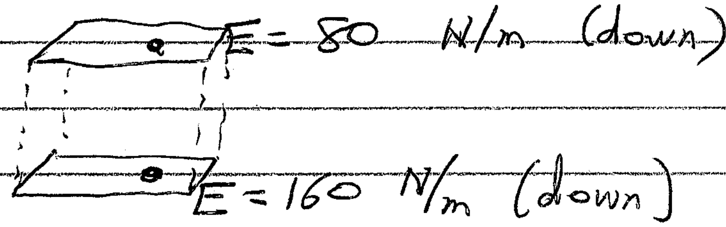
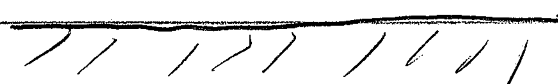
① Phys 2426 2016-09-08 Lec 5

Not done the homework Yet? Request an Extension on WebAssign. 1 week for 20% off.

HW1-13





What is in between the points?

For each surface:

$\Phi = E \cdot A$ ⊕ is "outward"

Top: $\Phi_E = -80 \cdot A$ (⊖ = "inward")

Bot: $\Phi_E = 160 \cdot A$

Sides: $\Phi = 0$ (not perp to surface)

Total: $\Phi = +80 \cdot A$

$$\Phi_E = 4\pi k Q_{enc}$$

$$80 A = 4\pi k \rho (A \cdot h)$$

$$\frac{80}{4\pi k h} = \rho$$

②

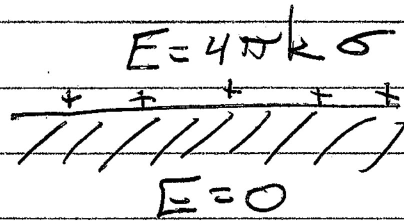
In Slab geometry:

$$\Delta E = 4\pi k \sigma = \frac{\sigma}{\varepsilon_0}$$

↑ Change in Elec Field between the top & bottom of the charge

Ex: metal surface

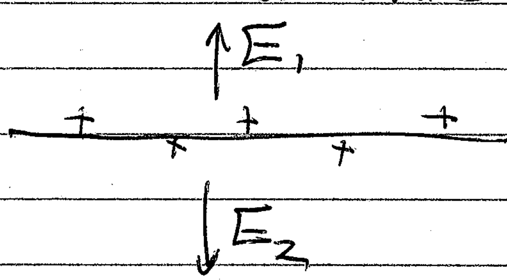
All Flux goes up →



$\sigma = \frac{Q}{A}$ on Surface

Ex: Isolated surface charge

Flux Splits



$E_1 = E_2$ (symmetry)

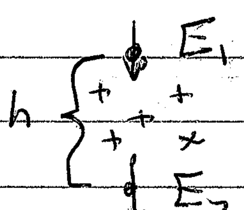
$\Delta E = 4\pi k \sigma$

$\vec{E}_{above} - \vec{E}_{below}$

$+E_1 - (-E_2) = 4\pi k \sigma$

$E_1 = 2\pi k \sigma$

Ex: Cloud



$\Delta E = 4\pi k \sigma$

$= 4\pi k \rho h$

$\sigma = \frac{Q}{A} = \frac{\rho V}{A} = \rho h$

Capacitors: Store charge and Energy

- Charge is always balanced (⊕ and ⊖)
- Charges kept apart inside cap.
- More charge means more voltage

$$Q = C\,V$$

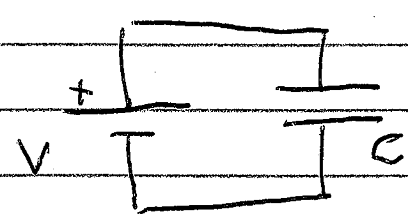
- Q: charge in coulombs (C)
- C: capacitance in Farads (F)
- V: voltage

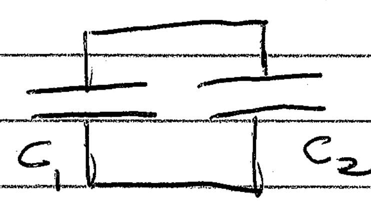
$$\text{Energy} = \tfrac{1}{2} Q V$$

Batteries: Store Energy

- Generate charge w/ chemistry
- Charges combine in molecules
- Voltage fairly constant

$$\text{Energy} = Q V$$





$Q_c = CV$

Initially: $Q_1 = (\text{known})$ $Q_2 = 0$

Very Quickly: charge splits

(1) $Q_{Tot} = q_1 + q_2$ can't change

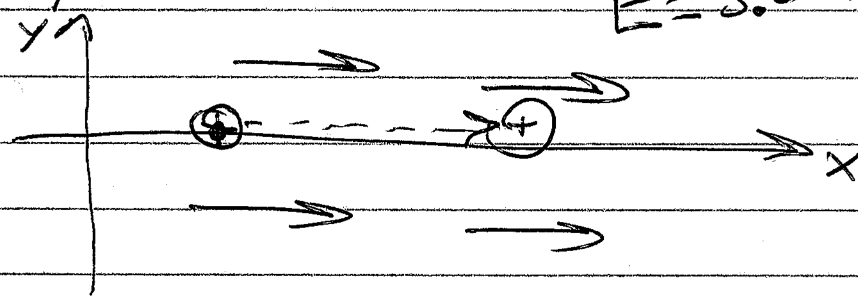
$V_1 = V_2$ (v is equal in parallel)

(2) $\frac{q_1}{C_1} = \frac{q_2}{C_2}$

④

HW1-9

$E = 3.6\ N/C\ (\hat{x})$



Move a ⊕ charge along the field.

- Work $W = \vec{F} \cdot \vec{\Delta x}$

$= q_0 E \Delta x$

- Electric Potential Energy Change

Remember dropped ball: $W = \oplus$ $\Delta U = \ominus$

$W = -\Delta U$

- Electric Potential Diff

$$\Delta V = \frac{\text{Energy}}{\text{Charge}} = \frac{\Delta U}{q_0}$$

$$\Delta V = -E \cdot \Delta x$$

(5)

HW1-20 Parallel-plate capacitor

$A = 2.7\ cm^2$ $C = ?$

$d = 0.5\ mm$

$V = 9.0\ V$ $Q = ?$

$E = ?$

① $E = \frac{\Delta V}{d} = \frac{9.0\,V}{0.5\times10^{-3}\,m} = 18000\ V/m$

② $E = 4\pi k\sigma = \frac{4\pi k Q}{A}$

$Q = \frac{EA}{4\pi k} = 4.3\times10^{-11}\ C$

$= 43\times10^{-12}\ C$

bigger (43) smaller (10^{-12})

$= 43\ pC$

③ $Q = CV$ $C = \frac{Q}{V} = \frac{43\,pC}{9\,V}$

$= 4.8\ pF$