Final Physique Moderne

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Ex 1) $\Delta t = 10 \Delta t_p$

donc $\gamma = 10 \Rightarrow \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} = 10$

$\frac{1}{1-\frac{v^2}{c^2}} = 100 \Rightarrow 1 = 100 - \frac{100 v^2}{c^2}$

$\frac{-v^2 \times 100}{c^2} = -99 \Rightarrow v^2 = 0{,}99 c^2 \Rightarrow$ $\boxed{v = 0{,}994c}$

Ex 2 :

il faut que λ est comparable avec taille de l'environnement

$E_{ph} = \frac{hc}{\lambda}$ donc $E_{ph\,min} \longrightarrow \lambda_{max}$

$\lambda_{max} = 0{,}25\,nm$

$E_{ph\,min} = \frac{hc}{\lambda_{max}} = \frac{1240}{0{,}25} = \boxed{4960\ e.V}$

Ex 3 :

$\lambda = 400\,nm$; $E_c = 1{,}2\,eV$

$E_{cr} = \frac{hc}{\lambda} - \phi \Rightarrow \phi = \frac{hc}{\lambda} - E_{cr}$

$E_{cr} = E_c - E_{rc} = 1{,}2 - m_e c^2$

$= 1{,}2 - 0{,}511 \times 10^{-6}$

$= 1{,}1999\ e.V$

$\phi = \frac{1240}{400} - 1{,}1999$

$\phi = \boxed{1{,}9\ e.V}$

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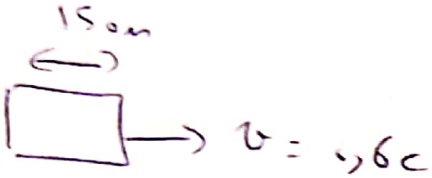
Ex4 :

La relativité est connue lorsque $v < c$ dans le vide

Ex5 :



$l_p = 15\,m$

$v = 0,6c$

$l = \frac{1}{\gamma} l_p = \sqrt{1 - \frac{v^2}{c^2}}\, l_p = \sqrt{1 - 0,6^2} \times 15$

$\boxed{l = 12\,m}$

Ex6 :

D'après conservation de l'énergie

$E_{ph} + \cancel{E_{ce^-}}^{mc^2} = E'_{ph} + E_{ce^-} + \cancel{E_{re^-}}^{mc^2}$

$E_{ph} = 400 + 150 = 550$ eV

$\frac{Q_c}{\lambda} = 55.000$ e.V

$\lambda = \frac{1240}{55.000} = \boxed{2,25 \cdot 10^{-3}\ nm}$

Ex 7 :

$$E_c = E_r$$

$$(\gamma - 1)mc^2 = mc^2$$

$$\gamma - 1 = 1 \Rightarrow \gamma = 2$$

$$\frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = 2 \Rightarrow 1 = 4\left(1 - \frac{v^2}{c^2}\right)$$

$$1 = 4 - \frac{4v^2}{c^2} \Rightarrow -\frac{4}{c^2}v^2 = -3$$

$$v^2 = \frac{3}{4}c^2 \Rightarrow \boxed{v = 0,86\,c}$$

Ex 8 : $m = 3 \cdot 10^{-4}\ kg$

$$\Delta v = \pm 10^{-6}\ m/s$$

$$\Delta x \cdot \Delta p_x = \frac{\hbar}{2} = \frac{h}{4\pi}$$

$$\Delta x \times m \times \Delta v = \frac{h}{4\pi}$$

$$\Delta x = \frac{h}{4\pi \times m \times \Delta v} = \pm \frac{6,6267 \times 10^{-34}}{4\pi \times 3 \times 10^{-4} \times 10^{-6}}$$

$$\Delta x = \pm 1,757619 \times 10^{-25}\ m$$