

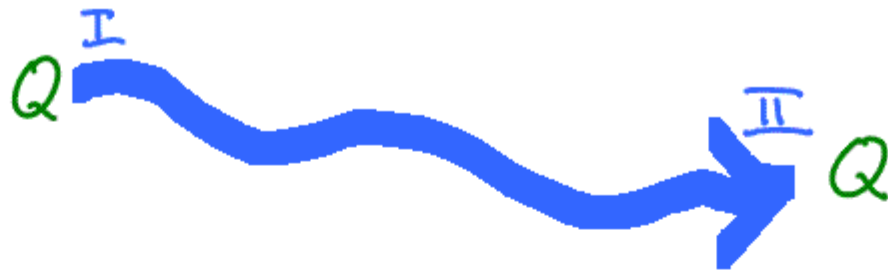
Physics 142- September 25, 2007

Exam 1 - Thursday October 4
during class

- bring calculators
- Can bring 1 8.5x11 inch sheet w/ formulas
- Past Phys Exams on web
- formula sheet supplied - as are integral tables
- Material coverage details forthcoming

Presentations

Last time



Work
charge

to move Q from $I \rightarrow II$ is potential difference

$$\Delta \text{ Energy of system} \equiv \Delta U$$

$$\frac{W}{q} = - \frac{\Delta U}{q} \equiv \text{Potential difference}$$

Well defined

Absolute potential requires
that a "zero" be defined

V or ΔV or $V_{II} - V_I$

units \rightarrow Joules / Coulomb

Man of the Hour



$$1 \text{ Volt} = 1 \text{ Joule} / \text{Coulomb}$$

Count Alessandro Giuseppe
Antonio Anastasio Volta

Como, Lombardy, Italy

1745 - 1827

Invented the Voltaic pile
forerunner of the

Modern battery

hopefully this man
didn't go thru his whole life
this pissed off

Electrostatics (Electromagnetism)
is a conservative force



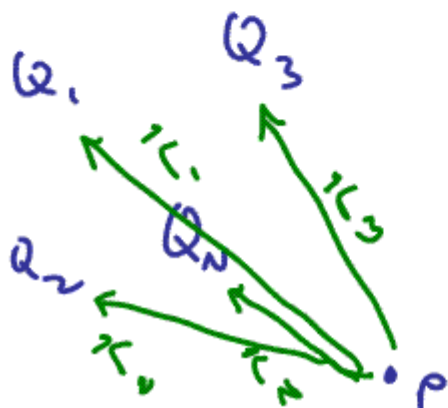
Potential difference is Path independent

