1. A sample of a hydrated compound, ZnSO₄·xH₂O has a mass of 0.625 g. The sample is heated to drive off all of the water. The resulting anhydrous compound ZnSO₄ has a mass of 0.351 g.

\[
\text{ZnSO}_4\cdot x\text{H}_2\text{O} \rightarrow \text{ZnSO}_4 + x\text{H}_2\text{O}
\]

\[
\begin{align*}
0.625\text{g} & \quad \rightarrow \quad 0.351\text{g} \\
0.274\text{g}\text{H}_2\text{O} & \quad + \quad x\text{H}_2\text{O}
\end{align*}
\]

a. What is the mass percent of water in the compound? (1 point)

\[
\frac{0.274\text{gH}_2\text{O}}{0.625\text{g}} \times 100\% = 43.8\% \text{H}_2\text{O}
\]

b. What is the actual formula of the hydrated compound? (i.e., determine the value of \(x\) in the hydrate formula ZnSO₄·xH₂O). (2 points)

\[
x = \frac{\text{moles of H}_2\text{O}}{\text{moles of ZnSO}_4} = \frac{0.0152}{0.00218} = 7
\]

\[
\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}
\]

2. Provide the missing name or chemical formula: (4 points)

<table>
<thead>
<tr>
<th>Formula</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. CuCl</td>
<td>Copper (I) chloride</td>
</tr>
<tr>
<td>b. Na₂CO₃</td>
<td>Sodium carbonate</td>
</tr>
<tr>
<td>c. SO₂</td>
<td>Sulfur dioxide</td>
</tr>
<tr>
<td>d. CaSO₄·2H₂O</td>
<td>Calcium sulfate dihydrate</td>
</tr>
</tbody>
</table>

3. TNT, trinitrotoluene, is a high explosive with molecular formula C₇H₅N₃O₆ and Molar Mass 227.13 g/mol

a. What is the mass percent of carbon in TNT? (1 point)

\[
\frac{7\text{mole C}}{227.13\text{g}} \times 12.01\text{g C/mole} = \frac{84.07\text{g C}}{227.13\text{g C}_7\text{H}_5\text{N}_3\text{O}_6} \times 100 = 37.04\% \text{C}
\]

b. How many hydrogen atoms are in 20.0 grams of TNT? (2 points)

\[
20.0\text{g TNT} \times \frac{1\text{mole TNT}}{227.13\text{g}} \times \frac{5\text{mole H}}{1\text{mole TNT}} \times \frac{6.022 \times 10^{23} \text{atoms}}{1\text{mole}} = 2.65 \times 10^{23} \text{H atoms}
\]