

Ch. 10 Quiz Review

Name: _____

10.1
10.2

- Moles & Mole Calculations

$1 \text{ mol} = 6.022 \times 10^{23} \text{ particles}$, $1 \text{ mol} = (\text{Molar Mass}) \text{ g}$

10.3 - % composition & chemical formulas

% by mass = $\frac{\text{mass of element}}{\text{mass of compound}} (100\%)$
of element

% by mass = $\frac{\text{mass of element in 1 mol compound}}{\text{Molar mass of compound}} (100\%)$
of element

Molecular Formula = (X) E.F. (X = whole #)

Molecular Formula = $\left(\frac{\text{Molar Mass}}{\text{E.F. mass}} \right) \text{ E.F.}$

One mole of a substance contains Avogadro's Number (6.02×10^{23}) of molecules.

How many molecules are in the quantities below?

1. 2.0 moles $\left(\frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mol}} \right) = 1.2 \times 10^{24} \text{ molecules}$

2. 1.5 moles $\left(\frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mol}} \right) = 9.0 \times 10^{23} \text{ molecules}$

3. 0.75 mole $\left(\frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mol}} \right) = 4.5 \times 10^{23} \text{ molecules}$

4. 3.4×10^{26} $\left(\frac{1 \text{ mol}}{6.022 \times 10^{23} \text{ molecules}} \right) = 560 \text{ mols}$

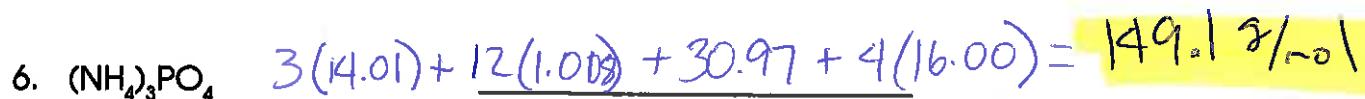
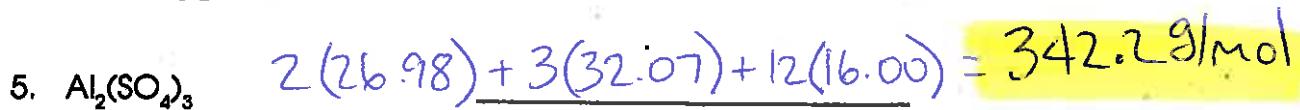
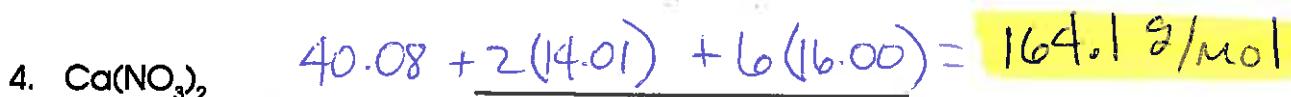
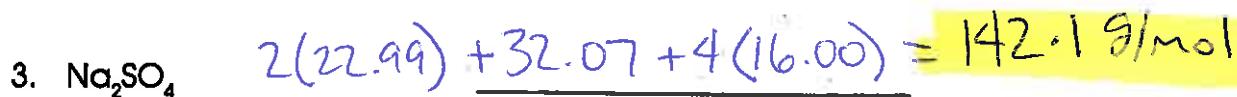
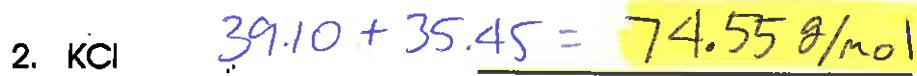
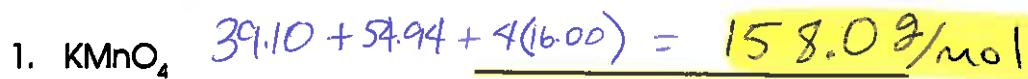
5. 7.5×10^{19} $\left(\frac{1 \text{ mol}}{6.022 \times 10^{23} \text{ molecules}} \right) = 0.00012 \text{ mols}$
 $= 1.2 \times 10^{-4} \text{ mols}$

