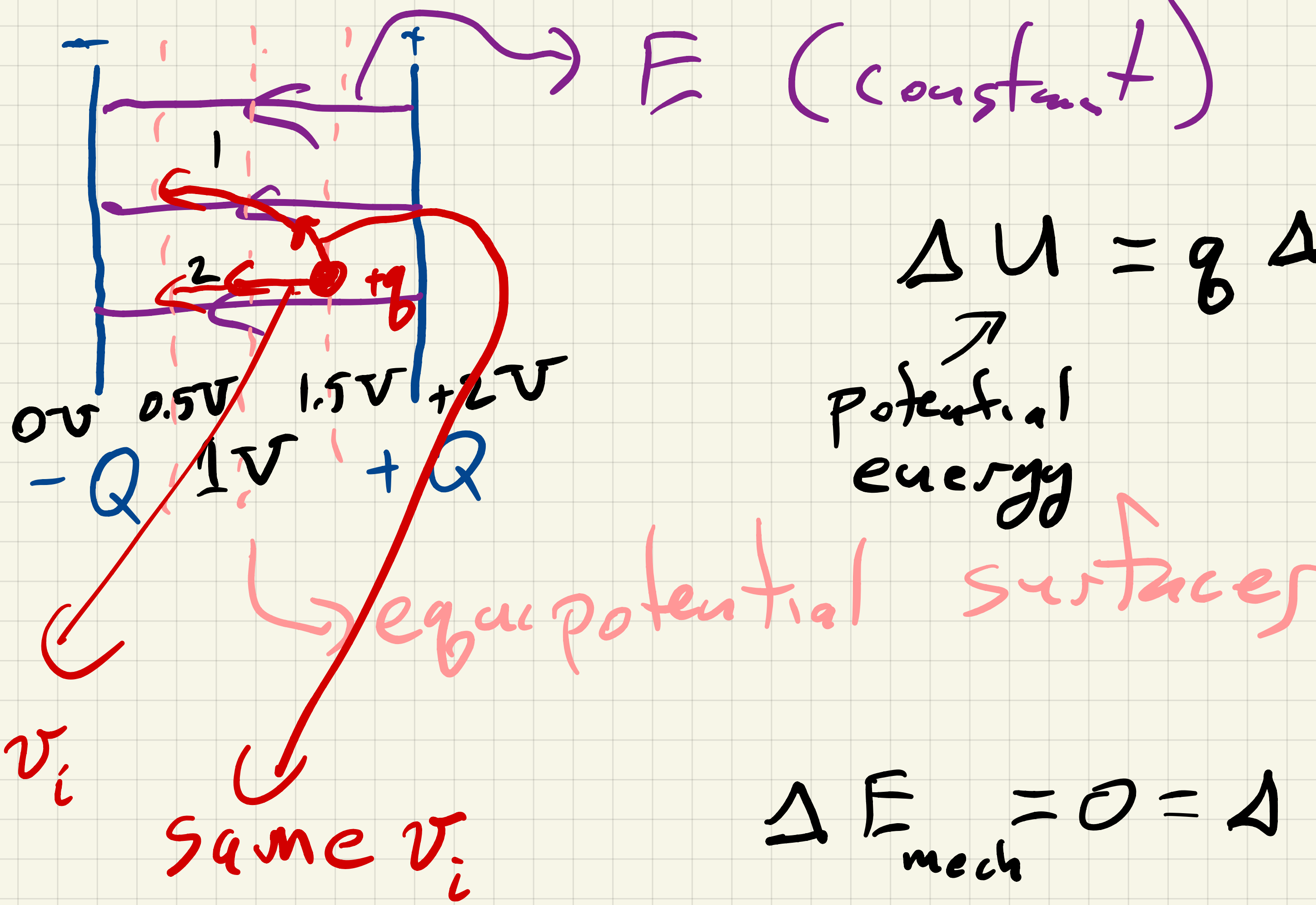
Phys 212 Lecture 25 3/19/21

F01

- record
- HW due today
- HW for next week posted
- Quiz today
- Lab next week (capacitance)
- Read chapter 26, start 27
- next week ... F2F monday & Weds .... then?

