

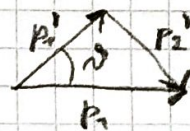
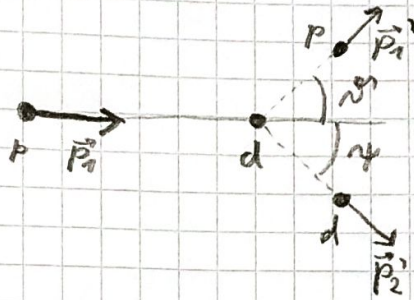
1a) $E_{k1} = 25 \text{ MeV}$

$\vartheta = 30^\circ$

$E_{k1}', p_1', v_1' = ?$

$\varphi = ?$

$E_{k2}', p_2', v_2' = ?$



ZZH: $0 = p_1' \sin \vartheta - p_2' \sin \varphi$
 $p_1 = p_1' \cos \vartheta + p_2' \cos \varphi$

$p_2'^2 = p_1^2 + p_1'^2 - 2p_1 p_1' \cos \vartheta$

ZZE: $\frac{p_1^2}{2m_1} = \frac{p_1'^2}{2m_1} + \frac{p_2'^2}{2m_2}$

$p_1^2 = p_1'^2 + \frac{m_1}{m_2} p_2'^2$

$p_1'^2 \left(1 + \frac{m_1}{m_2}\right) - p_1' 2 \frac{m_1}{m_2} p_1 \cos \vartheta - p_1^2 \left(1 - \frac{m_1}{m_2}\right) = 0$, $p_1 = \sqrt{2m_1 E_{k1}}$

$E_{k1}' \left(1 + \frac{m_1}{m_2}\right) - \sqrt{E_{k1}'} 2 \frac{m_1}{m_2} \sqrt{E_{k1}} \cos \vartheta - E_{k1} \left(1 - \frac{m_1}{m_2}\right) = 0$

$E_{k1}' = 21,82 \text{ MeV}$, $p_1' = \sqrt{2m_1 E_{k1}'} = 202,32 \text{ MeV}/c$, $v_1' = \frac{p_1'}{m_1} = 0,22c$

$E_{k2}' = E_{k1} - E_{k1}' = 3,18 \text{ MeV}$, $p_2' = \sqrt{2m_2 E_{k2}'} = 109,22 \text{ MeV}/c$,

$v_2' = 0,06c$

$\sin \varphi = \frac{p_1'}{p_2'} \sin \vartheta$

$\cos \varphi = \frac{p_1 - p_1' \cos \vartheta}{p_2'}$

$\varphi = 67,8^\circ$