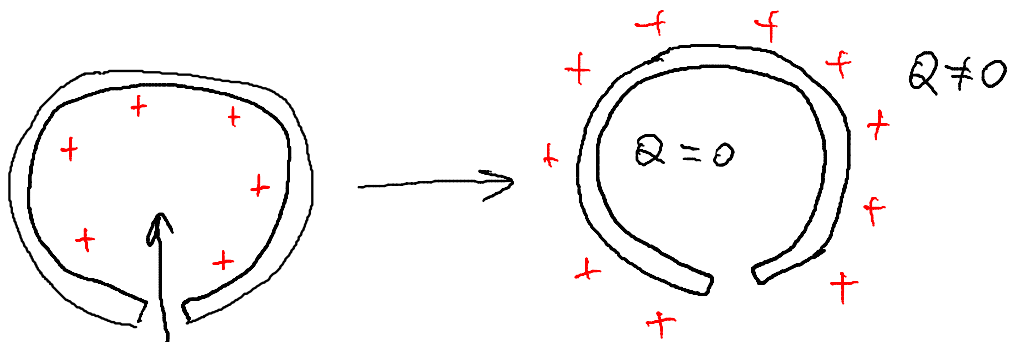
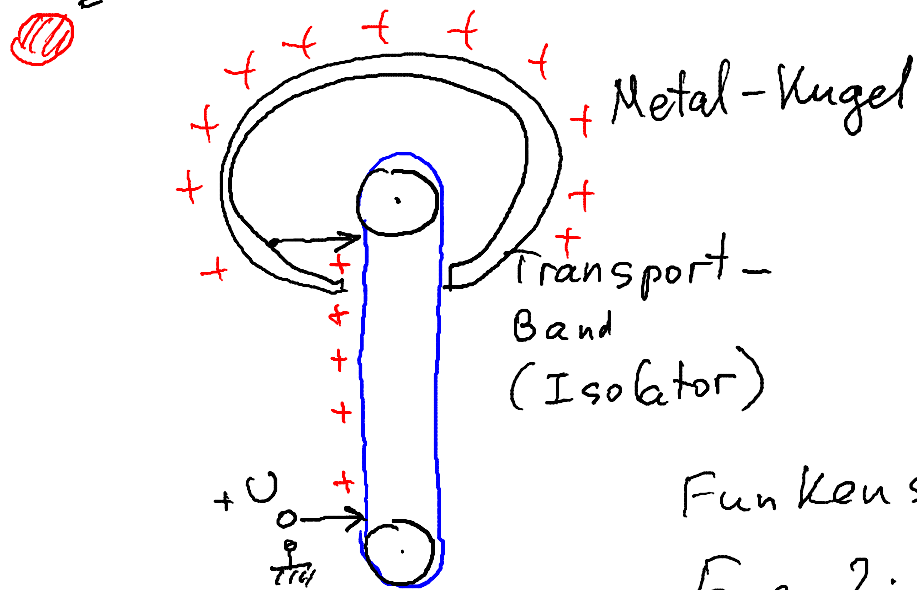
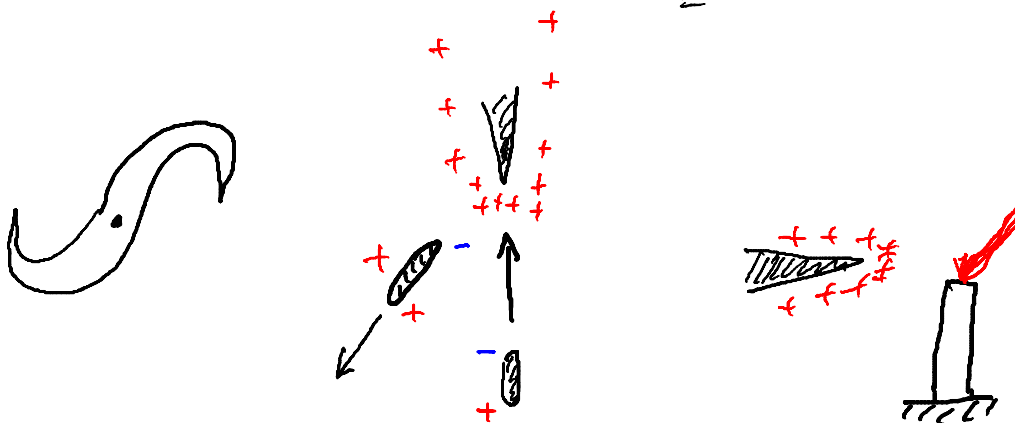




