Part A. Sample questions from Chapters 1 & 2

1. The key to success in chemistry is:
   A) curiosity.
   B) mathematical skills.
   C) commitment.
   D) practice.
   E) all of the above

2. A hypothesis is
   A) description of a pattern or relationship in experimental data
   B) tentative explanation for a natural phenomenon
   C) obeyed under any circumstances.
   D) theory that has been proved

3. The statement, "A chemical reaction never creates products that weigh more or less than the reactants", is based on three centuries of experimental observation. The statement is an example of:
   A) theory
   B) a hypothesis
   C) a law
   D) a data

4. A theory is the equivalent of an opinion.
   A. True
   B. False

5. Measurement and quantitative data is part of an observation.
   A. True
   B. False

6. The distance between the two hydrogen atoms in a molecule of water is 0.000000000172 m. Express this distance in scientific notation.
   A) $1.72 \times 10^{-7}$ m
   B) $1.72 \times 10^{-10}$ m
   C) $0.172 \times 10^{-10}$ m
   D) $1.72 \times 10^9$ m
   E) $1.72 \times 10^{10}$ m

7. The correct decimal representation of $1.201 \times 10^{-7}$ is:
   A) 12010000
   B) 0.0001201
   C) 0.0000001201
   D) 1201.000
   E) none of the above

8. There are exactly 2.54 centimeters in 1 inch. When using this conversion factor, how many significant figures are you limited to?
   A) 1
   B) 3
   C) ambiguous
   D) depends on if you are using it in multiplication/division or addition/subtraction
   E) infinite number of significant figures

9. The correct multiplier for the prefix milli is:
   A) $10^{-3}$
   B) $10^{-6}$
   C) $10^{-9}$
   D) $10^{-12}$
   E) none of the above

10. What is the standard SI unit for mass?
    A) kilogram
    B) gram
    C) pound
    D) ton
    E) none of the above

SHOW ALL WORK
Part B: For the following problems show all calculations using significant figures correctly to receive full credit.

1. Perform the following calculations to the correct number of significant figures.

a) \((5.11 \times 10^5) / (7.6 \times 10^{12})\) Ans: \(6.7 \times 10^{-8}\) (ans will have two s.f's)

b) \((9443 + 45 - 9.9) \times 8.9 \times 10^6\)
   \[= (9488 - 9.9) \times 8.9 \times 10^6 = 9478.1 \times 8.9 \times 10^6 = 8.4 \times 10^{10}\]
   (the result of 9488 – 9.9 should be rounded to 9478. I have written 9478.1 but shows where it needs to be rounded by using the underline).

2. Perform each of the following conversions.

a) \(9.35 \text{ cm to meters.}\)
   \[9.35 \text{ cm} \times \frac{10^{-2} \text{ m}}{1 \text{ cm}} = 9.35 \times 10^{-2} \text{ m}\]

b) \(2451 \text{ mL to microliters (uL)}\)
   \[2451 \text{ mL} \times \frac{10^3 \text{ microliter}}{1 \text{ mL}} = 2451 \times 10^3 \text{ microliter or (uL)} = 2.451 \times 10^6 \text{ uL}\]
   (Note: a microliter is smaller than a mL by 1000 times)

c) \(825 \text{ yd to kilometer.}[1 \text{ m} = 1.094 \text{ yd}]\)
   \[= 825 \text{ yd} \times \frac{1 \text{ m}}{1.094 \text{ yd}} \times \frac{1 \text{ km}}{10^3} = 0.754 \text{ km}\]
   (Assume the conversion factor to be an exact number, i.e do not count it in for sig. fig. purposes).

**Unit conversions raised to a power.**

3 a) Earth has a surface area of 197 million sq. miles. Convert this area into sq km.
   \([1 \text{ km} = 0.6214 \text{ mi}]\)
   \[1 \text{ km} = 0.6214 \text{ mi}
   \]
   squaring both sides \[1 \text{ sq. km} = 0.3861 \text{ sq mi}\].

   197 million sq miles in scientific notation is \(1.97 \times 10^8 \text{ sq mi}\).

   Using a dimensional analysis setup:
   \[1.97 \times 10^8 \text{ sq mi} \times \frac{1 \text{ sq km}}{0.3861 \text{ sq mi}} = 5.10 \times 10^8 \text{ sq km}\]
b) A classroom has a volume of 249 m$^3$. What is the volume in dm$^3$?

\[
\begin{align*}
1 \text{ m} &= 10 \text{ dm} \\
\text{cubing both sides} \quad 1 \text{ m}^3 &= 10^3 \text{ dm}^3
\end{align*}
\]

Ans: \(249 \times 10^3 \text{ dm}^3\) OR \(2.49 \times 10^5 \text{ dm}^3\)

**Density (using density as a conversion factor)**

4. A vase is said to be solid platinum. It is found to displace 18.65 mL of water and has a mass of 157 g. Could the vase be solid platinum? (density of platinum 21.4 g/cm$^3$)

Given: mass = 157 g; volume = 18.65 mL

Find Density = mass / volume = \(157 \text{ g} / 18.65 \text{ mL} = 8.42 \text{ g} / \text{ mL} = 8.42 \text{ g} / \text{ cm}^3\) Ans: No.

**Cumulative problem**

5. The mass of fuel in an airplane must be carefully accounted for before takeoff. If a Boeing 747 contains 155,211 L of fuel what is the mass of the fuel in kg? Assume the density of the fuel is 0.768 g/cm$^3$.

Given: Converting the volume of 155211 L in mL and scientific notation: \(1.55211 \times 10^8 \text{ mL}\)

\[
\text{Density} = 0.768 \text{ g/cm}^3
\]

\[
\text{Mass} = \text{volume} \times \text{density} = 1.55211 \times 10^8 \text{ mL} \times 0.768 \text{ g/mL} = 1.19 \times 10^8 \text{ g}
\]

\(= 1.19 \times 10^5 \text{ kg}\)

**Significant figures in measurements.**

6. Express your measurement using as many sig figs. as possible. Underline the estimated digit.

a) \(34.0 \text{ mL}\)  
   b) \(2.70 \text{ cm}\)  
   c) \(32.5 \text{ F}\)