

## AP Chemistry Summer Assignment

### Overview

Students are to complete the following problem set prior to the first day of class for the coming school year. ***This assignment will not be collected or graded, but all students will be assessed on the content of this assignment in Q1.***

This assignment is designed to help you review content from Regents chemistry and to also prepare you for the difficulty of AP Chemistry. It is imperative that you answer ALL questions on the assignment, even if you aren't sure that your answer is 100% correct. We will have time during the first few days to review this assignment, but you **MUST** have attempted the work beforehand.

For all questions on this packet, answer each question in the space provided. For problems with calculations, be sure to show all work, include units, round answers to the correct number of significant figures where appropriate, and place a box around your final answer.

To answer the questions that follow, read Chapter 1 sections 1.1-1.6 and refer to Sample Exercises 1.1-1.13 for guidance.

1. Classify the following as a pure substance or a mixture. If a pure substance, indicate whether it is an element or compound. If a mixture, indicate whether it is homogeneous or heterogeneous.

- |                    |       |
|--------------------|-------|
| a. Rice pudding    | _____ |
| b. Seawater        | _____ |
| c. Magnesium       | _____ |
| d. Gasoline        | _____ |
| e. Air             | _____ |
| f. Tomato juice    | _____ |
| g. Iodine crystals | _____ |
| h. Sand            | _____ |
| i. Blood           | _____ |
| j. White gold      | _____ |
| k. Quartz          | _____ |

2. State the law of definite proportions. How did this law help to confirm the existence of atoms?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. A molecular compound has the formula  $C_2H_6O$ . What exactly does this formula tell us about the compound? What doesn't it tell us?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. In the process of attempting to characterize a substance, a chemist makes the following observations: The substance is a silvery white, lustrous metal. It melts at  $649^{\circ}\text{C}$  and boils at  $1105^{\circ}\text{C}$ . Its density at room temperature is  $1.738\text{ g/mL}$ . The substance burns in air, producing an intense white light. It reacts with chlorine to give a brittle white solid. The substance can be pounded into thin sheets or drawn into wires. It is a good conductor of electricity. In the table below divide these characteristics into chemical or physical properties.

Chemical Properties	Physical Properties

5. Label each of the following as either intensive or extensive properties.

- a. Malleability \_\_\_\_\_
- b. Mass \_\_\_\_\_
- c. Density \_\_\_\_\_
- d. Reactivity with chlorine \_\_\_\_\_
- e. Temperature \_\_\_\_\_
- f. Melting point \_\_\_\_\_
- g. Volume \_\_\_\_\_
- h. Thermal conductivity \_\_\_\_\_
- i. Length \_\_\_\_\_

6. Label each of the following as either a chemical or physical change.

- a. Corrosion of aluminum metal \_\_\_\_\_
- b. Melting of ice \_\_\_\_\_
- c. Pulverizing an aspirin \_\_\_\_\_
- d. Digesting a candy bar \_\_\_\_\_
- e. Explosion of nitroglycerin \_\_\_\_\_
- f. A match burning \_\_\_\_\_
- g. Salt dissolving in water \_\_\_\_\_

7. Write a numbered procedure for the separation a mixture of sugar, sand, and iron filings. Include what materials to use and a brief explanation of your reasoning for each step.

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8. Two buckets of water are sitting at room temperature. The buckets are placed near a fire for ten minutes and they absorb the exact same amount of heat. At the end of this time the water in one bucket is at a higher temperature than the water in the other. How is this possible?

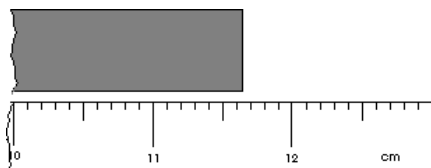
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9. What is the length of the object and how many significant figures are allowed for this reading? (Only the last section of the meter stick and object are shown.)



10. Perform the following calculations. Report answers with the correct significant figures and units.

a.  $4.50 \times 10^{-9} \text{ m} \div 6.0 \times 10^5 \text{ s}$

\_\_\_\_\_

b.  $340 \text{ J} \times 26.0 \text{ s}$

\_\_\_\_\_

c.  $230 \text{ mol} \times 0.006560 \text{ K}$

\_\_\_\_\_

d.  $35.000 \text{ g} - 23.73 \text{ g}$

\_\_\_\_\_

e.  $456 \text{ m} \times 6.02 \text{ m} \div 200.00 \text{ min}$

\_\_\_\_\_

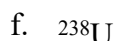
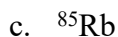
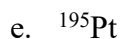
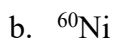
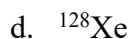
f.  $615 \text{ kg} - 44.00 \text{ kg} + 289.7 \text{ kg}$

\_\_\_\_\_



To answer the questions that follow, read Chapter 2 sections 2.1-2.9 and refer to Sample Exercises 2.1-2.15 for guidance.

