Physical and Chemical Properties of Matter

Content Objective:

I can express and manipulate chemical quantities using scientific conventions and mathematical procedures, including dimensional analysis, scientific notation, and significant figures.

Criteria for Success:

I can transform a statement of equality to a conversion factor.
I can utilize conversion factors to perform single-step and multi-step calculations.

Notes

Conversions

A. A_____of_____describes the relationship between two equivalent quantities expressed in different units.

B. A_____is a_____derived from a statement of equality that can be used to convert from one unit to the other.

1. Conversion factors are equal to_____. Therefore, when you convert you are not changing the amount of what you have, just the_____you are using to represent the amount.

2. When completing conversion calculations, choose the conversion factor that will _____ undesired units and leave desired units.

Example:

Statement of Equality	**Possible Conversion Factors**
There are 12 eggs in 1 dozen.	$\frac{1 \text{ dozen}}{12 \text{ eggs}}$ or $\frac{12 \text{ eggs}}{1 \text{ dozen}}$

Guided Practice

Directions: List the possible conversion factors from the statement of equality.

1. There are 365 days in 1 year.

2. There are 10 decimeters in 1 meter.

3. There are 6.02e23 atoms in 1 mole.

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Content Objective:

I can collect data and make measurements with accuracy and precision.

Criteria for Success:

I can explain the importance of a standard.
I can list the base units of measurement in the metric system for distance, volume, and mass.
I can explain how to use a system of prefixes to represent multiples of ten or submultiples of ten of these base units.

Notes

A. The metric system simplifies measurement by using a single base unit as a standard for each quantity.
1. Multiples or submultiples of 10 of the base unit are expressed using a series of prefixes.

Base unit

*A trick to converting units is to convert to the base unit and then convert to the desired unit. Ex: mL→L→ µL

Table 1: Base Units

Quantity	Symbol	Base Unit	Symbol
distance	d	meter	m
volume	V	liter	L
mass	m	gram	g

Table 2: SI Prefixes and Symbols

Prefix	Symbol	Conversion Factor	Conversion Factor	Conversion Factor	Conversion Factor
giga-	G	$1G=10^9$	$1Gm=10^9m$	$1GL=10^9L$	$1Gg=10^9m$
mega-	M	$1M=10^6$	$1Mm=10^6m$	$1ML=10^6L$	$1Mg=10^6m$
kilo-	k	$1k=10^3$	$1km=10^3m$	$1kL=10^3L$	$1kg=10^3m$
hecto-	h	$1h=10^2$	$1hm=10^2m$	$1hL=10^2L$	$1hg=10^2m$
deca-	da	$1da=10^1$	$1dam=10^1m$	$1daL=10^1L$	$1dag=10^1m$
BASE (meter, liter, or	m, L, or g	m, L, or g	m	L	g
deci-	d	$1d=10^{-1}$	$1dm=10^{-1}m$	$1dL=10^{-1}L$	$1dg=10^{-1}m$
centi-	c	$1c=10^{-2}$	$1cm=10^{-2}m$	$1cL=10^{-2}L$	$1cg=10^{-2}m$
milli-	m	$1m=10^{-3}$	$1mm=10^{-3}m$	$1mL=10^{-3}L$	$1mg=10^{-3}m$
micro-	µ	$1µ=10^{-6}$	$1µm=10^{-6}m$	$1µL=10^{-6}L$	$1µg=10^{-6}m$
nano-	n	$1n=10^{-9}$	$1nm=10^{-9}m$	$1nL=10^{-9}L$	$1ng=10^{-9}m$

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Guided Practice

Directions: Complete the following conversions using your understanding of conversion factors. Use the correct number of significant figures in your final answer.

1. A student measures 5.20×10^3cm of magnesium ribbon. Determine the length of ribbon in meters.

2. A student has 4.35×10^{16} kilobytes of data stored on her computer. How many megabytes is this?

3. Use the following conversion factors to answer the question below.

15 goobers = 3 bloopers
21 sandstorms = 2 rocks
11 rocks = 8 bloopers

How many sandstorms are equal to 27 goobers?

Independent Practice

4. Michael was collecting chicken eggs on his farm. If he collected 29 chicken eggs, how many dozen eggs does Michael have?

$$29 \text{ egg} \times \frac{1 \text{ dozen}}{12 \text{ egg}} = \boxed{2.4}$$

5. Convert 0.049kg of sulfur to grams of sulfur.

$$.049 \text{ kg} \times \frac{10^3 \text{ g}}{1 \text{ kg}} = \boxed{49 \text{ g}}$$

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6. Use the following conversion factors to answer the question below.

24 tillers = 7 sillybuckets
21 yellow rilly boppers= 2 sted buuts
8 sted buuts = 3 sillybuckets

How many yellow rilly boppers are equal to ~~18~~ tillers?

$$18\,t \times \frac{7\ silly}{24\ t} \times \frac{8\ sb}{3\ silly} \times \frac{21\ yrb}{2\ sb} = 150\ yrb$$

7. How many centimeters are in 11 kilometers?

$$11\,km \times \frac{10^3\ m}{1\ km} \times \frac{1\ cm}{10^{-2}\ m} = 1{,}100{,}000\ cm$$

8. How many millimeters are in 720 nanometers?

$$720\,nm \times \frac{10^{-9}\ m}{1\ nm} \times \frac{1\ mm}{10^{-3}\ m} = 7.2 \times 10^{-4}\ mm$$

9. How many µm are in 733 mm?

$$733\,mm \times \frac{10^{-3}\ m}{1\ mm} \times \frac{1\ \mu m}{10^{-6}\ m} = 7.33 \times 10^{5}\ \mu m$$

10. How many km are in 4679 ft?

ft → in → cm → m → km

$$4679\,ft \times \frac{12\ in}{1\ ft} \times \frac{2.54\ cm}{1\ in} \times \frac{10^{-2}\ m}{1\ cm} \times \frac{1\ km}{10^{3}\ m} = 1.426\ km$$

Conversion Factors
1 ft = 12in
1in = 2.54cm

11. Three weeks ago, Andres's weight was two hundred eighty-five and two tenths **kilograms**. He has since lost nineteen thousand, five hundred **grams**. What is his current weight in kilograms?

$$19{,}500\,g \times \frac{1\ kg}{10^{3}\ g} = 19.5\ kg$$

$$285.2 - 19.5 = 265.7\ kg$$

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Directions: Convert the following units to appropriate unit requested.

5.76cm	.0576 **m**	.00576 **dam**
7.82×10^{-2}mL	7.82×10^{-5} **L**	78.2 **µL**
0.0253mg	2.53×10^{-5} **g**	2.53×10^{-11} **Mg**
4.87e-12 kg	4.87×10^{-9} **g**	4.87×10^{-6} **mg**
737nm	7.37×10^{-7} **m**	7.37×10^{-10} **km**

Question:

Use the data table below to answer the following questions.

	Student A	Student B	Student C
Trial 1	10.49 g	9.78 g	10.03 g
Trial 2	9.79 g	9.82 g	9.99 g
Trial 3	9.92 g	9.75 g	10.03 g
Trial 4	10.31 g	9.80 g	9.98 g
Average	**10.13 g**	**9.79 g**	**10.01 g**

precise

precise

Accurate

Assuming that the true mass of a substance is exactly 10 grams, label each set of data above as either being accurate, precise or both.