SHOW ALL CALCULATIONS & USE PROPER SIGNIFICANT FIGURES AND UNITS

$N_A = 1 \text{ mole} = 6.02 \times 10^{23}$

Multiple Choice Questions: Circle the single best answer. No penalty for guessing.

1. Name the SI prefix used to indicate $10^{-3}$. (5 points)
   A) Centi (c)   B) Kilo (k)   C) Milli (m)   D) Nano (n)   E) Pico (p)

2. How many significant figures are present in 53.020? (5 points)
   A) 2   B) 3   C) 4   D) 5   E) 6

3. Which of the following has a negative charge? (5 points)
   A) Sodium atom   B) Neutron   C) beta particle   D) Proton   E) Alpha Particle

4. What is the charge on a sulfite anion? (5 points)
   A) +2   B) +1   C) –1   D) –2   E) –3

5. Calculate the mass of 1.50 mole of benzene, $C_6H_6$? (5 points)
   A) 18.0   B) 19.5   C) 52.1   D) 78.1   E) 117

6. Calculate the mass percent calcium in CaS. (5 points)
   A) 44.4 %   B) 50.0 %   C) 55.5 %   D) 75.0 %   E) 81.7 %

7. How many grams of sugar ($C_{12}H_{24}O_{12}$) do you need to burn to produce 25.3 g of CO$_2$. (15 points)
8. Write complete atomic symbols for two isotopes of the element boron. (5 points)

9. Name the following ionic compounds. (4 points each)

- $\text{K}_2\text{CO}_3$
- $\text{FeSO}_3$
- $\text{HClO}_3$
- $\text{NH}_4\text{Br}$

10. Write the empirical formula for the following compounds. (4 points each)

- lithium phosphate
- diphosphorus pentoxide
- titanium (IV) oxide
- phosphoric acid

11. Calculate the molecular weight of the following compounds. (5 points each)

- $\text{CaSO}_4\cdot6\text{H}_2\text{O}$
- $\text{C}_{14}\text{H}_{28}\text{O}_2$

12. Define the term “mole” as it applies to chemistry and Avogadro’s number? (5 points)
13. Vanillin, the dominant flavoring in vanilla, contains three elements: C, H and O. When 1.05 g of this substance is completely combusted, 2.43 g of CO$_2$ and 0.50 g of H$_2$O are produced. What is the empirical formula of this compound? (12 points)

14. Determine the number of neutrons and protons in a given atom for each of the following elements. (6 points)

<table>
<thead>
<tr>
<th>Element</th>
<th>Protons</th>
<th>Neutrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{106}$Pd</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>$^{122}$Sb$^{3+}$</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>$^{184}$W</td>
<td>_______</td>
<td>_______</td>
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</tbody>
</table>

15. Balance the following equations. (15 points)

\[ \text{_____ Mg}_3\text{N}_2 (s) + \text{_____ H}_2\text{O} (l) \rightarrow \text{_____ Mg(OH)}_2 (s) + \text{_____ NH}_3 (aq) \]

\[ \text{_____ (NH}_4\text{)}_2\text{Cr}_2\text{O}_7 (s) \rightarrow \text{_____ N}_2 (g) + \text{_____ Cr}_2\text{O}_3 (s) + \text{_____ H}_2\text{O} (l) \]