

PHYS 4 Exam 5 Cheat Sheet (with L^AT_EX)
Angular Kinematics

$$\theta = \frac{S}{r}; \omega = \frac{d\theta}{dt}; \alpha = \frac{d^2\theta}{dt^2}; (1) \omega(t) = \omega_0 + \alpha t$$

$$(2) \theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2; (3) \omega^2 = \omega_0^2 + 2\alpha\Delta\theta$$

$$v_t = \omega r; a_t = \alpha r; a_c = \omega r^2; T = \frac{2\pi}{\omega}$$

Electric Fields and Forces

$$e = 1.602 \times 10^{-19} \text{C}; \epsilon_0 = 8.85 \times 10^{-12} \frac{\text{C}^2}{\text{Nm}^2}$$

$$k = 8.99 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2} = \frac{1}{4\pi\epsilon_0}$$

$$\vec{F} = \frac{kq_1q_2}{r^2}\hat{r} = \frac{kq_1q_2}{r^3}\vec{r}; \vec{E} = \frac{kq}{r^2}\hat{r} = \frac{kq}{r^3}\vec{r}; F = qE$$

In a diagram, the direction of an electric field is represented by the direction of its arrows, while the strength of the field is represented by the proximity of the lines.

$$\lambda = \frac{Q}{r}; \sigma = \frac{Q}{A}; \rho = \frac{Q}{V}$$

$$E = \int dE = \int \frac{k dq}{r^3}\vec{r} = \int \frac{k\lambda}{r^3}\vec{r}dr$$

$$\vec{E}_{ring}(z) = \frac{kqz}{(z^2 + R^2)^{3/2}}\hat{k}$$

For a rod of length L, measured at a distance d from the close end from the rod of charge Q.

$$\vec{E}_{rod,axis}(d) = -\frac{kQ}{d(d-L)}\hat{i}$$

For a rod of length L, measured perpendicular to the rod at a distance d from the close end from the rod of charge Q.

$$\vec{E} = k\lambda \left[\frac{1}{z} - \frac{1}{L^2 + z^2} \right] \hat{i} + \frac{k\lambda L}{z\sqrt{L^2 + z^2}} \hat{j}$$

$$\vec{E}_{arc} = \frac{k\lambda}{r} \begin{pmatrix} 2\sin(\frac{\theta}{2}) \\ 0 \end{pmatrix}$$

$$\vec{E}_{disc} = \frac{\sigma}{2\epsilon_0} \left(1 - \frac{z}{\sqrt{z^2 + R^2}} \right)$$

Electric Dipoles

$$\vec{E} = \begin{cases} < 0 & \text{if } -\frac{d}{2} < z < \frac{d}{2} \\ > 0 & \text{otherwise} \end{cases}$$

$$= \frac{2kQd}{z^3 \left(1 - \frac{d^2}{4z^2}\right)^2} \hat{d}$$

In an electric field:

$$\vec{p} = Q\vec{d}$$

$$\vec{\tau} = \vec{p} \times \vec{E}$$

$$U = -\vec{p} \cdot \vec{E}$$

Current

$$I = \frac{dq}{dt}$$