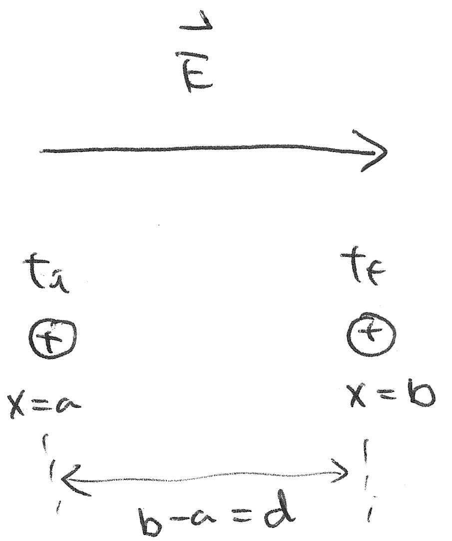


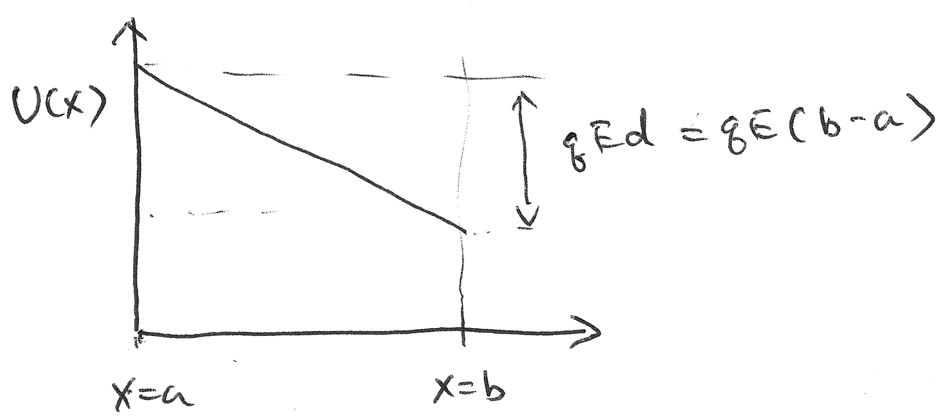
$\vec{V}(t_i) = 0$

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

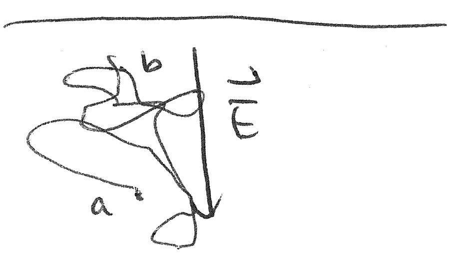
$W_{a\to b}$ = WORK DONE BY THE FIELD ON CHARGE

