Topic 1 Test Study Guide
Chemistry- What is all about?

I. The Science of Chemistry

A. What is Chemistry?
B. What do Chemists Do?
C. Careers

- Study of <u>matter</u> (anything that has mass & takes up space<volume>)
- Composition
- Structure
- Changes matter undergoes (reactions)
    - Energy changes

<u>Mass:</u> the amount of matter (doesn't change)

<u>Weight :</u> measure of the gravitational pull on an object (change)

<u>Chemical:</u> definite composition-known or can be found
H_20 2-H, 1-0 (Water) H_20_2 Hydrogen Peroxide

<u>5 traditional areas of Chemistry:</u>

1. <u>Organic:</u> study of all chemicals containing carbon
2. <u>Inorganic:</u> study of chemicals that do not contain carbon (nonliving things)
3. <u>Biochemistry:</u> study of processes that take place in organisms
4. <u>Analytical:</u> focuses on composition of matter
5. <u>Physical</u>: study of underlying scientific principles behind the changes that occur in matter

Pure Research
(Basic)

- Sake of knowledge (learn)

Apply Research

- Solve a problem (cure, invention, solution)

Technology

- Improve quality of life

Ex.)

- Teflon--> pots and pans
- Refrigerants--> refrigeration
- Catalytic convertors
- Computers

II. Scientific Method

A. Hypotheses and Models

B. Laws and Theories

Scientific Method

1. State the problem and collect data (make observations

Observation: something witnessed or recorded

A.) Qualitative Observations: DO NOT involve numbers
Ex. Sky is blue; the book is solid.

B.) Quantitative Observations: a measurement, involves a number and a unit
Ex. water boils at 100° C; the book weighs 45 g.

2. Formulate a hypothesis: a possible explanation for the observation; an educated guess

3. Perform experiments
    - Something we do to test the hypothesis
    - Gather information that allows us to decide whether the hypothesis is supported by the information/data we gathered from the experiment
    - Experiments always produce new observations

Observations -----> Hypothesis ------> Experiment

Theory: (model) set of tested hypotheses that give an explanation of some part of nature

- Interpretation
- Human invention- represents our attempts to explain

Law: summary of observed behavior. A law tells what happens; a theory (model) is our attempt to explain why it happens

Modify theory

Prediction

Experiment

III. Systems of Measurement

A. Why A System- System Comparisons

B. SI System-Common Units Used in Course

1. Prefixes
2. Basic units-mass, temp, time, length, amount of substance
3. Derived units-volume, density, speed, force, energy, pressure
4. Temperature conversions (°C and Kelvin)
5. Density (specific gravity)

C. Scientific Notation

1. Interpretation and Uses
2. Rules for calculations

- SI system is used because it is universal and understood everywhere

7 SI Base Units

Physical Quantity	Unit	Abbreviation
Length	meter	m
Mass	kilogram	kg
Temperature	Kelvin	K
Time	second	s
Amount of Substance	mole	mol
Luminous intensity	candela	Cd
Electric current	ampere	amp

10^{12} Terra T
10^{9} Giga G
10^{6} Mega M
10^{3} kilo k
10^{2} hecto h
10^{1} deka da
10^{0} meter/liter/gram m/l/g (BASE UNIT)
10^{-1} deci d
10^{-2} centi c
10^{-3} milli m
10^{-6} micro μ
10^{-9} nano n
10^{-12} pico P

Volume: length x width x height
Density = mass/volume
D_{H20}= 1g/mL
1mL= 1cm^3

Temperature:
$T_K=T_C+273$
$T_C=T_K-273$

Scientific Notation

Adding & Subtracting

2.840×10^{18} m	2.840×10^{18} m	5.36×10^{-1} kg	5.36×10^{-1} kg
3.60×10^{17} m	+ 0.360×10^{18} m	7.40×10^{-2} kg	- $.74 \times 10^{-1}$ kg
6.9×10^{16} m	0.069×10^{18} m		4.62×10^{-1} kg
	3.269×10^{18}		

Multiplying & Dividing

Add exponents
Multiply coefficients
$(2 \times 10^{3})(3 \times 10^{2})$

Divide coefficients
Subtract exponents
$\frac{9 \times 10^{8}}{3 \times 10^{-4}} = 3 \times 10^{12}$

IV. Measurements and Calculations

A. Accuracy v. Precision
   1. Uncertainties
   2. Deviations-Area estimate
B. Significant Figures
   1. Identifying/recording
   2. Rules for Calculations
C. Problem Solving
   1. Dimensional Analysis
   2. Conversions

Accuracy: the agreement of a particular value with the true value

Precision: the degree of agreement among several measurements of the same quantity. It reflects the reproducibility of a given type of measurement

Certain #'s: the first two numbers that are the same, regardless of the measurement

Uncertain #'s: the third digit that is estimated and can vary

- measurement always has a degree of uncertainty

Significant Figures: the numbers recorded in a measurement (all certain numbers plus the first uncertain number)

- The third digit in a number is usually assumed to be ± 1
    - Example: 1.86 kg--> 1.86±0.01
      1.86 kg-0.01kg= 1.85 kg OR 1.86 kg +0.01 kg=1.87 kg

deviation: + or - area of uncertainty

$$\% \text{ error} = \frac{|\text{experimental value} - \text{theoretical value}|}{\text{Theoretical}} \times 100$$

Sig. Fig. Rules:

1. Non-zero digits always count
2. In a # less than 1, leading zeros never count
3. Zero's between non-zero digits always count
4. Zero's at end of decimal digits always count
5. Zero's in whole # only count if there's a decimal after them
6. EXACT numbers. Numbers that were NOT obtained using measuring devices, but determined by counting : 10 experiments, 3 apples, 8 molecules. These numbers have an unlimited number of significant figures.

Adding and Subtracting Sig. Figs

- Restricted by the fewest # of decimal places

Multiplication and Division

- Restricted by fewest # of sig. figs.

Dimensional Analysis:

- Ways to solve a problem

1. List known's and unknown's
2. Solve for unknown
    - **Conversion factor:** ratios of equivalent quantities
3. Evaluate