&image&

r

p

E\_{p} = (kQ/L [1/r – 1/(r+ L )]

&image&

p

r

E\_{p} = (2kQ)/(rsqrt(L^2 + 4r^2))

&image&

Infinitely long

r

p

E\_{p} = (2klambda)/r

&image&

r

One end, extends till Infinity

E\_{p} = (sqrt(2)klambda)/r

&image&

W

E = (kq)/R^2 q = Q/(2piR)W

&image&

q

q

x

q

q

E = (kQx)/((x^2 + R^2)^(3/2))

Maximum : (dE)/(dx) = 0 at x = plusminus R/sqrt(2)

&image&

Ey

Ex

Θ2

Θ1

E\_{x} = (klambda)/r[costheta\_{2} – costheta\_{1}]

E\_{y} = (klmbda)/r [sintheta\_{1} – sintheta\_{2}]

Disc

E = sigma/(2epsilon\_{0})[1- x/(sqrt(x^2 + R^2))]

Large sheet

R = infty E = sigma/(2epsilon\_{0})

Metal sheet

&image&

+

+

+

+

+

+

+

+

σ

σ

E\_{p} = sigma/epsilon\_{0}

Hemisphere

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+ + + +

E = sigma/(4epsilon\_{0})

Sphere

Nonmetal:

E\_{out} = (kQ)/x^2

E\_inside = (kQx)/R^3 = (rhox)/(3epsilon\_{0})

cylinder

E\_{out} = (sigmaR)/(epsilon\_{0}x)

E\_{inside} = 0

E\_{s} = sigma/epsilon\_{0}

Non-metal

E\_{inside} = (rhox)/(2epsilon\_{0})

E\_{s} = (rhoR)/(2eplison\_{0})

E\_{out} = (rhoR^2) /(2epsilon\_{0}x)

Thick sheet

Metal: E = sigma/epsilon\_{0}

Non-metal: E\_{inside} = (rhox)/epsilon\_{0}

E\_{surface and out} = (rhod)/(2epsilon\_{0}) d = thickness

`E\_{outside} = sigma/epsilon\_{0}` for all conductors

Surface charge density `sigma propto 1/r` (isolated conductor only)

Electric potential

V = (kq)/r

V = int E\*dx

Ring (uniform and non uniformly charged ring)

At center: V = (kQ)/R

Any point on the axis passing through center: V = (kQ)/(sqrt(x^2 + R^2))

Disc

V =(sigmaR)/(2epsilon\_{0})

&image&

dE

EE

B

A

V\_{A} – V\_{B} = Ed = -int\_A^B E\*dr

&image&

+

+

+

+

r1

A

B

r2

V\_{A} – V\_{B} = -int\_r\_{1}^r\_{2} E\*dr

Equipotential surface

E is perpenduicular to surface at all points

Electric field is zero or constant at all points

E = -(dV)/(dx) = -[(dv)/(dx)hat I + (dv)/(dy)hat j + (dv)/(dz)hat k]

Closest distance of approach

&image&

1. 1/2mv^2 = (kq\_{1}q\_{2})/r\_{c}

&image&

1. m\_{1}(0) + m\_{2}u = (m\_{1} + m\_{2})v\_{0}

1/2m\_{2}u^2 = 1/2(m\_{1} +m\_{2})v\_{0}^2 + (kq\_{1}q\_{2})/r\_{c}

&image&

1. 1/2mu^2 = 1/2mv^2 + (kq\_{1}q\_{2})/r\_{c}

Mud = mvr\_{c}

Potential energy = `(kq\_{1}q\_{2})/r`

Electric potential = `(kq)/r`

It is a scalar quantity

Electric dipole moment vec p = qd

Electric dipole

`E\_{r}` is the radial component of E and `E\_{theta}` is the transverse component of E

E\_{r} = (2kpcostheta)/r^3

E\_{theta} = (kpsintheta)/r^3

&image&

Transverse

radial

α

p

Eeq

Eaxis

θ

E\_{axis} =(2kp)/r^3

E\_{eq} = (kq)/r^3

E\_{net} = sqrt(E\_{r}^2 + E\_{0}^2) = (kp)/r^3sqrt(1+ 3(cos)^2theta)

2tanalpha = tnatheta

Potential at p V = (kpcostheta)/r^2

Dipole placed in EF

&Image&

V1 +q

d

V2 -q

Tau = P xxE

U = - PE

V\_{1} – v\_{2} = Edcostheta

Non-0uniform EF

U =-PE

Force = -(dU)/(dr)hat r

F = (P \* (dE)/(dr))hat r

Potential inside a conducting body

&image&

+ + + + + ++++++++++ +++++++++++++++++++++++++++++ + + +

x

yu

E = 0 inside the body

V\_{x} – v\_{y} = intEdr

V\_{x} = v\_{y}

v\_{s} = v\_{in} = (kQ)/R for hollow and sphere with uniform charge

v\_{out}= (kQ)/x

potential due to no conducting body

v\_{s} = (kQ)/R

v\_{out} = (kQ)/x

v\_{in} = (kQ)/(2R^3)(3R^2 – x^2)

x = 0 v = 3/2(kQ)/R

eg: a bullet strikes the sphere and moves inward to point M and stop

&image&

y

q

M

q((kQ)/R) + 1/2mv^2 = (kQ)/(2R^3)(3R^2 – (R/2)^2)

&image&

+q

b

qe

a

V\_{inside} = (kq)/b + (kq\_{e})/a = 0 (due to earthing)

(kq)/b = (-kq\_{e})/a

&image&

E

q2

q1

qd

qa

qb

qc

q\_{b} = -q\_{c}

q\_{a}= q\_{d} = (q\_{1} + q\_{2})/2

sigma = Eepsilon\_{0}

electric pressure and energy density of EF

P\_{e} = (sigma^2)/(2epsilon\_{0})

Only for metal and body with E\_{net inside} = 0

= 1/2epsilon\_{0}E^2 = U\_{c}

Outside E\_{net} = sigma/epsilon\_{0}

U\_{c} = 1/2epsilon\_{0}E\_{net}^2

Self energy

Metal sphere = U\_{s} = (kQ^2)/(2R)

Non-metal sphere = U\_{s} = 3/5(kQ^2)/R