Capacitor

Q = CV

Unit = Farad

C of spherical conductor C =4piepsilon\_{0}R

Energy stored in a capacitor U = 1/2CV^2

Redistribution of charge when to spherical conductions of capacitance C\_{1} and C\_{2} are joined

`(q\_{1}’)/(q\_{2}’)= C\_{1}/C\_{2} = R\_{1}/R\_{2}

Common potential(V) = (text(total charge))/(text(total capacity)) = (q\_{1} + q\_{2})/(C\_{1} + C\_{2})

Loss of energy due to redistribution

U\_{i} = 1/2(q\_{1}^2)/(C\_{1}) + 1/2q\_{2}^2/C\_{2}

U\_{f} = 1/2((q\_{1} + q\_{2})^2)/(C\_{1} + C\_{2})

delta U = (C\_{1}C\_{2})/(2(C\_{1} + C\_{2}))(v\_{1} – v\_{2})^2

E = sigma/eplison\_ {0} in between plate

C = (eplison\_{0}A)/d capacitance depend only on A and d

For n plate C = ((n – 1)epsilon\_{0}A)/d

For dielectrics

E = E\_{0}/k v = v\_{0}/k

&image&

E0

-σ

σ

Ei

E = E\_{0} – E\_{i}

E\_{0}/k = E\_{0} – E\_{i}

sigma\_{i} = sigma(1 – 1/k)

q\_{i} = q(1 – 1/k)

E\_{vacum} = E\_{0} = q/(Aepsilon\_{0}) = sigma /epsilon\_{0}

E\_{diel} = E\_{0}/k

C = kC\_{0}

E\_{conductor} = 0

Partial dielectric

C = (epsilon\_{0}A)/(d-t + t/k)

Case 1: More than 1

C = (epsilon\_{0}A)/(d – t\_{1} – t\_{2}…..t\_{n}) + (t\_{1}/k\_{1} + t\_{2}/k\_{2}…..t\_{n}/k\_{n})

Case 2: t = d

C = (kepsilon\_{0}A)/d

Case 3: conductor, `k = infty`

C = (epsilonA)/(d – t)

Case 4: t = d and k = `infty`

C = `infty`

Capacitance of cylinder capacitor

C per unit length = (2piepsilon\_{0})/ln(b/a)

Force on charged conductor

F/A = 1/2epsilon\_{0}E^2

Force of plate attraction

F = q^2/(2Aepsilon\_{0})

Series capacitor

1/C\_{s} = 1/C\_{1} +1/C\_{2}

V\_{1}/V\_{2} = C\_{2}/C\_{1}

Parallel capacitor

C\_{p} = C\_{1} +C\_{2}

q\_{1}/q\_{2} = C\_{1}/C\_{2}

energy density

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

C-R circuits

q = q\_{0}(1 – e^(-t/tau\_{L}))

tau\_{L} = CR = time constant

I = i\_{0}e^(-t/tau\_{L})

&image&

x

R2

R1

X = (R\_{1} plusminus sqrt(R\_{1}^2 4R\_{1}R\_{2}))/2

&image&

R2

R1

x

R3

X = (R\_{s} plusminus sqrt(R\_{s}^2 + 4R\_{s}R\_{2}))/2