1. In each of the following pairs, pick the element with the higher ionization energy and explain your choice.
   a. C vs. N
      C: 1s²2s²2p²
      N: 1s²2s²2p³ (half filled).
   b. Cd vs. In
      Cd: [Kr] 4d¹⁰5s² (full filled).
      In: [Kr] 4d¹⁰5s²5p¹
   c. Cl vs. F
      Cl: 1s²2s²2p⁶3s²3p⁵
      F: 1s²2s²2p⁶

2. (a) Give the electronic configuration of \( \text{Cr}^0 \). What is the term symbol for the ground state of \( \text{Cr}^0 \)?

   \( \text{Cr}^0: [Ar] 4s¹ 3d⁵ \)

   \( L = \sum_i l_i = 0 + (+2) + (+1) + 0 + (-1) + (-2) = 0 \Rightarrow S \)

   \( S = \sum_i s_i = \frac{1}{2} \times 6 = 3 \)

   \( \therefore L \rightarrow S \)

   b) What is the contribution from electron spin to the magnetic moment of \( \text{Cr}^0 \)?

   That is, calculate the \( \mu_{\text{s.o.}} \) of \( \text{Cr}^0 \).

   \( \mu_{\text{s.o.}} = 2\sqrt{S(S+1)} \)

   \( S = 3 \)

   \( = 2\sqrt{3 \times 4} = 4\sqrt{3} = 6.928 \text{ B.M.} \)

   c) Give the electronic configuration of \( \text{Cr}^{2+} \). What is its ground state term symbol and \( \mu_{\text{s.o.}} \)?

   \( \text{Cr}^{2+}: [Ar] 3d⁴ \)

   \( L = \sum_i l_i = (+2) + (+1) + 0 + (-1) = 2 \Rightarrow D \)

   \( S = \sum_i s_i = \frac{1}{2} \times 4 = 2 \)

   \( \therefore 2S + 1 = 5 \Rightarrow L \rightarrow S \)
3. Give the electronic configuration for each atom/ion and explain the discrepancy in first I.E order at N and O.

\[ \text{N(g)} \rightarrow \text{N}^+(g) + e^- \quad \text{I.E (eV)} \quad 14.5341 \]

Explanation: For N, from half-filled \( \rightarrow \) not half-filled, from not half-filled \( \rightarrow \) half-filled.

\[ \text{O(g)} \rightarrow \text{O}^+(g) + e^- \quad \text{I.E (eV)} \quad 13.6181 \]

For O, it is easier for O to lose e\(^-\) to be O\(^+\), so FE(O) lower than FE(N).

4. Assign the following ionization energy values to the appropriate process below.

IE (in eV) : 15.75; 5.14; 5.98; 8.15

<table>
<thead>
<tr>
<th>Process</th>
<th>I.E (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na(g) ( \rightarrow ) Na(^+) (g) + e(^-)</td>
<td>5.14</td>
</tr>
<tr>
<td>Al(g) ( \rightarrow ) Al(^+) (g) + e(^-)</td>
<td>5.98</td>
</tr>
<tr>
<td>Si(g) ( \rightarrow ) Si(^+) (g) + e(^-)</td>
<td>8.15</td>
</tr>
<tr>
<td>Ar(g) ( \rightarrow ) Ar(^+) (g) + e(^-)</td>
<td>15.75</td>
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Grading:

<table>
<thead>
<tr>
<th>Points possible</th>
<th>received</th>
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<tbody>
<tr>
<td>1. 6</td>
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<tr>
<td>2. 9</td>
<td></td>
</tr>
<tr>
<td>3. 6</td>
<td></td>
</tr>
<tr>
<td>4. 4</td>
<td></td>
</tr>
<tr>
<td>Total: 25</td>
<td></td>
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</table>