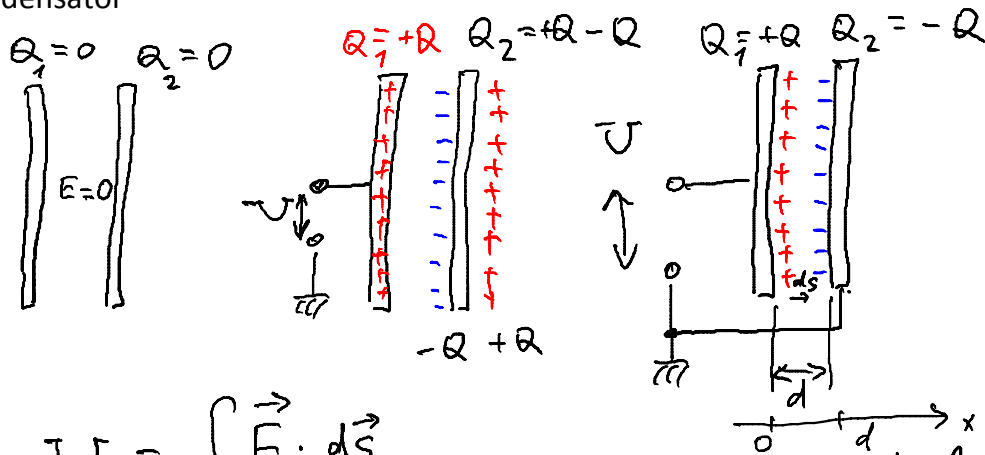
Van-de-Graaff Generator



Funkenschlag
 $E \sim 2 \cdot 10^6 \frac{V}{m}$



Kondensator



$$U = \int \vec{E} \cdot d\vec{s}$$

$$Q = \underline{C} \cdot U$$

Kapazität

$$[C] = 1 \frac{\text{Coulomb}}{\text{Volt}} = 1 \text{ Farad}$$

$$1 \text{ pF} = 10^{-12} \text{ F}$$

$$1 \text{ nF} = 10^{-9} \text{ F}$$

$$1 \text{ μF} = 10^{-6} \text{ F}$$

$$\frac{\partial^2 \phi}{\partial x^2} = 0 \quad ; \quad \rightarrow \quad \phi = ax + b$$

