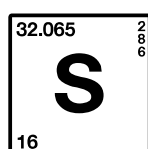
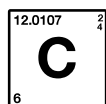


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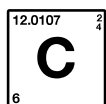


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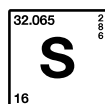
- Complete all 7 worksheets in the packet. They are due the first day of school.
- Be ready for the Polyatomic Ion/Common Ion Quiz that will take place the first week of school. See page 3 for the ions you will need to memorize.



ambridge



hristian



chool



AP Chemistry 2022 Summer Assignment

To: All Incoming AP Chemistry Students

From: Mrs. Peake, AP Chemistry Instructor

Greetings and welcome to AP Chemistry! I am so excited you decided to embark on the AP Chemistry journey. AP Chemistry is equivalent to a year of General Chemistry in college. It will be a challenging class that requires effort and dedication. Just know, my desire is to prepare you to be successful on the AP exam in May!

Over the summer, you will be responsible for completing all 7 worksheets and problems in this review packet. **You must show your work!** They are **due the first day of school** and will count as your first grade in AP Chemistry. You will have a memorization quiz the first week of school on the common ions and polyatomic ions listed in your packet – you will be allowed to use the periodic table, but you will need to know the name as well as the ion symbol with charge.

Please work on this packet throughout the summer – it will take you some time, so please don't wait until the last minute. Arrive ready to learn – I am excited for a great year!! Have a great summer!

Mrs. Peake

Lisa Peake

Lpeake@ccslancers.com

Textbooks:

- Chemistry The Central Science, Brown and Lemay
- The General Chemistry Workbook by Bassam Z. Shakhashiri, and Rodney Schreiner – this has been a favorite and most treasured resource of my students for years – you will get this when you arrive to school

Video Resources: See QR codes embedded in packet for extra help!!

- YouTube – Chad's General Chemistry Videos --
<https://www.youtube.com/playlist?list=PLMIqayk59IvrG4m2TiMdwQonjhXKUGjvY>
- YouTube – Tyler Dewitt -- <https://www.youtube.com/user/tdewitt451/playlists>
- Socratic - <https://socratic.org/chemistry>
- Polyatomic Ions - <https://youtu.be/69ZbHNNcfz0>

Socratic.com



Common Polyatomic Ion List

You must memorize this sheet. There will be a quiz on these polyatomic and common ions the first week of school. I will give you a periodic table to use– When I give you the name, you will have to give me the formula and charge AND when I give you the formula and charge, you will have to give me the name. MEMORIZE NAME, FORMULA, AND CHARGE!

| Per____ate | ____ate | ____ite | hypo____ite | Monatomic anions For REFERENCE |
|---|---|---|--|--------------------------------------|
| ClO_4^- per <u>chlorate</u> | ClO_3^- chlo <u>rate</u> | ClO_2^- chlor <u>ite</u> | ClO^- hypo <u>chlorite</u> | Cl^- chlor <u>ide</u> |
| BrO_4^- per <u>bromate</u> | BrO_3^- bro <u>mate</u> | BrO_2^- bro <u>mite</u> | BrO^- hypo <u>bromite</u> | Br^- bro <u>mide</u> |
| IO_4^- per <u>iodate</u> | IO_3^- io <u>date</u> | IO_2^- io <u>dite</u> | IO^- hypo <u>iodite</u> | I^- io <u>dide</u> |
| xxx | NO_3^- nit <u>rate</u> | NO_2^- nit <u>rite</u> | xxx | N^{3-} nit <u>ride</u> |
| xxx | SO_4^{2-} sul <u>rate</u> | SO_3^{2-} sul <u>fite</u> | xxx | S^{2-} sul <u>fide</u> |
| xxx | PO_4^{3-} pho <u>sphate</u> | PO_3^{3-} pho <u>sphite</u> | xxx | P^{3-} pho <u>sphide</u> |
| xxx | CO_3^{2-} carbo <u>nate</u> | xxx | xxx | C^{4-} carb <u>ide</u> |
| xxx | CrO_4^{2-} chro <u>mate</u> | xxx | xxx | xxx |