Today: Review potential & potential energy & conservation of energy, From potential to E field, potential around a loop ⇒ Kirchhoff's Loop rule, conductors in equilib.

Potential & potential energy & Conservation of mech. energy

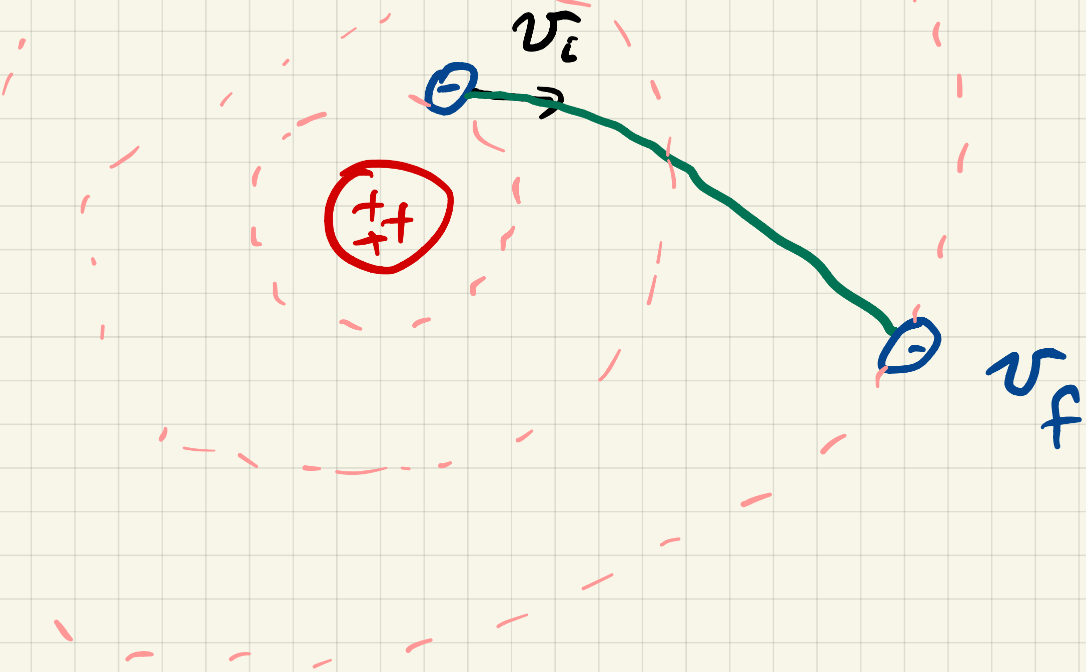


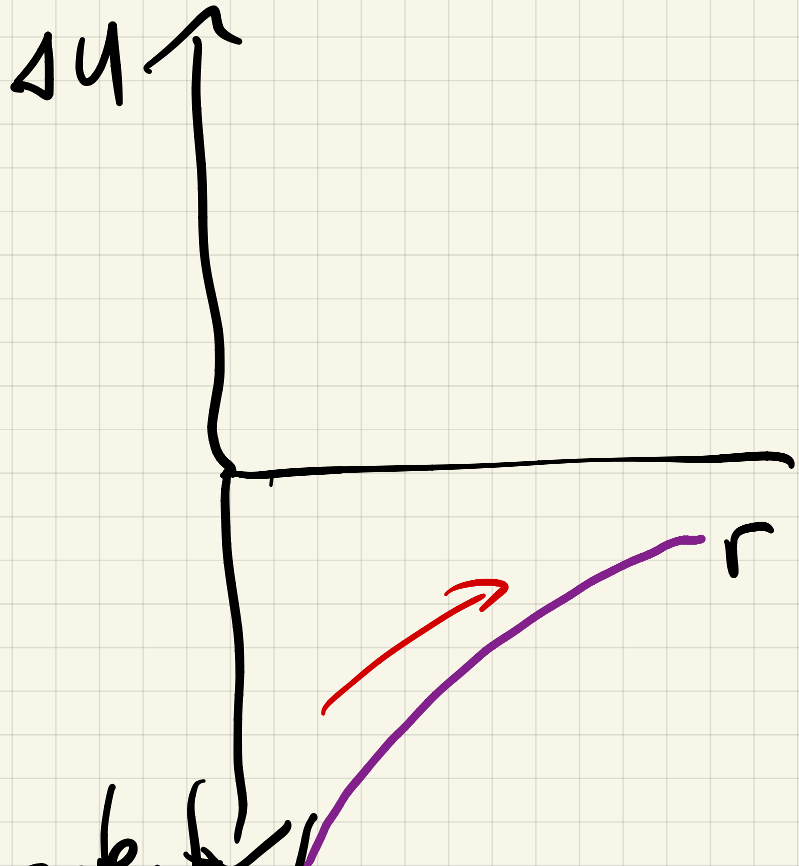
$$\Delta U = q\,\Delta V$$

ΔU ← potential energy; ΔV ← potential

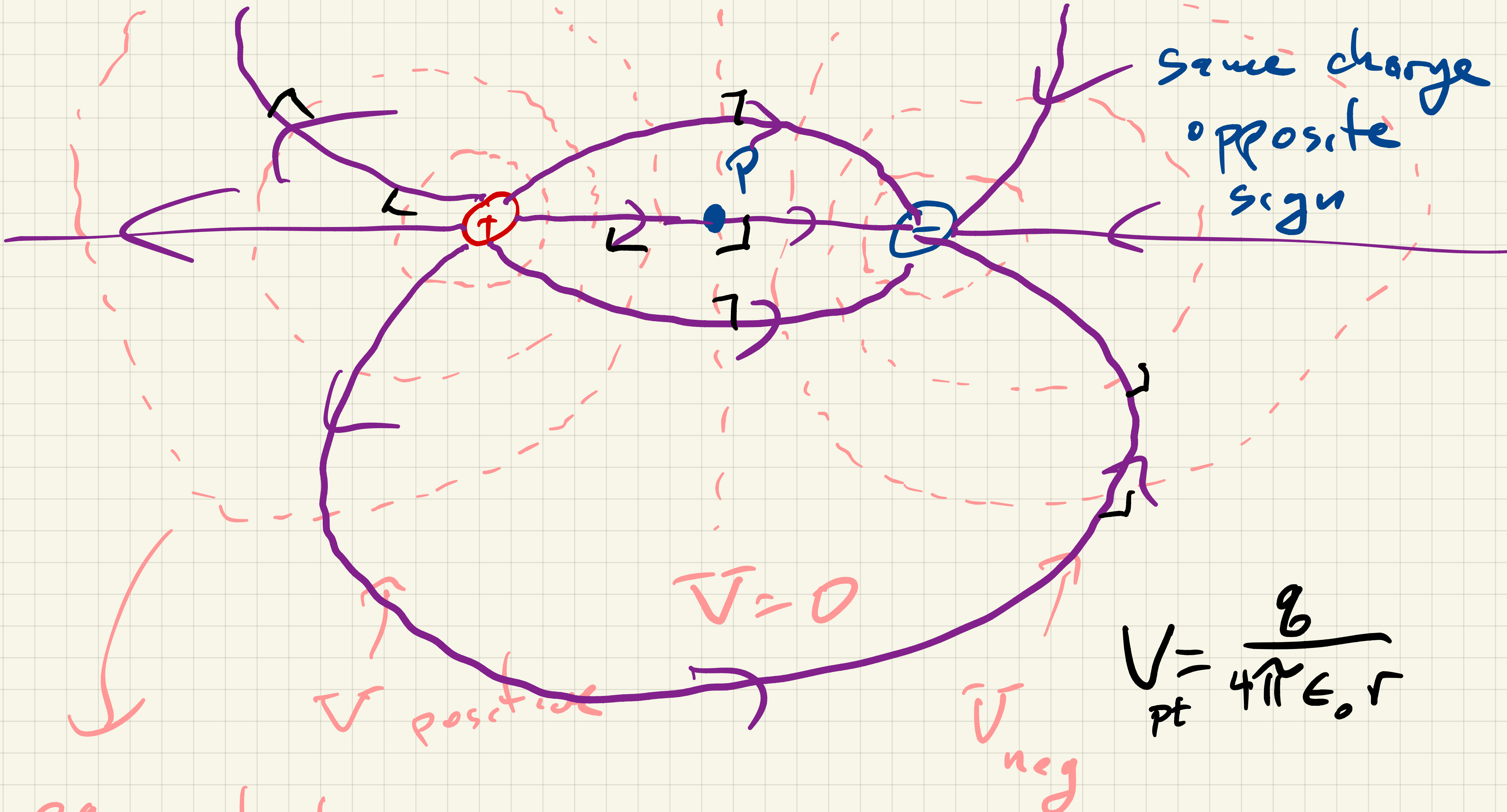
$$\Delta E_{mech} = 0 = \Delta U + \Delta K$$

