

CH 151 Summer 2025:

Problem Set #1

Instructions

Step One:

- **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/151>)
- **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!
- If you get stuck on a particular problem, you can watch the recitation video for Problem Set #1, found using this link: <http://mhchem.org/t/n.htm>

Step Two:

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.

Problem Set #1 will be **due on Wednesday, June 25 at 8 AM.**

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

CH 151 Problem Set #1 - Chapter 1

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

* Self correct problem set during recitation (**June 25, 8 AM**) before turning in to the instructor

Important Tables and/or Constants: $1 \text{ cm}^3 = 1 \text{ mL}$; $k = 10^3$; $c = 10^{-2}$; $m = 10^{-3}$; $\mu = 10^{-6}$; $n = 10^{-9}$; **273.15**, periodic table (<http://mhchem.org/pertab>)

- Determine the number of significant figures in each of the following measured values:
 - 0.1111010
 - 0.0000007
 - 4000
 - 4000.
 - 0.0040
 - 67,000,100
- Round off each of the following numbers to the number of significant figures indicated in parentheses.
 - 3883 (two)
 - 0.00003011 (two)
 - 4.4050 (three)
 - 2.1000 (three)
- Carry out the following mathematical operations, expressing your answers to the correct number of significant figures. Assume that all numbers are measured quantities.
 - $3.33 \times 3.03 \times 0.0333$
 - $300,003 \times 20,000 \times 1.33333$
 - $(2.322 + 4.00) / (3.200 + 6.73)$
 - $7.403 / (3.220 \times 5.000)$
 - $(5600 \times 300) / (22 \times 97.1)$
- Carry out the following mathematical operations, expressing your answers to the correct number of significant figures. Assume that all numbers are measured quantities.
 - $237 + 37 + 7$
 - $3.111 + 3.11 + 3.1$
 - $235.45 + 37 + 36.4$
 - $4.72 - 3.908$
 - $46,230 + 325 + 45$
- Express the following numbers in scientific notation.
 - 787.6
 - 0.01798
 - 40.0
 - 675,000
- Identify the metric prefixes corresponding to each of the following powers of ten, or vice versa.
 - 10^{-3}
 - 10^{-9}
 - 10^3
 - micro
 - centi

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7. Calculate the volume of each of the following objects, each of which has a regular geometrical shape.
- a cube of steel whose edge is 3.5175 mm ($V = s^3$)
 - a spherical marble with a radius of 1.212 cm ($V = \frac{4}{3}\pi r^3$)
 - a bar of iron 6.0 m long, 0.10 m wide and 0.20 m high ($V = l * w * h$)
 - a cylindrical rod of copper with radius = 3.2 mm and length = 62 mm ($V = \pi r^2 L$)
8. A piece of metal weighing 187.6 g is placed in a graduated cylinder containing 225.2 mL of water. The combined volume of solid and liquid is 250.3 mL. What is the volume (in cm^3) and density (in grams per milliliter) of the metal?
9. A pediatric dosage of a certain analgesic is 225 mg/kg of body weight per day. How much analgesic, in milligrams per day, should be administered to a child who weighs 12.3 kg?
10. A 2004 US penny (zinc plated with a thin layer of copper) with a mass of 2.552 g contains 2.448 g of zinc. What is the mass percentage in the penny of copper? of zinc?
11. Carry out the following temperature scale conversions. **$T(\text{K}) = T(^{\circ}\text{C}) + 273.15$**
- Mercury freezes at 234.3 K. What is this temperature in degrees Celsius?
 - Normal body temperature for a chickadee is 41.0 $^{\circ}\text{C}$. What is this temperature in Kelvin?
 - A recommended temperature setting for household hot water heaters is 60. $^{\circ}\text{C}$. What is this temperature in degrees Fahrenheit? $T(^{\circ}\text{F}) = 1.8 * T(^{\circ}\text{C}) + 32$
12. What should the recorded uncertainty be (± 0.1 unit, ± 0.01 unit, etc.) for measurements made using the following measuring device scales?
- a graduated cylinder scale with markings in 10 mL intervals
 - a meter stick scale with markings in 1 cm intervals
 - a buret (a volumetric device) scale with markings in 0.1 mL intervals
 - a double pan mass balance scale with markings in 100 g intervals
13. With a high grade measuring device, the length of an object is determined to be 13.452 mm. Three students are asked to determine the length of the same object using a lower grade measuring device. How do you evaluate the following work of the three students with regard to accuracy and precision?

Trial	Student A	Student B	Student C
1	13.6 mm	13.4 mm	13.9 mm
2	13.9 mm	13.5 mm	13.9 mm
3	13.3 mm	13.5 mm	14.0 mm
4	13.6 mm	13.4 mm	14.1 mm

14. The accepted value for the normal boiling point of benzaldehyde, a substance used as an almond flavoring, is 178 $^{\circ}\text{C}$. In a laboratory setting, three students are asked to experimentally determine the normal boiling point of benzaldehyde. Their results are:

Student 1: 175 $^{\circ}\text{C}$ *Student 2:* 190. $^{\circ}\text{C}$ *Student 3:* 181 $^{\circ}\text{C}$

Calculate the percent error associated with each student's reported boiling point. *Helpful formula: % error = absolute value |(difference)| / (accepted) * 100%*

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15. The following are properties of the metal beryllium. Classify them as **physical** or **chemical**.
- In powdered form, it burns brilliantly on ignition.
 - Bulk metal melts at 1287 °C
 - It has a density of 1.85 g/cm³ at 20 °C.
 - It is a relatively soft silvery white metal.
16. Consider the following classifications of matter: **heterogeneous mixture**, **homogeneous mixture** and **pure substance**
- In which of these classifications must the composition be constant?
 - In which of these classifications is separation into simpler substances using physical means possible?
17. Based on the information given, classify each of the pure substances A through D as **elements** or **compounds**, or indicate that no such classification is possible because of insufficient information.
- Substance A cannot be broken down into simpler substances by chemical means
 - Substance B cannot be broken down into simpler substances by physical means
 - Substance C readily dissolves in water
 - Substance D readily reacts with the element chlorine
18. Indicate whether each of the following statements is **true** or **false**.
- Compounds can be separated into their constituent elements using chemical means.
 - Elements can be separated into their constituent compounds using physical means.
 - A compound must contain at least two elements.
 - A compound is a physical mixture of different elements
19. Give the name of the element associated with each of the following chemical symbols, or vice versa.
- Li
 - He
 - F
 - Zn
 - mercury
 - chlorine
 - gold
 - selenium
20. Write the chemical symbol for each member of the following pairs of elements:
- copper and cobalt
 - potassium and phosphorus
 - iron and iodine
 - silicon and silver