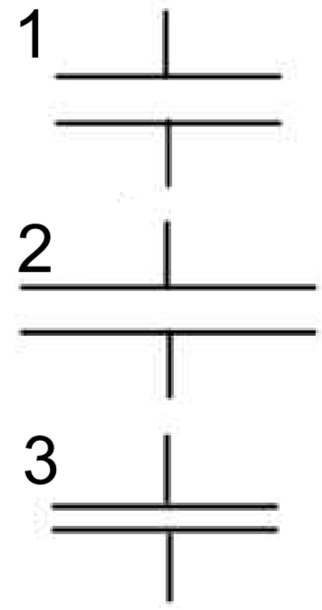
Outline

- Capacitors
- Screening
- Currents

Office hours Thursday 12.30-2

Three capacitors 1, 2, 3 are connected to identical batteries so they each have the same ΔV.
Their plate areas and separations are as follows:
$A_2 = 2\ A_1 = 2\ A_3$; $d_1 = d_2 = 2d_3$.

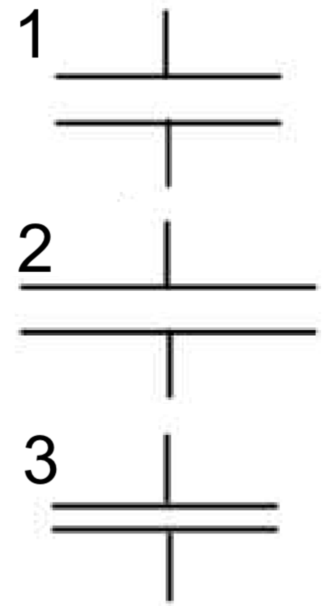
How do the E fields inside them rank?



1. $E_2 = E_3 > E_1$
2. $E_3 > E_1 = E_2$
3. $E_2 > E_1 > E_3$
4. $E_2 > E_1 = E_3$
5. $E_1 = E_2 > E_3$
6. $E_1 = E_2 = E_3$
7. Other

Three capacitors 1, 2, 3 are connected to identical batteries so they each have the same ΔV.
Their plate areas and separations are as follows:
$A_2 = 2\ A_1 = 2\ A_3$; $d_1 = d_2 = 2d_3$.

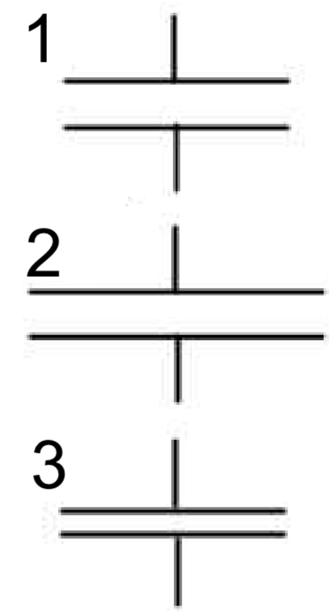
How do the net charges on them rank?



1. $Q_2 = Q_3 > Q_1$
2. $Q_3 > Q_1 = Q_2$
3. $Q_2 > Q_1 > Q_3$
4. $Q_2 > Q_1 = Q_3$
5. $Q_1 = Q_2 > Q_3$
6. $Q_1 = Q_2 = Q_3$
7. Other

Three capacitors 1, 2, 3 are connected to identical batteries so they each have the same ΔV.
Their plate areas and separations are as follows:
$A_2 = 2\ A_1 = 2\ A_3$; $d_1 = d_2 = 2d_3$.

How do the positive charges on their top plate rank?



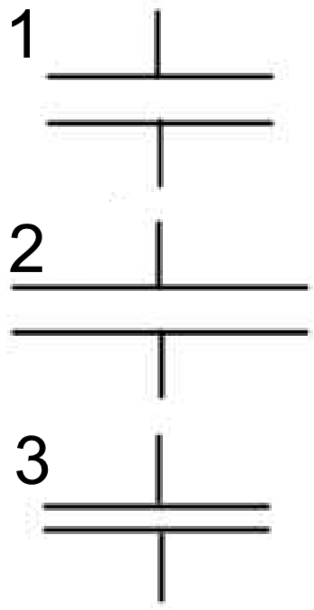
1. $Q_2 = Q_3 > Q_1$
2. $Q_3 > Q_1 = Q_2$
3. $Q_2 > Q_1 > Q_3$
4. $Q_2 > Q_1 = Q_3$
5. $Q_1 = Q_2 > Q_3$
6. $Q_1 = Q_2 = Q_3$
7. Other

Three capacitors 1, 2, 3 are connected to identical batteries so they each have the same ΔV.
Their plate areas and separations are as follows:

$A_2 = 2\ A_1 = 2\ A_3$; $d_1 = d_2 = 2d_3$.

