

Unit 6 Review Worksheet (Accel)

Define the following vocabulary words:

Avogadro's number – # of particles (atoms, molecules, formula units) in 1 mole of substance

Mole – group of particles

Molar Mass (units are g/mol) – mass of 1 mole of substance

Empirical Formula – simplest whole # ratio of elements in a formula

Molecular Formula – exact # of atoms in a formula

Percent Composition – % of each element in a compound by mass

Show your work and answer with units for the following problems:

1. Find the molar mass for each of the following:

a. Cu 63.546 g/mol Cu

b. $\text{Mg}(\text{NO}_3)_2$
 $24.305 + 2(14.007) + 6(15.999) = 148.313 \text{ g/mol Mg}(\text{NO}_3)_2$

c. $\text{Al}_2(\text{CO}_3)_3$
 $2(26.982) + 3(12.011) + 9(15.999) = 233.988 \text{ g/mol Al}_2(\text{CO}_3)_3$

2. How many atoms of Pb are in 2.35 moles of Pb?

$$\frac{2.35 \text{ mol Pb}}{1 \text{ mol Pb}} \times 6.02 \times 10^{23} \text{ atoms Pb} = 1.41 \times 10^{24} \text{ atoms Pb}$$

3. How many moles of H_2O are in 3.05×10^{20} molecules of water?

$$\frac{3.05 \times 10^{20} \text{ molecules H}_2\text{O}}{6.02 \times 10^{23} \text{ molecules H}_2\text{O}} \times 1 \text{ mol H}_2\text{O} = 5.07 \text{ mol H}_2\text{O}$$

4. How many moles of NaCl are in 17.5 g of NaCl?

$$\frac{17.5 \text{ g NaCl}}{58.44 \text{ g NaCl}} \times 1 \text{ mol NaCl} = 0.299 \text{ mol NaCl}$$

5. How many grams of Cl_2F_3 are in 0.059 moles of Cl_2F_3 ?

$$0.059 \text{ mol Cl}_2\text{F}_3 \times 127.89 \text{ g Cl}_2\text{F}_3 = 7.55 \text{ g Cl}_2\text{F}_3$$

6. 8.75×10^{23} molecules of HCl are how many grams of HCl?

$$\frac{8.75 \times 10^{23} \text{ molecules HCl}}{6.02 \times 10^{23} \text{ molecules HCl}} \times 1 \text{ mol HCl} \times 36.458 \text{ g HCl} = 53.0 \text{ g HCl}$$

7. Find the empirical formula given the following analysis: 31.9% K, 28.9% Cl, 39.2% O.

$$\begin{aligned} \frac{31.9 \text{ g K}}{39.098 \text{ g K}} &= 0.816 \text{ mol K} = 1 \\ \frac{28.9 \text{ g Cl}}{35.45 \text{ g Cl}} &= 0.815 \text{ mol Cl} = 1 \\ \frac{39.2 \text{ g O}}{15.999 \text{ g O}} &= 2.45 \text{ mol O} = 3 \end{aligned}$$

KClO_3

8. Find the % composition for each element in $\text{C}_6\text{H}_{12}\text{O}_6$.

$$\begin{aligned} \% \text{C} &= \frac{4(12.011)}{180.156} \times 100 = 40.0\% \text{ C} \\ \% \text{H} &= \frac{12(1.008)}{180.156} \times 100 = 6.71\% \text{ H} \\ \% \text{O} &= \frac{6(15.999)}{180.156} \times 100 = 53.3\% \text{ O} \end{aligned}$$

9. Write the following numbers in scientific notation:

a. 1875000 1.875×10^6

b. 0.0000254 2.54×10^{-5}

10. How many significant figures are in the following measurements?

a. 5650 km 3 b. 0.00125 3

c. 505 L 3
 d. 4500. cm 4

11. Round the following numbers to 3 significant figures:

a. 876512.1 8.77×10^5

b. 0.00058942 5.89×10^{-4}

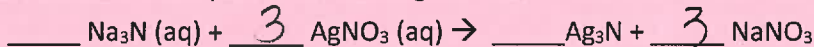
12. Complete the following calculations and give your answer with the proper number of significant figures.

a. $55.87 + 12.0 - 6.789 = 61.081 = 61.1$

b. $39.9 \times 0.20 \times 687 = 5482.26 = 5500$

Show all of your work and label your answers!

13. What is stoichiometry? How is it used? *quantitative relationship between substances in chemical reaction. Tells us how much reactant is needed or how much product is produced*
14. How many grams of sodium nitrate are produced if 20.0 g of ~~Na₃N~~ in solution are reacted with excess silver nitrate?



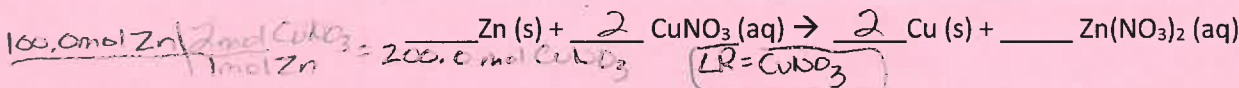
$$\frac{20.0 \text{ g Na}_3\text{N}}{82.977 \text{ g Na}_3\text{N}} \times \frac{1 \text{ mol Na}_3\text{N}}{1 \text{ mol Na}_3\text{N}} \times \frac{3 \text{ mol NaNO}_3}{1 \text{ mol Na}_3\text{N}} \times \frac{69.994 \text{ g NaNO}_3}{1 \text{ mol NaNO}_3} = \boxed{61.5 \text{ g NaNO}_3}$$

15. How many moles of sodium carbonate are produced if 5.00 moles of sodium oxide are reacted with excess carbon monoxide?