OTHERS YOU NEED TO KNOW:

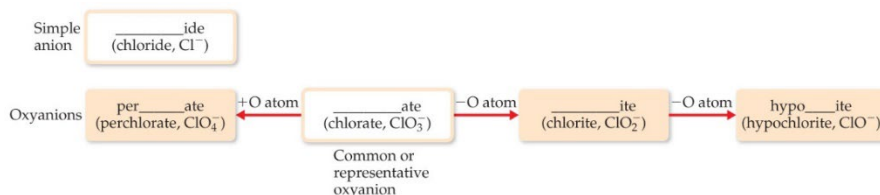
| | | | |
|------------------------------------|----------------------------------|------------------------------|------------|
| MnO_4^- | permanganate | $\text{Cr}_2\text{O}_7^{2-}$ | dichromate |
| $\text{C}_2\text{H}_3\text{O}_2^-$ | acetate | OH^- | hydroxide |
| HCO_3^- | hydrogen carbonate (bicarbonate) | CN^- | cyanide |
| NH_4^+ | ammonium | (note positive charge) | |

per____ate: has one more oxygen than “ATE”

____ate: most common form

____ite: one less oxygen than “ATE”

hypo____ite: two less oxygens than “ATE”



NOTE: The number should be shown before the charge BUT you would not lose credit if you had the charge first! Also, if a charge is either +1 or -1, you may show just the sign (+ or -). The 1 is not required to be shown.

STEALTH BOMBER – http://www.kwanga.net/chemnotes/stealth_bomber.pdf

Video to help you memorize: Awesome!!!! <https://youtu.be/69ZbHNNcfz0>



AP Chemistry Worksheet 1: Significant Figures

YouTube: Tyler Dewitt Significant Figures
<https://www.youtube.com/playlist?list=PL3hPm0ZdYhy0PQUQ1ka94hxVQPdYGS9m>



YouTube: Fast forward to the significant figures
<https://youtu.be/R5ZoEqipoY>



Rules

1. **All non-zero digits are significant.** For example. 123. (3 sig figs)
2. **Zeros between non-zero digits are significant.** For example: 12.507 (5 sig figs)
3. **Zeros to the left of the first non-zero digit are not significant.** For example: 1.02 (3 sig figs), 0.12 (2 sig figs), 0.012 (2 sig figs)
4. **If a number ends in zeros to the right of the decimal point, those zeros are significant.** For example: 2.0 (2 sig figs), 2.00 (3 sig figs)
{This signifies greater accuracy.}
5. **If a number ends in zeros to the left of the decimal point, those zeros *may or may not be* significant.** For example:
If we make a statement that the weight of an object is 120 g, how do we convey our knowledge of whether the balance was accurate to ± 1 g or ± 10 g?
Answer: The ambiguity can be removed by using *exponential notation*.
The weight can be expressed as $12. \times 10^1$ g or 1.2×10^2 g if we wish to quote unambiguously to 2 sig figs, and 12.0×10^1 g or 1.20×10^2 g if we have a confidence level extending to 3 sig figs.
Note: We cannot write 120.0 g since this requires known accuracy of ± 0.1 g.

Multiplication or Division: the result can have no more sig figs than the least accurate number. For example:

If an object has mass of 29.1143 g and a volume of 25.0 cm³, then its density is given by

$$\text{Density} = \frac{29.1143 \text{ g}}{25.0 \text{ cm}^3} = 1.164572 \text{ g cm}^{-3} = 1.16 \text{ g cm}^{-3}$$

Addition or Subtraction: the result must be reported to the same number of decimal places as the number with the fewest decimal places. For example:

$$\begin{array}{r} 19.2 \text{ g} \\ 0.4745 \text{ g} \\ \hline 19.6745 \text{ g} \end{array}$$

SUM = 19.6745 g = 19.7 g because one weight is known only to the nearest 1 g!

NOTE: Round off numbers only at the END of calculations; otherwise, errors may be inadvertently carried through.

