

**Vakioita:**

$\epsilon_0 = 8.854 \times 10^{-12} C^2/N \cdot m^2$ ,  $\mu_0 = 4\pi \times 10^{-7} T \cdot m \cdot A^{-1}$  ja  $e = 1.602 \times 10^{-19} C$ .  $1eV = 1.602 \times 10^{-19} J$ .  
 $c = 3.0 \times 10^8 m/s$ , elektronin massa  $m_e = 9.11 \times 10^{-31} kg$ ,  $\hbar = \frac{h}{2\pi} = 1.05 \times 10^{-34} Js$ ,  $h = 6.626 \times 10^{-34} Js = 4.136 \times 10^{-15} eV \cdot s$ .

Matemaattisia kaavoja:  $\sin^2(\alpha) + \cos^2(\alpha) = 1$ ,

Ohessa sekalainen kokoelma kaavoja, joista voi olla hyötyä. Huomaa, että kaikki kaavat eivät ole yleispäteviä vaan soveltuvat vain erikoistapauksiin

$$\begin{aligned} x &= x' + ut & y &= y' & z &= z' & t &= t' & v &= v' + u \\ x' &= \gamma(x - ut) & y' &= y & z' &= z & t' &= \gamma(t - ux/c^2) & v' &= \frac{v-u}{1-uv/c^2} & v &= \frac{v'+u}{1+u'v'/c^2} \end{aligned}$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{u^2}{c^2}}} \quad \Delta t = \gamma \Delta t_0 \quad l = \frac{l_0}{\gamma}$$

$$\frac{f}{f_0} = \sqrt{\frac{c+v}{c-v}} \text{ sinisiirtymä.} \quad \frac{f}{f_0} = \sqrt{\frac{c-v}{c+v}} \text{ punasiirtymä.}$$

$$\vec{p} = \gamma m \vec{v} \quad E = K + mc^2 \quad K = (\gamma - 1)mc^2 \quad E = \gamma mc^2 \quad E = \sqrt{(mc^2)^2 + (pc)^2}$$

$$E = hf = h \frac{c}{\lambda} \quad E = pc \quad \lambda = h/p \quad p = h/\lambda \quad \Delta x \Delta p \geq \frac{\hbar}{2} \quad \Delta E \Delta t \geq \frac{\hbar}{2}$$

$$K_{\max} = hf - \phi \quad hf = E_f - E_i \quad hf = E_i - E_f \quad hf = n_f^2 E_1 - n_i^2 E_1 \quad \frac{1}{\lambda} = R \left( \frac{1}{m^2} - \frac{1}{n^2} \right)$$

$$-\frac{\hbar^2}{2m} \frac{d^2 \psi}{dx^2} + U\psi = E\psi \quad \psi = \sqrt{2/L} \sin(n\pi x/L) \quad \int_{-\infty}^{\infty} |\psi|^2 dx = 1$$

$$E_n = \frac{n^2 \hbar^2}{8mL^2} \quad E = (n + \frac{1}{2}) \hbar \omega \quad E = -\frac{13.60 \text{ eV}}{n^2} \quad E = -\frac{Z_{\text{eff}}^2 13.60 \text{ eV}}{n^2}$$

$$L = \sqrt{l(l+1)} \hbar \quad L_z = m_l \hbar \quad S = \sqrt{s(s+1)} \hbar \quad S_z = m_s \hbar$$