

# ΤΥΠΟΛΟΓΙΟ ΗΜΟ ΣΦ

$$\vec{E} = k_e \lim_{\Delta q_i \rightarrow 0} \sum_i \frac{\Delta q_i}{r_i^2} \hat{r}_i = k_e \int \frac{dq}{r^2} \hat{r} \quad \Delta U = U_B - U_A = -q_0 \int_A^B \vec{E} \cdot d\vec{s} \quad V = k_e \int \frac{dq}{r} \quad \Phi_E = \int_{\text{επιφάνεια}} \vec{E} \cdot d\vec{A} \quad \vec{E} = -\nabla V$$

$$C = \frac{Q}{\Delta V} = \frac{Q}{Ed} = \frac{Q}{Qd/\epsilon_0 A} = \frac{\epsilon_0 A}{d}, \quad C = 4\pi\epsilon_0 R$$

$$U = \frac{Q^2}{2C} = \frac{1}{2} Q \Delta V = \frac{1}{2} C (\Delta V)^2 \quad u_E = \frac{1}{2} \epsilon_0 E^2$$

$$\vec{J} = \sigma \vec{E} \quad I = \vec{J} \cdot \vec{A} \quad R = \rho \frac{\ell}{A} \quad P = I \Delta V = I^2 R = \frac{(\Delta V)^2}{R} \quad q(t) = CE(1 - e^{-t/RC}) = Q(1 - e^{-t/RC}), \quad q(t) = Qe^{-t/RC}$$

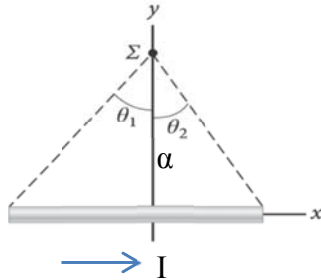
$$B = \frac{\mu_0 I}{4\pi a} (\sin \theta_1 + \sin \theta_2)$$

$$0 < \theta_1, \theta_2 < \pi/2$$

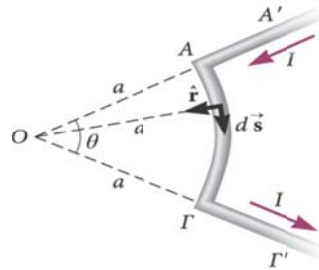
$$u_B = \frac{1}{2\mu_0} B^2$$

$$HE_{\text{επαγ}} = -\frac{d\Phi_B}{dt}$$

$$L = \frac{N\Phi_B}{I} = -\frac{\epsilon_L}{dI/dt}$$



$$B = \frac{\mu_0 I}{4\pi a} \theta$$

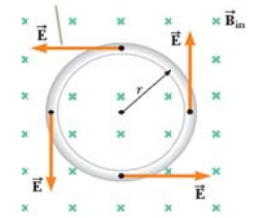


$$HE_{\text{επαγ}} = \vec{\ell} \cdot (\vec{u} \times \vec{B})$$

Ράβδος μήκους  $\ell$

$$i = \frac{\epsilon}{R} (1 - e^{-Rt/L})$$

$$i = I_0 e^{-t/\tau} = \frac{\epsilon}{R} e^{-t/\tau}$$



$$\vec{E} = -\frac{1}{2\pi r} \frac{d\Phi_B}{dt} \hat{\phi}$$

Ηλεκτρικό πεδίο επαγώμενο

$$P_{\text{μέση}} = \frac{1}{2} I_{\text{max}} \Delta V_{\text{max}} \cos \varphi = I_{\text{rms}} \Delta V_{\text{rms}} \cos \varphi$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$\varphi = \tan^{-1} \left( \frac{X_L - X_C}{R} \right) \quad \omega_0 = \frac{1}{\sqrt{LC}}$$

$$\oint \vec{E} \cdot d\vec{A} = \frac{q}{\epsilon_0} \quad \oint \vec{B} \cdot d\vec{A} = 0$$

$$\oint \vec{E} \cdot d\vec{\ell} = -\frac{d\Phi_B}{dt} \quad \oint \vec{B} \cdot d\vec{\ell} = \mu_0 I + \mu_0 \epsilon_0 \frac{d\Phi_E}{dt}$$