Rules taken from <http://www.dartmouth.edu/~genchem/sigfigs.html>

1. Round each of the following numbers to four significant figures, and express the result in scientific notation:

a. 300.235800 _____

b. 456,500 _____

c. 0.006543210 _____

d. 0.000957830 _____

e. - 0.035000 _____

2. Carry out the following operations, and express the answers with the appropriate number of significant figures:

a. $1.24056 + 75.80$ _____

b. $23/67 - 75$ _____

c. $890,000 \times 112.3$ _____

d. $78,132 / 2.50$ _____

AP Chemistry Worksheet 2: Structure of the Atom and the Periodic Table



1. Complete the following chart – explain the experiment/model each scientist used

<https://youtu.be/KMCYPROxnAM> and <https://www.youtube.com/playlist?list=PL3hPm0ZdYhyxYBS94sd8iqDttfDiaY19Z>

| Scientist | Discovery with regards to the Atom | Experiment/Model or Theory |
|-------------------|------------------------------------|----------------------------|
| John Dalton | | |
| J.J. Thomson | | |
| Robert Millikan | | |
| Ernest Rutherford | | |
| James Chadwick | | |
| Niels Bohr | | |

Playlist: <https://www.youtube.com/playlist?list=PL3hPm0ZdYhywb0pyaNisXFzIOB3FESr0y>



2. Let's pretend you are holding two atoms of carbon that are isotopes. Describe what the two atoms have in common and what they have different.

3. Fill in the gaps in the following table, assuming each column represents a neutral atom:

| | Symbol | Protons | Neutrons | Electrons | Mass Number |
|----|----------------------|---------|----------|-----------|-------------|
| a. | $^{39}_{19}\text{K}$ | | | | |
| b. | | 25 | 30 | | |
| c. | | | 64 | 48 | |
| d. | | | | 56 | 137 |
| e. | | 82 | | | 207 |

4. Write the correct symbol, with both superscripts and subscripts, for each of the following:

- a. the isotope of sodium with mass 23 _____
- b. the atom of vanadium that contains 28 neutrons _____
- c. the isotope of chlorine with mass 37 _____
- d. an atom of magnesium that has an equal number of protons and neutrons _____

