**Problem Session 1: Chapters 1, 2, 3, 5, and 11**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. Underline the significant digits in the following measurements:
   1. 12.202 km
   2. 0.01 mL
   3. 205 °C
   4. 0.010 g
2. Perform the following calculations and give the answer to the correct number of significant figures:
   1. (5.03 + 7.2)/0.003
   2. (0.93 × 0.054)/1.32
   3. (6.23 × 0.042) + 9.86
3. Classify each of the following as an element, compound, mixture or solution.
   1. Sea water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Uranium \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. Ethanol, C2H5OH \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. Nitrogen gas, N2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   5. Diamond \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   6. 3% hydrogen peroxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. State whether each is a property of metal or nonmetal:
   1. ductile \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. conducts electricity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. brittle \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. reacts with metals and nonmetals \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Is each of the following is a physical or chemical property?
   1. iron oxidizes to rust \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. titanium pulls into a fine wire \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. water has a density of 1.00 g/mL \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. sugar ferments to alcohol \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Complete the following conversions:
   1. How many megaseconds are in 20.0 years?
   2. Calculate the number of mm in 1.75 miles.
   3. Convert room temperature, 25 °C, to °F.
   4. Convert body temperature, 37 °C, to K.
   5. Convert 2.00 in2 to mm2.
7. Bronze is 80.0% by mass copper and 20.0% by mass tin. A sculptor is preparing to cast a 1.75 lb bronze figure. How many kg of copper is needed?
8. A 355 mL (12.0 fl oz) can of Diet Dr. Pepper contains 55 mg of sodium (2% of the daily recommended allowance). How many pounds of sodium are ingested if 7.7 × 102 gallons of Diet Dr. Pepper are consumed?
9. A graduated cylinder is initially filled with 15.0 mL of water. A piece of aluminum weighing 0.033 lbs is added to the water and the water level rises to 21.3 mL.
   1. What is the measured density of aluminum in g/mL?
   2. If the actual density of aluminum is 2.7 g/cm3, what is the percent error?
10. If a bullet is shot at 500.0 ft/s, how fast is this bullet traveling in mi/hr?
11. The recommended intravenous dose for “DOPRAM”, a respiratory stimulant, is 0.75 mg/kg body weight. DOPRAM is sold as a solution that contains 20.0 mg per mL of solution. How many mL of DOPRAM solution are required to provide an adequate dose to a 145 lb person?
12. What are the forms of energy involved in the following examples?
    1. hydroelectric power plant \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    2. sunlight falling on a solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    3. burning gasoline in a car engine \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. Potassium has three main isotopes. Potassium-39 has a mass of 38.9637 amu and is the most abundant isotope at 93.2581%, potassium-40 has a mass of 39.9640 amu and a percent abundance of 0.0117%, potassium-41 has a mass of 40.9618 amu and a percent abundance of 6.7302%. What is the atomic mass of potassium?
14. Complete the following table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Atomic | Atomic | Mass | Number of | Number of | Number of |
|  | Notation | Number | Number | Protons | Electrons | Neutrons |
|  |  |  | 78 | 34 | 36 |  |
|  | Xe-131 |  | 131 |  |  | **77** |
|  | 50Sn4+ | 50 |  |  |  | 70 |

1. Suppose you want to turn atoms of lead into atoms of gold. What would you have to do to the nucleus of the lead atoms?
2. Write the shorthand electronic configuration for the following:
   1. Si: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Pb: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. Cl: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. Cr2+: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   5. S2-: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   6. Pb4+: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Rank the following atoms in order of increasing radius:

\_\_\_\_\_N \_\_\_\_\_Sb \_\_\_\_\_Rb \_\_\_\_\_Cs \_\_\_\_\_F

1. Name the element that corresponds to each of the following:
   1. alkali metal with the smallest atomic radius \_\_\_\_\_\_\_\_\_\_\_\_
   2. Group 5A element with the highest ionization energy \_\_\_\_\_\_\_\_\_\_\_\_
   3. [Kr] 5s24d10 \_\_\_\_\_\_\_\_\_\_\_\_