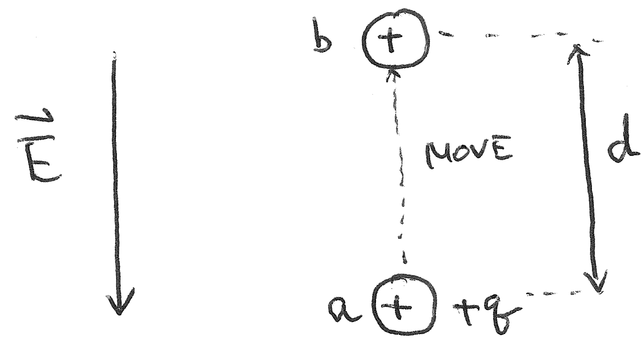
$= qEd$

$W_{a\to b} = U_a - U_b = qEd$



$$W = \int_{\text{PATH}} \vec{F} \cdot d\vec{r}$$

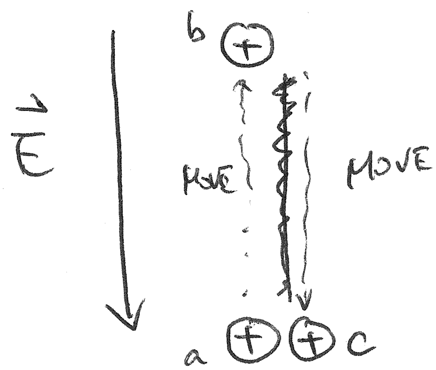




IF I MOVE FROM $a \to b$ BY MY HAND

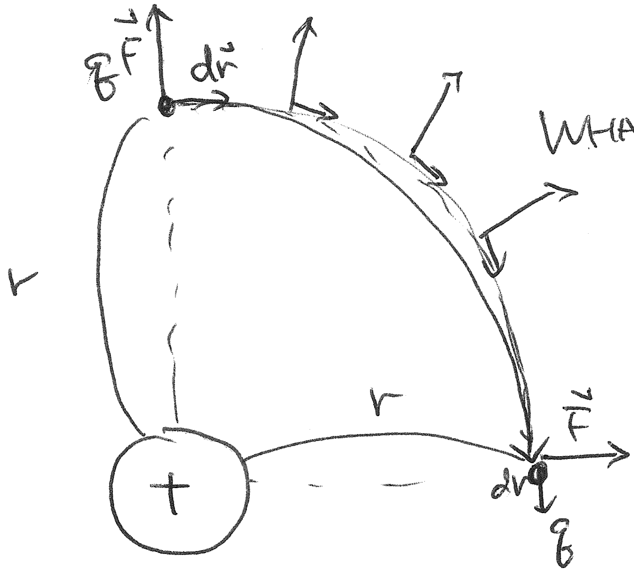
WORK DONE BY MY HAND

$$W = qEd$$



$$W = qEd - qEd$$
$$= 0$$

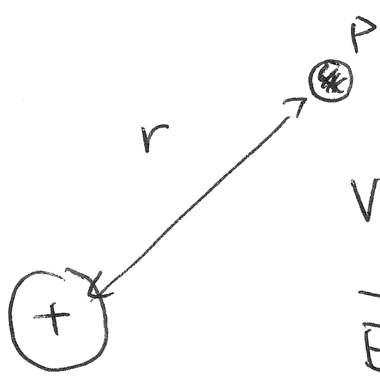
$\vec{E}$ EXERTS CONSERVATIVE FORCES



WHAT'S THE WORK DONE BY THE FIELD ON q?

WORK = 0

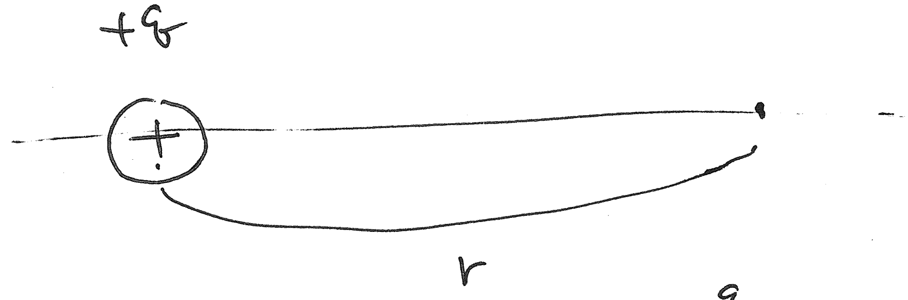
$$V = \frac{U}{q}$$ UNITS : VOLTS



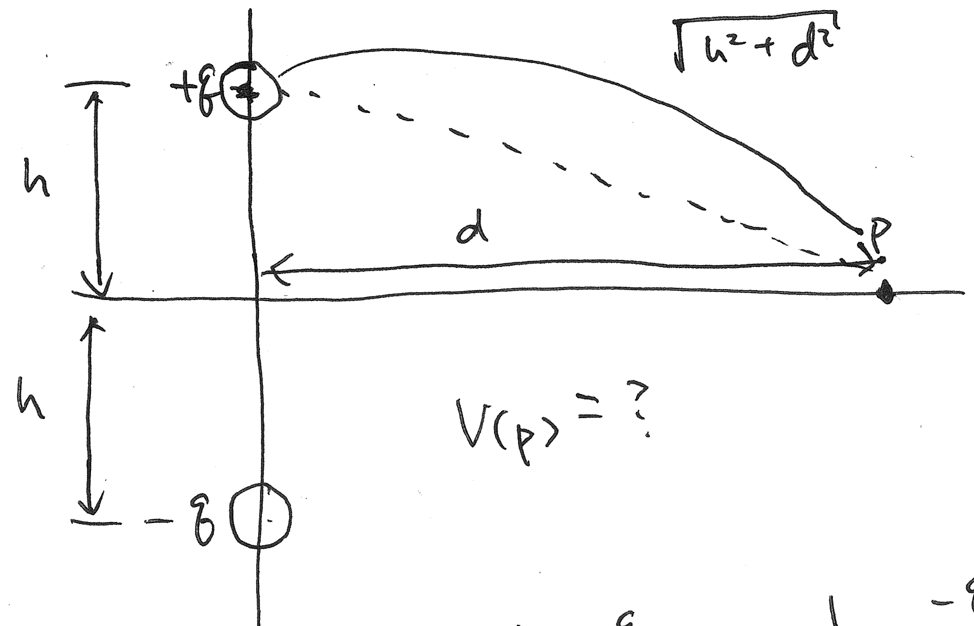
$$V(\vec{P}) = \frac{Q}{4\pi\varepsilon_0} \frac{1}{r}$$

