Study Guide for Chapter 1: Matter, Measurement, and Problem Solving

1. Know how to write numbers in scientific notation (Appendix 1).

2. Understand the difference between atoms and molecules.

3. Know the component parts of the scientific approach to knowledge: observations, experiments, hypotheses, laws, and theories.

4. Know the differences between the three major states of matter (solid, liquid, gas) in terms of the motion of atoms or molecules, how close together the atoms or molecules are, the volume (fixed or variable), and the shape (fixed or taking the shape of the container)

5. Be able to classify matter as pure substances (elements or compounds) or mixtures (heterogeneous or homogeneous).

6. Be able to classify changes and properties of matter as physical vs. chemical based on whether composition changes.

7. Know the base units for length (meter, m), mass (kilogram, kg), time (second, s), and temperature (Kelvin, K) in the SI metric system, as well as the derived units for volume (m^3; liter, L) and density (g/cm^3; g/mL).

8. Know the meaning of the following metric prefix multipliers and their abbreviations: tera, giga, mega, kilo, deci, centi, milli, micro, nano, and pico. Be able to write out relationships between them. For example, 100 cm = 1 m; 1000 μg = 1 mg; 1 dL = 0.1 L. Be able to write the relationships using scientific notation (for example, 1 μg = 10^{-6} g) . Be able to use these relationships to change a measurement from one unit size to another (for example, 35 mL = 0.035 L).

9. Know the difference between intensive and extensive properties of substances.

10. Know that 1 cm^3 (1 cc) is the same volume as 1 mL.

11. Be able to calculate the density of a solid or liquid from information about mass and volume. Be able to rearrange the density formula to calculate mass or volume when density and volume or mass are known.

12. Know the rules for counting significant figures in a measurement and be able to apply them. Know the rules for handling significant figures in calculations (addition/subtraction vs. multiplication/division) and be able to apply them.

13. Understand the difference between measured numbers and exact numbers.

14. Understand the terms precision and accuracy.

15. Be able to do conversions between metric units and U.S. units (for example: cm/inches, kg/pounds, Celsius/Fahrenheit, liters/quarts).

16. Be able to use conversion factors to solve problems involving multiple steps.

Equations and Relationships:

(A) <u>Temperature conversions</u> **(will be provided for exams)**

Relationship between Kelvin (K) and Celsius (°C):

$$K = °C + 273.15$$

Relationship between Celsius (°C) and Fahrenheit (°F):

$$°C = \frac{(°F - 32)}{1.8} \qquad\qquad °F = 1.8\,°C + 32$$

(B) <u>Relationship between density (*d*), mass (*m*), and volume (*V*)</u> **(memorize)**

$$d = m/V$$

Be able to rearrange the density equation to solve for *m* or *V*.

(C) <u>Relationships between metric prefixes listed in point 8 above</u> **(memorize)**