AP Chemistry Worksheet 3: Naming Inorganic Compounds

Naming Compounds Flowchart

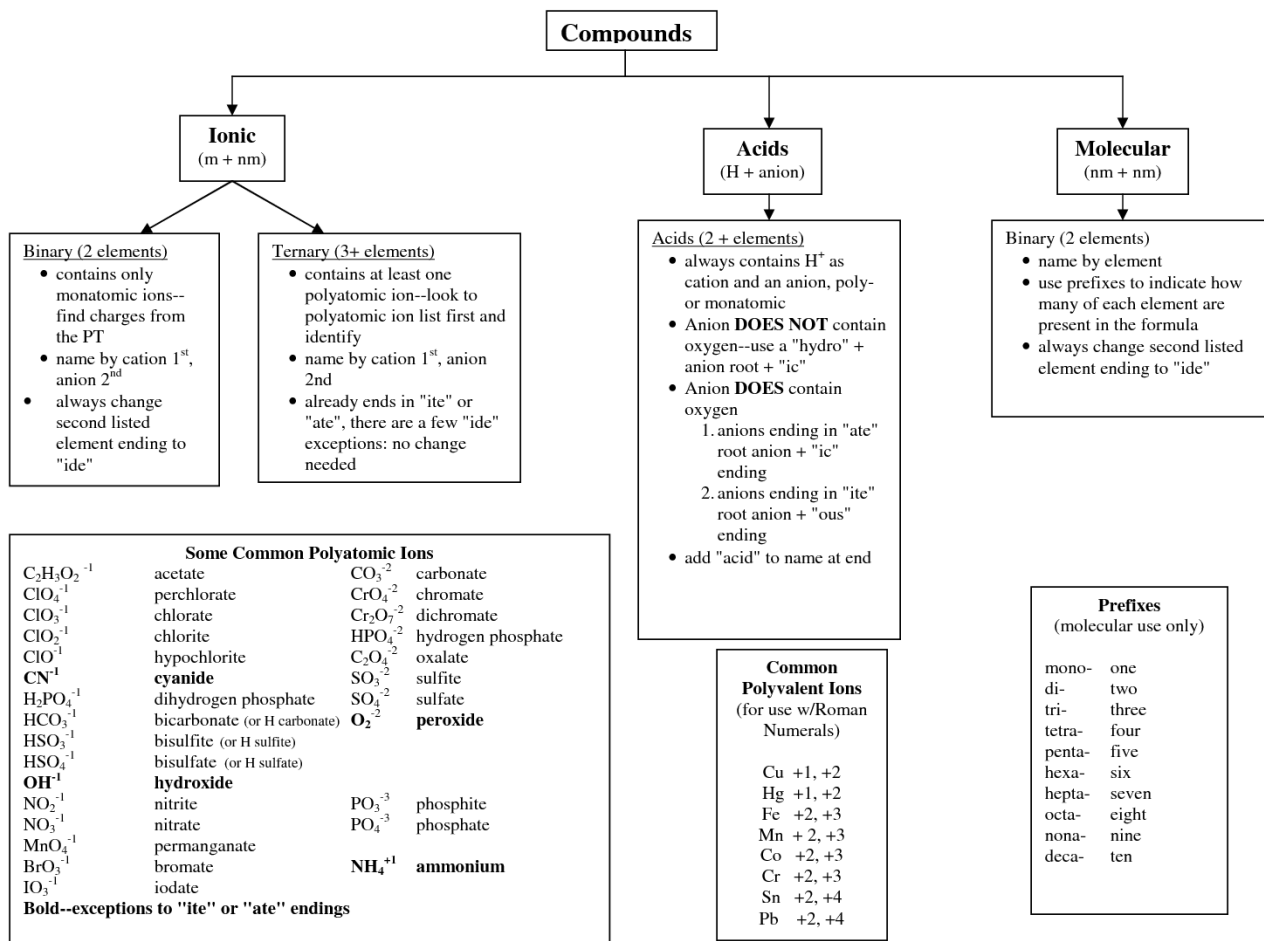
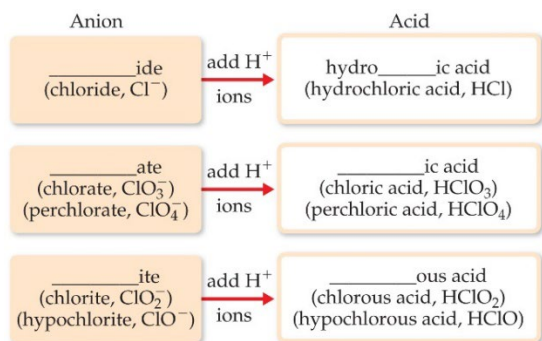


Chart Found: http://www.gridgit.com/postpic/2011/04/naming-covalent-compounds-flow-chart_261961.png

Remember: Most transition metals (3-12) and Group 4A (14) metals form 2 or more positive ions, except Zn²⁺, Ag⁺, and Cd²⁺, which form only one ion.

Rules for Naming Acids:



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Naming Ionic:

https://www.youtube.com/playlist?list=PL1pnKcPoB0iZgyHFEa_NI414YDWBvdvxO3

<https://youtu.be/eGlifOV-oLo>



Naming Covalent:

<https://youtu.be/DejkrR4pvRw>

<https://youtu.be/bjFTKzqjC54>



Naming Acids:

<https://youtu.be/5Jb2u9ihfm4>

<https://youtu.be/VyjnMk-Ta10>

<https://youtu.be/MV8YRKz7gds>



Naming needs to be really strong – please practice! *Some additional practice can be found here:

