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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 ground state.
2. Bohr's model of the atom predicted the frequencies of the lines in hydrogen's atomic emission spectrum.
3. According to Bohr's atomic model, the smaller an electron's orbit, the lower the atom's energy level.
4. According to Bohr's atomic model, the larger an electron's orbit, the higher the atom's energy level.
5. Bohr proposed that when energy is added to a hydrogen atom, its electron 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 energy levels associated with the two orbits it transitions between.
7. Bohr's atomic model failed to explain the atomic emission spectrum 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.
   No; the wavelength is far too small to be seen or measured even with the most sensitive scientific instrument.
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.
   The proton would have the larger wavelength because wavelength increases with decreasing mass and velocity.

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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
c	10. The modern model of the atom that treats electrons as waves	a. Heisenberg uncertainty principle
a	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
d	12. A three-dimensional region around the nucleus representing the probability of finding an electron	c. quantum mechanical model of the atom
b	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?
    The quantum mechanical model treats electrons as waves and does not describe the electrons' path around the nucleus. The Bohr model treats electrons as particles traveling in specific circular orbits.

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.

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