Physics 114 - February 10, 2015

- Exam Thurs., during lecture time, in Hoyt
- Sent out Formula sheet
- Q+A session in Hoyt 5pm Wed.
- Exam logistics questions ?
- Lects. last week okay ?
- Questions on last week's lectures ?

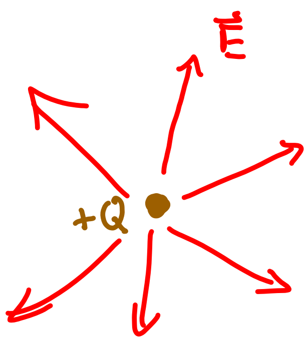
Last Time

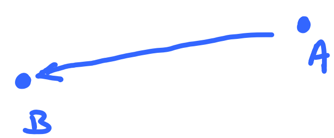
Electric Potential (difference) between Points A + B

$\equiv$ $\frac{\text{Work}}{\text{unit charge}}$ to move charge from Point A to Point B

$\equiv \Delta V_{AB} \equiv V_B - V_A \equiv V_{AB}$ . . .

Consider potential differences in space around point charge





$$V_{AB} = kQ\left[\frac{1}{r_B} - \frac{1}{r_A}\right]$$

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as $r_A \to \infty$, $\frac{1}{r_A} \to 0$