<http://www.sciencegeek.net/APchemistry/Quizzes/Nomenclature/>

Complete the following table – First decide if the substance is Ionic, Covalent or an Acid – you use different naming rules for each of these three types of substances. Then, once you have checked the appropriate classification, complete either the formula or name. (Remember Magic Triangle)

| | Name | Formula | Ionic | Covalent | Acid |
|-----|------------------------------|---------------------------------|--------------|-----------------|-------------|
| 1. | Copper (I) oxide | | | | |
| 2. | Hypochlorous Acid | | | | |
| 3. | Zinc nitrate | | | | |
| 4. | | H ₃ PO ₄ | | | |
| 5. | | SF ₆ | | | |
| 6. | | Fe(OH) ₂ | | | |
| 7. | Tetraphosphorous hexasulfide | | | | |
| 8. | Sulfurous acid | | | | |
| 9. | Potassium oxide | | | | |
| 10. | Calcium acetate | | | | |
| 11. | | IF ₅ | | | |
| 12. | | Li ₃ PO ₄ | | | |
| 13. | | HCl | | | |
| 14. | | N ₂ O ₄ | | | |
| 15. | | AgCl | | | |

16. Write the balanced chemical equation for each reaction given below:

a. Zinc carbonate can be heated to form zinc oxide and carbon dioxide

b. On treatment with hydrofluoric acid, silicon dioxide forms silicon tetrafluoride and water.

c. Sulfur dioxide reacts with water to form sulfurous acid.

AP Chemistry Worksheet 4: Atomic and Molecular Masses

Show Your Work!

1. The atomic weight of magnesium is reported as 24.3, yet no atom of magnesium has the mass of 24.3 amu. Explain.
2. Only two isotopes of copper occur naturally, Cu-63 (abundance 69.09 percent) and Cu-65 (abundance 30.91 percent). Calculate the average atomic mass of copper.
4. Determine the molar mass of each of the following compounds:
 - a. N_2O_5
 - b. $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$
 - c. $(\text{NH}_4)_3\text{PO}_4$
5. Calculate the percentage by mass of oxygen in the following compounds:
 - a. NO_2
 - b. $\text{CH}_3\text{COOCH}_3$
 - c. $\text{Cr}(\text{NO}_3)_3$
 - d. $(\text{NH}_4)_2\text{CO}_3$

<https://www.youtube.com/playlist?list=PL3hPm0ZdYhywV7J-IfeuOaCws8qKyVCh0>



<https://youtu.be/lywmGCfIUIA>



<https://youtu.be/XDp0S1jTmE0>



AP Chemistry Worksheet 5: Empirical and Molecular Formulas

Show Your Work!!

To find the Empirical Formula:

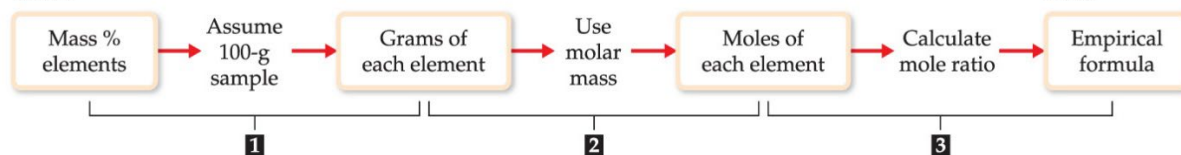
Step 1: Change the % sign to grams

Step 2: Convert grams to moles

Step 3: Divide by the smallest number of moles

Step 4: Multiply if needed to establish a whole number ratio

Given:



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To Find the Molecular Formula:

Step 1: Divide the Molar Mass by the Mass of the Empirical Formula – you should get a whole number

Step 2: Use the whole number from step 1 – multiply subscripts of empirical formula to get molecular formula

*For each problem below, write the equation and **show your work**. Always use units and box in your final answer.*

