5.4 Review Questions

1. If hydrogen's electron exists in a spherical orbital, why doesn't this mean that the electron moves around the nucleus in a circle?

2. What is the difference between a 1s orbital and a 2s orbital? What does that difference indicate about an electron possessing energy equal to $n = 2$ as compared to $n = 1$?

3. Describe the two differences between a $2p_x$ orbital and a $3p_y$ orbital.

4. The lobes of a p orbital disappear at the nucleus. What does this tell us about electrons in p orbitals?

5. You may have heard in previous science classes that the maximum numbers of electrons that can exist in the first four energy levels are 2, 8, 8, and 18 respectively. Do you agree with those numbers and if not, what should they be?

6. The electron configuration for phosphorus, written in core notation, is [Ne] $3s^2\,3p^3$.
What two things does Hund's rule tell us about the three electrons in the 3p sublevel?

7. Use the periodic table to complete the following table:

Atom or Ion	Full Electron Configuration	Core Notation
Ge		
Zn^{2+}		
Sr		
Br^-		
Sn		
In^{3+}		

8. (a) Use the periodic table to identify the neutral atoms having the following electron configurations:

Electron Configuration	Element Name
[Ne] $3\mathbf{s}^2$	
[Ar] $4s^2\,3\mathbf{d}^5$	
[Kr] $5s^2\,4d^{10}\,5\mathbf{p}^3$	
[Xe] $6s^2\,4\mathbf{f}^7$	

(b) Notice where each of these elements is located on the periodic table. Look at the highest energy sublevel being filled (**bold type**) in each of the atoms in the table, and identify the four different sections of the periodic table associated with each of these four sublevels.

9. Consider the following six stable ions: N^{3-}, O^{2-}, F^-, Na^+, Mg^{2+}, and Al^{3+}.
(a) How many electrons are present in each ion?

(b) Write a single electron configuration representing all of the ions.

(c) Which neutral atom possesses this electron configuration? What does this suggest about a possible reason for some ion formation?

10. (a) Complete the following table for some elements in two families of the periodic table.

Alkali Metals	Core Notation	# Outer Electrons	Halogens	Core Notation	# Outer Electrons
lithium			fluorine		
sodium			chlorine		
potassium			bromine		
rubidium			iodine		

(b) Consider the numbers of outer electrons present and suggest a reason why elements belonging to the same chemical family demonstrate similar chemical behaviour.

(c) What change occurs in the atoms as we move down each chemical family?

11. (a) On a separate sheet of paper, draw an orbital diagram for an atom of iron with sublevel energy increasing vertically. Arrange equal energy orbitals in each sublevel horizontally.

(b) Use a highlighter to label the electrons that would be lost when the Fe^{3+} cation forms.

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