A capacitor is a device that stores electrical energy in an electric field. It is composed of two conductors separated by an insulator, called the dielectric. The conductors are usually metal plates, and the dielectric is usually a thin layer of insulating material such as paper, plastic, or air.

The capacitor works by storing charge on the plates. The electric field between the plates stores the energy. The amount of charge on the plates and the voltage across the capacitor determine the amount of stored energy.

The capacitance of a capacitor is the ratio of the charge on the plates to the voltage across the capacitor. TheSI unit of capacitance is the farad (F), which is equal to one coulomb per volt (C/V).

The farad is a very large unit, so most capacitors have values in the microfarad (µF), nanofarad (nF), or picofarad (pF) range.

The capacitor is a basic component of electronic circuits. It is used to store energy, to smooth out voltage fluctuations, and to filter out unwanted frequencies.

When a capacitor is connected to a voltage source, it will charge up to the voltage of the source. The amount of time it takes to charge up depends on the capacitance and the resistance of the circuit.

The voltage across a capacitor cannot change instantaneously. This property is used to smooth out voltage fluctuations in electronic circuits.

A capacitor can also be used to filter out unwanted frequencies. For example, if a circuit is designed to operate at a certain frequency, a capacitor can be used to block out frequencies that are not needed.

Practice Problems:

1. What is the capacitance of a capacitor with a plates separated by 1mm and a dielectric with a permittivity of 3?

2. What is the voltage across a capacitor with a charge of 10 µC and a capacitance of 100 nF?

3. A capacitor is connected to a voltage source and begins to charge up. After 5 minutes, the voltage across the capacitor is 10 V. What is the capacitance of the capacitor?

4. A capacitor is used to smooth out voltage fluctuations in an electronic circuit. The capacitor is connected across a 100 V power supply. The power supply is turned on and off at a 1 Hz rate. What is the minimum capacitance needed for the capacitor to effectively smooth out the voltage fluctuations?