Understanding De Broglie's Wave-Particle Duality

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Response: The correct statement is **(1) Describes wave-particle duality of matter**.

Key Concepts

- **De Broglie Equation:** Expressed as $\lambda = \frac{h}{p} = \frac{h}{mv}$, where λ represents the wavelength (a wave property) and p or mv represents momentum/mass (a particle property).
- **Wave-Particle Duality:** By relating wavelength directly to momentum, the equation bridges the gap between wave and particle descriptions, illustrating that moving matter possesses both wave and particle characteristics.

Why the Other Options Are Incorrect

- **(2) & (3):** The equation does not describe wave or particle nature in isolation; it explicitly links both properties together.
- **(4):** The equation is theoretical and applies to **all** moving objects regardless of size. While the wavelength of macroscopic objects is extremely small and undetectable in practice, the equation mathematically still applies.
- **(5):** α particles (helium nuclei) are microscopic moving particles with mass and momentum, so they follow de Broglie's relation and display wave properties under appropriate conditions.