$$\Rightarrow \Delta K = -\Delta U$$





$v_f < v_i$ since the electron is gaining potential energy



$$V_{pt} = \frac{q}{4\pi\epsilon_0 r}$$

equipotential surfaces

$E \perp V$

↳ potential surfaces

note @ P

$V=0$ but $E \neq 0$ pointing right

Electric Fields From potentials

$$\Delta V = \frac{\Delta U}{q} \quad \& \quad \Delta U = -W \quad \& \quad W = \int \vec{F} \cdot d\vec{s}$$

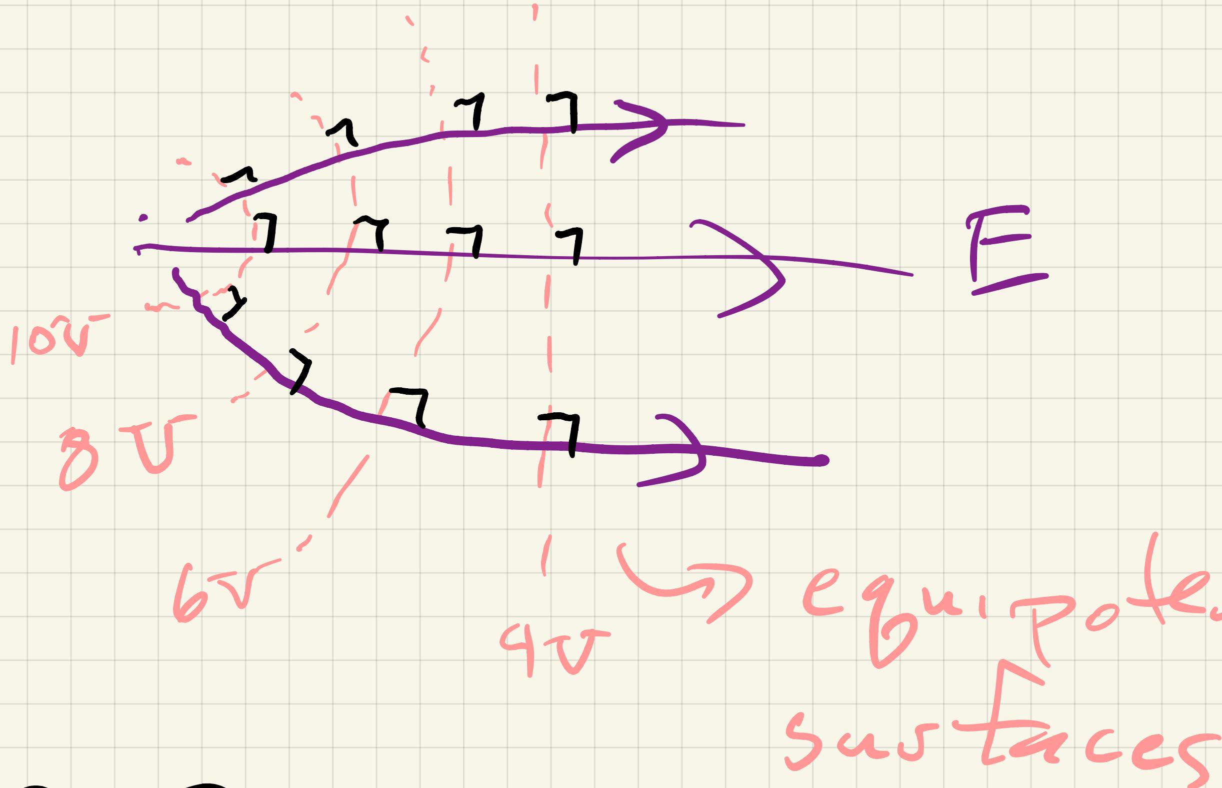