Point
charge



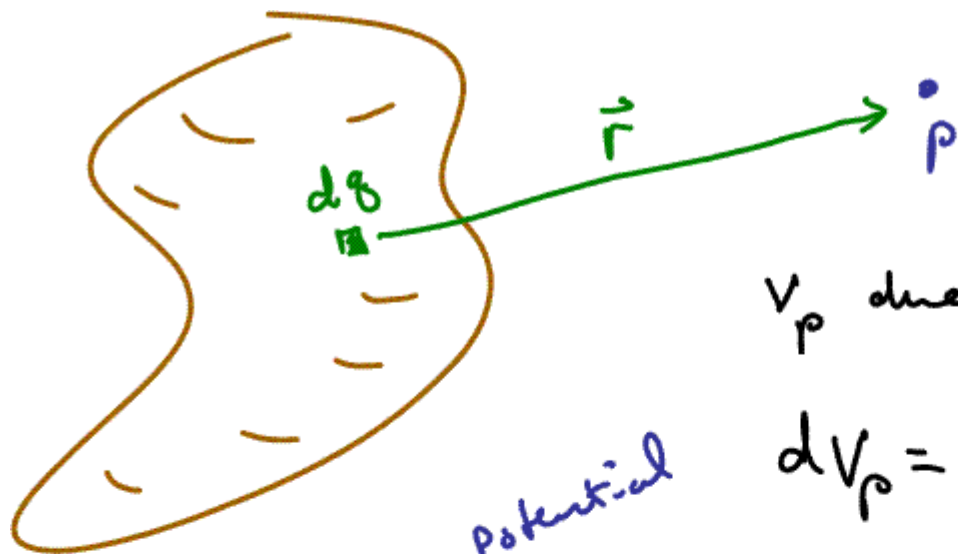
$$V_p = \frac{kQ}{r}$$

Note this is
a scalar



$$V_p = \sum_i \frac{kQ_i}{r_i}$$

Potential of
Sum is
Scalar sum
of Potentials



V_p due dq

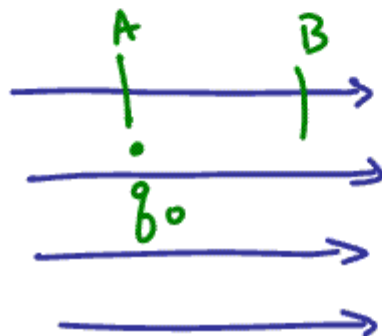
$$dV_p = \frac{kz dq}{r}$$

Potential

$$V_p = \int \frac{k dq}{r}$$

Volume

$\int dv$
Volume



E_x

$$V = \frac{W}{q_0}$$

q_0 goes from A to B

Work system does $\int \vec{F} \cdot d\vec{x} = q \int E dx$

$$dV = -E_x dx$$

potential

$$E_x = -\frac{dV}{dx} \leftarrow \text{potential}$$

Arbitrary direction - s

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

in 3d

$V(x, y, z)$

need is

E_x, E_y, E_z
^(x, y, z)

$$E_x = -\frac{dV}{dx}$$

$$E_y = -\frac{dV}{dy}$$

$$E_z = -\frac{dV}{dz}$$



$$\hookrightarrow E_x = -\frac{\partial V(x,y,z)}{\partial x}$$

$$\frac{\partial v}{\partial x} = \frac{dv}{dx} \quad \text{Hold all other variables constant}$$

$$V(x,y,z) = 2x^2 y z^3$$

$$\frac{\partial v}{\partial x} = 4x y z^3$$

$$\frac{\partial v}{\partial y} = 2x^2 z^3$$

$$\frac{\partial v}{\partial z} = 6x^2 y z^2$$

$$V(x, y, z)$$

$$E_x = -\frac{\partial V}{\partial x}$$

$$E_y = -\frac{\partial V}{\partial y}$$

$$E_z = -\frac{\partial V}{\partial z}$$

$$\vec{E} = -\frac{\partial V}{\partial x} \hat{i} - \frac{\partial V}{\partial y} \hat{j} - \frac{\partial V}{\partial z} \hat{k}$$

$$\vec{E} = -\vec{\nabla} V \equiv -\text{grad } V$$

Vector operator
"Del"
"gradient"

$$\vec{\nabla} \equiv \frac{\partial}{\partial x} \hat{i} + \frac{\partial}{\partial y} \hat{j} + \frac{\partial}{\partial z} \hat{k}$$

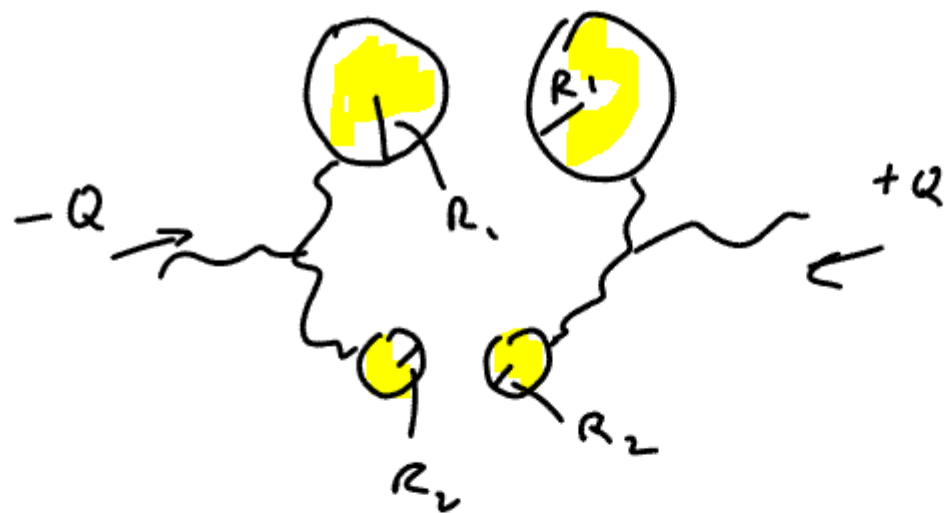
PRS problem: 2 conducting spheres connected by conducting wire
put charge Q on structure ... how is Q distributed?



Equipotential

$$\frac{k Q_1}{R_1} = \frac{k Q_2}{R_2}$$

$$\frac{Q_1}{Q_2} = \frac{R_1}{R_2}$$



where will
spark
occur?

$$E \sim \frac{Q}{R^2}$$

$$\frac{Q_1}{Q_2} = \frac{R_1}{R_2}$$

$$E_1 \sim \frac{Q_1}{R_1^2} \sim \frac{1}{R_1}$$

$$E_2 \sim \frac{1}{R_2}$$

E at Surface 2 is largest because $R_2 < R_1$

\Rightarrow Spark jumps between smaller balls (if distances the same)