**Chapter 30: Capacitors and Dielectrics**

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## 30.1 Capacitance

A capacitor consists of two equal and opposite charges, , with a potential difference between them.

Here, is the constant of proportionality, called the capacitance of the capacitor.

Capacitance is measured in farads (), or coulombs/volt.

## 30.2 Calculating Capacitance

For two parallel plates with an electric field between then, according to Gauss’s Law,

Also, so

Thus,

This formula can be used to find .

Capacitors in parallel:

Capacitors in series:

## 30.3 Energy Stores in an Electric Field

At a given time, let a capacitor of charge have a potential difference of . If an extra charge is added, the extra work that must be done is

Thus,

Since, ,

It can be assumed that the energy stored by the capacitor resides in an electric field.

Thus, the energy density stored per unit volume,

and so,

This equation holds true for all shapes, meaning if an electric field exists at any point, that point has a stored energy per unit volume of