FÍSICA MODERNA – 1° PARCIAL 2024

PROBLEMA 1

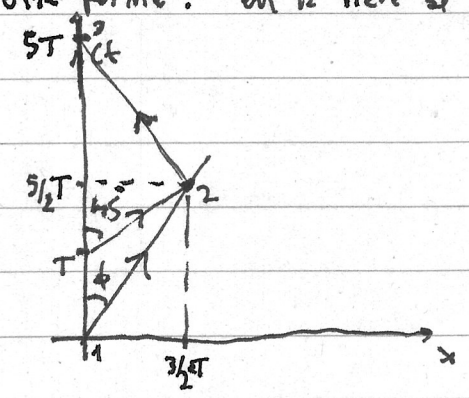
a) $\Delta X_{nave} = \Delta X_{pulso} \Rightarrow Mt = C(t-T) \Rightarrow 0{,}6Ct = C(t-T) \Rightarrow 0{,}4t = T \Rightarrow \boxed{t = \frac{5}{2}T}$ ($M = 0{,}6C$)

$\Rightarrow x = 0{,}6Ct = \frac{3}{5}C\frac{5}{2}T \Rightarrow \boxed{x = \frac{3}{2}CT}$

b) Por T. Lorentz: $t' = \gamma\left(t - \frac{v}{c^2}x\right) = \frac{5}{4}\left(\frac{5}{2}T - \frac{3}{5}\frac{3}{2}T\right) = \frac{5}{4}\cdot\frac{8}{5}T \Rightarrow \boxed{t' = 2T}$ ($\gamma(0{,}6c) = 5/4$)

Otra forma: en la nave se percibe el tiempo propio $\tau = \frac{\Delta t}{\gamma} = \frac{5}{2}T\cdot\frac{4}{5} = 2T$ ✓

c)



$\tan\phi = \beta = \frac{v}{c} = 0{,}6 \Rightarrow \phi \simeq 31°$

PROBLEMA 2

a) $E_i = E_F = E + 4E = 5E$

$\vec{p}_i = \vec{p}_F = \frac{4E}{c}\hat{\imath} - \frac{E}{c}\hat{\imath} = \frac{3E}{c}\hat{\imath}$

$\Rightarrow \frac{E_i^2}{c^2} - \vec{p}_i^{\,2} = M^2C^2 \Rightarrow \frac{(5E)^2}{c^2} - \frac{(3E)^2}{c^2} = M^2C^2$

$\frac{16E^2}{c^2} = M^2C^2 \Rightarrow \boxed{M = \frac{4E}{c^2}}$

NOTE QUE COMO $\vec{p}_i \neq 0$, EL BOSON NO DECAE EN REPOSO

b) $E = \gamma Mc^2$, $p = \gamma Mv$ $\Rightarrow \frac{E}{p} = \frac{c^2}{v} \Rightarrow M = \frac{pc^2}{E} = \frac{3E\,c^2}{c\,5E} \Rightarrow \boxed{M = \frac{3}{5}c}$

c) En MCM: $E_i = E_F \Rightarrow M_*c^2 = E_1 + E_2 \Rightarrow \boxed{4E = E_1 + E_2}$

$\vec{p}_i = \vec{p}_F \Rightarrow |\vec{p}_1| = |\vec{p}_2| \Rightarrow \frac{E_1}{c} = \frac{E_2}{c} \Rightarrow \boxed{E_1 = E_2}$

$\Rightarrow \boxed{E_1 = E_2 = 2E}$

$\Rightarrow \boxed{\begin{cases} \vec{p}_1 = \frac{2E}{c}\hat{\imath} \\ \vec{p}_2 = -\frac{2E}{c}\hat{\imath} \end{cases}}$

PROBLEMA 3

a) $\frac{hc}{\lambda} = \phi + 1\,eV \Rightarrow \frac{2hc}{\lambda} = 2\phi + 2\,eV$

$\frac{2hc}{\lambda} = \phi + 4\,eV$

$0 = \phi - 2\,eV \Rightarrow \boxed{\phi = 2\,eV}$

b) $I = \frac{E}{A\cdot\Delta t} = \frac{N\cdot E_{Fotón}}{A\cdot\Delta t} = \frac{N\cdot h\nu_0}{A\cdot\Delta t} = \frac{N\cdot\phi}{A\Delta t} \Rightarrow \boxed{\frac{N}{\Delta t} = \frac{I\cdot A}{\phi} = 2\times10^{18}\ e/s}$

c) $r \propto n^2 \Rightarrow \frac{r_i}{r_f} = \frac{9}{4} = \frac{3^2}{2^2} \Rightarrow \begin{cases} n_i = 3 \\ n_F = 2 \end{cases} \Rightarrow |\Delta E| = 13{,}6\,eV\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = 1{,}89\,eV$

$\Rightarrow E_{fotón} = |\Delta E| = 1{,}89\,eV < 2\,eV = \phi \Rightarrow$ No hay efecto fotoeléctrico.