We may summarise the properties of a capacitor thus:

- A capacitor is not like a resistor it does not allow DC current to through it.
- A capacitor is not like a battery or other emf generator it must be charged before it can supply a current. It can also be charged to many different voltages.
- A capacitor stores electric charge.

The parallel-plate capacitor

Any configuration of conductors separated by an insulating material is capable of storing charge and, consequently, of possessing capacitance. For example, the earth and the ionosphere, a layer of charged particles surrounding our planet at a height of roughly 100km, may be together considered as a huge capacitor.

The simplest form of a capacitor is the type considered above – two flat, metal plates, separated by a thin layer of insulating material (air). This is termed a **parallel-plate capacitor**. Assuming the potential of the battery or other emf source is constant, how can we vary the capacitance of our parallel plate device?

Because the two plates are oppositely charged, there must be an electric field between them; if the plates are close together, we can assume that the electric field lines are straight and parallel. In the area within the plates, the electric field (E) is simply the potential difference (V) divided by the distance (d) between them:

electric field = potential difference/distance apart

$E = V/d$

One value which cannot change in this equation is V, the potential difference across the plates; because V is generated by the constant emf source, V remains fixed in magnitude.

If we reduce the distance (d) between the two plates, the electric field (E) must increase, as the potential difference (V) cannot change. As E increases, then so too must the charge (Q) on each plate. This in turn increases the capacitance. Hence, the capacitance is inversely proportional to the distance separating the two plates. Mathematically:

$C \alpha 1/d$

Another option is to increase the area (A) of the two plates. Suppose two larger plates are held the same distance apart and the same potential applied across them. The charge per unit area must remain the same since the electric field is the same as before. But as the area is greater, so too must be the amount of charge stored. Hence, the capacitance is directly proportional to the area of the plates:

$C \alpha A$