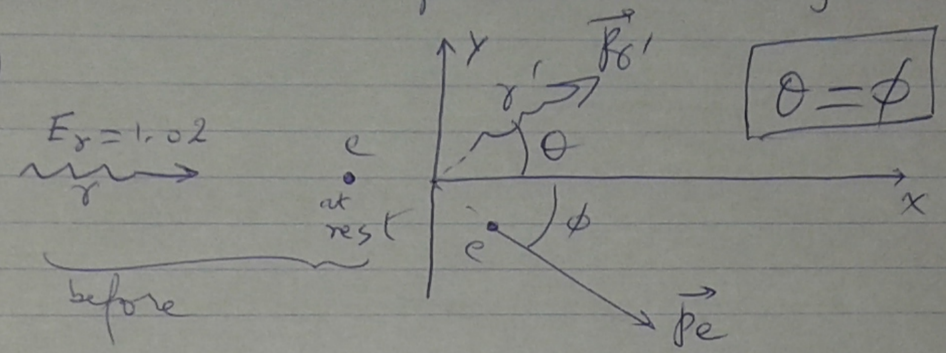
Solutions_Problems Ch. 3

24&25 : same as problem 2 in Assignment 3

(29)



Conservation of momentum:

$$Y: \quad 0 + 0 = p_{\gamma'} \sin\theta - p_e \sin\theta \quad \Rightarrow p_e = p_{\gamma'} = \frac{E_{\gamma'}}{c}$$

$$X: \quad \frac{E_\gamma}{c} + 0 = \frac{E_{\gamma'}}{c} \cos\theta + p_e \cos\theta \Rightarrow \cos\theta = \frac{E_\gamma}{E_{\gamma'} + p_e c} = \frac{E_\gamma}{2E_{\gamma'}}$$

Conservation of Energy $E_\gamma + m_e c^2 = E_{\gamma'} + \sqrt{m_e^2 c^4 + p_e^2 c^2}$

$$= E_{\gamma'} + \sqrt{m_e^2 c^4 + E_{\gamma'}^2}$$

$$\sqrt{m_e^2 c^4 + E_{\gamma'}^2} = E_\gamma + m_e c^2 - E_{\gamma'}$$

$$m_e^2 c^4 + E_{\gamma'}^2 = E_\gamma^2 + 2 m_e c^2 E_\gamma - 2 E_\gamma E_{\gamma'} + m_e^2 c^4 - 2 m_e c^2 E_{\gamma'} + E_{\gamma'}^2$$

$$E_{\gamma'} = \frac{(E_\gamma + 2 m_e c^2) E_\gamma}{2(E_\gamma + m_e c^2)} = 0.680 \text{ MeV}$$

$$\cos\theta = \frac{E_\gamma}{E_{\gamma'} + E_{\gamma'}} = \frac{1.02}{1.36} \Rightarrow \theta = 41.4^\circ$$