mole

GRAM FORMULA MASS

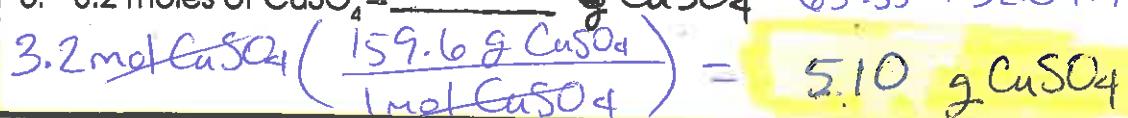
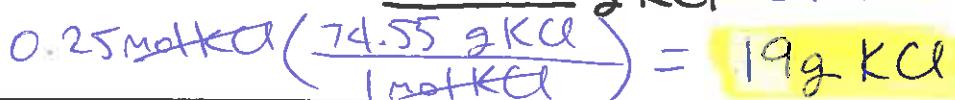
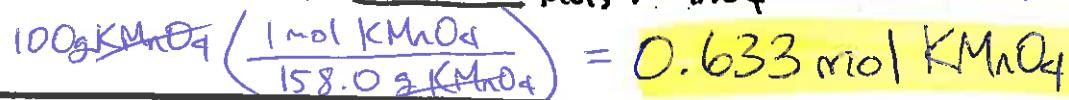
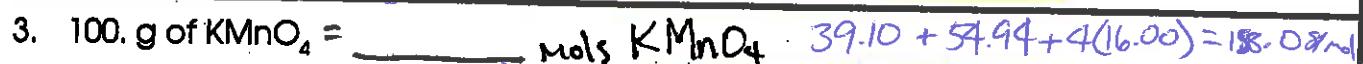
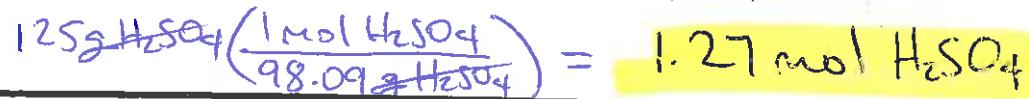
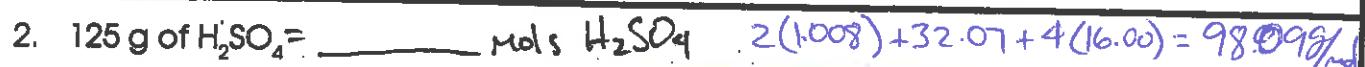
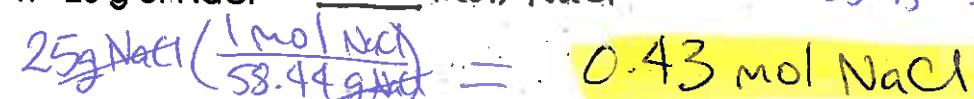
Name _____

Determine the gram formula mass (the mass of one mole) of each compound below.



MOLES AND MASS

Name _____



Mixed Mol Problems

1. How many grams are there in 1.5×10^{25} molecules of CO_2 ? $12.01 + 2(16.00) = 44.01$

$$1.5 \times 10^{25} \text{ CO}_2 \left(\frac{1 \text{ mol CO}_2}{6.022 \times 10^{23} \text{ CO}_2} \right) \left(\frac{44.01 \text{ g CO}_2}{1 \text{ mol CO}_2} \right) = 1.1 \times 10^3 \text{ g CO}_2$$

5. How many atoms are there in 1.3×10^{22} molecules of NO_2 ?

1 molecule NO_2 = 3 atoms (N + 2O)

$$(1.3 \times 10^{22}) 3 = 3.9 \times 10^{22} \text{ atoms}$$

6. A 5.0 g sample of O_2 is in a container. How many mols of O_2 are in the container?

$$2(16.00) = 32.00 \text{ g/mol}$$

$$5.0 \text{ g O}_2 \left(\frac{1 \text{ mol O}_2}{32.00 \text{ g O}_2} \right) = 0.16 \text{ mol O}_2$$

7. How many molecules of O_2 are in the container in Problem 6? How many atoms of oxygen?

$$0.16 \text{ mol O}_2 \left(\frac{6.022 \times 10^{23} \text{ O}_2}{1 \text{ mol O}_2} \right) = 9.4 \times 10^{22} \text{ molecules O}_2$$

$$\times 2 = 1.9 \times 10^{23} \text{ atoms O}$$

PERCENTAGE COMPOSITION

Name _____

Determine the percentage composition of each of the compounds below.

