Name _____ Section _____ Date _____

Chapter 11: Basic Review Worksheet

1. What is *electromagnetic radiation*?

2. Sketch a representation of a wave and indicate on your drawing one wavelength of the wave.

3. Explain what it means for an atom to be in an *excited state* and what it means for an atom to be in its *ground state*.

4. What is a *photon*?

5. Describe Bohr's model of the hydrogen atom.

6. Explain what is meant by the term *orbital*.

7. What is the symbol for the lowest-energy hydrogen orbital?

8. Give the symbols for each of the orbitals that constitute the third and fourth principal energy levels of hydrogen.

9. Describe *electron spin*.

10. What does the *Pauli exclusion principle* tell us about electrons?

11. List the *order* in which the orbitals are filled as the atoms beyond hydrogen are built up.

12. How many electrons can be placed in a given *s* subshell? In a given *p* subshell? In a specific *p* orbital?

13. Define the *valence electrons* and the *core electrons* in an atom.

14. Sketch the overall shape of the periodic table and indicate the *general regions* of the table that represent the various *s, p, d,* and *f* orbitals being filled.

15. Write the electron configurations for the following atoms:
    a. Na b. N c. Be d. Sr

16. What are the *representative elements*? In what region(s) of the periodic table are these elements found? In what general area of the periodic table are the *metallic* elements found? In what general area of the table are the *nonmetals* found? Where in the table are the *metalloids* located?

17. Define the terms *ionization energy* and *atomic radius*.

18. How do the *ionization energies* and *atomic sizes* of elements vary, both within a vertical group (family) of the periodic table and within a horizontal row (period)?

19. Arrange the following atoms from largest to smallest atomic radius, and from highest to lowest ionization energy.
    a. Na, K, Rb b. C, O, F c. Na, Si, O

Name _____ Section _____ Date _____

Chapter 11: Review Worksheet

1. Give some examples of electromagnetic radiation.

2. Explain what the *wavelength* (λ) and *frequency* (ν) of electromagnetic radiation represent.

3. At what speed does electromagnetic radiation move through space? How is this speed related to λ and ν?

4. How does an excited atom *return* to its ground state?

5. How is the wavelength (color) of light related to the energy of the photons being emitted by an atom? How is the energy of the photons being *emitted* by an atom related to the energy changes taking place *within* the atom?

6. How did Bohr envision the relationship between the electron and the nucleus of the hydrogen atom? How did Bohr's model explain the emission of only discrete wavelengths of light by excited hydrogen atoms? Why did Bohr's model not stand up as more experiments were performed using elements other than hydrogen?

7. How does the wave mechanical picture of the atom fundamentally differ from the Bohr model?

8. How do wave mechanical *orbitals* differ from Bohr's *orbits*? What does it mean to say that an orbital represents a probability map for an electron?

9. Describe the general characteristics of the first (lowest-energy) hydrogen atomic orbital. Does this orbital have a sharp "edge"? Does the orbital represent a surface upon which the electron travels at all times?

10. What do the *principal energy levels* and their sublevels represent for a hydrogen atom? How do we designate specific principal energy levels and sublevels in hydrogen?

11. Describe the sublevels and orbitals that constitute the third and fourth principal energy levels of hydrogen. What are the general shapes of their probability maps?

12. How does electron spin affect the total number of electrons that can be accommodated in a given orbital?

13. Why do we place unpaired electrons in the 2*p* orbitals of carbon, nitrogen, and oxygen?

14. How many electrons overall can be accommodated in the first and second principal energy levels?

15. Why are the valence electrons more important to the atom's chemical properties than the core electrons? How is the number of valence electrons in an atom related to the atom's position on the periodic table?

16. Explain how the valence-electron configuration of most of the elements can be written just by knowing the relative *location* of the element on the table. Give specific examples.

17. Write the electron configurations for the following atoms:
    a. P
    b. Se
    c. Zr
    d. Ce

18. Arrange the following atoms from largest to smallest atomic radius, and from highest to lowest ionization energy.
    a. Na, K, P
    b. Rb, N, Al
    c. Cs, I, O

Name _____ Section _____ Date _____

Chapter 11: Challenge Review Worksheet

1. Do atoms in excited states emit radiation randomly, at any wavelength? Explain.

2. What does it mean to say that the hydrogen atom has only certain *discrete energy levels* available? How do we know this?

3. Why was the quantization of energy levels surprising to scientists when it was first discovered?

4. Schrodinger and de Broglie suggested a "wave-particle duality" for small particles – that is, if electromagnetic radiation showed some particle-like properties, then perhaps small particles might exhibit some wave-like properties. Explain this duality.

5. Use the wave mechanical picture of the hydrogen atom to describe what happens when the atom absorbs energy and moves to an "excited" state.

6. Summarize the postulates of the wave mechanical model of the atom.

7. Explain *why* the ionization energies and atomic sizes of the elements are related to the position on the periodic table.

8. Write an electron configuration for the following atoms that corresponds to an excited state.
   a. C
   b. Cr
   c. Br
   d. Os