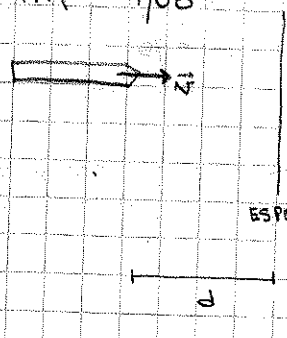
EX FM IPA 7/08

① 

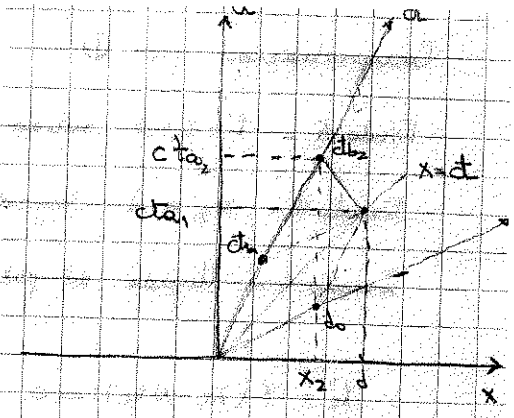

a) $t_{a_1} = \frac{d}{c}$

$t_{a_2} - t_{a_1} = \frac{d - x_2}{c}$

$t_{a_2} = \frac{x_2}{v} \rightarrow x_2 = v t_{a_2}$

$t_{a_2} = \frac{d - v t_{a_2}}{c} + \frac{d}{c}$

$t_{a_2} = \frac{2d}{c} \frac{1}{1 + v/c} = \frac{10}{9} \frac{d}{c} \rightarrow \boxed{t_a = \frac{10}{9} \frac{d}{c}}$




b) $d_0 = \frac{d}{\gamma} = \frac{3}{5} d$

$t_{b_1} = \frac{3}{5} d/c$

$d - x_2 = d - v t_{a_2} = d - 0{,}8 \times \frac{10}{9} d$

$d - x_2 = \left(1 - \frac{40}{45}\right) d = \left(1 - \frac{8}{9}\right) d = \frac{d}{9}$ ($0{,}8 = \frac{4}{5}$)

$d'_{20} = \frac{d}{9\gamma} = \frac{d \cdot 3}{9 \times 5} = \frac{d}{15}$

$ct_{b_2} - ct_{b_1} = \frac{d}{15}$

$t_{b_2} = \frac{d}{15c} + t_{b_1} = \left(\frac{1}{15} + \frac{3}{5}\right) \frac{d}{c} = \frac{10}{15} \frac{d}{c} = \frac{2}{3} \frac{d}{c} \rightarrow \boxed{t_b = \frac{2}{3} \frac{d}{c}}$

$0/12 = 1/0{,}9 = \frac{10}{9}$

② $E = 15{,}7\ \text{MeV} = 15{,}7 \times 1{,}6 \times 10^{-19} \times 10^6\ \text{J} = 2{,}51 \times 10^{-12}\ \text{J}$

Ⓗ (no relativista) $E = \frac{m_0 v^2}{2} \rightarrow v = \sqrt{2K/m_0} = 7{,}8c$ NO VALE !!

$K^2 = E^2 - m_0^2 c^4 = 6{,}3 \times 10^{-24} = p^2 c^2 \rightarrow p = 8{,}37 \times 10^{-21}\ \text{kg m/s}$ $\quad \lambda = \frac{h}{p} = 7{,}9 \times 10^{-14}\ \text{m}$

$r = 10^{-15} A^{1/3} = 2{,}3 \times 10^{-15}\ \text{m}$ $\quad \text{sen}\,\theta_{mín} = \frac{\lambda}{2r}$ (DIFRACCIÓN) $\quad \frac{\lambda}{2r} = 17 \rightarrow$ NO SE OBSERVARÍA

$\text{sen}\,\theta_{mín} = \text{sen}\,15° = \frac{\lambda}{2r} \rightarrow \lambda \cong 1{,}2 \times 10^{-15}\ \text{m} \rightarrow p = 5{,}6 \times 10^{-19}\ \text{kg m/s}$

$K = pc = 1043\ \text{MeV}$

$E_0 = m_0 c^2 = 8{,}19 \times 10^{-14}\ \text{J}$

$E_0 = 0{,}512\ \text{MeV} \ll K$

③ 


$K_0 = 187\ \text{MeV}$

$M_0 = 12u = 2{,}0 \times 10^{-26}\ \text{kg}$

$E_0 = M_0 c^2 = 1{,}79 \times 10^{-9}\ \text{J} = 11{,}2\ \text{GeV}$

e⁻ $E^2 = m_0^2 c^4 + p^2 c^2 \cong p^2 c^2 = (187\ \text{MeV})^2$

N⁺ $E^2 = M_0^2 c^4 + p'^2 c^2$

a) $\Delta E = 2\ \text{MeV}$ que se emplean en un "retroceso" del átomo

b) Más allá de esos 2MeV, el choque elástico se produjo con átomos en su estado fundamental, mientras los inelásticos corresponden a que el e⁻ incidente logró excitar los niveles del carbono entregándole:

$\Delta E_1 \cong 185{,}0 - 180{,}5\ \text{MeV} = 4{,}5\ \text{MeV}$ ; $\Delta E_2 \cong 185{,}0 - 177 = 8\ \text{MeV}$ ; $\Delta E_3 \cong 185 - 175{,}5 = 9{,}5\ \text{MeV}$