Commonly define Absolute potential at $\infty \to 0$

Then Absolute potential at point B at r_A

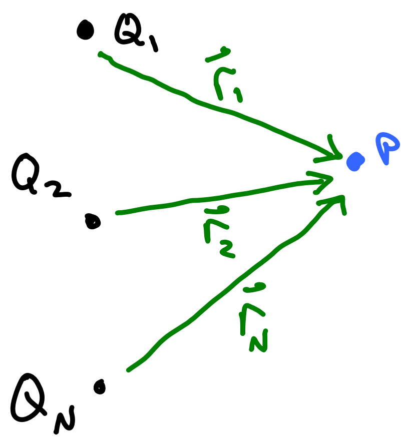
$$V_B = \frac{kQ}{r_B}$$

Work/charge to bring charge in from ∞ to distance r_A from charge Q

Form of potential of point charge with $V=0$ at $r \to \infty$

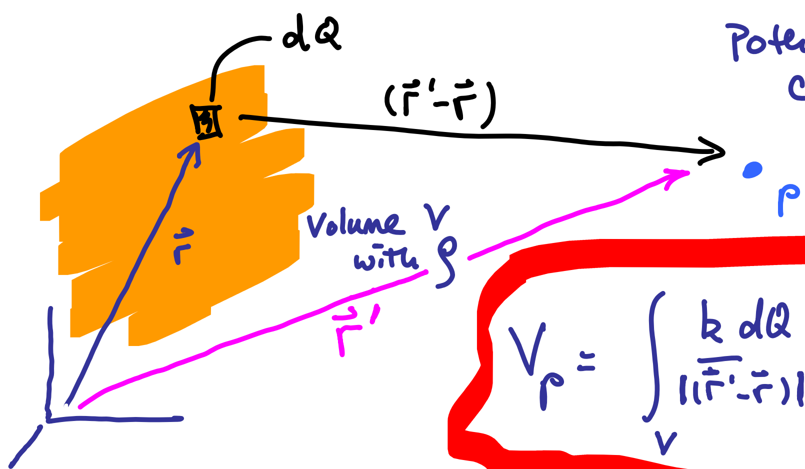
have freedom to define $V=0$ position

Similar to height convention



$$V_P = \sum_{i=1}^{N} V_i = \sum_{i=1}^{N} \frac{kQ_i}{r_i}$$

Potential for system of discrete point charges

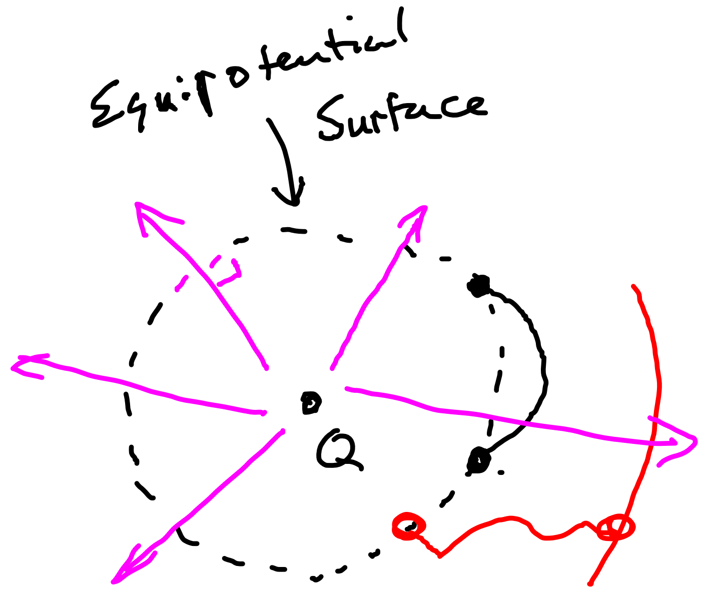


Potential for a continuous charge distribution

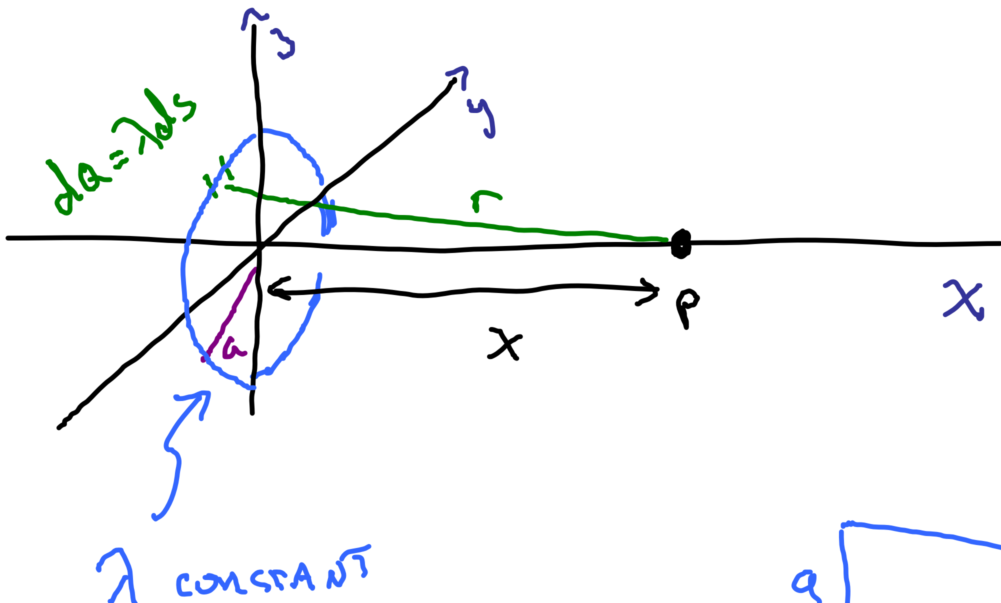
$$V_P = \int_V \frac{k\, dQ}{|(\vec{r}\,' - \vec{r})|} = \int_V \frac{k\, \rho(\vec{r})\, dV}{|\vec{r}\,' - \vec{r}|}$$

$$E_s = -\frac{dV}{ds}$$

The electric field component in a certain direction is the rate of change of the electric potential in that direction!



