2.6 (*a*) The wavelength of green light is $\lambda = 550$ nm. If an electron has the same wavelength, determine the electron velocity and momentum. (*b*) Repeat part (*a*) for red light with a wavelength of $\lambda = 440$ nm. (*c*) For parts (*a*) and (*b*), is the momentum of the photon equal to the momentum of the electron?

a) Per (2.2), $p = \frac{h}{\lambda} = \frac{6.62607 \times 10^{-34}}{550 \times 10^{-9}}$

$$p_g = 1.2047 \times 10^{-27} \text{ kg m/s}$$

$$v_g = \frac{p_g}{m_0} = \frac{1.2047 \times 10^{-27}}{9.1093837 \times 10^{-31}} \Rightarrow v_g = 1322.53 \text{ m/s}$$

b) $p_r = \frac{6.62607 \times 10^{-34}}{440 \times 10^{-9}} \Rightarrow p_r = 1.5059 \times 10^{-27} \text{ kg m/s}$

$$v_r = \frac{p_r}{m_0} = \frac{1.5059 \times 10^{-27}}{9.1093837 \times 10^{-31}} \Rightarrow v_r = 1653.16 \text{ m/s}$$

Note: A wavelength of 440 nm corresponds to a purple/indigo/violet color NOT red (652 – 740 nm).

c) Per de Broglie, Yes