# CHEM 1305 - Chapter 02 - Notes

**Memorize:**
**tables of metric prefixes and units;**
**temperature conversion formulas;**
**density of water**

*Define the following terms; explain the following concepts, and answer the following questions:*

1) The two 'types' of MEASUREMENTS:

   QUALITATIVE and QUANTITATIVE

2) **Quantitative** measurements consist of two parts:

   a NUMBER and a UNIT

3) When properly recording a measurement, the number and the unit (should / should not) have a space between them.

4) Which of the following is the correct designation for "twelve seconds":
   a) 12s
   b) 12 s

5) Measurements are often reported in Scientific notation.

   a) What are the two 'parts' of a number written in Scientific Notation?

      COEFFICIENT and POWER or EXPONENTIAL or "10-TO-THE-N"

   b) For a number to be in scientific notation, the coefficient must be a number between: ONE and TEN

   c) As a memory device, the exponential term may be referred to as the "10-TO-THE-N" term.

6) The "Bigger-Smaller Method" for converting a number in Scientific Notation.

   a) ( T / F ) A number in scientific notation can be considered to be the product of two numbers: the Coefficient times the "10-to-the-N" term.

b) Describe the Bigger-Smaller method.

THE COEFFICIENT CAN BE MADE LARGER OR SMALLER, SO LONG AS THE 10-TO-THE-N TERM IS MADE PROPORTIONATELY SMALLER, AND VICE VERSA.

7) There are two main systems of UNITS: METRIC and ENGLISH.

8) Metric system units are either taken directly or derived from the 7 (number) fundamental SI units.

9) Name the seven commonly used PREFIXES in the metric system:
   a) METER (distance)
   b) KILOGRAM (weight)
   c) SECOND (time)
   d) KELVIN (temperature)
   e) MOLE (amount)
   f) AMPERE (current)
   g) CANDELA (luminosity)

10) One "metric" measurement can be readily converted to another using the "Bigger-Smaller Method. To use this method, measurements are considered the product of the

NUMBER and the UNIT.

In other words, the UNIT is treated as a NUMBER.

11) Describe what is meant by the terms ACCURACY and PRECISION.

ACCURACY is the ability to measure the true value; PRECISION is the ability to measure without much variation.

12) SIGNIFICANT FIGURES are digits believed to be correct by the person making the measurement. At some point, the digit representing the lowest decimal place must be estimated due to uncertainty.

   a) ( T / F ) The last significant figure is always the first estimated digit.

   b) ( T / F ) For a given measurement, no more than two digits may be estimated.

13) Measurements with a ruler having markings ("tick marks") every 1 cm apart should be reported to the nearest:
   a) m (meter)
   b) dl (deciliter)
   c) cm (centimeter)
   d) mm (millimeter) <--

14) Give the three steps of the Box-And-Dot method for determining the number of significant figures in a given number.

   a) Draw a box around the numbers bound by the First and Last non-zero digits, inclusive.

   b) Note the presence or absence of a "dot".

   c) If and only if a dot is present, box the trailing zero(s).

15) When determining significant digits to the solution of a math problem, remember that one counts DECIMAL PLACES for addition/subtraction operations, and one counts SIGNIFICANT FIGURES for multiplication/division problems.

16) How many significant figures are in the correct answer to the problem:
   15 + 2.0 + 1.05 = 2 sf (answer is only good to the one's place = 18)

17) How many significant figures are in the correct answer to the problem:
   15.0 x 2.1 x 2 = 1 sf (thus, answer is "60", which is 63 rounded down)

18) Rounding is performed dropping the first digit to the right of the last significant figure, and rounding the last significant figure (up / down / neither) if the dropped digit is less than five.

19) Write the correct answer to the following:

   a) 9.2 + 6.16 = 15.36 --> **15.4**

   b) 17.1 + 0.77 + 241 = 258.87 --> 258.~~8~~ --> **259**

   c) 0.072 / 4.36 = 0.0165 --> **0.017**

20) Describe the basic concept of DIMENSIONAL ANALYSIS

   A measurement if converted from one unit to another via multiplication with one or more Conversion Factors, each of which has a Numerator and a Denominator. IF the the unit to be 'cancelled out' is in the numerator, then the Conversion Factor is arranged such that its corresponding unit is in the denominator, and vice versa. The process is continued until only desired units remain.

21) Define or describe, in one line, each of the following:

a) Heat is the energy content of a substance. It is associated with 'movement', or Kinetic Energy

b) Temperature is a measure of heat. It represents the *average* Kinetic Energy.

22) List the three temperature scales, and give formulas for converting one to another.

Kelvin, Centigrade, and Fahrenheit

$°F = 1.8°C + 32$

$°K = °C + 273$

- Conversion from one temperature scale (say, Fahrenheit) to another (say, Celsius) can NOT be accomplished with Dimensional Analysis because…

  the formulas 'connecting' one to another have addition and/or subtraction operations.

- Give the formula for, and describe, DENSITY.

  $D = m/V$

  Density is the weight of a sample per unit volume.

- What is often a good way to determine the volume of an irregularly shaped object?

  Sink it in water, and note the difference between the initial and final volumes.

- What is the difference between DENSITY and SPECIFIC GRAVITY?

  **Density** carries the units g/mL ; whereas **Specific Gravity** is a ration of densities, and it is unit-less.