

MODELS OF THE ATOM

5.1

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
- quantum mechanical model
- 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. electrons within them.
- The first modern atomic theory, proposed by 2. J. Dalton portrayed the atom as a solid, indivisible mass. After the discovery of the electron by 3. JJ Thomson, the atomic model was revised to include them. JJ Thomson's model is referred to as the 4. plum pudding model. Rutherford pictured the atom as a dense 5. nucleus surrounded by electrons. In the Bohr model, the electrons move in 6. circular paths. The 7. quantum mech. model is the modern description of the electrons in atoms. This model estimates the 8. probability of finding an 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.

- AT 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.
- ST 10. The electron probability clouds for atomic orbitals are spherical in shape.

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

- C 15. quantum
- A B 16. atomic orbitals
- B A 17. energy level
- D 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. p. 128
 Dalton proposed indestructible particles - atom
 Thomson - neg. e- embedded in + mass.
 Rutherford - sm. dense + nucleus, space - e-
 Bohr - conc. circles for e-
 Q. van. Mech. Model - e- in prob. clouds
20. How many orbitals are in each of the following sublevels?
 a. 4p sublevel 3 S-1
 b. 3d sublevel 5 P-3
 c. 4f sublevel 7 J-5
 d. 2s sublevel 1 F-7