Chapter 7 Reading Guide **Name:**

AP Chemistry 2016-2017 **Date:** **Period:**

Concepts in this chapter include photons, light, the photoelectric effect, transitions in electronic energy levels, understanding the historical perspective of how the model of the atom changed, and the evidence leading to each change. These concepts are part of Big Idea 1. The drawing of orbitals and learning quantum numbers are **not** part of the AP Chemistry Curriculum.

7.1 Schrodinger's Cat

1. Why do we need to understand properties and behaviors of electrons?

2. What is true of the **quantum electron** that is not true in the macroscopic world?

3. What atom properties does the Quantum Mechanical Model explain?

7.2 The Nature of Light

4. How are wave **frequency** and **wavelength** related?

5. Describe the difference in wavelength and frequency in high-energy waves and low-energy waves.

6. Define frequency, and give two units used to measure frequency.

7. How are wave frequency and wave speed related?

8. Write the equation relating wave speed, frequency and wavelength. Give the units for each variable.

9. Red light has a wavelength of 700 **nanometers**. How long is this in meters? Write the number using scientific notation. (NOTE: Nanometers are used whenever a problem involves wavelengths in the visible light range. You must be able to convert to meters.)

10. In visible light, which colors have the most energy? The least energy?

11. How did data from the **photoelectric effect** experiments change our understanding of the atom?

12. What is a **photon**?

13. Show how the energy of a photon is related to the speed of light and the wavelength of light.

7.3 Atomic Spectroscopy and the Bohr Model

14. Explain what happens when a gas-filled tube has an electric charge passed through it.

15. Explain what an emission spectrum is and what it can be used for.

16. Use the Bohr model of the atom to explain the bright lines observed in emission spectra.

7.4 The Wave Nature of Matter: The De Broglie Wavelength, the Uncertainty Principle, and Indeterminancy

(NOTE: Focus on key **ideas** in this section. You will not have to calculate the De Broglie wavelength)

17. Why is it impossible to observe both the wave and particle nature of an electron at the same time?

18. Explain how a quantum-mechanical probability distribution map for electrons is different from the trajectory based on Newton's laws of motion.

7.5 Quantum Mechanics and the Atom

(NOTE: You are not responsible for assigning quantum numbers)

19. What is an orbital?

20. Review Figure 7.22. Answer the Conceptual Connection question 7.5 to make sure that you understand the connection between electron transitions and the wavelength of emitted light.

7.6 The Shape of Atomic Orbitals

21. What is shape of an *s* orbital?

22. Where is the highest probability of finding an electron in an *s* orbital?

23. How does the shape of an *s* orbital change from 2*s* to 3*s*?

24. Describe the general shape of a *p* orbital.

25. How many *p* orbitals exist?

26. How many *d* orbitals exist?

27. Why are atoms usually shown as spheres, regardless of the different orbital shapes?