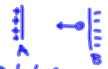
Exam 1

Electron Volt




potential energy between 'A' & 'B'

$= V_{AB}\, q$

= 1 electron Volt if:

$V_{AB} = 1$ volt & $q = e$

e = charge on electron

$= 1.602 \times 10^{-19}$ Coulombs

Ex

$V = 6V$
$q = 15e$

$E_k = Vq$

$= 6\text{volts} \times 15e$

$= 90\ eV$

$= 6\text{ volts} \times 15 \times 1.6\times10^{-19} C$

$= (90 \cdot 1.6\times10^{-19})\ J$

Joule = 1 Volt x 1 Coulomb

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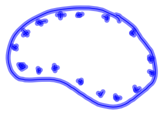
# Electric Field in a Conductor

is zero

Electric field at surface of a conductor can be non zero



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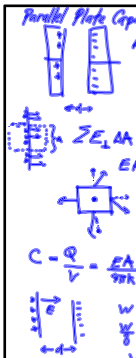
Parallel Plate Capacitor



A = area of plates

$\sum E_\perp \Delta A = 4\pi k Q_{enclosed}$

$EA = 4\pi k Q$

$C = \frac{Q}{V} = \frac{EA}{4\pi k V}$

$W = F \cdot d$

$\frac{W}{q} = \frac{F}{q} d$

$V = Ed$

$= \frac{EA}{4\pi k E d}$

$= \frac{1}{4\pi k}\frac{A}{d}$

$C = \frac{1}{4\pi k}\frac{A}{d}$

$= \epsilon_0 \frac{A}{d}$ $\epsilon_0 = \frac{1}{4\pi k}$

Capacitance depends on geometry of capacitor

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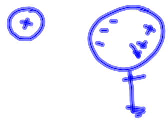
# Energy to charge a capacitor

$U = \frac{1}{2} C V^2$ $C = \frac{Q}{V}$

$= VQ$

$= CV^2$ ← $\frac{1}{2}$



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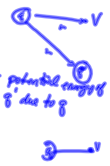
Potential of a point charge

$\phi = \frac{kq}{r}$ = volts

$\Phi = \phi q'$

$= \frac{kqq'}{r}$ = potential energy of $q'$ due to $q$



$\frac{G m_1 m_2}{r}$

Electric field at r is $E_0$. What is electric field at 2r?

$E_0 = \frac{kq}{r^2} = \frac{kq}{(2r)^2} = \frac{kq}{4r^2}$

$= \frac{1}{4}E_0$

Answ. $\frac{E_0}{4}$

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Formula's to memorize [p.c. = point charge]

1. $F = \frac{kq_1q_2}{r^2}$ Coulomb's Law (Force between p.c.'s)
2. $E = \frac{kq}{r^2}$ Electric field of p.c.
3. $\Phi = \frac{kq_1q_2}{r}$ Potential Energy between p.c.'s
4. $\phi = \frac{kq}{r}$ Potential of a p.c.
5. $U = \frac{1}{2}CV^2$ Energy of capacitor
6. $C = \frac{Q}{V}$ Def. of capacitance
7. $C = \epsilon_0 \frac{A}{d}$ Capacitance of parallel plate capacitor (area A, plate separation = d)
8. $u = \frac{1}{2}\epsilon_0 E^2$ energy density u of electric field E

$\epsilon_0 = \frac{1}{4\pi k}$

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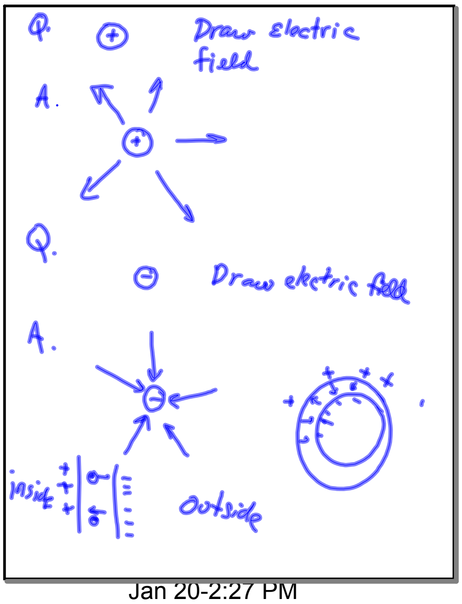
Q. Draw electric field
A.
Q. Draw electric field
A.
inside
outside

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