

# *CH 221 Fall 2024:*

# **Problem Set #1**

## *Instructions*

*Step One (all sections):*

- **Learn the material** for Problem Set #1 by **reading Chapter 1** of the textbook and/or by watching the videos found on the website (<https://mhchem.org/221>)
- **Try the problems** for Problem Set #1 found on the next pages on your own first. **Write out the answers (and show your work) by hand (on a tablet or paper)**; do not type your answers (and work) to avoid a point penalty. If you write the answers on the problem set itself, you will receive fewer points. Include your name on your problem set!

*Step Two:*

Section 01 and H1: We will go over Problem Set #1 during recitation. ***Self correct all problems*** of your problem set before turning it in at the end of recitation.

- *Section 01:* due **Monday, September 30 at 1:10 PM**
- *Section H1:* due **Wednesday, October 2 at 1:10 PM**

Section W1: **Watch the recitation video** for Problem Set #1:

<http://mhchem.org/w/a.htm>

- **Self correct all of the problems** while viewing the video. Mark correct problems with a star (or other similar mark), and correct all incorrect problems (show the correct answer and the steps required to achieve it.)
- **Submit Problem Set #1 via email (mike.russell@mhcc.edu) as a single PDF file** (use CamScanner (<https://camscanner.com>), CombinePDF (<https://combinepdf.com>), etc.) by **11:59 PM Wednesday, October 2.**

*If you have any questions regarding this assignment, please email (mike.russell@mhcc.edu) the instructor! Good luck on this assignment!*

## CH 221 Problem Set #1

\* Complete problem set on separate pieces of paper showing all work, circling final answers, etc.

\* Self correct your work before turning it in to the instructor.

Covering: **Chapter One and Chapter Guide One**

Important Tables and/or Constants:  $1 \text{ cm}^3 = 1 \text{ mL}$ , **273.15** (temperature); know these metric prefixes: **nano** ( $10^{-9}$ ), **micro** ( $10^{-6}$ ), **milli** ( $10^{-3}$ ), **centi** ( $10^{-2}$ ) and **kilo** ( $10^3$ ).

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1. Give the name of each of the following elements: Mn, Cu, Na, K, Xe, Fe
2. Give the symbol for each of the following elements: silver, fluorine, plutonium, tin, technetium, krypton
3. In each of the following pairs, decide which is an element and which is a compound:
  - a.  $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$  and Pt
  - b. copper and copper(II) oxide
  - c. silicon and silane
4. A piece of silver metal has a mass of 2.365 g. If the density of silver is  $10.5 \text{ g/cm}^3$ , what is the volume of the silver?
5. Make the following temperature conversions:
  - a. 77 K to  $^\circ\text{C}$
  - b.  $63 \text{ }^\circ\text{C}$  to K
  - c. 1450 K to  $^\circ\text{C}$
  - d.  $67.6 \text{ }^\circ\text{F}$  to  $^\circ\text{C}$  *Helpful equation:*  $^\circ\text{F} = 1.8 * (^\circ\text{C}) + 32$
6. A compact disc has a diameter of 11.8 cm. Calculate the surface area of one side of the disc in square centimeters and square meters. (area of a circle =  $\pi r^2$  where r = radius; ignore the center hole.)
7. The separation between carbon atoms in diamond is 0.154 nm. Express this distance in meters and picometers.
8. The solder once used by plumbers to fasten copper pipes together consists of 67% lead and 33% tin by mass. What is the mass of lead in a 250 g block of solder?
9. You have a white crystalline solid known to be one of the potassium compounds listed below. To determine which, you measure the solid's density. You measure out 18.82 g and transfer it to a graduated cylinder containing kerosene (which doesn't dissolve the salts.) The liquid level rises from 8.50 mL to 15.30 mL. Calculate the density of the solid and identify the compound from the following list:
  - a. KF, density =  $2.48 \text{ g/cm}^3$
  - b. KCl, density =  $1.98 \text{ g/cm}^3$
  - c. KBr, density =  $2.75 \text{ g/cm}^3$
  - d. KI, density =  $3.13 \text{ g/cm}^3$
10. Four balloons are each filled with a different gas. If the density of air is  $1.12 \text{ g/L}$ , which balloon or balloons float in the air?
  - a. He, density =  $0.164 \text{ g/L}$
  - b. Ne, density =  $0.825 \text{ g/L}$
  - c. Ar, density =  $1.633 \text{ g/L}$
  - d. Kr, density =  $4.425 \text{ g/L}$

*Problem Set #1 continues on the next page*

Problem Set #1, Continued from previous page

11. Give the number of significant figures in each of the following numbers:
- 0.00546 g
  - 1600 mL
  - $2.300 \times 10^{-4}$  g
  - $2.34 \times 10^9$  atoms
  400. km
12. Carry out the following calculation and report the answer to the correct number of significant figures.
- $$(1.68) \left[ \frac{23.56 - 2.3}{1.248 \times 10^3} \right]$$
13. Copper has a density of  $8.96 \text{ g/cm}^3$ . An ingot of copper with a mass of 57 kg (126 lb) is drawn into a wire with a diameter of 9.50 mm. What length of wire (in meters) can be produced? [Volume of the wire =  $\pi r^2(\text{length})$ ]
14. When you heat popcorn, it pops because it loses water explosively. Assume a kernel of corn with a mass of 0.125 g has a mass of only 0.106 g after popping.
- What percentage of its mass did the kernel lose on popping?
  - Popcorn is sold by the pound in the United States. Using 0.125 g as the average mass of a popcorn kernel, how many kernels are there in a pound of popcorn? [*helpful conversion*: 1 lb = 453.6 g]
15. The fluoridation of city water supplies has been practiced in the United States in many major cities for several decades. It is accomplished by continuously adding sodium fluoride to water as it comes from a reservoir. Assume you live in a medium-sized city of 150,000 people and that 660 L (170 gal) of water is consumed per person per day. What mass of sodium fluoride (in kilograms) must be added to the water supply each year (365 days) to have the required fluoride concentration of 1 ppm (part per million) - that is, 1 kilogram of fluoride per 1 million kilograms of water? (Sodium fluoride is 45.0% fluoride, and water has a density of  $1.00 \text{ g/cm}^3$ .)
16. Automobile batteries are filled with an aqueous solution of sulfuric acid. What is the mass of acid (in grams) in 500. mL of the battery acid solution if the density of the solution is  $1.285 \text{ g/cm}^3$  and if the solution is 38.08% sulfuric acid by mass?

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