12. How many protons, neutrons, and electrons are in the following atoms:



13. Why is Rutherford's nuclear model of the atom more consistent with the results of his  $\alpha$ -particle scattering experiment than Thomson's "plum pudding" model?

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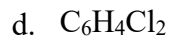
14. The element lead (Pb) consists of four naturally occurring isotopes with masses 203.97302, 205.97444, 206.97587 and 207.97663 amu. The relative abundances of these four isotopes are 1.4, 24.1, 22.1, and 52.4%, respectively. From these data, calculate the average atomic mass of lead.

15. Only two isotopes of copper occur naturally,  $^{63}\text{Cu}$  (mass = 62.9296 amu; abundance 69.17%) and  $^{65}\text{Cu}$  (mass = 64.9278 amu; abundance 30.83%). Calculate the atomic weight (average atomic mass) of copper

16. Gallium (Ga) consists of two naturally occurring isotopes with masses of 68.926 and 70.925 amu.

- a. How many protons and neutrons are in the nucleus of each isotope?
- b. Write the complete atomic symbol for each, showing the atomic number and mass number.
- c. The average atomic mass of Ga is 69.72 amu. Calculate the abundance of each isotope.

17. Write the empirical formula corresponding to each of the following molecular formulas:



18. Provide the systematic name for each compound.

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|--|-------|
| a. $\text{Na}_2\text{CO}_3$                | _____ |
| b. $\text{NaOH}$                           | _____ |
| c. $\text{MgBr}_2$                         | _____ |
| d. $\text{P}_4\text{S}_5$                  | _____ |
| e. $\text{KCl}$                            | _____ |
| f. $\text{FeCl}_2$                         | _____ |
| g. $\text{FeCl}_3$                         | _____ |
| h. $\text{HF(aq)}$                         | _____ |
| i. $\text{HgBr}_2$                         | _____ |
| j. $\text{Zn(OH)}_2$                       | _____ |
| k. $\text{O}_2$                            | _____ |
| m. $\text{CsSCN}$                          | _____ |
| n. $\text{BeSO}_4$                         | _____ |
| o. $\text{CrF}_2$                          | _____ |
| p. $\text{SeF}_6$                          | _____ |
| q. $\text{HClO}_3\text{(aq)}$              | _____ |
| r. $\text{Al}_2\text{S}_3$                 | _____ |
| s. $\text{PbO}$                            | _____ |
| t. $\text{HNO}_3\text{(aq)}$               | _____ |
| u. $\text{HNO}_2\text{(aq)}$               | _____ |
| v. $\text{Hg}_2\text{S}$                   | _____ |
| w. $\text{Li}_3\text{PO}_4$                | _____ |
| x. $\text{Si}_2\text{Br}_6$                | _____ |
| y. $\text{SCl}_4$                          | _____ |
| z. $\text{TiI}_4$                          | _____ |
| aa. $\text{Co}_3\text{N}_2$                | _____ |
| bb. $\text{Mg}_3\text{P}_2$                | _____ |
| dd. $\text{Ga(NO}_2)_3$                    | _____ |
| ee. $\text{Ag}_2\text{SO}_3$               | _____ |
| ff. $\text{NF}_3$                          | _____ |
| gg. $\text{Al(CN)}_3$                      | _____ |
| hh. $\text{H}_2\text{S(g)}$                | _____ |
| ii. $\text{H}_2\text{S(aq)}$               | _____ |
| jj. $\text{H}_2\text{SO}_4\text{(aq)}$     | _____ |
| kk. $\text{Na}_2\text{S}_2\text{O}_3$      | _____ |
| ll. $\text{Be(C}_2\text{H}_3\text{O}_2)_2$ | _____ |

