1. Using only a periodic table, assign charges for each ion below, then complete the table with formulas and names for compounds formed by the combination of each cation and anion.

<table>
<thead>
<tr>
<th></th>
<th>Ca</th>
<th>K</th>
<th>Al</th>
<th>NH₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cl</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO₄</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO₃</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO₃</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ClO₃</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO₄</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Fill in the missing name or formula for each compound listed below. Fill in column 1 without using any notes, and then fill in column 2 with the use of notes.

<table>
<thead>
<tr>
<th>Compound</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium nitrate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferrous chloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver hydroxide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strontium phosphate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper(II) acetate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc nitrite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium sulfite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonium carbonate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iodine heptafluoride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bromine trifluoride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CuClO₄</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ag₂SO₄</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N₂O₅</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hg₂I₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PbO₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OF₂</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. For each compound shown below, determine if the name or formula is incorrect, and write the correct form in the space provided:

a) Ag₂S  Disilver sulfide
b) MgOH  Magnesium hydroxide
c) Ca(NO₃)₂  Calcium (II) nitrate
d) SnO₂  Tin (II) oxide
e) PbS  Lead sulfide
f) ZnCl₂  Zinc dichloride
g) SO₂  Sodium dioxide
h) CaSO₄  Calcium sulfide
i) Ba₂O  Barium oxide
j) Cu₂O  Copper (II) oxide

4. Balance the following equations by providing the missing coefficients:

a)  ____NH₄NO₃ → ____N₂O + ____H₂O

b)  ____Mg₃N₂ + ____H₂O → ____Mg(OH)₂ + ____NH₃

c)  ____NCl₃ + ____H₂O → ____NH₃ + ____HOCl

d)  ____C₅H₁₀O₂ + ____O₂ → ____CO₂ + ____H₂O

e)  ____(NH₄)₂Cr₂O₇ → ____N₂ + ____Cr₂O₃ + ____H₂O

f)  ____PCl₅ + ____H₂O → ____H₃PO₄ + ____HCl
5. Write a balanced equation for each reaction described below. Include state designations:

a) When an aqueous solution of potassium dichromate is added to and aqueous solution of lead(II) nitrate, solid lead(II) dichromate and aqueous potassium nitrate are formed.

b) When chlorine gas is bubbled though an aqueous solution of potassium bromide, bromine gas and aqueous potassium chloride are formed.

c) When zinc metal is reaction with aqueous nitric acid, the reaction produces nitrogen gas, water and aqueous zinc nitrate.

6. What mass of chlorine is present in 12.2 g of PbCl₂?

7. How many atoms of oxygen are present in 2.15 g of Ca₃(PO₄)₂?
8. What is the percent composition of caffeine (C₈H₁₀N₄O₂)?

9. Determine the empirical formula for a compound with the following composition:

<table>
<thead>
<tr>
<th></th>
<th>62.1% C</th>
<th>5.21% H</th>
<th>12.1% N</th>
<th>20.7% O</th>
</tr>
</thead>
</table>

10. Combustion analysis of a 12.01-g sample of an unknown acid—which contains only carbon, hydrogen and oxygen—produced 14.08 g CO₂ and 4.32 g H₂O. Determine the empirical formula for this acid.
11. A phosphorous compound that contains 34.00% phosphorus by mass has the formula \( X_3P_2 \). Identify the element \( X \).

12. A 3.41-g sample of a hydrate of copper(II) chloride was heated to drive off the water of hydration. The anhydrous salt was found to have a mass of 2.69 g. Determine the formula for this hydrate.

13. Classify each hydrocarbon below as alkane, alkene or alkyne, and write a molecular formula for each:

   a) \[
   \begin{array}{c}
   H \\
   \end{array}
   \begin{array}{c}
   C=\textbf{C} \\
   \end{array}
   \begin{array}{c}
   H \\
   \end{array}
   \begin{array}{c}
   \text{H}_3\text{C} \\
   \end{array}
   \begin{array}{c}
   \text{CH}_3 \\
   \end{array}
   \]
   
   c) \[
   \begin{array}{c}
   \text{CH}_3 \\
   \end{array}
   \begin{array}{c}
   - \text{CH} - \text{CH}_3 \\
   \end{array}
   \begin{array}{c}
   \text{CH}_3 \\
   \end{array}
   \]
   
   b) \[
   \begin{array}{c}
   \text{H} \\
   \end{array}
   \begin{array}{c}
   \text{H} \\
   \end{array}
   \begin{array}{c}
   \text{C} \equiv \text{C} \\
   \text{C} \\
   \text{H} \\
   \text{H} \\
   \end{array}
   \begin{array}{c}
   \text{H} \\
   \end{array}
   \begin{array}{c}
   \text{H} \\
   \end{array}
   \begin{array}{c}
   \text{H} \\
   \end{array}
   \begin{array}{c}
   \text{H} \\
   \end{array}
   \begin{array}{c}
   \text{H} \\
   \end{array}
   \]
   
   d) \[
   \begin{array}{c}
   \text{CH}_3 \text{C} \equiv \text{CHCH}_2\text{CH}_3 \\
   \end{array}
   \begin{array}{c}
   \text{CH}_3 \\
   \end{array}
   \]

\[\text{alkane} \quad \text{alkene} \quad \text{alkyne}\]
14. Identify the functional groups present in the structures below:

a) 

b) 

c) 