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. $Mg(NO_3)_2$ $24.305 + 2(14.007) + 6(15.999) =$ 148.313 g/mol $Mg(NO_3)_2$

   c. $Al_2(CO_3)_3$ $2(26.982) + 3(12.011) + 9(15.999) =$ 233.988 g/mol $Al_2(CO_3)_3$

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

   $2.35\ mol\ Pb \left| \frac{6.02 \times 10^{23}\ atoms\ Pb}{1\ mol\ Pb} \right. = 1.41 \times 10^{24}\ atoms\ Pb$

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

   $3.05 \times 10^{20}\ molecules\ H_2O \left| \frac{1\ mol\ H_2O}{6.02 \times 10^{23}\ molecules\ H_2O} \right. = 5.07 \times 10^{-4}\ mol\ H_2O$

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

   $17.5\ g\ NaCl \left| \frac{1\ mol\ NaCl}{58.44\ g\ NaCl} \right. = 0.299\ mol\ NaCl$

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

   $0.059\ mol\ Cl_2F_3 \left| \frac{127.894\ g\ Cl_2F_3}{1\ mol\ Cl_2F_3} \right. = 7.55\ g\ Cl_2F_3$

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

   $8.75 \times 10^{23}\ molecules\ HCl \left| \frac{1\ mol\ HCl}{6.02 \times 10^{23}\ molecules\ HCl} \right. \left| \frac{36.458\ g\ HCl}{1\ mol\ HCl} \right. = 53.0\ g\ HCl$

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

   $31.9\ g\ K \left| \frac{1\ mol\ K}{39.098\ g\ K} \right. = 0.816\ mol\ K = 1$

   $28.9\ g\ Cl \left| \frac{1\ mol\ Cl}{35.453\ g\ Cl} \right. = 0.815\ mol\ Cl = 1$

   $39.2\ g\ O \left| \frac{1\ mol\ O}{15.999\ g\ O} \right. = 2.45 \ldots = 3$

   $KClO_3$

8. Find the % composition for each element in $C_6H_{12}O_6$.

   $\%C = \frac{72.066}{180.156} \times 100 = 40.0\%\ C$

   $\%H = \frac{12.096}{180.156} \times 100 = 6.71\%\ H$

   $\%O = \frac{95.994}{180.156} \times 100 = 53.3\%\ O$

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 877000 or 8.77×10^5

    b. 0.00058942 5.89×10^{-4} or 0.000589

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 ~~NaN3~~ Na_3N in solution are reacted with excess silver nitrate?

_____ Na_3N (aq) + __3__ $AgNO_3$ (aq) → _____ Ag_3N + __3__ $NaNO_3$

$20.0\,g\,Na_3N \left| \frac{1\,mol\,Na_3N}{92.9774\,g\,Na_3N} \right| \frac{3\,mol\,NaNO_3}{1\,mol\,Na_3N} \left| \frac{84.994\,g\,NaNO_3}{1\,mol\,NaNO_3} \right. = 61.5\,g\,NaNO_3$

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

__2__ Na_2O (s) + _____ CO (g) → _____ Na_2CO_3 (s) + __2__ Na (s)

$5.00\,mol\,Na_2O \left| \frac{1\,mol\,Na_2CO_3}{2\,mol\,Na_2O} \right. = 2.50\,mol\,Na_2CO_3$

16. What is a limiting reactant? the reactant that gets used up in a reaction

17. How does a limiting reactant affect a reaction? 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 liming reactant? How many grams of copper metal will be produced according to the following equation?

_____ Zn (s) + __2__ $CuNO_3$ (aq) → __2__ Cu (s) + _____ $Zn(NO_3)_2$ (aq)

$100.0\,mol\,Zn \left| \frac{2\,mol\,CuNO_3}{1\,mol\,Zn} \right. = 200.0\,mol\,CuNO_3$ LR = $CuNO_3$

$100.0\,mol\,CuNO_3 \left| \frac{1\,mol\,Zn}{2\,mol\,CuNO_3} \right. = 50.0\,mol\,Zn$

$100.0\,mol\,CuNO_3 \left| \frac{2\,mol\,Cu}{2\,mol\,CuNO_3} \right| \frac{63.546\,g\,Cu}{1\,mol\,Cu} = 6.355\,g\,Cu$

20. What is percent yield?

21. What does percent yield tell you about a reaction? relationship between how much should be produced & how much is actually produced

22. What is the equation for percent yield? $\frac{actual\ yield}{theoretical\ yield} \times 100$

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?

$2\,Mg\,(s) + O_2\,(g) \rightarrow 2\,MgO(s)$

$20.0\,g\,Mg \left| \frac{1\,mol\,Mg}{24.305\,g\,Mg} \right| \frac{2\,mol\,MgO}{2\,mol\,Mg} \left| \frac{40.304\,g\,MgO}{1\,mol\,MgO} \right. = 33.2\,g\,MgO$

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

25. Write the balanced chemical equation for the reaction between H_2 (g) & O_2 (g) to produce water: $2H_2 + O_2 \rightarrow 2H_2O$

a. What is the mole ratio between H_2 and O_2? $\frac{2\,mol\,H_2}{1\,mol\,O_2}$

b. 6 moles of hydrogen would react with __3__ moles of oxygen. $6\,mol\,H_2 \left| \frac{1\,mol\,O_2}{2\,mol\,H_2} \right. = 3\,mol\,O_2$

c. How many moles of water would form from 10 moles of oxygen?

$10\,mol\,O_2 \left| \frac{2\,mol\,H_2O}{1\,mol\,O_2} \right. = 20\,mol\,H_2O$

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

$16.2\,g\,H_2 \left| \frac{1\,mol\,H_2}{2.016\,g\,H_2} \right| \frac{1\,mol\,O_2}{2\,mol\,H_2} \left| \frac{31.998\,g\,O_2}{1\,mol\,O_2} \right. = 129\,g\,O_2$

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

$21.8\,g\,O_2 \left| \frac{1\,mol\,O_2}{31.998\,g\,O_2} \right| \frac{2\,mol\,H_2O}{1\,mol\,O_2} \left. = 1.36\,mol\,H_2O \right.$

f. If 10.0 mol of H_2 and 10.0 mol of O_2 reacted, which is the limiting reagent? How many moles of H_2O will form?

$10.0\,mol\,H_2 \left| \frac{1\,mol\,O_2}{2\,mol\,H_2} \right. = 5.00\,mol\,O_2$ LR = H_2

$10.0\,mol\,O_2 \left| \frac{2\,mol\,H_2}{1\,mol\,O_2} \right. = 20.0\,mol\,H_2$

$10.0\,mol\,H_2 \left| \frac{2\,mol\,H_2O}{2\,mol\,H_2} \right. = 10.0\,mol\,H_2O$

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?

$22.4\,g\,O_2 \left| \frac{1\,mol\,O_2}{31.998\,g\,O_2} \right| \frac{2\,mol\,H_2O}{1\,mol\,O_2} \left| \frac{18.015\,g\,H_2O}{1\,mol\,H_2O} \right. = 25.2\,g\,H_2O$

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