$$\& \quad \vec{F} = q\vec{E}$$

$$\Delta V = -\int \frac{\vec{F} \cdot ds}{q} = -\int \vec{E} \cdot ds$$

$\Rightarrow$ For const $E \Rightarrow \Delta V = -E\Delta s$

$\Rightarrow E = -\dfrac{\Delta V}{\Delta s}$ or in diff. form

$$E = -\frac{dV}{ds}$$ ← gradient of the potential



pointing "down" the electric hill

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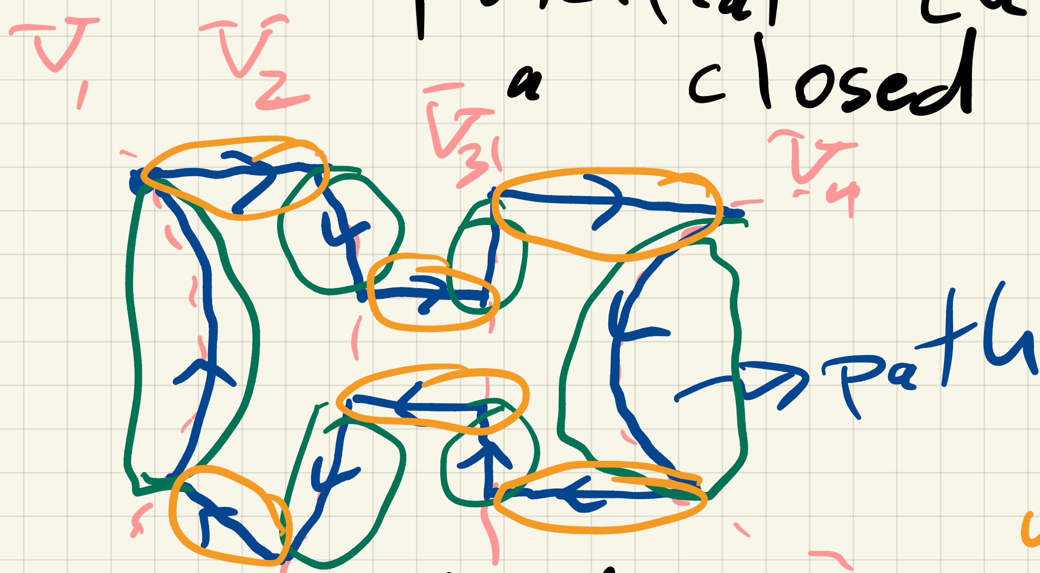
potential change around a closed loop