Electrostatics is a conservative force



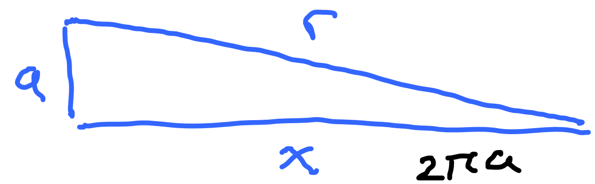
what is V_P?

and from that

calculate E_x

dV_P due to dQ

$$dV_P = \frac{k\,dQ}{r}$$



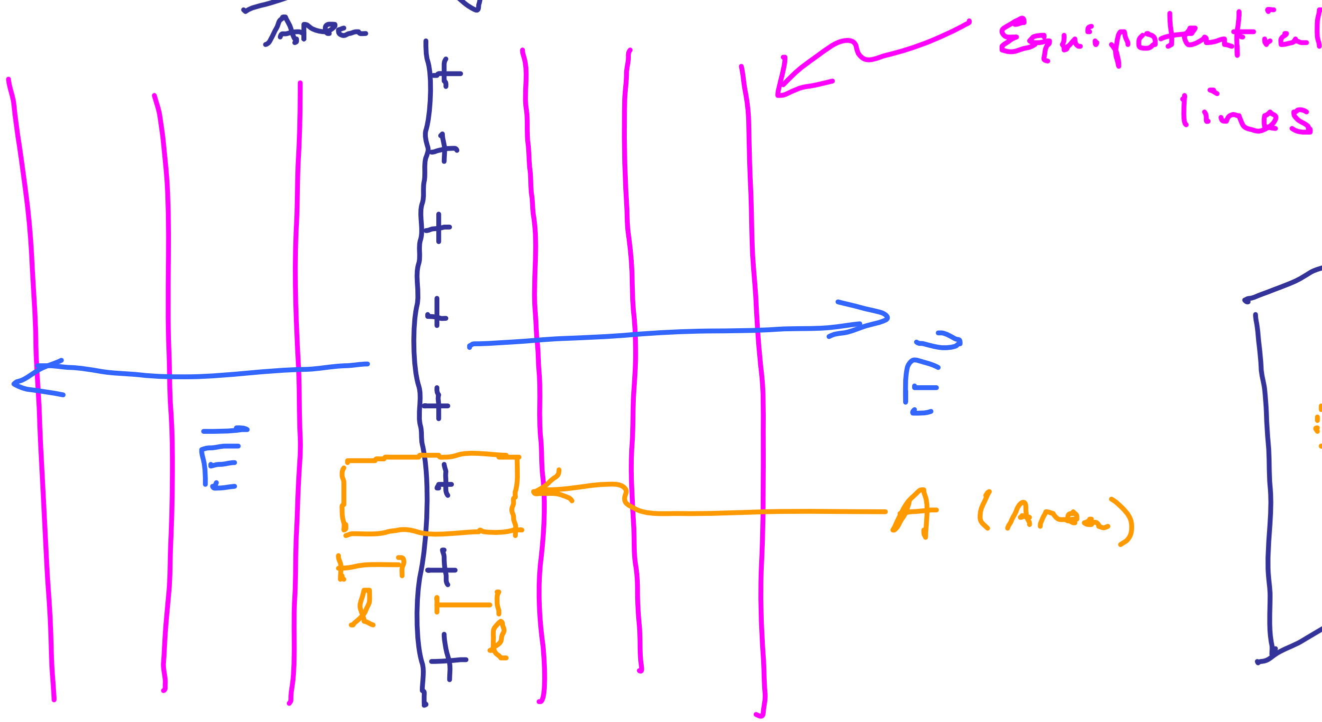
$$V_P = \int_{vol} \frac{k\,dQ}{r} = \int_0^{2\pi a} \frac{k\lambda\,ds}{(x^2+a^2)^{1/2}}$$

