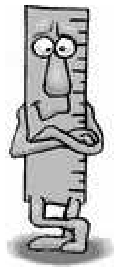
Name: ___________________________ Date: ___________ Class Notes Chemistry

SI, Metric and Derived Units



Science involves collecting data and much of that data comes from measurements. So, scientists realized they needed a standard of measurement for all scientists. A standard would allow scientists to make accurate and precise measurements that are reproducible and unchanging.

The original standard for scientific measurement was the metric system introduced in 1791 during the French Revolution but not accepted as the scientific standard until 1874. The metric system is based on the powers of 10 (decimal system) thus making conversions very easy.

Then in 1960, the International System (SI) was introduced as the new scientific standard. The SI system is still based the on metric system but is defined as having only 7 fundamental units and all other units are derived from the fundamental units.

Metric System Units

Property	Unit	Symbol
length		
mass		
volume		
time		
temperature		

International System 7 Fundamental Units

Property	Unit	Symbol
length		
mass		
time		
temperature		
electric current		
luminous intensity		
amount of a substance		

Prefixes

Both the metric and SI systems are based on the decimal system and make use of prefixes to indicate **multiples of ten**. The same prefixes are used with all the units.

Prefixes for Large Measurements			
Prefix	**Symbol**	**Meaning**	**Value**
tera-	T		
giga-	G		
mega-	M		
kilo-	k		

Prefixes for Small Measurements			
Prefix	**Symbol**	**Meaning**	**Value**
centi-	c		
milli-	m		
micro-	µ		
nano-	n		
pico-	p		

The value of each prefix is a **conversion factor** because it is used to convert from one unit to the other.

Metric Conversion Rule

Large to small = [ ] move the decimal [ ]

small to Large = [ ] move the decimal [ ]

Practice

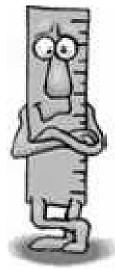
Directions: Convert the following units. Remember move the decimal point.

2500 g = ____________ kg 10 m = ____________ km 2 km = ____________ cm

250 mL = ____________ L 2000 g = ____________ kg 10 kg = ____________ g

1500 cc = ____________ L 1357 g = ____________ kg 791 g = ____________ kg

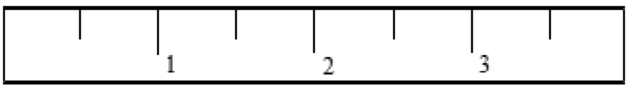
Accuracy and Precision



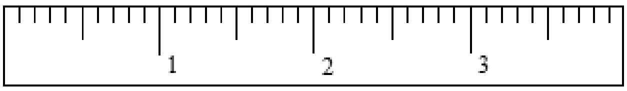
It is very important to maintain accuracy and precision in scientific measurements. But, many times people get accuracy and precision mixed up. **Accuracy** is how close your measurements are to the true or accepted value and **precision** is how repeatable the measurements are to each other.

In order to insure your data is as accurate as possible, you must have accurate tools made with precision. Cheap, shoddy tools will not produce good data. Besides good tools the experimenter must also have adequate skills in data collecting. It doesn't matter how well the tools are made if the person recording the measurements uses sloppy techniques. Therefore, it is very important that the experimenter uses good tools, knows how to use them and knows how to properly measure.

Which ruler is more precise? Explain



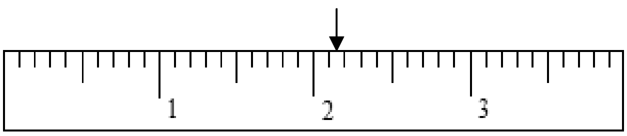
(A)



(B)

When reading a measurement you record all the readable digits plus one guess. The readable digits are significant figures and must always be recorded. The guess would be your margin of error. On ruler A above the you accurately read to .5 unit but anything smaller would be a guess. But on ruler B you can read to .1 unit and your guess would be .01 unit.

Although many of our tools are simple, these tools are very accurate and precise. Thus you must include all the significant figures possible with each tool to show others how precise these tools are.



The value that would be recorded at the arrow would be 2.16 units. The "2" and the "1" are both readable but the "6" is our guess.

How well this data can be repeated is precision. It is possible to be very precise and not be accurate. If the tool is not well made or you don't read the measurements correctly the data can be very precise but wrong. It is important to have both well-made tools and proper lab skills for obtain good data.

Significant Figures

How scientists collect and record their data is extremely important for maintaining validity. Thus, scientists must be aware of the tools they use and their own skills at using these tools. A tool is only as good as the person using it.

Using significant figures (sig figs) allows scientists to show the precision of the measuring tools they used in their data collecting and the accuracy of their own abilities. Also, significant figure rules help maintain the precision and integrity of any calculations performed with their data. So, in our study of chemistry we will always use significant figures with measurements and calculations from this point.

Recognizing Significant Figures

1. All non-zero digits are significant. ((1, 2, 3, 4, 5, 6, 7, 8, 9)
2. **All** zeroes between sig figs are significant.
3. Leading zeroes are **never** significant.
4. Trailing zeroes are significant only in the decimal portion.
5. Zeroes between sig figs and a written decimal point are significant.

Examples

0.09870	has 4 sig figs	rule #1, rule #3 and rule #4
10.023	has 5 sig figs	rule #1 and rule #2
1000.	has 4 sig figs	rule #1 and rule #5

Practice

Using the rules for significant figures tell how many sig figs are in each number.

1. ____________ 309.009
2. ____________ 1.6000040
3. ____________ 1,000,000
4. ____________ 0.045090
5. ____________ 200.
6. ____________ 0.095
7. ____________ 107
8. ____________ 0.00058900

"Nothing is more powerful for your future than being a gatherer of good ideas and information. That's called doing your homework."
– Jim Rohn