Name _____ Date _____

Electrons in Atoms

Section 2 Quantum Theory and the Atom

Main Idea — Details

Skim *Section 2 of your text. Write three questions that come to mind from reading the headings and the illustration captions.*

1. **Accept all reasonable answers.**
2. _____
3. _____

New Vocabulary *Use your text to define each term.*

ground state — **the lowest allowable energy state of an atom**

quantum number — **number assigned to each orbit of an electron**

de Broglie equation — **equation that predicts that all moving particles have wave characteristics**

Heisenberg uncertainty principle — **states that both the velocity and position of a particle cannot be known at the same time**

quantum mechanical model of the atom — **the atomic model in which electrons are treated as waves**

atomic orbital — **a three-dimensional region around the nucleus**

principal quantum number — **number indicating the relative sizes and energies of atomic orbitals**

principal energy level — **major energy levels of an atom**

energy sublevel — **an energy level contained within a principal energy level**

Name _____ Date _____

Section 2 Quantum Theory and the Atom (continued)

Main Idea — Details

Bohr's Model of the Atom

Use with pages 146–148.

Classify *the characteristics of each series in hydrogen's line spectrum. Include the following information.*

1. Beginning orbit(s)/ending orbit
2. Description of the spectral lines

Balmer	Paschen	Lyman
1. electrons drop from the third, fourth, fifth, and sixth orbits to the second orbit	1. electrons drop from the fourth, fifth, sixth, and seventh orbits to the third orbit	1. electrons drop from all higher orbits to the first orbit
2. four distinct colors	2. infrared	2. ultraviolet

The Quantum Mechanical Model of the Atom

Use with page 149–150.

Sequence *de Broglie's process in developing his equation by completing the flow chart below.*

Whole **numbers** of **wavelengths** are allowed in a circular orbit of fixed **radius**.

→ Light has both **wave** and **particle** characteristics.

→ Can particles of matter, including electrons, behave like **waves**?

→ If an electron has **wavelike motion** and is restricted to circular orbits of fixed radius, the **electron** is allowed only certain possible wavelengths, **frequencies**, and **energies**.

Name _____ Date _____

Section 2 Quantum Theory and the Atom (continued)

Main Idea — Details

The Heisenberg Uncertainty Principle

Use with pages 151–152.

Discuss *how Heisenberg's principle influenced Schrödinger to develop his wave equation.*

Heisenberg's uncertainty principle states that it is impossible to know both the velocity and position of a particle at the same time. This insight allowed Schrödinger to develop an equation for finding the probable location of an electron rather than a specific location. The probable location of the electrons is called the atomic orbital.

Hydrogen's Atomic Orbitals

Use with page 153.

Identify *four facts about atomic orbitals by completing the following statements.*

1. **Principal quantum numbers** indicate the relative sizes and energies of atomic orbitals.
2. The atom's major energy levels are called **principal energy levels**.
3. Principal energy levels contain **sublevels**.
4. The number of **energy sublevels** in a principal energy level **increases** as *n* increases.

SUMMARIZE

Compare and contrast the Bohr and quantum mechanical models of the atom.

Both consider ground state of the atom to be when the electron is in the n = 1 orbit. Bohr believed that atoms moved around the nucleus in certain allowed circular orbits, whereas the quantum model suggests a three-dimensional region around the nucleus called an atomic orbital. The quantum theory further accounts for the chemical behavior of atoms and applies to hydrogen as well as other elements. Bohr's theory only explained the spectrum of hydrogen.