1. Determine the empirical formula of each of the following compounds if a sample contains

a. 0.104 mol K, 0.052 mol C, and 0.156 mol O

b. 5.28 g Sn and 3.37 g F

c. 87.5 percent N and 12.5 percent H by mass

2. Determine the empirical formulas of the compounds with the following compositions by mass

a. 10.4 percent C, 27.8 percent S, and 61.7 percent Cl

b. 21.7 percent C, 9.6 percent O, and 68.7 percent F

3. What is the molecular formula of each of the following compounds?

a. empirical formula CH_2 , molar mass = 84 g/mol

b. empirical formula NH_2Cl , molar mass = 51.5 g/mol

<https://www.youtube.com/playlist?list=PL3hPm0ZdYhyWlwHs-N8En7iTuj9jZQqr>



<https://youtu.be/XDp0S1jTmE0>



4. Determine the empirical and molecular formulas of each of the following substances:

a. Ibuprofen, a headache remedy contains 75.69 percent C, 8.80 percent H, and 15.51 percent O by mass; molar mass about 206 g

b. Benzene contains only carbon and hydrogen and is 7.74% hydrogen by mass. The molar mass of benzene is 78.1 g/mol.

5. Many homes in rural America are heated by propane gas, a compound that contains only carbon and hydrogen. Complete combustion of a sample of propane produced 2.641 g of carbon dioxide and 1.442 g of water as the only products. Find the empirical formula of propane. (Hint: Write the reaction – combustion means hydrocarbon + O_2 . Then, figure out how many moles of C and H were produced. They all came from the fuel.)

6. Menthol, the substance we can smell in mentholated cough drops, is composed of C, H, and O. A 0.1005 g sample of menthol is combusted, producing 0.2829 g of CO_2 and 0.1159 g of H_2O .

a. What is the empirical formula for menthol?

b. If the compound has a molar mass of 156 g/mol, what is its molecular formula?

AP Chemistry Worksheet 6: Stoichiometry (you must show work and set up using dimensional analysis!)



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Table 3.2 Mole Relationships

| Name of Substance | Formula | Formula Weight (amu) | Molar Mass (g/mol) | Number and Kind of Particles in One Mole |
|--------------------|-------------------|----------------------|--------------------|---|
| Atomic nitrogen | N | 14.0 | 14.0 | 6.02×10^{23} N atoms |
| Molecular nitrogen | N ₂ | 28.0 | 28.0 | $\left\{ \begin{array}{l} 6.02 \times 10^{23} \text{ N}_2 \text{ molecules} \\ 2(6.02 \times 10^{23}) \text{ N atoms} \end{array} \right.$ |
| Silver | Ag | 107.9 | 107.9 | 6.02×10^{23} Ag atoms |
| Silver ions | Ag ⁺ | 107.9 ^a | 107.9 | 6.02×10^{23} Ag ⁺ ions |
| Barium chloride | BaCl ₂ | 208.2 | 208.2 | $\left\{ \begin{array}{l} 6.02 \times 10^{23} \text{ BaCl}_2 \text{ formula units} \\ 6.02 \times 10^{23} \text{ Ba}^{2+} \text{ ions} \\ 2(6.02 \times 10^{23}) \text{ Cl}^- \text{ ions} \end{array} \right.$ |

^aRecall that the mass of an electron is more than 1800 times smaller than the masses of the proton and the neutron; thus, ions and atoms have essentially the same mass.

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1. A sample of glucose, C₆H₁₂O₆, contains 2.03×10^{21} atoms of carbon

- How many atoms of hydrogen does it contain?
- How many molecules of glucose does it contain?
- How many moles of glucose does it contain?
- What is the mass of the sample in grams?

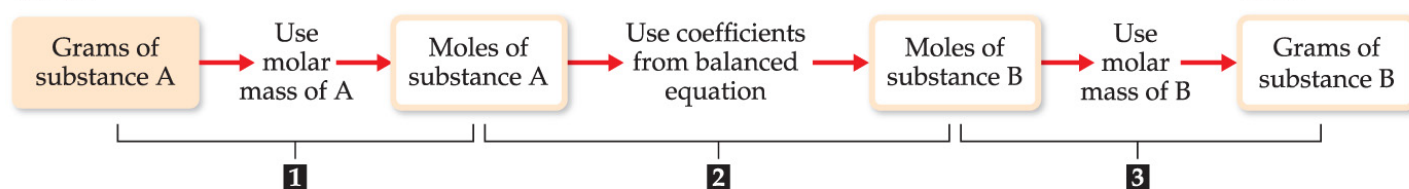
2. Calculate the following amounts:

