

## 1.8: Matter, Measurement, and Problem Solving (Exercises)

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These are homework exercises to accompany the Textmap created for [Chemistry: A Molecular Approach](#) by Nivaldo Tro. Complementary General Chemistry question banks can be found for other Textmaps and can be accessed [here](#). In addition to these publicly available questions, access to private problems bank for use in exams and homework is available to faculty only on an individual basis; please contact [Delmar Larsen](#) for an account with access permission.

### Additional Questions

#### A1

Perform the following mathematical operations and give the answer with the correct number of significant figures:

- a.  $\frac{(9.008 \times 10^4)(6.5227 \times 10^7)}{6.53 \times 10^{-4}}$
- b.  $\sqrt{(7.1 \times 10^2) + 924} \times 7.508 \times 10^4$
- c.  $\frac{(9.008 \times 10^4)(6.5227 \times 10^7)}{6.53 \times 10^{-4}}$

#### A2

Perform the following unit conversions. Express your answers in scientific notation with the appropriate number of significant figures.

- Convert 78.01 inches into: feet, meters, centimeters, millimeters and kilometers.
- Convert 14511 feet into miles, kilometers and meters.
- Convert 15.42 meters into kilometers, centimeters, millimeters, micrometers, and nanometers.
- Convert 98.6 °F into °C and K.
- Convert 75 miles per hour into: km per hour and  $\text{m s}^{-1}$ .
- Convert 23.15  $\text{m}^2$  into  $\text{ft}^2$ ,  $\text{in}^2$ , and  $\text{cm}^2$

#### A3

In the movie Goldfinger, James Bond foils a plot to break into Fort Knox. 007 does some quick mental calculations to determine the feasibility of removing the gold. If the price of gold is \$14.00 per troy ounce (31.1035 grams) at the time the movie was produced, what is the mass (in kg) of 1 million dollars of gold? What is the volume of 1 million dollars of gold in L. How much would this gold be worth today if the price of gold is \$9068.77 per kg?

#### A4

The following experiment is performed with an unknown liquid. The liquid is added to a graduated cylinder with a mass of 54.6789 grams. After 20.00 mL of the liquid is added to the cylinder (at 298 K), the mass is 74.6215 grams. Is the liquid water? How do you know? If it is not water, what could it be?

#### A5

The experiment above is repeated with a second liquid, after 21.3 mL of this liquid (at 20 °C) is added the mass of the cylinder is 72.7364 grams. Is the second liquid ethanol? How do you know? If it is not ethanol, what could it be?

### Answers

#### Exercise 1.8.1

##### A1

##### Answer

- a) and c) (Sorry, I can't take out the repeat!)  $9.00 \times 10^{15}$  only 3 sig dig because of denominator
- b) 9600 or  $9.6 \times 10^3$  only 2 sig dig because of  $7.1 \times 10^2$

### Exercise 1.8.2

A2

#### Answer

- a) 6.501 ft; 1.981 m; 198.1 cm; 1981 mm;  $1.981 \times 10^{-3}$  km
- b) 2.7483 miles; 4.4230 km; 4423.0 m
- c) 0.01542 km; 1542 cm; 15,420 mm;  $1.542 \times 10^8 \mu\text{m}$ ;  $1.542 \times 10^{11}$  pm
- d) 37.0°C; 310.2 K
- e)  $1.2 \times 10^2$  km/h; 34 m/s
- f)  $2.492 \times 10^2$  ft<sup>2</sup>;  $2.315 \times 10^4$  cm<sup>2</sup>;  $3.588 \times 10^3$  in<sup>2</sup>

### Exercise 1.8.3

A3

#### Answer

$2.222 \times 10^3$  kg; To get the volume you need the density of gold, which is 19.32 g/ml. The volume is  $1.150 \times 10^2$  L; the value today is  $\$2.015 \times 10^7$

### Exercise 1.8.4

A4

#### Answer

The density is found by first finding the mass of the liquid ( $74.6215 - 54.6789 = 19.9426$  g), then dividing the mass by the volume ( $19.9426/20.00 = 0.9971$  g/mL). That is the density of water at 25 °C. There are not any other common liquids with this density. You could create a mixture that has this density.

### Exercise 1.8.5

A5

#### Answer

The density is found by first finding the mass of the liquid ( $72.7364 - 54.6789 = 18.0575$  g), then dividing the mass by the volume ( $18.0575/21.3 = 0.848$  g/mL). That is the not density of ethanol at 20 °C. The liquid could be mineral oil, which a mixture of many  $\text{C}_x\text{H}_y$  compounds.

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