

Metric System- Part 3

I. Dimensional analysis- Dimensional Analysis is just a fancy name for a method of calculating that

1. uses *numbers in the form of fractions*.
2. enables us to *convert from one type of unit measurement to another*.
3. It is something that you will encounter *heavily* in this class and can also be useful in your daily lives outside our class (cooking, work, etc). This guide is intended to help you get comfortable with manipulating numbers in terms of their units (i.e. dimensional analysis). In this worksheet you will encounter some definitions or terms that you may or may not have seen before. These are terms that we will be using in the class, so please get to know them. I identify these terms by putting them in **bold green** font.

II. What is a Unit?

A **unit** is something that gives definition to a numerical value, quantity, or measurement. Let us consider “1 mile”. The **unit** involved here is the “mile”. Without the **unit**, you would not know what is being referred to. Different measurements often times have multiple possible **units** associated with them. For example:

Length- Meters, centimeters, feet, inches, miles, kilometers

Mass- Kilograms, grams, pounds

Time- Hours, minutes, seconds, days, months

Volume- Cups, teaspoons, liters, milliliters, gallons, quarts

Currency- Dollars, cents, dimes

III. Turning Numbers (or quantities) into Fractions.

If a quantity does not appear as a fraction, it is possible to put it in a fraction form. Doing this sometimes makes solving **dimensional analysis** problems easier. Remember that numbers and **units** that appear above the fraction line are in the “**numerator**” and numbers and units that appear below the fraction line are in the “**denominator**”. Here are some examples.

- **2 eggs**: This quantity is not in the form of a fraction. To put in a fraction form we put the number and **unit** that is given in the **numerator**, and simply put “1” in the **denominator**.

$$2 \text{ eggs} = 2 \frac{\text{eggs}}{1}$$

The numbers on both sides of the equal sign mean the same thing. We have not changed the value or the unit involved.

- **60 seconds/minute**: This quantity does not look like a fraction, but it actually is fraction. This quantity reads “60 seconds **per** minute”. The word “**per**” refers to the “fraction line” mentioned above. Again, notice that we have not changed the value or meaning of the quantity.

$$60 \text{ seconds/minute} = \frac{60 \text{ seconds}}{1 \text{ minute}}$$

The quantity given tells us there are 60 seconds. This goes in the **numerator**. We are not specifically given the number of minutes. In this case we can assume it is 1. This value then goes in the **denominator**.

IV. Canceling Units

If a **unit** appears in the **numerator** and the same **unit** appears in the **denominator**, it can be **cancelled** or removed. This **unit** can be in the **numerator** and **denominator** of the same fraction or in two different fractions being **multiplied** together.

Sometimes in order to change the quantity we are “given,” we must “invert” the other quantity (or quantities) we intend on using to **convert** from one set of **units** to the other. The quantity (or quantities) that is **given** is the quantity (or quantities) specifically identified in a problem. It is what we start out with and need to **convert** (or change) into what is being asked for. In order to **convert** from one quantity to another, we must use other sets of known quantities called **constants**. Your text will identify **constants** that you may use for problem solving.

What do I mean by “invert”? First, it is important to know that the quantities you are **given** are **not** to be **inverted**. Only the **constants** you are using to perform dimensional analysis can be **inverted**. To **invert** a **constant** simply flip it over or around.

Constant	=	Inverted
7 days	=	1 week
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1 week		7 days

OR another way to think of it:

$$\text{Given unit} \times \frac{\text{Wanted unit}}{\text{Given unit}} = \text{Wanted unit}$$

The given units cancel out and leave you with the desired unit.