

Name _____

(R) Factor Label Method

Frequently Asked Factor-Label Questions:

Why are we doing this?

Factor Label is a method for solving problems. It gives us a neat and organized method to solve problems. You can use this method in chemistry, math, shopping, building, cooking and home improvement/maintenance.

How do we do this?

Factor label entails connecting information that you know or are given with information that you need to find. It also involves developing a skill in writing conversion factors. A **CONVERSION FACTOR** is a fraction where the numerator is equal to the denominator, except they are in different units.

All factor label problems involve the following basic approach:

what you want to find = what you know (given) x the fraction(s) you need to get your answer
AKA conversion factor

Example: How many feet are in 56 inches?

$$1 \text{ ft} = 12 \text{ in}$$

$$.001 \text{ L} = 1 \times 10^{-3} = 10^{-3}$$

$$\# \text{ ft} = 56 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} = 4.6667 \text{ ft} = 4.7 \text{ ft}$$

The fraction that has been highlighted is known as a **CONVERSION FACTOR**. The **CONVERSION FACTOR** is derived from the relationship between the unit you know and what you are trying to find. For example, 1 foot = 12 inches; therefore, you set up the fraction with the "find" unit value in the numerator and the "given" or "known" unit value in the denominator

Practice Problem #1: How many liters are in 156.2 milliliters? *From: mL To: L (starting value)* $1 \text{ L} = 1000 \text{ mL}$

$$156.2 \text{ mL} \left(\frac{1 \text{ L}}{1000 \text{ mL}} \right) = 0.1562 \text{ L}$$
$$156.2 \text{ mL} \left(\frac{.001 \text{ L}}{1 \text{ mL}} \right) = 0.1562 \text{ L}$$

Table C
 $10^3 \text{ L} = 1 \text{ mL}$
(.001 L)

Practice Problem #2: How many centimeters are in 9.85 meters? $1 \text{ m} = 100 \text{ cm}$

$$9.85 \text{ m} \left(\frac{100 \text{ cm}}{1 \text{ m}} \right) = 985 \text{ cm}$$

Table C
 $10^{-2} \text{ m} = 1 \text{ cm}$
(.01 m)

What seems to be the key idea when determining which value goes in the numerator and which value goes in the denominator? The given unit goes in the denominator.

Practice Problem #3: How many meters are in .456 kilometers? $1 \text{ km} = 1000 \text{ m}$

$$0.456 \text{ km} \left(\frac{1 \text{ m}}{.001 \text{ km}} \right) \text{ or } 0.456 \text{ km} \left(\frac{1000 \text{ m}}{1 \text{ km}} \right) = 456 \text{ m}$$

Table C
 $10^3 \text{ m} = 1 \text{ km}$

Practice Problem #4: How many hours are in 3 days? $24 \text{ hr} = 1 \text{ day}$

$$3 \text{ days} \left(\frac{24 \text{ hr}}{1 \text{ day}} \right) = 72 \text{ hrs} \rightarrow 76 \text{ hrs}$$

Self-Test: Use the factor label method to perform the following conversions. Even if it is a problem that you can solve mentally, it is important to practice the process.

For mass:

1 gram = 1000 milligrams

1 gram = 100 centigrams

1000 gram = 1 kilograms

For volume:

1 liter = 1000 milliliters

1 liter = 100 centiliters

1000 liter = 1 kiloliters

1 milliliter = 1 cubic centimeter (cm³)

For length:

1 meter = 1000 millimeters

1 meter = 100 centimeters

1000 meter = 1 kilometers

For time:

1 year = 365 days

1 leap year = 366 days

1 day = 24 hours

1 hour = 60 minutes

1 minute = 60 seconds

1 second = 1000 milliseconds

Find the number of:

1. grams in 355 milligrams

$$355 \cancel{\text{mg}} \left(\frac{1 \text{g}}{1000 \cancel{\text{mg}}} \right) = 0.355 \text{g}$$

2. centimeters in 245 meters

$$245 \cancel{\text{m}} \left(\frac{100 \text{cm}}{1 \cancel{\text{m}}} \right) = 24,500 \text{cm}$$

3. liters in 885 milliliters

$$885 \cancel{\text{mL}} \left(\frac{1 \text{L}}{1000 \cancel{\text{mL}}} \right) = 0.885 \text{L}$$

4. kilograms in 352 grams

$$352 \cancel{\text{g}} \left(\frac{1 \text{kg}}{1000 \cancel{\text{g}}} \right) = 0.352 \text{kg}$$

5. minutes in 24 hours

$$24 \cancel{\text{hr}} \left(\frac{60 \text{min}}{1 \cancel{\text{hr}}} \right) = 1440 \text{min}$$

↓

1400 min

6. seconds in 101 minutes

$$101 \cancel{\text{min}} \left(\frac{60 \text{s}}{1 \cancel{\text{min}}} \right) = 6060 \text{s}$$

(6.06 × 10³ s)

7. meters are in 12 kilometers

$$12 \cancel{\text{km}} \left(\frac{1000 \text{m}}{1 \cancel{\text{km}}} \right) = 12,000 \text{m}$$

8. milliseconds are in 45 seconds (1000ms = 1s)

$$45 \cancel{\text{s}} \left(\frac{1000 \text{ms}}{1 \cancel{\text{s}}} \right) = 45,000 \text{ms}$$

9. centiliters in 6.72 liters

$$6.72 \cancel{\text{L}} \left(\frac{100 \text{cL}}{1 \cancel{\text{L}}} \right) = 672 \text{cL}$$

10. millimeters there are in 0.25 meters

$$0.25 \cancel{\text{m}} \left(\frac{1000 \text{mm}}{1 \cancel{\text{m}}} \right) = 250 \text{mm}$$