Formules – PHS0102

Constantes

$k = \dfrac{1}{4\pi\varepsilon_0} = 9\times10^9 \text{ N.m}^2/\text{C}^2$

$\varepsilon_0 = 8{,}85\times10^{-12} \text{ F/m}$

$\mu_0 = 4\pi\times10^{-7} \text{ T}\cdot\text{m/A}$

$m_p = 1{,}672\times10^{-27} \text{ kg}$

$m_e = 9{,}109\times10^{-31} \text{ kg}$

$e = 1{,}602\times10^{-19} \text{ C}$

$1 \text{ eV} = 1{,}602\times10^{-19} \text{ J}$

Mécanique

$v_x = v_{0x} + a_x t$

$x = x_0 + \frac{1}{2}(v_{0x} + v_x)t$

$x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$

$v_x{}^2 = v_{0x}{}^2 + 2a_x(x - x_0)$

$a_r = v^2/r$

$\sum \vec{F} = m\vec{a}$

$K = \frac{1}{2}mv^2$

$\Delta K + \Delta U = W_{ext}$

$P = \dfrac{dU}{dt}$

Électrostatique

$\vec{F}_{12} = \dfrac{kQ_1Q_2}{r_{21}^2}\vec{u}_{r_{21}}$

$\vec{F} = Q\vec{E}$

$\vec{E} = \dfrac{kQ}{r^2}\vec{u}$

$V = \dfrac{U}{q}$

$V = k\dfrac{Q}{R}$

$\Delta V = V_B - V_A = -\int_A^B \vec{E}\cdot d\vec{s} = \pm Ed$

$\lambda = Q/L$; $\sigma = Q/A$; $\rho = Q/V$

$\phi_E = \oint \vec{E}\cdot d\vec{A} = Q_{\text{int}}/\varepsilon_0$

Circuits DC

$C = \dfrac{Q}{\Delta V}$

$\dfrac{1}{C_{éq}} = \dfrac{1}{C_1} + \dfrac{1}{C_2} + ... + \dfrac{1}{C_N}$

$C_{éq} = C_1 + C_2 + ... + C_N$

$C_D = \kappa C_0$

$U_E = \frac{1}{2}Q\Delta V = \dfrac{Q^2}{2C} = \frac{1}{2}C\Delta V^2$

$C_{plan} = \dfrac{\varepsilon_0 A}{d}$

$I = \dfrac{\mathrm{d}Q}{\mathrm{d}t} = nAev_d$

$R = \dfrac{\rho\,\ell}{A}$

$\Delta V = RI$

$P = I\,\Delta V = RI^2 = \dfrac{\Delta V^2}{R}$

Circuit DC (suite)

$$R_{éq} = R_1 + R_2 + \ldots + R_N$$

$$\frac{1}{R_{éq}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots + \frac{1}{R_N}$$

$$\sum_{noeud} I = 0$$

$$\sum_{maille} \Delta V = 0$$

$$\rho = \rho_0 \left[1 + \alpha (T - T_0)\right]$$

$$Q = Q_0 e^{-t/\tau}$$

$$Q = Q_0 \left(1 - e^{-t/\tau}\right)$$

$$I = I_0 e^{-t/\tau}$$

$$\tau = RC$$

Magnétisme

$$\vec{F}_B = q\vec{v} \times \vec{B}$$

$$F_B = |q| vB \sin\theta$$

$$\vec{F}_B = I\vec{\ell} \times \vec{B}$$

$$\vec{F} = q\left(\vec{E} + \vec{v} \times \vec{B}\right)$$

$$r = \frac{mv}{|q|B}$$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$\frac{F}{\ell} = \frac{\mu_0 I_1 I_2}{2\pi d}$$

$$\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I$$

$$B = \mu_0 n I$$

$$B = \mu_0 N I / 2\pi r$$

Induction

$$\Phi_B = \int \vec{B} \cdot d\vec{A}$$

$$\mathcal{E} = -N \frac{d\Phi_B}{dt}$$

$$N\Phi_B = LI$$

$$\mathcal{E}_L = -L \frac{dI}{dt}$$

$$I = I_0 \left(1 - e^{-t/\tau}\right)$$

$$I = I_0 e^{-t/\tau}$$

$$\tau = L/R$$

$$U_L = \tfrac{1}{2} L I^2$$

Circuits AC

$$i(t) = I_0 \sin(\omega t)$$

$$\Delta v(t) = \Delta V_0 \sin(\omega t + \phi)$$

$$I_{eff} = \frac{I_0}{\sqrt{2}} \quad ; \quad \Delta V_{eff} = \frac{\Delta V_0}{\sqrt{2}}$$

$$\Delta V_0 = Z I_0 \quad ; \quad \Delta V_{eff} = Z I_{eff}$$

$$Z = \sqrt{R^2 + (Z_L - Z_C)^2}$$

$$Z_L = \omega L$$

$$Z_C = 1/\omega C$$

$$\omega_0 = 1/\sqrt{LC}$$

$$\tan\phi = \frac{Z_L - Z_C}{R}$$

$$p(t) = i(t) \cdot \Delta v(t)$$

$$P_{eff} = R I_{eff}^{\ 2} = I_{eff} \Delta V_{eff} \cos\phi$$