For all green legs $\Delta V = 0$

orange legs add up to $\Delta V = 0$

$\Sigma \Delta V$ for a closed loop is 0

Kirchhoff's Voltage Loop rule

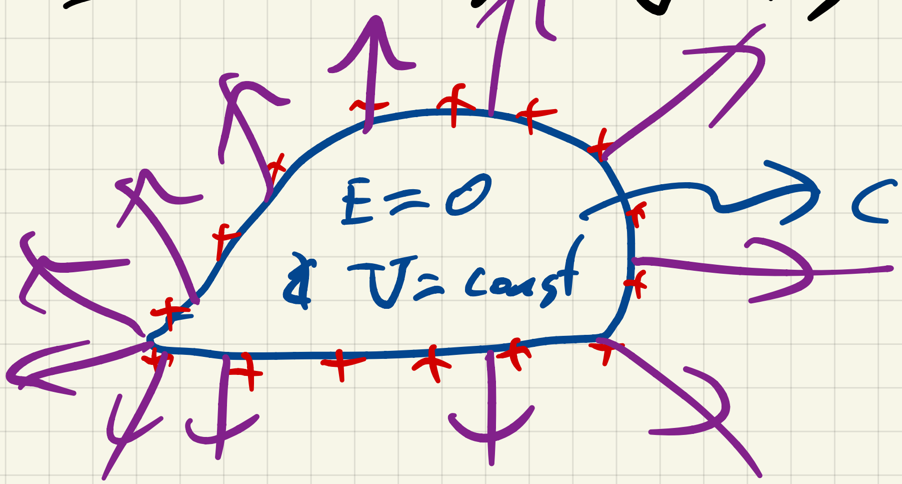
$$\sum \Delta V = 0$$

↳ around a closed loop

Conductors

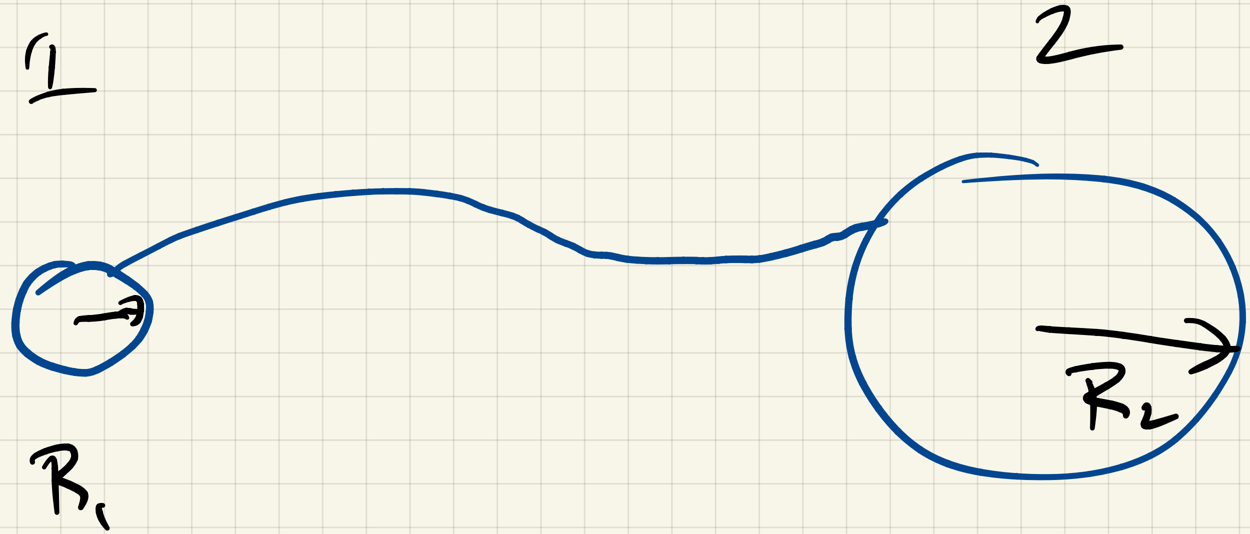
$E = 0$ in a conductor

IF $E = 0 \Rightarrow V$ is **constant**



→ conductor with charge +Q

$E \perp$ to surface of conductor



2 charged conductors connected by conducting wire

sphere 1 has same V as 2

$$V_1 = \frac{Q_1}{4\pi\epsilon_0 R_1} = V_2 = \frac{Q_2}{4\pi\epsilon_0 R_2}$$

$$\Rightarrow \quad Q_1 = Q_2 \frac{R_1}{R_2} \qquad\qquad E_1 = E_2 \frac{R_2}{R_1}$$