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(38) $p = \frac{h}{\lambda}$

$$\lambda = \frac{h}{mv} = \frac{(6.63\times10^{-34}\ \text{J·s})}{(1.6\times10^{-27}\ \text{kg})(5.5\times10^{4}\ \text{ms}^{-1})} = 7.5\times10^{-12}\ \text{m}$$

(44) $\lambda = \frac{h}{mv}$ $\qquad W = qV = \frac{1}{2}mv^2$

$$v = \sqrt{\frac{2qV}{m}}$$

$$\lambda = \frac{h}{m}\sqrt{\frac{m}{2qV}} = \sqrt{\frac{h^2}{2mqV}} = \sqrt{\frac{(6.63\times10^{-34}\ \text{Js})^2}{2(9.11\times10^{-31}\ \text{kg})(1.6\times10^{-19}\text{C})(2\times10^{4}\text{V})}}$$

$\lambda = 8.68\times10^{-12}\ \text{m}$

negligible diffraction

$$\theta = \frac{\lambda}{h} = \frac{8.68\times10^{-12}\ \text{m}}{5\times10^{-2}\ \text{m}} = 1.74\times10^{-10}\ \text{radians}$$

very, very small

(43) $E_p = \frac{1}{2}m_p v_p^2$ $\qquad E_e = \frac{1}{2}m_e v_e^2$ $\qquad E_p = E_e = E$

$$v_p = \sqrt{\frac{2E}{m_p}} \qquad v_e = \sqrt{\frac{2E}{m_e}}$$

$$\lambda_p = \frac{h}{m_p v_p} \qquad \lambda_e = \frac{h}{m_e v_e}$$

$$= \frac{h}{m_p}\sqrt{\frac{m_p}{2E}} \qquad = \frac{h}{m_e}\sqrt{\frac{m_e}{2E}}$$

$$\lambda_p = \sqrt{\frac{h^2}{2m_p E}} \qquad \lambda_e = \sqrt{\frac{h^2}{2m_e E}}$$

$m_p > m_e$

$\therefore \quad \lambda_p < \lambda_e$

(45) $\lambda = \frac{h}{p}$ $\lambda < 10\,m$

so calculate p for $\lambda = 10\,m$.

$$p = \frac{h}{\lambda} = \frac{6.63 \times 10^{-34}\ Js}{10\ m} = 6.63 \times 10^{-35}\ kg\,m\,s^{-1}$$

$p = mv$

$$v = \frac{p}{m} = \frac{6.63 \times 10^{-35}\ kg\,ms^{-1}}{1400\ kg} = 4.7 \times 10^{-38}\ ms^{-1}$$

$$\frac{30\ ms^{-1}}{4.7 \times 10^{-38}\ ms^{-1}} = 6.3 \times 10^{38}\ \text{times smaller}$$