$$\vec{E}(\vec{P}) = \frac{Q}{4\pi\varepsilon_0} \frac{1}{r^2} \hat{r}$$

LECTURE 7



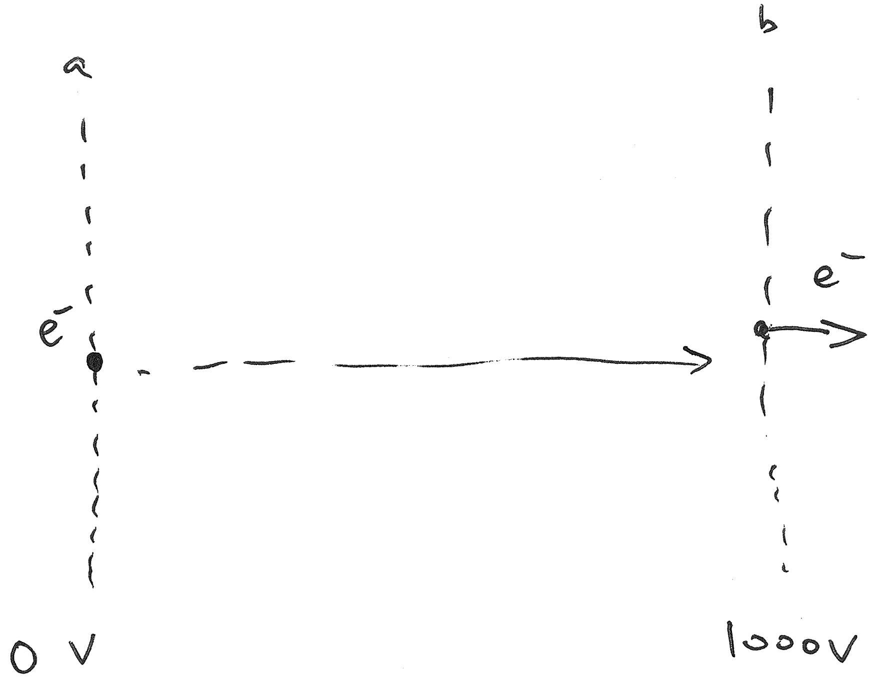
$$V(r) = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$$



$V(p) = ?$

$$V(p) = V_+ + V_- = \frac{1}{4\pi\varepsilon_0}\frac{q}{\sqrt{h^2+d^2}} + \frac{1}{4\pi\varepsilon_0}\frac{-q}{\sqrt{h^2+d^2}}$$

$$V(p) = 0$$



$$V(b) - V(a) = 1000\,V$$

$$U(b) - U(a) = q\,[V(b) - V(a)]$$

$$= -1.6\times10^{-19}\,C \cdot 1000\,V$$

$$= -1.6\times10^{-16}\,J$$

$$= -1000\,eV$$

$$1\,eV = 1.6\times10^{-19}\,J$$

ROOM TEMPERATURE = 0.025 eV

= 25 meV

$$\vec{E} = -\vec{\nabla} V$$

$$\vec{\nabla} = \frac{\partial}{\partial x}\hat{x} + \frac{\partial}{\partial y}\hat{y} + \frac{\partial}{\partial z}\hat{z}$$

$$\vec{V}(x,y,z) = xyz$$

$$\vec{E} = -yz\hat{x} - xz\hat{y} - xy\hat{z}$$

CYLINDRICAL COORD

$$\vec{\nabla} = \frac{\partial}{\partial r}\hat{r} + \frac{1}{r}\frac{\partial}{\partial \theta}\hat{\theta} + \frac{\partial}{\partial z}\hat{z}$$

SPHERICAL COORD

$$\vec{\nabla} = \frac{\partial}{\partial r}\hat{r} + \frac{1}{r}\frac{\partial}{\partial \theta}\hat{\theta} + \frac{1}{r\sin\theta}\frac{\partial}{\partial \phi}\hat{\phi}$$

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$$\frac{3x}{2} - \frac{3x^2}{2}(25-9)$$

-24

$r > a$

$$\Phi = E \cdot A = \underline{\underline{E}} \cdot 4\pi r^2 = \frac{Q}{\varepsilon_0}$$

$$E(r) = \frac{1}{4\pi\varepsilon_0} \frac{Q}{r^2}$$

$r < a$

$E = 0$ BECAUSE IT IS A CONDUCTOR

BECAUSE ~~i.e.~~ $Q_{enc} = 0$

- - - - - - - — —

$$\vec{E} = -\vec{\nabla} V$$

$$\vec{E} = E(r)\,\hat{r} = -\frac{\partial}{\partial r} V \hat{r}$$

$$\frac{1}{4\pi\varepsilon_0} \frac{Q}{r^2} = -\frac{\partial}{\partial r} V(r)$$

$$V(r) = -\int \frac{1}{4\pi\varepsilon_0} \frac{Q}{r^2}\, dr$$

$$V(r) = \frac{1}{4\pi\varepsilon_0} \frac{Q}{r} + C$$

$C = 0$ BECAUSE I DEFINE $V(\infty) = 0$ CONVENSION

$$V(r) = \frac{1}{4\pi\varepsilon_0} \frac{Q}{r} \qquad r > a$$

$r < a$

$\vec{E} = 0$

$$-\frac{\partial V}{\partial r} = 0$$

$$V(r) = -D$$

$= \text{CONSTANT}$

FROM OUTSIDE

$$V(a) = \frac{1}{4\pi\varepsilon_0}\frac{Q}{a}$$

FROM INSIDE

$$V(a) = -D = \frac{1}{4\pi\varepsilon_0}\frac{Q}{a}$$