0.50 \text{ mol H}}{0.25 \text{ mol O}} = \frac{2 \text{ H}}{1 \text{ O}}$$

$$4.0 \text{ g O} \times \frac{1 \text{ mol O}}{16.0 \text{ g O}} = 0.25 \text{ mol O} \qquad \text{OCH}_2$$

b. If its molar mass is 180 g/mol, determine its molecular formula.

$$n = \frac{180 \text{ g/mol}}{30 \text{ g/mol}} = 6 \qquad (\text{OCH}_2)_6 = \text{O}_6\text{C}_6\text{H}_{12}$$

6. What is the molecular formula for a compound with the empirical formula of HO, and a molar mass around 34?

$$n = \frac{34}{17} = 2 \qquad (\text{HO})_2 = \text{H}_2\text{O}_2$$

7. A certain compound contains 25.9% N and 74.1% O. What is its empirical formula?

$$25.9 \text{ g N} \times \frac{1 \text{ mol N}}{14.01 \text{ g N}} = 1.85 \text{ mol N} \qquad \frac{4.63 \text{ mol O}}{1.85 \text{ mol N}} = \frac{2.5 \text{ O}}{1 \text{ N}} \times \frac{2}{2} = \frac{5 \text{ O}}{2 \text{ N}}$$

$$74.1 \text{ g O} \times \frac{1 \text{ mol O}}{16.0 \text{ g O}} = 4.63 \text{ mol O} \qquad \text{N}_2\text{O}_5$$