$$\frac{E_{\text{max}}}{B_{\text{max}}} = \frac{\omega}{k} = \frac{E}{B} = c, \quad k = \beta = \frac{2\pi}{\lambda}$$

$$u_{\text{μέση}} = \epsilon_0 (E^2)_{\text{μέση}} = \frac{1}{2} \epsilon_0 E_{\text{max}}^2 = B_{\text{max}}^2 / 2\mu_0, \quad I = S_{\text{μέση}} = cu_{\text{μέση}}$$

$$t' = \frac{t - ux/c^2}{\sqrt{1 - u^2/c^2}} = \gamma(t - ux/c^2) \quad v' = \frac{v - u}{1 - uv/c^2}$$

$$l = \frac{l_0}{\gamma}$$

$$\Delta t = \Delta t_0 \cdot \gamma$$

$$E = \gamma \cdot m_0 \cdot c^2$$

$$p = \gamma \cdot m_0 \cdot v \quad E^2 = (mc^2)^2 + (pc)^2$$

$$\Delta x \cdot \Delta p_x \approx \hbar \text{ (προσεγγιστικά)}$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

Κάτοπτρα:  $1/s + 1/s' = 2/R$  και  $m = -y'/y = -s'/s$

Δίοπτρα:  $n_a/s + (n_b/s') = (n_b - n_a)/R$  και  $m = y'/y = -n_a s' / n_b s$

$$\text{Φακοί: } \frac{1}{s} + \frac{1}{s'} = \frac{1}{f} = \frac{n_2 - n_1}{n_1} \left( \frac{1}{R_1} - \frac{1}{R_2} \right) \quad \frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$\tan \theta_{\text{φωτ}} = \sin \theta_{\text{φωτ}} = m \lambda / d \quad m = 0, \pm 1, \pm 2 \quad 2nt = (m + \frac{1}{2})\lambda \quad (m = 0, 1, 2, \dots)$$

(υμενία ενίσχυ συμβολή)

$$\theta_{\text{min}} = 1.22 \frac{\lambda}{D}$$

$$y_{\text{φωτ.}} = L \frac{m\lambda}{d} \quad \text{και} \quad y_{\text{σκοτ.}} = L \frac{(m + \frac{1}{2})\lambda}{d}$$

$$\sin \theta_{\text{σκοτ.}} = m\lambda / a \quad m = \pm 1, \pm 2, \pm 3, \dots \text{ Περίθλαση}$$

$$h = 6,626 \times 10^{-34} \text{ [J s]}$$

Μαγνητική διαπερατότητα κενού	$\mu_0 = 4\pi \times 10^{-7} \text{ H/m (ορισμός)} \approx 1,256 637 \times 10^{-6} \text{ H/m}$
Επιτρεπτότητα κενού	$\epsilon_0 = 1/\mu_0 c^2 \approx 8,854 185 \times 10^{-12} \text{ F/m}$
Ταχύτητα φωτός στο κενό	$c = (\epsilon_0 \mu_0)^{-1/2} \approx 2,997 925 \times 10^8 \text{ m/sec}$
Σύνθετη αντίσταση κενού	$Z_0 = (\mu_0/\epsilon_0)^{1/2} = \mu_0 c \approx 3,767 304 \times 10^2 \Omega \approx 120\pi \Omega$
Στοιχειώδες ηλεκτρικό φορτίο	$e \approx 1,602 192 \times 10^{-19} \text{ C}$
Μάζα ηρεμίας ηλεκτρονίου	$m_e \approx 9,109 558 \times 10^{-31} \text{ kg}$

Προσεγγιστικές τιμές του  $\gamma$  για διάφορες τιμές ταχύτητας

$$\lambda = \frac{h}{p} = \frac{h}{mu}$$

v/c	$\gamma$
0	1
0.001 0	1.000 000 5
0.010	1.000 05
0.10	1.005
0.20	1.021
0.30	1.048
0.40	1.091
0.50	1.155
0.60	1.250
0.70	1.400
0.80	1.667
0.90	2.294
0.92	2.552
0.94	2.931
0.96	3.571
0.98	5.025
0.99	7.089
0.995	10.01
0.999	22.37