- How many moles of **chloride ions** are in 0.0750 g of magnesium chloride?
- What is the mass, in grams, of 3.50×10^{-3} mol of aluminum sulfate?
- What is the mass, in grams, of 1.75×10^{20} molecules of caffeine, C₈H₁₀N₄O₂?
- What is the molar mass of cholesterol if 0.00105 mol weigh 0.406 g?

<https://www.youtube.com/playlist?list=PL3hPm0ZdYhyxMcbHkcUgRIM4-w4gAgfRA>



Given:



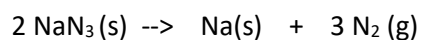
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3. Aluminum sulfide reacts with water to form aluminum hydroxide and hydrogen sulfide.

a. Write the balanced chemical equation for this reaction.

b. How many grams of aluminum hydroxide are obtained from 10.5 g of aluminum sulfide?

4. Automotive air bags inflate when sodium azide, NaN_3 , rapidly decomposes to its component elements:



a. How many moles of N_2 are produced by the decomposition of 1.50 moles of NaN_3 ?

b. How many grams of NaN_3 are required to form 5.00 g of nitrogen gas?

c. How many grams of NaN_3 are required to produce 10.0 L of nitrogen gas if the gas has a density of 1.25 g/L?

AP Chemistry Worksheet 7: Limiting Reactants and Theoretical Yield (you must **show your work** and set up using dimensional analysis!)

For each problem below, write the equation and show your work. Always use units and box in your final answer.

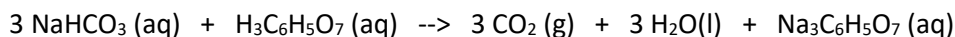
1. A manufacturer of bicycles has 50 wheels, 30 frames, and 24 seats.

a. How many bicycles can be manufactured using these parts?

b. How many parts of each kind are left over?

c. Which part is like a limiting reactant in that it limits the production of bicycles?

2. The fizz produced when an Alka-Seltzer tablet is dissolved in water is due to the reaction between sodium bicarbonate, NaHCO_3 , and citric acid, $\text{H}_3\text{C}_6\text{H}_5\text{O}_7$:



In a certain experiment 1.00 g of sodium bicarbonate and 1.00 g of citric acid are allowed to react.

a. Which reactant is the limiting reactant? You must show work to support your answer.

b. How many grams of carbon dioxide form?

c. How much of the limiting reactant is left when the reaction is complete?

d. How much of the excess reactant remains after the reaction is complete?

<https://youtu.be/nZ0VR8EMwRU>



https://youtu.be/Mlu_v8rE1TY



<https://youtu.be/N0dTXcoHI-I>



<https://youtu.be/ewS-BtwgdV4>



3. When hydrogen sulfide gas is bubbled into a solution of sodium hydroxide, the reaction forms sodium sulfide and water. How many grams of sodium sulfide are formed if 2.50 g of hydrogen sulfide is bubbled into a solution containing 1.85 g of sodium hydroxide, assuming that the limiting reagent is completely consumed?

4. Solutions of sulfuric acid and lead (II) acetate react to form solid lead (II) sulfate and a solution of acetic acid. If 10.0 g of sulfuric acid and 10.0 g of lead (II) acetate are mixed, calculate the number of grams of sulfuric acid, lead (II) acetate, lead (II) sulfate, and acetic acid present in the mixture after the reaction is complete.

5. A student reacts benzene, C_6H_6 , with bromine, Br_2 , to prepare bromobenzene, $\text{C}_6\text{H}_5\text{Br}$, and HBr .

a. What is the theoretical yield of bromobenzene in this reaction when 30.0 g of benzene reacts with 65.0 g of bromine?

b. If the actual yield of bromobenzene was 56.7 g, what was the percent yield?



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