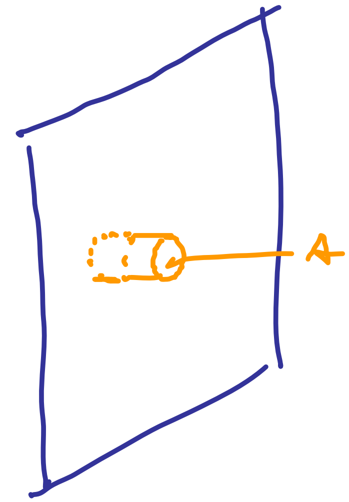
$$V_p = \frac{k\lambda}{(x^2+a^2)^{1/2}} \int_0^{2\pi a} ds = \frac{k\lambda 2\pi a}{(x^2+a^2)^{1/2}}$$

$$E_x = -\frac{dV}{dx} = -\left[k\lambda 2\pi a \left(-\tfrac{1}{2}\right)\left(x^2+a^2\right)^{-3/2} 2x\right]$$

$$= \frac{k\lambda 2\pi x a}{(a^2+x^2)^{3/2}}$$

$$\text{Constant } \frac{\text{Charge}}{\text{Area}} = \sigma$$

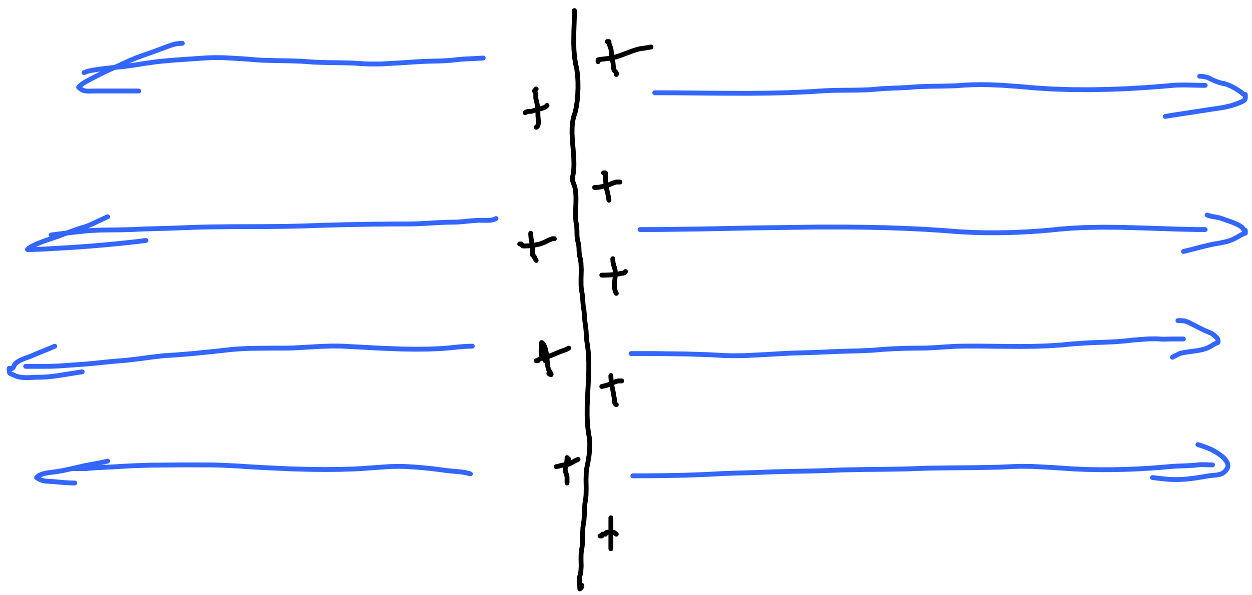




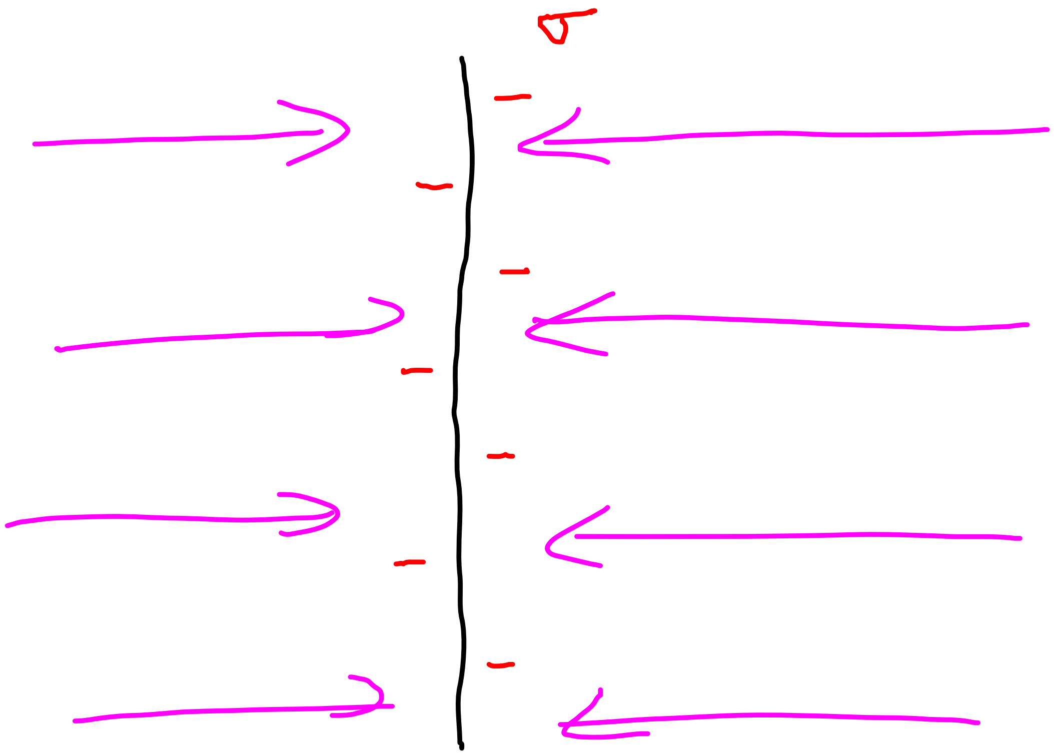
$$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{encl}}{\epsilon_0}$$

