Work Session Review 1: Atomic Properties

1. What properties of an electron’s wave description do the quantum numbers \( n \), \( \ell \), \( m_\ell \), and \( m_s \) indicate?

2. What are the values of \( n \) and \( \ell \) for electrons in the following orbitals?

\[
\begin{array}{cccc}
3s & 4p & 3d & 6f \\
6d & 6p & & \\
\end{array}
\]

3. There are three 2p orbitals. Sketch them, one each on a separate set of cartesian coordinates.

4. If there were 3 electrons in these 2p orbitals, what would the set of 4 quantum numbers for each electron be? Write the set of quantum number under each set of coordinates from question 2.

5. If a 4th electron went into the 2p orbitals, what would its set of quantum numbers be? Where would it be on the sketch?

6. Show where the s block, the p block, the d block, and the f block of elements are on the skeletal periodic table. What are the common names given to the s and p block elements? To the d block elements? To the f block elements?
7. Fill in electrons for elements Be, Mg, Ca, Sr, and Ba using arrows pointing up or down in the following lines. Put the symbol for the element on the left, along with its atomic number:

```
1s   2s   2p   3s   3p   4s   3d   4p   5s   4d   5p   6s
---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---
1s   2s   2p   3s   3p   4s   3d   4p   5s   4d   5p   6s
---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---
1s   2s   2p   3s   3p   4s   3d   4p   5s   4d   5p   6s
---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---
1s   2s   2p   3s   3p   4s   3d   4p   5s   4d   5p   6s
---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---
1s   2s   2p   3s   3p   4s   3d   4p   5s   4d   5p   6s
---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---
```

8. Fill in electrons for elements O, S, Se, and Te using arrows pointing up or down in the following lines. Put the symbol for the element on the left, along with its atomic number:

```
1s   2s   2p   3s   3p   4s   3d   4p   5s   4d   5p   6s
---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---
1s   2s   2p   3s   3p   4s   3d   4p   5s   4d   5p   6s
---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---
1s   2s   2p   3s   3p   4s   3d   4p   5s   4d   5p   6s
---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---
1s   2s   2p   3s   3p   4s   3d   4p   5s   4d   5p   6s
---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---
1s   2s   2p   3s   3p   4s   3d   4p   5s   4d   5p   6s
---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---   ---
```

9. Indicate with an arrow marked “Radius Increasing” the general trend for increasing radius of atoms on the periodic table. Do the same with another arrow marked “Ionization Energy Increasing”. Finally, do the same with an arrow marked “Electronegativity Increasing”.

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10. Explain how the three trends in number 9 are interconnected.

11. Show where metals, non-metals, and semi-metals are located on the periodic table.

12. a) Which sections of the periodic table interact to form ionic compounds?

   b) Which sections interact to form covalent compounds?

   c) Distinguish between pure covalent and polar covalent compounds. Give examples of elements reacting to form each. Indicate where elements that react to form pure covalent and those that form polar covalent are located in the table above.
13. Indicate which blocks of elements form oxides that are acidic anhydrides, and which form oxides that are basic anhydrides.

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14. For the main group elements in row 3, columns 1, 2, 13, and 15 to 17, show the relative size of the atoms and of the ions that form from those atoms. Explain why the ion size differs from the atomic size in the way that they do.

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