Circle the letter corresponding to the one best answer for each of the following multiple choice questions. Each multiple choice question is worth two points.

1. Which one of the following statements is true about a gas?
   a. the particles in a gas are very close together
   b. a gas occupies the volume of its container but has a flat top
   c. a gas is not compressible
   d. the particles of a gas move very rapidly compared to particles of liquids and solids
   e. particles of a gas are fixed in position

2. Which one of the following statements refers to a physical property?
   a. benzene boils at 80.1 °C
   b. water can be broken into hydrogen and oxygen by running electricity through it
   c. gasoline can start on fire in the presence of air
   d. copper does not react with water
   e. silver metal reacts with copper in solution

3. Which one of the following is an example of an intensive property?
   a. boiling point
   b. mass
   c. volume
   d. length of a sample of wire
   e. weight

4. The nuclide symbol for a nucleus containing 24 protons and 29 neutrons is:
   \[ a. _{24}^{29}Cr \quad b. _{29}^{24}Cu \quad c. _{29}^{53}Cu \quad d. _{24}^{53}Cr \quad e. _{53}^{24}Xe \]

5. An isotope of rubidium has a mass number of 87. What is its nuclide symbol?
   \[ a. _{37}^{50}Rb \quad b. _{37}^{87}Rb \quad c. _{50}^{37}Rb \quad d. _{87}^{37}Rb \quad e. _{37}^{86}Rb \]

6. Which one of the following is NOT an SI unit?
   a. g   b. m   c. mol   d. K   e. s
7. (3 points) Use the letter before each name below to match the name with the contribution attributed to that person.

A. JJ Thomson _____ Oil drop experiment
B. John Dalton _____ Cathode Ray Tube
C. Robert Millikan _____ Gold foil experiment
D. Ernest Rutherford _____ Early atomic theory

8. (5 points) Place a mark in ALL of the boxes below that are examples of a chemical change.

☐ bread is toasted in a toaster
☐ a piece of meat is cooked on the grill
☐ sugar is dissolved in water
☐ dry ice sublimes (goes from solid to vapor without any intervening liquid)
☐ food you eat helps your body function

If you have concerns about any of your answers, please give a very brief description as to what those might be:

9. (5 points) Place a mark in all of the boxes below that are examples of homogeneous mixtures.

☐ smoggy air in Los Angeles
☐ a pinch of sugar in a gallon of water
☐ clean air
☐ asphalt
☐ pure water

If you have concerns about any of your answers, please give a very brief description as to what those might be:
Short answer questions and problems. Point totals are indicated in parentheses to the right of each problem number.

10. (5 points) An element has two naturally occurring isotopes as shown in the table below.

<table>
<thead>
<tr>
<th>Atomic mass (amu)</th>
<th>% natural abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>68.925580</td>
<td>60.108</td>
</tr>
<tr>
<td>69.926028</td>
<td>39.892</td>
</tr>
</tbody>
</table>

Find the average atomic mass of this element and **SHOW YOUR WORK**.

11. (10 points) Conduct the following metric conversions. You can use the right hand side of the problem for scratch work.

   6.75 mm = _________ km

   3.67 \times 10^{-4} \text{ g} = _________ mg

   9.14 \times 10^{8} \text{ kg} = _________ \mu \text{g}

   4.65 \text{ cs} = _________ \text{ ms}

   6.55 \times 10^{5} \text{ mmol} = _________ \text{ dmol}

12. (5 points) Give the value of Avogadro’s number and describe what it means.
13. (10 points) Make the following conversions as indicated and show your work.

a. How many grams of Ca are in 14.6-mol of Ca?

b. How many atoms of copper are in a sample with a mass of 96.5-g?

c. The number of mol of Zr in a 8.65-g sample is __________.

d. How many mol of In are in a sample with a mass of 150.6-g?

e. Which contains more atoms – 50.0-g of Rh or 50.0-g of W?
<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tera-</td>
<td>T</td>
<td>$1 \times 10^{12}$ (1,000,000,000,000)</td>
<td>1 teragram (Tg) = $1 \times 10^{12}$ g</td>
</tr>
<tr>
<td>Giga-</td>
<td>G</td>
<td>$1 \times 10^{9}$ (1,000,000,000)</td>
<td>1 gigawatt (GW) = $1 \times 10^{9}$</td>
</tr>
<tr>
<td>Mega-</td>
<td>M</td>
<td>$1 \times 10^{6}$ (1,000,000)</td>
<td>1 megahertz (MHz) = $1 \times 10^{6}$</td>
</tr>
<tr>
<td>Kilo-</td>
<td>k</td>
<td>$1 \times 10^{3}$ (1,000)</td>
<td>1 kilometer (km) = $1 \times 10^{3}$ m</td>
</tr>
<tr>
<td>Deci-</td>
<td>d</td>
<td>$1 \times 10^{-1}$ (0.1)</td>
<td>1 deciliter (dL) = $1 \times 10^{-1}$ L</td>
</tr>
<tr>
<td>Centi-</td>
<td>c</td>
<td>$1 \times 10^{-2}$ (0.01)</td>
<td>1 centimeter (cm) = $1 \times 10^{-2}$ m</td>
</tr>
<tr>
<td>Milli-</td>
<td>m</td>
<td>$1 \times 10^{-3}$ (0.001)</td>
<td>1 millimeter (mm) = $1 \times 10^{-3}$ m</td>
</tr>
<tr>
<td>Micro-</td>
<td>μ</td>
<td>$1 \times 10^{-6}$ (0.0000001)</td>
<td>1 microliter (μL) = $1 \times 10^{-6}$ L</td>
</tr>
<tr>
<td>Nano-</td>
<td>n</td>
<td>$1 \times 10^{-9}$ (0.000000001)</td>
<td>1 nanosecond (ns) = $1 \times 10^{-9}$ s</td>
</tr>
<tr>
<td>Pico-</td>
<td>p</td>
<td>$1 \times 10^{-12}$ (0.000000000001)</td>
<td>1 picogram (pg) = $1 \times 10^{-12}$ g</td>
</tr>
</tbody>
</table>
A periodic table is shown with atomic number, element symbol, element name, and average atomic mass. It includes a key for understanding the table's layout. The average atomic mass is noted with a star (*) symbol, indicating it refers to the most stable isotope. The table includes elements from 1 to 118, covering all the known elements.