Instructions: Read the instructions for each question carefully and answer the questions to the best of your ability. You may use the Periodic Table below and a calculator to answer the following questions.

### Periodic Table of the Elements

<table>
<thead>
<tr>
<th>1</th>
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<th>16</th>
<th>17</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>He</td>
<td>Li</td>
<td>Be</td>
<td>B</td>
<td>C</td>
<td>N</td>
<td>O</td>
<td>F</td>
<td>Ne</td>
<td>Na</td>
<td>Mg</td>
<td>Al</td>
<td>Si</td>
<td>P</td>
<td>S</td>
<td>Cl</td>
<td>Ar</td>
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<tr>
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<td>Ca</td>
<td>Sc</td>
<td>Ti</td>
<td>V</td>
<td>Cr</td>
<td>Mn</td>
<td>Fe</td>
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<td>Cu</td>
<td>Zn</td>
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<td>Ge</td>
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<td>Se</td>
<td>Br</td>
<td>Kr</td>
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<tr>
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<td>Sr</td>
<td>Y</td>
<td>Zr</td>
<td>Nb</td>
<td>Mo</td>
<td>Tc</td>
<td>Ru</td>
<td>Rh</td>
<td>Pd</td>
<td>Ag</td>
<td>Cd</td>
<td>In</td>
<td>Sn</td>
<td>Sb</td>
<td>Te</td>
<td>I</td>
<td>Xe</td>
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<tr>
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<td>La</td>
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<td>Tb</td>
<td>Dy</td>
<td>Ho</td>
<td>Er</td>
<td>Tm</td>
<td>Yb</td>
<td>Lu</td>
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</tr>
</tbody>
</table>

Good luck!

This material was distributed by the Austin College Academic Skills Center in the General Chemistry Tutorial Series.

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(903) 813-2454
1. Periodic Trends:
   
a. Identify the relationship between elements in the same group.
   
   **Elements in the same group have a similar valence configuration.**
   
b. Identify the relationship between elements in the same period.
   
   **Periods represent valence shells being filled**
   
2. Classify the elements as metal, nonmetal, or metalloid:
   
a. Mg  **metal**
   
b. S  **nonmetal**
   
c. Rb  **metal**
   
d. Cr  **metal (transition)**
   
e. Te  **metalloid**
   
3. Describe effective nuclear charge.
   
   **Amount of charge valence electrons experience from the nucleus**
   
4. Cations are **smaller** than anions (in relation to size).
   
5. Write the name of the following molecules:
   
a. NF₃  **Nitrogen trifluoride**
   
b. CaCl₂  **Calcium chloride**
   
c. NH₃  **Nitrogen trihydrogen**
   
d. Zn₃(PO₄)₂  **Zinc phosphate**
   
6. Write chemical formulas for each of the following:
   
a. Iron(III) chloride
   
   **FeCl₃**
b. Carbon tetrafluoride
   \( \text{CF}_4 \)

c. Nitrate
   \( \text{NO}_3^- \)

d. Potassium Dichromate
   \( \text{K}_2(\text{Cr}_2\text{O}_7) \)

7. Identify all the intermolecular forces associated with the following:

   a. Nitrite \( \text{LDF, Dipole-Dipole} \ (\text{NO}_2^-) \)
   
   b. \( \text{H}_2\text{O} \ \text{LDF, Dipole-Dipole, Hydrogen Bonding} \)
   
   c. \( \text{CF}_4 \ \text{LDF} \)
   
   d. \( \text{KCN} \ \text{LDF, Dipole-Dipole} \)

8. Write the electron configuration for the following ions (short and long forms):

   a. \( \text{Ca}^{2+} \)
      \[ [\text{Ar}] 4s^2 \]
      \[ 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 \]
   
   b. \( \text{Cl}^- \)
      \[ [\text{Ar}] \]
      \[ 1s^2 2s^2 2p^6 3s^2 3p^6 \]
   
   c. \( \text{Cr}^{3+} \)
      \[ [\text{Ar}] 3d^3 \]
      \[ 1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 \]

9. Identify the element from this electron configuration: \([\text{Ar}] 3d^9\)
   
10. Rank from highest to lowest:

   a. Atomic Radius of: \( \text{Cl}, \text{Ni}, \text{Fr}, \text{Al}, \text{Kr} \)
   
      \( \text{Fr}, \text{Ni}, \text{Kr}, \text{Al}, \text{Cl} \)

   b. First Ionization Energy of: \( \text{Cd}, \text{O}, \text{B}, \text{Rb}, \text{Cs} \)

      \( \text{O}, \text{B}, \text{Cd}, \text{Rb}, \text{Cs} \)

   c. Electronegativity of: \( \text{Se}, \text{F}, \text{Ca}, \text{O}, \text{C} \)

      \( \text{F}, \text{O}, \text{C}, \text{S}, \text{Ca} \)
11. Draw the Lewis structure for $\text{PCl}_5$. State the molecular geometry, formal charge of each atom, and the hybridization state. Show the dipoles with a vector arrow and indicate the net dipole moment.

12. Draw all of the resonance structures and the resonance hybrid for nitrate. State the molecular geometry, formal charge of each atom, and the hybridization state. Show the dipoles with a vector arrow and indicate the net dipole moment.
13. Identify the percent composition of each of the elements present in $\text{C}_6\text{H}_{12}\text{O}_6$.

\[
\begin{align*}
(6 \times 12.011) &= 72.066 \\
(12 \times 1.008) &= 12.096 \\
(6 \times 15.9994) &= 95.994 \\
\text{C}_6\text{H}_{12}\text{O}_6 &= 180.156
\end{align*}
\]

\[
\begin{align*}
\frac{72.066}{180.156} \times 100 &= 40.07\% \\
\frac{12.096}{180.156} \times 100 &= 6.73\% \\
\frac{95.994}{180.156} \times 100 &= 53.3\% \\
100\% &= 100\%
\end{align*}
\]

14. What is the empirical formula of a compound containing 40.92% C, 4.58% H, and 54.50% O?

\[
\begin{align*}
\text{C} & \quad \frac{40.92}{12.011} = \frac{3.41}{3.41} = 1.00 \times 3 = 3 \\
\text{H} & \quad \frac{4.58}{1.008} = \frac{4.54}{3.41} = 1.33 \times 3 = 4 \\
\text{O} & \quad \frac{54.50}{15.999} = \frac{3.41}{3.41} = 1.00 \times 3 = 3
\end{align*}
\]

$\text{C}_3\text{H}_4\text{O}_3$

15. If the compound from the above question has a known molecular weight of 176.12 g/mol, what is the molecular formula?

\[
\begin{align*}
\text{C}_3\text{H}_4\text{O}_3 &= 88.062 \\
176.12/88.062 &= 1.999 \\
\text{C}_6\text{H}_{12}\text{O}_6
\end{align*}
\]