de Broglie Equation Practice

Name KEY Pd. _____ Date _____

$$\lambda = \frac{h}{mv}$$

1. Use the de Broglie relationship to determine the wavelength of an 85-kg person skiing at 50 km/hr.

$50\ \frac{km}{hr} \times \frac{1000\ m}{1\ km} \times \frac{1\ hr}{3600\ s} = 13.88\ m/s$

$$\lambda = \frac{(6.626\times10^{-34}\ J\cdot s)}{(85\ kg)(13.88\ m/s)}$$

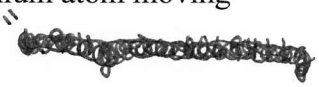
$$\lambda = 5.6\times10^{-37}\ m$$

2. Use the de Broglie relationship to determine the wavelength of a 10.0-g bullet fired at 250 m/s.

$$\lambda = \frac{(6.626\times10^{-34}\ J\cdot s)}{(0.010\ kg)(250\ m/s)}$$

$$\lambda = 2.65\times10^{-34}\ m$$

3. Use the de Broglie relationship to determine the wavelength of a lithium atom moving at 2.5×10^5 m/s.



$$\lambda = \frac{(6.626\times10^{-34}\ Js)}{(1.15\times10^{-25}\ kg)(2.5\times10^{5}\ m/s)} = 2.3\times10^{-14}\ m$$

4. Neutron diffraction is an important technique for determining the structures of molecules. Calculate the velocity of a neutron that has a characteristic wavelength of 0.955 Å. (The mass of a neutron is 1.675×10^{-24}g).

$0.955\ \text{Å} \times \frac{1\times10^{-10}\ m}{1\ \text{Å}} =$

$$(9.55\times10^{-11}\ m) = \frac{(6.626\times10^{-34}\ J\cdot s)}{(1.675\times10^{-27})\ V}$$

$$V = 4142\ m/s$$

$1.675\times10^{-24}\ g \times \frac{1\ kg}{1000\ g}$

$$\frac{(9.55\times10^{-11})(1.675\times10^{-27})}{(9.55\times10^{-11})(1.675\times10^{-27})}V = \frac{6.626\times10^{-34}}{1.5996\times10^{-37}}$$

5. When an electron is accelerated through a particular potential field, it attains a speed of 9.38×10^6 m/s. What is the characteristic wavelength of this electron? (Mass of an electron = 9.11×10^{-28} g).

$$\lambda = \frac{(6.626\times10^{-34}\ J\cdot s)}{(9.11\times10^{-28}\ kg)(9.38\times10^{6}\ \frac{m}{s})}$$

$$\lambda = 7.75\times10^{-14}\ m$$