1. Write complete electron configurations for the following atoms:
   a) F $1s^2 2s^2 2p^5$
   b) Al $1s^2 2s^2 2p^6 3s^2 3p^1$
   c) V $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$
   d) Cu $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$ (copper is an exception)
   e) Kr $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$

2. Write noble gas electron configurations for the following atoms:
   a) Cd $[Kr] 5s^2 4d^{10}$
   b) I $[Kr] 5s^2 4d^{10} 5p^5$
   c) Ba $[Xe] 6s^2$
   d) Rn $[Xe] 6s^2 4f^{14} 5d^{10} 6p^6$
   e) U $[Rn] 7s^2 5f^3 6d^1$ (not on test)

3. How many core, outer, and valence electrons do each of the following atoms have?

<table>
<thead>
<tr>
<th></th>
<th>Core</th>
<th>Outer</th>
<th>Valence</th>
</tr>
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</table>
   a) H    | 0    | 1     | 1       |
   b) Si   | 10   | 4     | 4       |
   c) Ti   | 18   | 2     | 4       |
   d) Br   | 28   | 7     | 7       |
   e) Ag   | 36   | 1     | 11      |

   (3d e$^-$ are core e$^-$ for rep. elements)

   (an exception)

4. Write orbital notations for the following atoms:

   a) O
   - $1s$ 2s 2p 3s 3p 4s 3d

   b) P
   - $1s$ 2s 2p 3s 3p 4s 3d

   c) Cr
   - $1s$ 2s 2p 3s 3p 4s 3d

   (an exception)

   d) Co
   - $1s$ 2s 2p 3s 3p 4s 3d
5. Complete the valence level orbital notation for the following monatomic ions.

a) Fe$^{3+}$ \[ \begin{array}{c}
4s \\
3d
\end{array} \]

b) Sn$^{2+}$ \[ \begin{array}{c}
5s \\
5p
\end{array} \]

c) Br$^-$ \[ \begin{array}{c}
4s \\
4p
\end{array} \]

d) Cr$^{3+}$ \[ \begin{array}{c}
4s \\
3d
\end{array} \]

6. Which of the ions in Question 5 would be paramagnetic? Fe$^{3+}$, Cr$^{3+}$ diamagnetic? Sn$^{2+}$, Br$^-$

7. Match the principle or rule to the related statement:

A. The aufbau principle
B. Hund’s rule
C. The Heisenberg uncertainty principle
D. The Pauli exclusion principle

C. electrons are described as clouds and probability

B. electrons occupy their own orbital within a sublevel before sharing

A. electrons occupy the lowest energy orbital available in the ground state

B. any unpaired electrons have the same spin

D. an orbital can only hold a maximum of two electrons

8. Arrange the following neutral atoms in order of increasing atomic radii: S, As, Se, Br, Te

S < Br < Se < As < Te

(the vertical trend dominates over the horizontal trend)

9. Which would you expect to be larger, IE$_2$ for potassium or IE$_3$ for scandium?

IE$_2$ for potassium

(IE$_1$ would give potassium a noble gas electron configuration, while IE$_2$ would disrupt it)

10. Arrange the following monatomic ions in order of increasing atomic radii: P$^{3-}$, Cr$^{6+}$, Ca$^{2+}$, Cl$^-$, Ti$^{4+}$

Cr$^{6+}$ < Ti$^{4+}$ < Ca$^{2+}$ < Cl$^-$ < P$^{3-}$

(each ion has the same electron configuration (e$^-$–e$^-$ repulsion), therefore more protons give a smaller radius (greater attraction) and fewer protons gives a larger radius)

<table>
<thead>
<tr>
<th>Ion</th>
<th># Electrons</th>
<th># Protons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cr$^{6+}$</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>Ti$^{4+}$</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Ca$^{2+}$</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Cl$^-$</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>P$^{3-}$</td>
<td>18</td>
<td>15</td>
</tr>
</tbody>
</table>