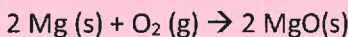
$$\frac{5.00 \text{ mol Na}_2\text{O}}{2 \text{ mol Na}_2\text{O}} \times \frac{1 \text{ mol Na}_2\text{CO}_3}{1 \text{ mol Na}_2\text{O}} = \boxed{2.50 \text{ mol Na}_2\text{CO}_3}$$

16. What is a limiting reactant? *the reactant that gets used up in a reaction*
17. How does a limiting reactant affect a reaction? *it determines how much product can be formed*
18. What do you call the leftover chemicals in a reaction? *excess reactants*
19. If 100.0 moles of zinc metal and 100.0 moles of copper (I) nitrate react, what is the limiting reactant? How many grams of copper metal will be produced according to the following equation?



$$\frac{100.0 \text{ mol CuNO}_3}{2 \text{ mol CuNO}_3} = 50.0 \text{ mol Zn} \quad \frac{100.0 \text{ mol CuNO}_3}{2 \text{ mol CuNO}_3} \times \frac{2 \text{ mol Cu}}{1 \text{ mol CuNO}_3} = \boxed{63.546 \text{ g Cu}} = \boxed{6355 \text{ g Cu}}$$

20. What is percent yield?
21. What does percent yield tell you about a reaction?
22. What is the equation for percent yield? *actual yield / theoretical yield x 100*
23. How does the actual yield of a chemical reaction compare to the theoretical yield? Why? *actual yield is usually less bc reactions aren't 100% efficient*
24. Burning 20.0 g of Mg (s) produces 32.5 g of solid product. What is the percent yield for this reaction?



$$\frac{20.0 \text{ g Mg}}{24.305 \text{ g Mg}} \times \frac{1 \text{ mol Mg}}{1 \text{ mol Mg}} \times \frac{2 \text{ mol MgO}}{2 \text{ mol Mg}} \times \frac{40.304 \text{ g MgO}}{1 \text{ mol MgO}} = \boxed{33.2 \text{ g MgO}}$$

$$\frac{32.5 \text{ g}}{33.2} \times 100 = \boxed{97.9\%}$$

25. Write the balanced chemical equation for the reaction between H₂ (g) & O₂ (g) to produce water: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

- a. What is the mole ratio between H₂ and O₂? $\frac{2 \text{ mol H}_2}{1 \text{ mol O}_2}$
- b. 6 moles of hydrogen would react with 3 moles of oxygen. $\frac{6 \text{ mol H}_2}{2 \text{ mol H}_2} = 3 \text{ mol O}_2$
- c. How many moles of water would form from 10 moles of oxygen?

$$\frac{10 \text{ mol O}_2}{1 \text{ mol O}_2} \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol O}_2} = \boxed{20 \text{ mol H}_2\text{O}}$$

- d. How many grams of oxygen would react with 16.2 g of hydrogen?

$$\frac{16.2 \text{ g H}_2}{2.016 \text{ g H}_2} \times \frac{1 \text{ mol H}_2}{2 \text{ mol H}_2} \times \frac{1 \text{ mol O}_2}{2 \text{ mol H}_2} \times \frac{31.998 \text{ g O}_2}{1 \text{ mol O}_2} = \boxed{129 \text{ g O}_2}$$

- e. How many moles of water would form from 21.8 g of oxygen?

$$\frac{21.8 \text{ g O}_2}{31.998 \text{ g O}_2} \times \frac{1 \text{ mol O}_2}{1 \text{ mol O}_2} \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol O}_2} = \boxed{1.36 \text{ mol H}_2\text{O}}$$

- f. If 10.0 mol of H₂ and 10.0 mol of O₂ reacted, which is the limiting reagent? How many moles of H₂O will form?

$$\frac{10.0 \text{ mol H}_2}{2 \text{ mol H}_2} = 5.00 \text{ mol O}_2 \quad \text{LR} = \text{H}_2 \quad \frac{10.0 \text{ mol H}_2}{2 \text{ mol H}_2} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol H}_2} = \boxed{10.0 \text{ mol H}_2\text{O}}$$

- g. A student carried out this experiment in the lab by reacting 22.4 g of oxygen with excess hydrogen and 24.5 g of water were formed. What is the percent yield?

$$\frac{22.4 \text{ g O}_2}{31.998 \text{ g O}_2} \times \frac{1 \text{ mol O}_2}{1 \text{ mol O}_2} \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol O}_2} \times \frac{18.015 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 25.2 \text{ g H}_2\text{O}$$

$$\frac{24.5 \text{ g}}{25.2 \text{ g}} \times 100 = \boxed{97.2\%}$$