1. $\text{KMnO}_4 = 158.09 \text{ g/mol}$

K = 24.7%

Mn = 34.8%

O = 40.5%

$$\frac{39.10 \text{ g}}{158.09} = 24.7\% \text{ K}$$

$$\frac{64.00 \text{ g}}{158.09} = 40.5\% \text{ O}$$

$$\frac{54.94 \text{ g}}{158.09} = 34.8\% \text{ Mn}$$

2. $\text{Al}_2(\text{SO}_4)_3 = 342.22 \text{ g/mol}$

Al = 15.8%

S = 28.1%

O = 56.1%

$$\frac{53.96 \text{ g}}{342.22} = 15.8\% \text{ Al}$$

$$\frac{192.0 \text{ g}}{342.22} = 56.1\% \text{ O}$$

$$\frac{96.21 \text{ g}}{342.22} = 28.1\% \text{ S}$$

Solve the following problems.

3. How many grams of oxygen can be produced from the decomposition of 100. g of KClO_3 ? 39.15 g O_2 (work on next page)

4. How much iron can be recovered from 25.0 g of Fe_2O_3 ? 17.5 g Fe

5. How much silver can be produced from 125 g of Ag_2S ? 108.8 g Ag

% Comp # 3-5

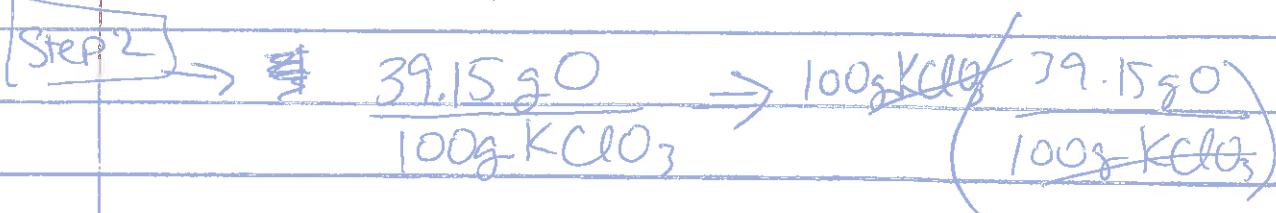
3) Step 1 - determine % comp.



$$\% \text{ K} = \frac{39.10}{122.6} (100\%) = 31.91\%$$

$$\% \text{ Cl} = \frac{35.45}{122.6} (100\%) = 28.92\%$$

$$\% \text{ O} = \frac{48.00}{122.6} (100\%) = 39.15\%$$



$$= 39.15 \text{ g O}$$

④ $\text{Fe}_2\text{O}_3 \quad 2(55.85) + 3(16.00) = 159.7 \text{ g/mol}$

$$\% \text{ Fe} = \frac{111.7 \text{ g}}{159.7 \text{ g}} = 69.94\%$$

$$\% \text{ O} = \frac{48.00 \text{ g}}{159.7 \text{ g}} = 30.06\%$$

$$\frac{25.0 \text{ g Fe}_2\text{O}_3}{100 \text{ g Fe}_2\text{O}_3} \left(\frac{69.94 \text{ g Fe}}{159.7 \text{ g Fe}_2\text{O}_3} \right) = 17.5 \text{ g Fe}$$

⑤ $\text{Ag}_2\text{S} \quad 2(107.87) + 32.07 = 247.88 \text{ g/mol}$

$$\% \text{ Ag} = \frac{215.7}{247.8} = 87.06\% \quad \% \text{ S} = \frac{32.07}{247.8} = 12.94\%$$

$$125 \text{ g} \left(\frac{87.06\%}{100\%} \right) = 108.8 \text{ g Ag}$$

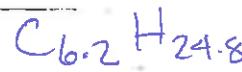
WHAT IS THE MOLECULAR FORMULA?

