Chemistry 103, Fall 2024
Worksheet # 1 (25 points)

Name:_____

1. (4 points) Fill in the blanks correctly with the word “accurate” or “precise”.

   a. The analytical balance (that measures mass to 4 decimal places) is more precise than a top-loading balance that measures mass to 2 decimal places.
   b. A lab procedure instructs students to use 2 mL of water for an experiment. Jessica measured 1.545 mL of water – so her obtained volume was quite precise but not very accurate
   c. Anna and Nia weighed 3 identical pennies. The masses obtained by Anna are 3.10 g, 2.50 g and 2.69 g. The masses obtained by Nia are 2.55 g, 2.51 g and 2.48 g. The data obtained by Nia are more precise than the data obtained by Anna.

2. (11 points) *Follow the instructions to perform the calculations. Show the calculations and state how many significant figures (SF) are in each number used in the calculations. Report answers to the correct number of significant figures.*

   To find the density of a soda sample, a student needs to measure its mass and volume.

   The student begins by weighing a container on an analytical balance and records the mass of 26.2403 g (# of SF: 6). She then fills the container with soda whose volume was measured with a pipet – the resulting mass (of container + soda sample) is 34.6113 g (# of SF: 6).

   34.6113 g – 26.2403 g = 8.3710 g

   Mass of soda sample: 8.3710 g # of SF: 5

   To measure the volume of the soda sample, the student fills a pipet to a mark, records the initial volume then drains the contents of the pipet into the container, recording the final volume. The total volume of the sample is the difference between the initial and the final volume. The initial volume is 1.95 mL and the final volume is 10.00 mL.

   10.00 mL – 1.95 mL = 8.05 mL

   Volume of soda sample: 8.05 mL # of SF: 3

Now that the student has the mass and the volume of the soda sample, she can get the density by dividing the mass of the soda sample by the volume of the soda sample.

$\frac{8.3710\ g}{8.05\ mL} = 1.04\ g/mL$

Density of the soda sample: 1.04 g/mL # of SF: 3

3. (10 points) Gold can be hammered into extremely thin sheets called gold leaf. An architect wants to cover a 100 ft x 82 ft ceiling with gold leaf that is 5 x 10^{-6} in thick. The density of gold is 19.32 g/cm^3, and gold costs $1654 per troy ounce (one troy ounce = 31.1034768 g). How much will it cost the architect to buy the necessary gold? (1 foot = 12 inches; 1 inch = 2.54 cm)

- Volume of gold is needed; volume $\xrightarrow{d=\frac{m}{V}}$ mass → price
- 1 ft = 12 in ; 1 in = 2.54 cm

- A = Area of ceiling = 100 ft · 82 ft ⇒

$A = 8200\ ft^2 \times \left(\frac{12\ in}{1\ ft}\right)^2 \Rightarrow$

$A = 11\ 80800\ in^2$
(1 SF)

- Height of gold coat = 5.10^{-6} in

$V = A \cdot h = (11\ 80800\ in^2)(5.10^{-6}\ in) = 5.904\ in^3$

- $5.904\ in^3 \times \frac{2.54\ cm^3}{1\ in^3} \times \frac{19.32\ g}{1\ cm^3} \times \frac{1\ troy\ ounce}{31.1034768\ g} \times \frac{1654\ dollars}{1\ troy\ ounce} = \$99,399$

$\sim \$100000$ (1 SF)

1. A 76.00-lb flask of mercury costs $127.00. The density of mercury is 13.534 g/cm³.
   a) Determine the price of 1 in³ of mercury by first calculating the following three intermediate values.

      i) What is the price of 1 lb of mercury?
      ii) What is the price of 1 g of mercury?
      iii) What is the price of 1 cm^3 of mercury?
      iv) What is the price of 1 in^3 of mercury?

   b) It takes 2.400 in^3 of mercury to make one manometer. Find the price of the mercury used to make 15 manometers by first calculating the cost of mercury for one manometer.