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Chapter 5

STUDY GUIDE

5.1 MODERN ATOMIC STRUCTURE

Complete the sentence or answer the question.

1. Define or explain the following.
   a. wave-particle duality of nature _____
   b. Newtonian mechanics _____
   c. quantum mechanics _____
   d. the Heisenberg uncertainty principle _____
   e. quantum numbers _____

2. The product of mass and velocity of an object is called the _____.

3. The French scientist whose hypothesis on the wave nature of particles helped lead to the present-day theory of atomic structure was _____.

4. The region in which an electron travels around the nucleus of an atom is called a(n) _____.

5. Complete the table, using de Broglie's equation, $\lambda = \frac{h}{mv}$, for the wavelength λ of a particle of mass m and velocity v. Note: Planck's constant $h = 6.63 \times 10^{-34}$ kg · m²/s.

m (kg)	v (m/s)	λ (m)
0.005 00	9.10×10^{6}	
0.0220		1.51×10^{-34}
	5.10	1.13×10^{-5}

6. Explain what is meant by the *probability* of finding an electron at a point in space.

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Write T *for true or* F *for false. If a statement is false, replace the underlined word or phrase with one that will make the statement true, and write your correction on the blank provided.*

_____ 7. De Broglie used Einstein's relationship between matter and energy and Schrödinger's wave equation to develop his equation for wavelength of a particle.

_____ 8. To be able to give a full description of an electron, you would need to know two things: its present position and its radius.

_____ 9. It is impossible to know both the exact position and the exact momentum of an object at the same time.

_____ 10. One of the most important developments of Schrödinger's wave equation was the idea of quantum numbers, which describe the behavior of electrons.

_____ 11. In Schrödinger's wave equation, n can have only negative whole number values.

Match each mathematical expression with the correct description.

a. de Broglie's equation for the wavelength of a particle
b. Einstein's equation relating matter and energy
c. Planck's quantum equation
d. term for total energy in Schrödinger's wave equation

___ 12. $\lambda = \frac{h}{mv}$

___ 13. $\frac{2\pi^2 me^4}{h^2 n^2}$

___ 14. $E = h\nu$

___ 15. $E = mc^2$