

## Section 5.2 Quantum Theory and the Atom

*In your textbook, read about the Bohr model of the atom.*

Use each of the terms below to complete the statements.

atomic emission spectrum	electron	frequencies	ground state
higher	energy levels	lower	

- The lowest allowable energy state of an atom is called its \_\_\_\_\_.
- Bohr's model of the atom predicted the \_\_\_\_\_ of the lines in hydrogen's atomic emission spectrum.
- According to Bohr's atomic model, the smaller an electron's orbit, the \_\_\_\_\_ the atom's energy level.
- According to Bohr's atomic model, the larger an electron's orbit, the \_\_\_\_\_ the atom's energy level.
- Bohr proposed that when energy is added to a hydrogen atom, its \_\_\_\_\_ moves to a higher-energy orbit.
- According to Bohr's atomic model, the hydrogen atom emits a photon corresponding to the difference between the \_\_\_\_\_ associated with the two orbits it transitions between.
- Bohr's atomic model failed to explain the \_\_\_\_\_ of elements other than hydrogen.

*In your textbook, read about the quantum mechanical model of the atom.*

Answer the following questions.

- If you looked closely, could you see the wavelength of a fast-moving car? Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

- Using de Broglie's equation,  $\lambda = \frac{h}{mv}$  which would have the larger wavelength, a slow-moving proton or a fast-moving golf ball? Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

**Section 5.2** *continued*

In your textbook, read about the Heisenberg uncertainty principle.

For each item in Column A, write the letter of the matching item in Column B.

## Column A

## Column B

- |  |   |
|--|---|
| _____ 10. The modern model of the atom that treats electrons as waves  | a. Heisenberg uncertainty principle     |
| _____ 11. States that it is impossible to know both the velocity and the position of a particle at the same time | b. Schrödinger wave equation            |
| _____ 12. A three-dimensional region around the nucleus representing the probability of finding an electron      | c. quantum mechanical model of the atom |
| _____ 13. Originally applied to the hydrogen atom, it led to the quantum mechanical model of the atom            | d. atomic orbital                       |

Answer the following question.

14. How do the Bohr model and the quantum mechanical model of the atom differ in how they describe electrons?

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In your textbook, read about hydrogen's atomic orbitals.

In the space at the left, write the term in parentheses that correctly completes the statement.

- \_\_\_\_\_ 15. Atomic orbitals (do, do not) have an exactly defined size.
- \_\_\_\_\_ 16. Each orbital may contain at most (two, four) electrons.
- \_\_\_\_\_ 17. All s orbitals are (spherically shaped, dumbbell shaped).
- \_\_\_\_\_ 18. A principal energy has ( $n$ ,  $n^2$ ) energy sublevels.
- \_\_\_\_\_ 19. The maximum number of (electrons, orbitals) related to each principal energy level equals  $2n^2$ .
- \_\_\_\_\_ 20. There are (three, five) equal energy p orbitals.
- \_\_\_\_\_ 21. Hydrogen's principal energy level 2 consists of (2s and 3s, 2s and 2p) orbitals.
- \_\_\_\_\_ 22. Hydrogen's principal energy level 3 consists of (nine, three) orbitals.