MULTIPLE CHOICE (3 points each)

1) A cube of an unknown metal measures 0.161 cm on one side. The mass of the cube is 36 mg. Which of the following is most likely the unknown metal?

<table>
<thead>
<tr>
<th>Metal</th>
<th>Density (g/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhodium</td>
<td>12.4</td>
</tr>
<tr>
<td>Copper</td>
<td>8.96</td>
</tr>
<tr>
<td>Niobium</td>
<td>8.63</td>
</tr>
<tr>
<td>Vanadium</td>
<td>6.11</td>
</tr>
</tbody>
</table>

A) copper   B) rhodium   C) zirconium   D) niobium

2) Of the three types of radioactivity characterized by Rutherford, which is/are electrically charged?
   A) beta-particles   B) alpha-particles
   C) alpha-particles and beta-particles   D) alpha-particles, beta-particles, and gamma-rays

3) Isotopes are atoms that have the same number of __________ but differing number of __________.
   A) neutrons, electrons   B) protons, electrons
   C) protons, neutrons   D) electrons, protons

4) The temperature of 25°C is __________ in Kelvin.
   A) 248   B) 138   C) 298   D) 103

5) The atomic masses in the periodic table are not integral numbers. For example, carbon is listed as 12.01115 instead of 12.00000. Why?
   A) Our technology does not allow for exact measurement of such a small quantity.
   B) Atomic masses are measured in real samples that are always contaminated with other elements.
   C) There is a theoretical uncertainty in the masses of atoms.
   D) Atomic masses listed in the periodic table are weighted averages of naturally occurring isotopes.

6) __________ and __________ reside in the atomic nucleus.
   A) Protons, neutrons   B) Protons, electrons
   C) Electrons, neutrons   D) none of the above

7) Cathode rays are __________.
   A) electrons   B) protons   C) x-rays   D) atoms
8) Which one of the following is an intensive property?  
   A) temperature  B) amount  C) volume  D) mass

9) Which states of matter are significantly compressible?  
   A) solids only  B) liquids only  C) liquids and gases  D) gases only

10) In the symbol below, X = __________.  
    A) Al  B) K  C) C  D) N

11) 1 milligram = __________ micrograms  
    A) 1,000  B) 0.01  C) 0.001  D) 10

12) The correct result of the following addition is __________.  
    12  
    1.2  
    0.12  
    + 0.012  
    A) 13  B) 13.3  C) 13.33  D) 13.332

13) Which one of the following is a pure substance?  
    A) elemental copper  B) wood  C) milk  D) salt water

14) The density of lead is 11.4 g/cm³. The mass of a lead ball with a radius of 0.050 cm is __________ g.  
    A) 4.6 x 10⁻²  B) 6.0  C) 4.6 x 10⁻¹  D) 6.0 x 10⁻¹

15) In the following list, only __________ is not an example of matter.  
    A) light  B) dust  C) elemental phosphorus  D) planets

16) Of the objects below, __________ is the most dense.  
    A) an object with a volume of 13 dm³ and a mass of 1.29 x 10³ g  
    B) an object with a volume of 2.5 L and a mass of 12.5 kg  
    C) an object with a volume of 139 mL and a mass of 93 g  
    D) an object with a volume of 3.91 mL and a mass of 7.93 mg

17) Which pair of substances could be used to illustrate the law of multiple proportions?  
    A) CO, CO₂  B) SO₂, H₂SO₄  C) H₂O, O₂  D) NaCl, KCl

18) The atomic number indicates __________.  
    A) the number of protons or electrons in a neutral atom  
    B) the number of different isotopes of an element  
    C) the number of atoms in 1 g of an element  
    D) the total number of neutrons and protons in a nucleus
19) Which one of the following is often easily separated into its components by simple techniques such as filtering or decanting?

A) heterogeneous mixture  B) homogeneous mixture
C) compounds  D) solutions

20) Which one of the following is not a physical property of water?

A) It is clear and colorless.
B) It freezes at 0°C at 1 atm pressure.
C) It boils at 100°C at 1 atm pressure.
D) It reacts rapidly with potassium metal to form potassium hydroxide.

21) Which of the following is an illustration of the law of constant composition?

A) Water and salt have different boiling points.
B) Water boils at 100°C at 1 atm pressure.
C) Water can be separated into other substances by a chemical process.
D) Water is 11% hydrogen and 89% oxygen by mass.

22) The density of silver is 10.5 g/cm\(^3\). What would be the mass (in grams) of a piece of silver that occupies a volume of 23.6 cm\(^3\)?

A) 0.445  B) 23.6  C) 2.25  D) 248

23) What is the correct answer (reported to the proper number of significant figures) to the following?

\[6.3 \times 3.25 = \_\_\_\_\_\_
\]

A) 20.48  B) 20.5  C) 20.475  D) 20

24) Which combination of protons (p\(^+\)), neutrons (n\(^0\)), and electrons (e\(^-\)) is correct for the isotope of copper, \(^{63}_{29}\)Cu?

A) 29 p\(^+\), 29 n\(^0\), 63 e\(^-\)  B) 63 p\(^+\), 29 n\(^0\), 63 e\(^-\)
C) 34 p\(^+\), 34 n\(^0\), 29 e\(^-\)  D) 29 p\(^+\), 34 n\(^0\), 29 e\(^-\)

25) The number with the most significant zeros is __________.

A) 2.5100000  B) 0.02500001  C) 0.00002510  D) 250000001

Problems (SHOW ALL WORK ON THIS PAPER)

(5 points) The speed of light in a vacuum is \(2.998 \times 10^8\) m/s. What is the speed of light in km/hr?

\[2.998 \times 10^8 \text{ m/s} \times \left(\frac{1\text{ km}}{1 \times 10^3 \text{ m}}\right) \times \left(\frac{60 \text{ sec}}{1 \text{ min}}\right) \times \left(\frac{60 \text{ min}}{1 \text{ hr}}\right) = 1.079 \times 10^9\text{ km/hr}\]
(10 points) The Morgan silver dollar has a mass of 26.73g. By law, it was required to contain 90% silver, with the remainder being copper. When the coin was minted in the late 1800’s, silver was worth $1.18 per troy ounce (1 troy oz = 31.1g). At this price, what is the value of the silver in the silver dollar?

\[
\frac{26.73g}{\text{coin}} \cdot \left( \frac{0.90g \text{ Ag}}{1.00g \text{ coin}} \right) \cdot \left( \frac{1 \text{ troy oz}}{31.1g} \right) \cdot \left( \frac{$1.18}{1 \text{ troy oz}} \right) = $0.91 or 91 cents