

## 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       |              |

1. The lowest allowable energy state of an atom is called its \_\_\_\_\_ .
2. Bohr's model of the atom predicted the \_\_\_\_\_ of the lines in hydrogen's atomic emission spectrum.
3. According to Bohr's atomic model, the smaller an electron's orbit, the \_\_\_\_\_ the atom's energy level.
4. According to Bohr's atomic model, the larger an electron's orbit, the \_\_\_\_\_ the atom's energy level.
5. Bohr proposed that when energy is added to a hydrogen atom, its \_\_\_\_\_ moves to a higher-energy orbit.
6. 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.
7. 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.**

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

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9. 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.

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*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**

\_\_\_\_\_ **10.** The modern model of the atom that treats electrons as waves

\_\_\_\_\_ **11.** States that it is impossible to know both the velocity and the position of a particle at the same time

\_\_\_\_\_ **12.** A three-dimensional region around the nucleus representing the probability of finding an electron

\_\_\_\_\_ **13.** Originally applied to the hydrogen atom, it led to the quantum mechanical model of the atom

**Column B**

**a.** Heisenberg uncertainty principle

**b.** Schrödinger wave equation

**c.** 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.