$$2|E|A = \sigma A / \epsilon_0$$

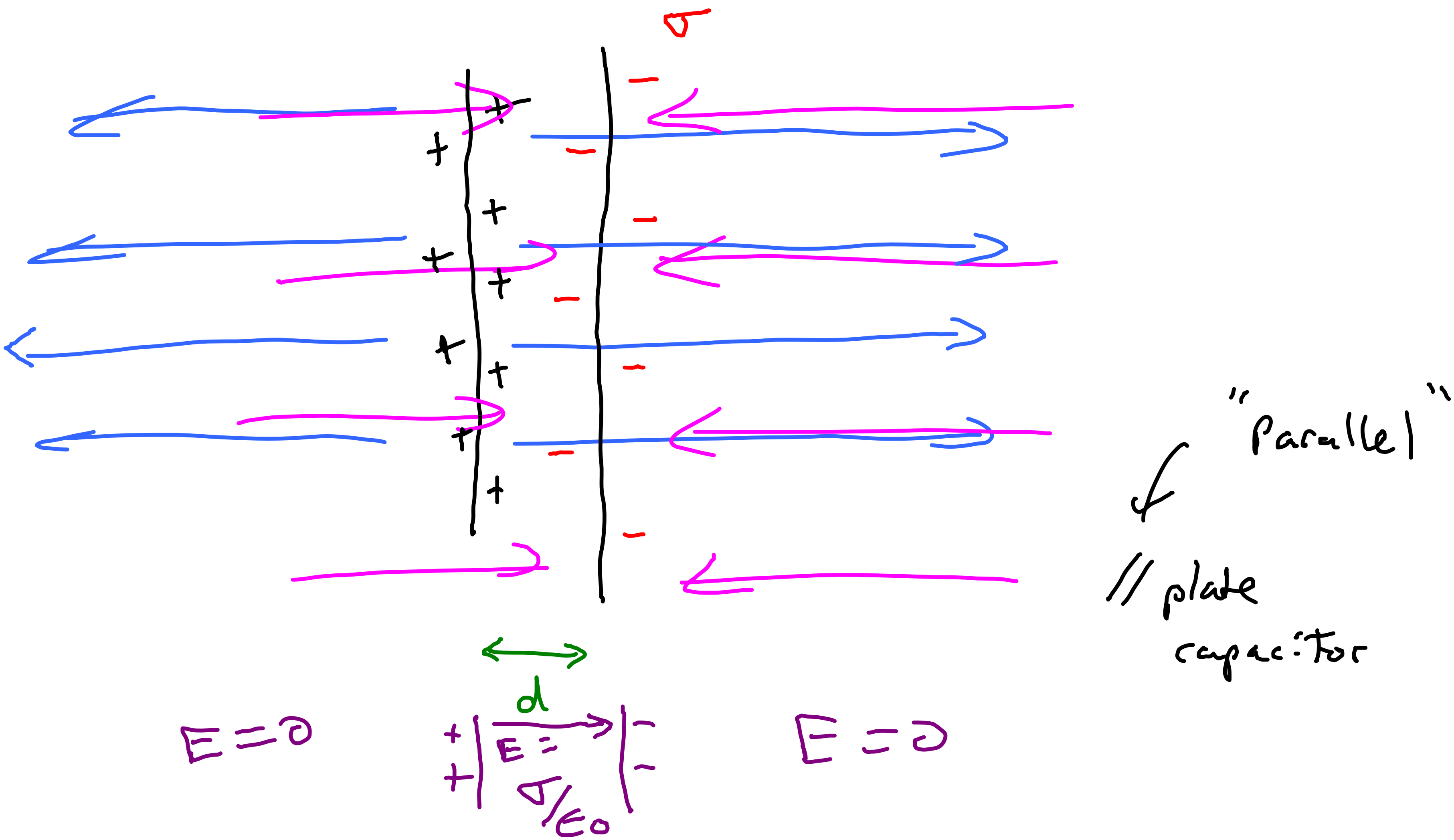
$$|E| = \frac{\sigma}{2\epsilon_0}$$

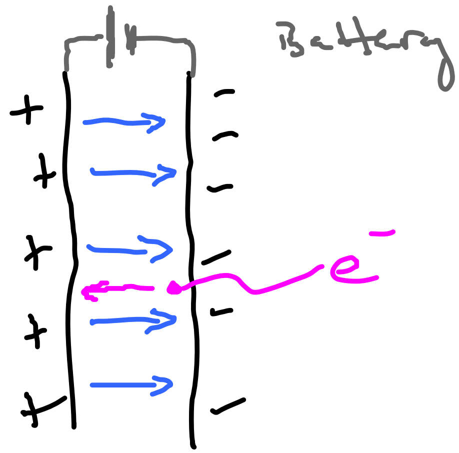


$$|\vec{E}| = \frac{\sigma}{2\epsilon_0}$$

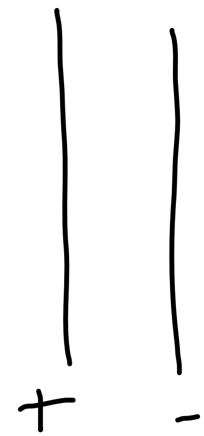


$$|E| = \frac{\sigma}{2\epsilon_0}$$


σ
d
E = 0
E = σ/ε₀
E = 0
"Parallel"
// plate
capacitor



say 1 Volt



$$|\vec{E}| = \sigma/\epsilon_0$$

what is the energy of e^-

$$V = \frac{W}{q}$$

$W = q V = KE$ gain of e^-

$KE = |q| V = KE$ gain

$$KE = (1.6\times10^{-19} C)(1\ J/C) = 1.6\times10^{-19} J$$

electron-Volt = eV