

5.1

MODELS OF THE ATOM

Section Review

Objectives

- Identify inadequacies in the Rutherford atomic model
- Identify the new assumption in the Bohr model of the atom
- Describe the energies and positions of electrons according to the quantum mechanical model
- Describe how the shapes of orbitals at different sublevels vary

Vocabulary

- energy levels
- quantum mechanical model
- quantum
- atomic orbital

Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

The chemical properties of atoms, ions, and molecules are related to the arrangement of the 1 within them. 1. _____

The first modern atomic theory, proposed by 2 , portrayed the atom as a solid, indivisible mass. After the discovery 2. _____

of the electron by 3 , the atomic model was revised to 3. _____

include them. J.J. Thomson's model is referred to as the 4 4. _____

model. Rutherford pictured the atom as a dense 5 5. _____

surrounded by electrons. In the Bohr model, the electrons move 6. _____

in 6 paths. The 7 model is the modern description 7. _____

of the electrons in atoms. This model estimates the 8 of finding an 8. _____

electron within a certain volume of space surrounding the nucleus.

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

_____ 9. Electrons must have a certain minimum amount of energy called a quantum in order to move from one energy level to the next higher energy level.

_____ 10. The electron probability clouds for atomic orbitals are spherical in shape.

- _____ 11. The number of sublevels in an energy level is equal to the square of the principal quantum number of that energy level.
- _____ 12. The maximum number of electrons that can occupy the fourth principal energy level of an atom is 32.
- _____ 13. The higher the energy level occupied by an electron the more energetic it is.
- _____ 14. The principal quantum number equals the number of sublevels within that principal energy level.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A

- _____ 15. quantum
- _____ 16. atomic orbitals
- _____ 17. energy level
- _____ 18. quantum mechanical model

Column B

- a. a region in space around the nucleus of an atom where an electron is likely to be moving
- b. the regions around the nucleus within which the electrons have the highest probability of being found
- c. the amount of energy required to move an electron from its present energy level to the next higher one
- d. the modern description of the behavior of electrons in atoms

Part D Questions and Problems

Answer the following in the space provided.

19. Summarize the development of atomic theory.

20. How many orbitals are in each of the following sublevels?

- a. $4p$ sublevel _____
- b. $3d$ sublevel _____
- c. $4f$ sublevel _____
- d. $2s$ sublevel _____