• WHAT IS THE EMPIRICAL FORMULA?

1. 75% carbon, 25% hydrogen

$$75 \text{ g C} \left(\frac{1 \text{ mol C}}{12.01 \text{ g C}} \right) = 6.2 \text{ mol C}$$

$$25 \text{ g H} \left(\frac{1 \text{ mol H}}{1.008 \text{ g H}} \right) = 24.8 \text{ mol H}$$



$$\frac{6.2}{6.2} = 1$$

$$\frac{24.8}{6.2} = 4$$



2. 52.7% potassium, 47.3% chlorine

$$52.7 \text{ g K} \left(\frac{1 \text{ mol K}}{39.10 \text{ g K}} \right) = 1.35 \text{ mol K}$$

$$47.3 \text{ g Cl} \left(\frac{1 \text{ mol Cl}}{35.45 \text{ g Cl}} \right) = 1.33 \text{ mol Cl}$$



$$\frac{1.35}{1.33} = 1.01$$

$$\frac{1.33}{1.33} = 1$$

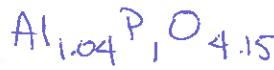


3. 22.1% aluminum, 25.4% phosphorus, 52.5% oxygen

$$22.1 \text{ g Al} \left(\frac{1 \text{ mol Al}}{26.98 \text{ g Al}} \right) = 0.819$$

$$24.5 \text{ g P} \left(\frac{1 \text{ mol P}}{30.97 \text{ g P}} \right) = 0.791$$

$$52.5 \text{ g O} \left(\frac{1 \text{ mol O}}{16.00 \text{ g O}} \right) = 3.28$$



OK to round



1. The empirical formula of a compound is NO_2 . Its molecular mass is 92 g/mol.

What is its molecular formula?

$$\text{NO}_2 = 14.01 + 2(16.00) = 46.01 \text{ g/mol}$$

$$\frac{92}{46.01} = 1.9996 \Rightarrow 2$$



2. The empirical formula of a compound is CH_2 . Its molecular mass is 70 g/mol.

What is its molecular formula?

$$\text{CH}_2 = 12.01 + 2(1.008) = 14.03 \text{ g/mol}$$

$$\frac{70}{14.03} = 4.99 \Rightarrow 5$$



3. A compound is found to be 40.0% carbon, 6.7% hydrogen and 53.5% oxygen.

Its molecular mass is 60. g/mol. What is its molecular formula?

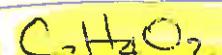
$$40 \text{ g C} \left(\frac{1 \text{ mol C}}{12.01 \text{ g C}} \right) = 3.33 \text{ mol C} = 1 \text{ mol C}$$

$$6.7 \text{ g H} \left(\frac{1 \text{ mol H}}{1.008 \text{ g H}} \right) = 6.65 \text{ mol H} = 2 \text{ mol H}$$

$$53.5 \text{ g O} \left(\frac{1 \text{ mol O}}{16.00 \text{ g O}} \right) = 3.34 \text{ mol O} = 1 \text{ mol O}$$

$$12.01 + 2(1.008) + 16.00 = 30.01$$

$$\frac{60}{30} = 2$$



4. A compound is 64.9% carbon, 13.5% hydrogen and 21.6% oxygen. Its molecular mass is 74 g/mol. What is its molecular formula?

$$64.9 \text{ g C} \left(\frac{1 \text{ mol C}}{12.01 \text{ g C}} \right) = 5.40 \text{ mol C} \Rightarrow 4$$

$$13.5 \text{ g H} \left(\frac{1 \text{ mol H}}{1.008 \text{ g H}} \right) = 13.4 \text{ mol H} \Rightarrow 9.9 \Rightarrow 10$$

$$21.6 \% \text{ O} \left(\frac{1 \text{ mol O}}{16.00 \text{ g O}} \right) = 1.35 \text{ mol O} \Rightarrow 1$$

$$\text{EF} = \text{C}_4\text{H}_{10}\text{O}_1$$

$$4(12.01) + 10(1.008) + 16.00 = 74.12 \text{ g/mol}$$

$$\frac{74.2 \text{ g/mol}}{74.12 \text{ g/mol}} = \sim 1$$

