Test 1 Formula Sheet

Chapter 22

Coloumbs law: $F_{12} = \dfrac{k\,|q_1|\,|q_2|}{r_{12}^2}$

Electric field: $\vec{E} = \dfrac{\vec{F}_{so}}{q_o}$ s: source, o: test

Electric field (point charge): $E = \dfrac{k\,|Q|}{r^2}$

Electric force: $\vec{F} = q\vec{E}$

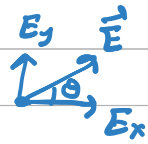
acceleration by uniform field: $\vec{a} = \dfrac{q\vec{E}}{m}$

Chapter 23

Electric field (cont. charge dist.):

$$dE = \frac{k\,dq}{r^2}$$

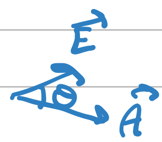
$$E_x = \int \frac{k\,dq\cos\theta}{r^2}$$



$$E_y = \int \frac{k\,dq\sin\theta}{r^2}$$

Charge density: $\rho = \dfrac{Q}{V}$, $dq = \rho\,dV$; $\sigma = \dfrac{Q}{A}$, $dq = \sigma\,dA$; $\lambda = \dfrac{Q}{L}$, $dq = \lambda\,dl$

Electric flux: $\Phi = \vec{E}\cdot\vec{A} = EA\cos\theta$



$\Phi_E = \int \vec{E}\cdot d\vec{A}$ → $\oint$: closed surface

Gauss's law: $\Phi_E = \frac{q_{in}}{\varepsilon_0}$

Chapter 24

Electric potential energy change: $\Delta U = U_B - U_A = -q\int_A^B \vec{E}\cdot d\vec{s}$

Work: $W = -\Delta U$ by field
$W_{ext} = \Delta U$ external

Electric potential: $V_x = \frac{U_x}{q}$

Electric potential difference: $\Delta V = V_B - V_A = -\int_A^B \vec{E}\cdot d\vec{s}$

ΔV for uniform field: $\Delta V = -Ed$ (d is negative if against field direction)

$$\Delta V = -\vec{E}\cdot\vec{s}$$

Conservation of energy: $\Delta K + \Delta U = 0$ $\qquad K = \frac{1}{2}mv^2$

Electric Potential (point charge): $V = \frac{kq}{r}$ $\qquad V_\infty = 0$

$$V = k\sum \frac{q_i}{r_i} = \frac{kq_1}{r_1} + \frac{kq_2}{r_2} + \cdots$$

Electric potential energy (point charge): $U = \frac{kq_1q_2}{r_{12}}$

$$U = \frac{kq_1q_2}{r_{12}} + \frac{kq_2q_3}{r_{23}} + \frac{kq_1q_3}{r_{13}} + \cdots$$

Electric field from Potential : $E_r = -\frac{dV}{dr}$ r, x, y, z

Electric potential (cont. charge dist.) : $dV = \frac{k\,dq}{r}$

$V = \int dV$

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

Special Electric fields:

infinite sheet/plane: $E = \frac{\sigma}{2\varepsilon_0}$

infinite charged wire: $E = \frac{\lambda}{2\pi\varepsilon_0 r} = \frac{2k\lambda}{r}$

Special Potentials:

charged ring: $V = \frac{kQ}{\sqrt{R^2 + x^2}}$