$$\phi(0) = b \quad ; \quad \phi(d) = ad + b$$

$$a = \frac{\phi(d) - \phi(0)}{d} = -\frac{U}{d}$$

$$\phi(x) = -\frac{U}{d}x + \phi(0)$$

$$\vec{E} = -\text{grad } \phi = \frac{U}{d} \hat{x}$$

$$d\vec{s} \equiv \hat{x}$$

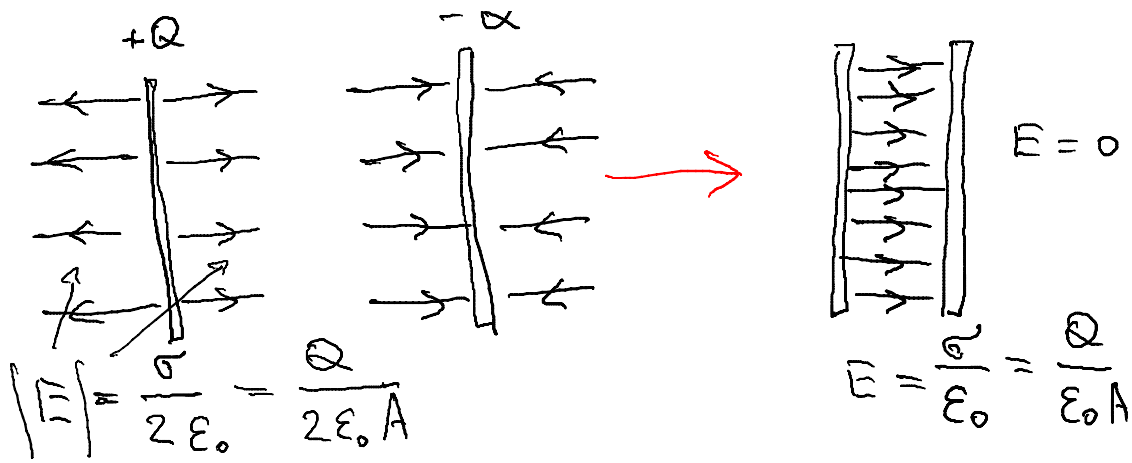
$$\boxed{E = \frac{U}{d}}$$

Platenfläche A

$$E = \frac{Q}{A \epsilon_0}$$

$$\boxed{C = \epsilon_0 \frac{A}{d}}$$

m



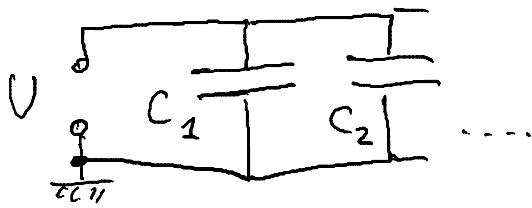
Beispiel

$$A = 10 \times 10 \text{ cm}^2 = 10^{-2} \text{ m}^2$$

$$d = 1 \text{ mm}$$

$$C = \frac{\epsilon_0 A}{d} \approx 88,5 \text{ pF}$$

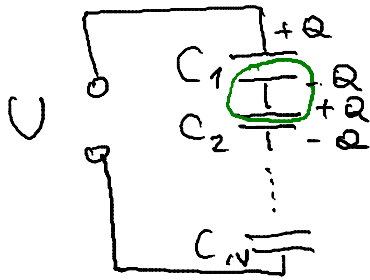
Parallele und serielle Schaltung von Kondensatoren



$$C = \sum_i C_i$$

parallele Schaltung

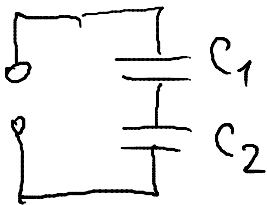
$$C = C_1 + C_2$$



$$U = U_1 + U_2 + \dots = \sum_i \frac{Q}{C_i} = \frac{Q}{C}$$

$$\frac{1}{C} = \sum_i \frac{1}{C_i}$$

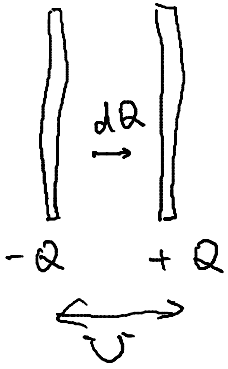
Serielle Schaltung



$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{C_1 + C_2}{C_1 C_2}$$

$$C = \frac{C_1 \cdot C_2}{C_1 + C_2}$$

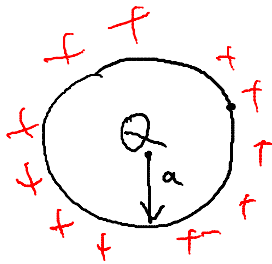
Die Energie des elektrischen Feldes



$$dW = U \cdot dQ$$

$$\text{Arbeit} = \int_0^Q dW = \int_0^Q U dQ = \int_0^Q \frac{Q}{C} dQ$$

$$W = \frac{Q^2}{2C} = \frac{CU^2}{2}$$

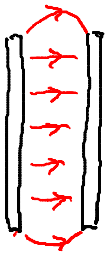


$$dW = dQ (\phi_a - \phi_\infty)$$

$$\phi_\infty = 0; \phi_a = \frac{Q}{4\pi\epsilon_0 \cdot a}$$

$$W = \frac{1}{4\pi\epsilon_0 a} \int_0^Q Q dQ = \frac{Q^2}{8\pi\epsilon_0 a} = \frac{Q^2}{2C}$$

Kapazität der aufgel. Kugel $C = 4\pi\epsilon_0 a$



Dielektrika im elektr. Feld

$$C_{\text{Diel.}} = \epsilon C_{\text{vak}} = \epsilon \epsilon_0 \frac{A}{d}$$

relative Dielektrizitätskonstante
(Dielektrizitätszahl)