19. Write the formula for each compound.

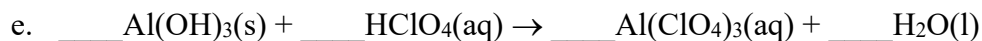
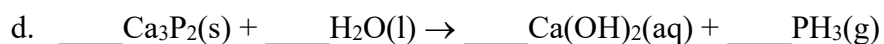
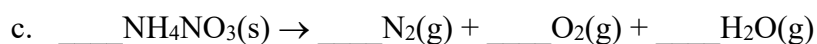
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|-----------------------------|-------|
| a. Sodium phosphide         | _____ |
| b. Magnesium nitrate        | _____ |
| c. Antimony tribromide      | _____ |
| d. Lead (II) sulfite        | _____ |
| f. Calcium phosphate        | _____ |
| g. Ammonium sulfate         | _____ |
| h. Hexaboron silicide       | _____ |
| i. Phosphoric acid          | _____ |
| j. Silver cyanide           | _____ |
| k. Aluminum sulfide         | _____ |
| m. Chlorine dioxide         | _____ |
| n. Hydrogen iodide          | _____ |
| o. Beryllium chloride       | _____ |
| p. Copper (I) arsenide      | _____ |
| q. Iron (III) oxide         | _____ |
| r. Gallium nitride          | _____ |
| s. Iron (II) bromide        | _____ |
| t. Vanadium(V) phosphate    | _____ |
| u. Calcium hydrogen sulfate | _____ |
| v. Copper(I) borate         | _____ |
| w. Calcium oxide            | _____ |
| x. Iodine pentafluoride     | _____ |
| y. Oxalic acid              | _____ |
| z. Potassium permanganate   | _____ |
| aa. Magnesium acetate       | _____ |
| cc. Aluminum sulfate        | _____ |
| dd. Dinitrogen trioxide     | _____ |
| ee. Copper (I) carbonate    | _____ |
| ff. Barium oxide            | _____ |
| gg. Ammonium sulfate        | _____ |
| hh. Phosphorous triiodide   | _____ |
| ii. Silver bromide          | _____ |
| jj. Sulfuric acid           | _____ |
| kk. Lead (IV) nitrate       | _____ |

You are also responsible for the following:

- Know the names and symbols of the following elements: 1-56, 78-88, 91-94
  - It may be helpful to make flash cards with the name of the element on one side and the symbol on the other.
  - It is not necessary to remember the atomic numbers or weights, however you may find that memorizing this information for at least elements 1-20 will save you time.
  - Refer to your textbook for the correct spellings of the elements
- Know the names, formulas, and charges for all the ions listed on the **“Golden Sheet of Nomenclature.”**
  - It may be helpful to make flash cards with the name of the ion on one side and its formula and charge on the other.

To answer the questions that follow, read Chapter 3 sections 3.1-3.7 and refer to Sample Exercises 3.1-3.20 for guidance.

20. Balance the following equations:



21. Convert these descriptions into balanced equations:

a. When sulfur trioxide gas reacts with water, a solution of sulfuric acid forms.

b. Boron sulfide,  $\text{B}_2\text{S}_3(\text{s})$ , reacts violently with water to form dissolved boric acid,  $\text{H}_3\text{BO}_3$ , and hydrogen sulfide gas.

c. Phosphine,  $\text{PH}_3(\text{g})$ , combusts in oxygen gas to form gaseous water and solid tetraphosphorus decoxide.

d. Copper metal reacts with hot concentrated sulfuric acid solution to form aqueous copper(II) sulfate, sulfur dioxide gas, and water.

22. Calculate the percentage by mass of the indicated element in the following compounds:

- a. Hydrogen in ammonium sulfate,  $(\text{NH}_4)_2\text{SO}_4$ , a substance used as a nitrogen fertilizer
  
  
  
  
  
  
  
  
  
  
- b. Oxygen in ascorbic acid,  $\text{HC}_6\text{H}_7\text{O}_6$ , also known as vitamin C
  
  
  
  
  
  
  
  
  
  
- c. Carbon in capsaicin,  $\text{C}_{18}\text{H}_{27}\text{NO}_3$ , the compound that gives the hot taste to peppers

23. Answer the following questions about different mixtures of chloride compounds.

- a. A mixture of NaCl and KCl are in a container. The percent of chloride in NaCl is 60.6%. Would the percent of chloride in the mixture be greater than, less than, or equal to the percent of chloride in NaCl. Explain your reasoning.
  
  
  
  
  
  
  
  
  
  
- b. A mixture of NaCl and LiCl are in a container. The percent of chloride in NaCl is 60.6%. Would the percent of chloride in the mixture be greater than, less than, or equal to the percent of chloride in NaCl. Explain your reasoning.

24. Calculate the following quantities:

- a. Mass, in grams, of 1.73 mol  $\text{CaH}_2$
- b. Number of moles of  $\text{NH}_2\text{Cl}$  in 76.5 g of this substance
- c. Number of  $\text{NO}_3^-$  ions in  $4.88 \times 10^{-3}$  mol  $\text{Al}(\text{NO}_3)_3$
- d. What is the mass, in grams, of  $7.70 \times 10^{20}$  molecules of caffeine,  $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$ ?

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

- a. Ibuprofen, a headache remedy that contains 75.60% C, 8.80% H, and 15.51% O by mass; molar mass about 206 g/mol
- b. Epinephrine (adrenaline), a hormone secreted into the bloodstream in times of danger or stress: 59.0% C, 7.1% H, 26.2% O and 7.7% N by mass; MW approx 180 amu.