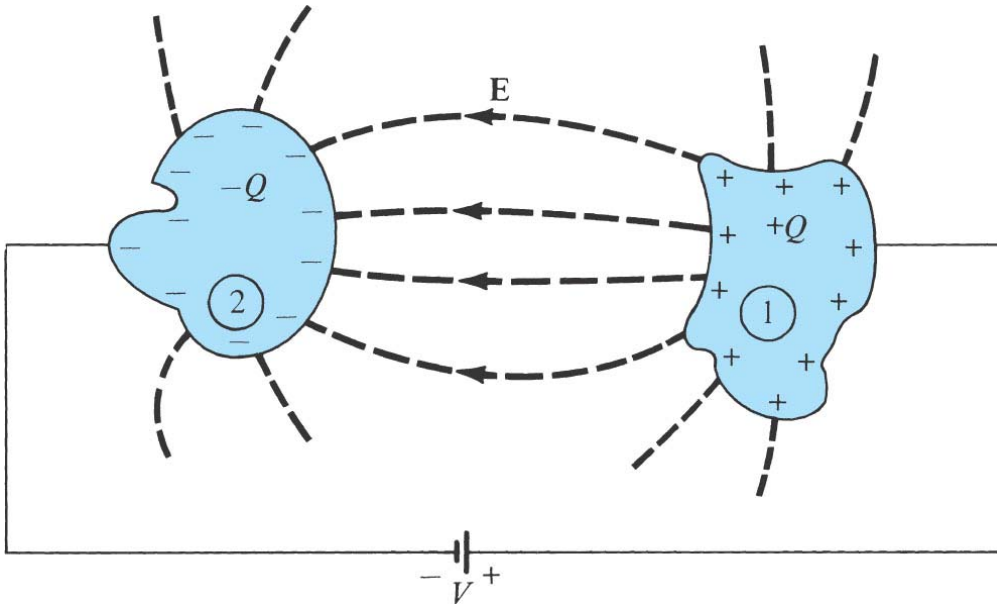


CAPACITANCE AND CAPACITORS

Capacitance consists of two conductors separated by free space or a dielectric medium.



When a dc voltage source is connected between the conductors, a charge transfer occurs, resulting in a charge $+Q$ on one conductor and $-Q$ on the other. (Field lines are perpendicular to the conductor surface).

Then the capacitance is:

$$C = \frac{Q}{V} \quad (\text{Farad})$$

The capacitance of a capacitor is a physical property of the two-conductor system. It depends on the geometry of the conductors and the permittivity of the medium between them. It does not depend on Q or on V . A capacitor has a capacitance even when no voltage is applied to it and no free charges exist on its conductors.

To find the capacitance of a system:

- 1) Choose an appropriate coordinate system.
- 2) Assume charges $+Q$ and $-Q$ on the conductors.
- 3) Find \vec{E} from Q by using any relation. i. e. Gauss Law or
 $D_n = \epsilon E_n = \rho_s$.

4) Find
$$V = - \int_{\text{from } -Q}^{\text{to } +Q} \vec{E} \cdot d\vec{l}$$

- 5) Find C by taking the ratio $C = \frac{Q}{V}$.