

Name \_\_\_\_\_

HONORS CHEM

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### Dimensional Analysis

- Used to convert a number from one system of units to another.
- **Understanding dimensional analysis is crucial. This process will help you when performing difficult calculations later in the year.**
- When using dimensional analysis you should set up your problem so that any unit you wish to cancel appears as both a numerator and a denominator.

**Example 1:** Calculate how many kilometers there are in 5.00 miles.

**Solution:** (Needed Equivalents: 1 mile = 1760 yards, 1 meter = 1.094 yards)

$$\frac{5.00 \text{ miles}}{1 \text{ mile}} \times \frac{1760 \text{ yards}}{1 \text{ mile}} \times \frac{1 \text{ meter}}{1.094 \text{ yards}} \times \frac{1 \text{ kilometer}}{1000 \text{ meters}} = 8.04 \text{ kilometers}$$

**You try:** A certain blue whale weighs 147.82 ton. How much does the whale weigh in ounces?

- Sometimes you will need to convert both parts of a derived unit. Do one unit at a time.

**Example 2:** Convert 55.0 miles/hour to meters/second

**Solution:** (Needed Equivalents: 1 mile = 1760 yards, 1 meter = 1.094 yards, 1 hour = 60.0 minutes, 1 minute = 60.0 seconds)

$$\frac{55.0 \text{ miles}}{\text{hour}} \times \frac{1760 \text{ yards}}{1 \text{ mile}} \times \frac{1 \text{ meter}}{1.094 \text{ yards}} \times \frac{1 \text{ hour}}{60.0 \text{ minutes}} \times \frac{1 \text{ minute}}{60.0 \text{ seconds}} = 24.5785 \text{ (rounded to) } \mathbf{24.6 \text{ m/s}}$$

**You try:** At room temperature oxygen gas travels at 393.5 meters per second. Calculate how fast oxygen gas travels in miles per hour.

**Homework:** Convert all of the following. You must show all work to receive credit. All answers should have exactly three significant figures. Place your final answer on the line in front of each problem. You must include units. This is a graded assignment (3 points each).

\_\_\_\_\_

1. 5.50 miles to centimeters

\_\_\_\_\_

2. 20.4 kilograms to pounds

\_\_\_\_\_

3. 7.00 kilopascals to torr

\_\_\_\_\_ 4. 0.0397 ton to ounces

\_\_\_\_\_ 5. Cesium atoms are the largest naturally occurring atoms. The **radius** of a cesium atom is  $2.62 \text{ \AA}$  (angstroms). How many cesium atoms would have to be laid side by side to give a row of cesium atoms 3.00 inches long? Assume that the atoms are spherical.

\_\_\_\_\_ 6. A parsec is an astronomical unit of distance.  $1 \text{ parsec} = 3.26 \text{ light years}$  (or the distance traveled by light in one year). Light speed = 186,282.397 miles per second. An object travels 9.60 parsecs. Calculate this distance in cm.

\_\_\_\_\_ 7. The amount of mercury(Hg) in a polluted lake is  $0.250 \mu\text{g/mL}$ , what is the total mass in kilograms of mercury in the lake? (The lake has a surface area of  $50.0 \text{ mi}^2$  and an average depth of 20.0 ft.)

**Note: The information for the following three questions continues from 8a through 8c.**

\_\_\_\_\_ 8a. The current cost of gasoline is  $\$3.87/\text{gallon}$ . If my car gets 12.0 kilometers/liter, how many miles will I be able to travel if I put  $\$18.35$  of gasoline in my car?

\_\_\_\_\_ 8b. If my house is 10.9 miles away from school, how many **complete round trips** can I make on  $\$18.35$ ?

\_\_\_\_\_ 8c. At the above cost of gas, how much will I pay to make 194 **round trips** between home and work this year?