

ChemQuest 1

Numbers in Chemistry

Name: _____

Date: _____

Hour: _____

Information: Qualitative vs. Quantitative

The following observations are qualitative.

The building is really tall.

It takes a long time for me to ride my bike to the store.

I live really far away.

The following observations are quantitative.

The river is 31.5 m deep.

The cheese costs \$4.25 per pound.

It is 75° F outside today.

Critical Thinking Questions

1. What is the difference between qualitative and quantitative observations? (Your answers should reveal an understanding of the definitions for qualitative and quantitative.)
2. Write an example of a quantitative observation that you may make at home or at school.
3. Why are instruments such as rulers, scales (balances), thermometers, etc. necessary?

Information: Units

The following tables contain common metric (SI) units and their prefixes.

Table 1: metric base units

Quantity	Unit	Unit Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Temperature	Kelvin	K
Volume	Liter	L
Amount of substance	mole	mol

Table 2: prefixes for metric base units.

Prefix	Symbol	Meaning
Mega	M	million
Kilo	k	thousand
Deci	d	tenth
Centi	c	hundredth
Milli	m	thousandth
Micro	μ	millionth
Nano	n	billionth
Pico	p	trillionth

Note the following examples:

- “milli” means thousandth so a milliliter (symbol: mL) is one thousandth of a Liter and it takes one thousand mL to make one L.
- “Mega” means million so “Megagram” (Mg) means one million grams NOT one millionth of a gram. One millionth of a gram would be represented by the microgram (μg). It takes one million micrograms to equal one gram and it takes one million grams to equal one Megagram.
- One cm is equal to 0.01 m because one cm is “one hundredth of a meter” and 0.01 m is the expression for “one hundredth of a meter”

Critical Thinking Questions

4. How many milligrams are there in one kilogram?
5. How many meters are in 21.5 km?
6. Is it possible to answer this question: How many mg are in one km? Explain.
7. What is the difference between a Mm and a mm? Which is larger one Mm or one mm?

Information: Scientific Notation

“**Scientific notation**” is used to make very large or very small numbers easier to handle. For example the number 45,000,000,000,000,000 can be written as “ 4.5×10^{16} ”. The “16” tells you that there are sixteen decimal places between the right side of the four and the end of the number.

Another example: $2.641 \times 10^{12} = 2,641,000,000,000$ → the “12” tells you that there are 12 decimal places between the right side of the 2 and the end of the number.

Very small numbers are written with negative exponents. For example, 0.000000000000000378 can be written as 3.78×10^{-15} . The “-15” tells you that there are 15 decimal places between the right side of the 3 and the end of the number.