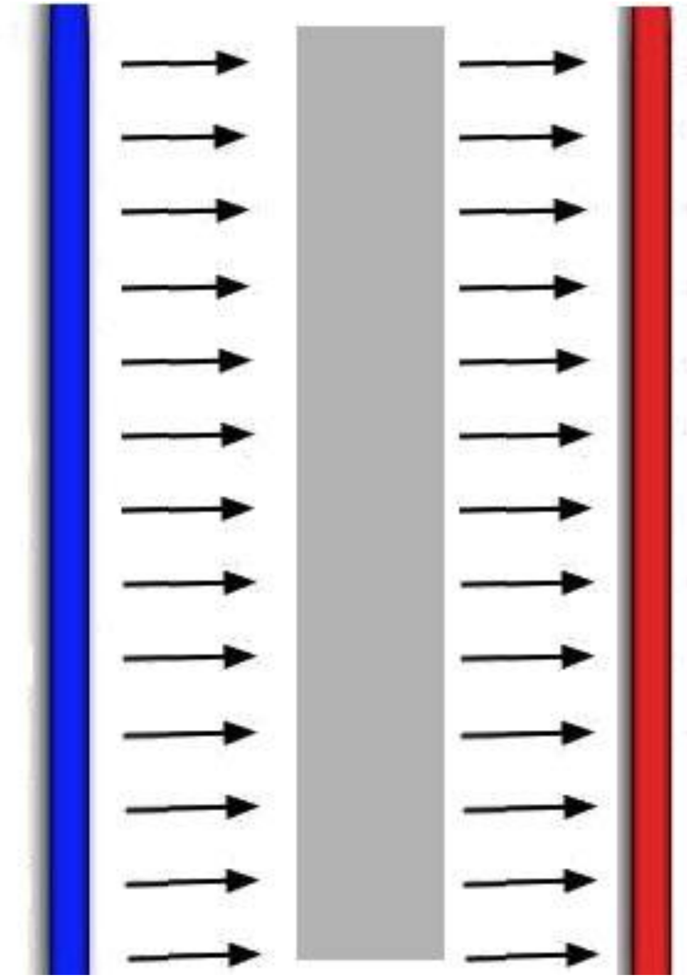
How do the voltage drops across their plates rank?

1. $\Delta V_2 = \Delta V_3 > \Delta V_1$
2. $\Delta V_3 > \Delta V_1 = \Delta V_2$
3. $\Delta V_2 > \Delta V_1 > \Delta V_3$
4. $\Delta V_2 > \Delta V_1 = \Delta V_3$
5. $\Delta V_1 = \Delta V_2 > \Delta V_3$
6. $\Delta V_1 = \Delta V_2 = \Delta V_3$
7. Other



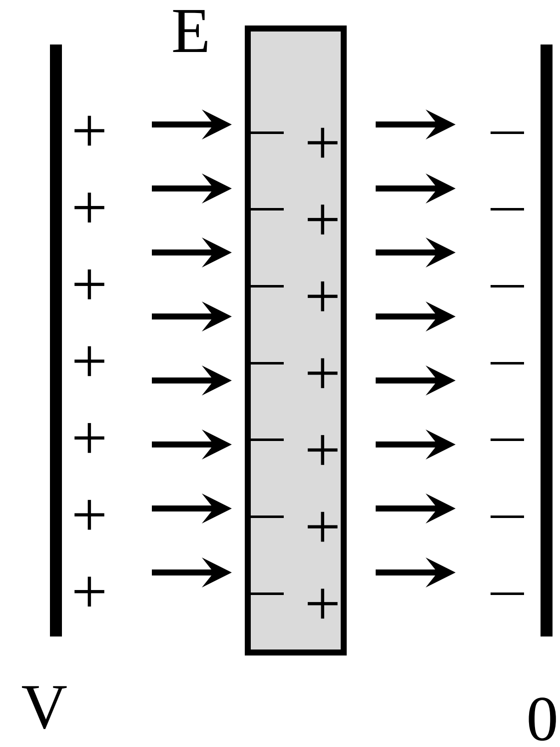
What happens if we fill half the gap between plates with a conductor?

1. The electric field inside the conductor is the same as outside
2. The electric field inside the conductor is opposite to the field outside
3. The electric field inside the conductor is zero
4. Not enough information



Capacitor with a fixed charge, with a conductor inside

1. The electric field is larger
2. The electric field is the same
3. The electric field is smaller
4. Not enough info

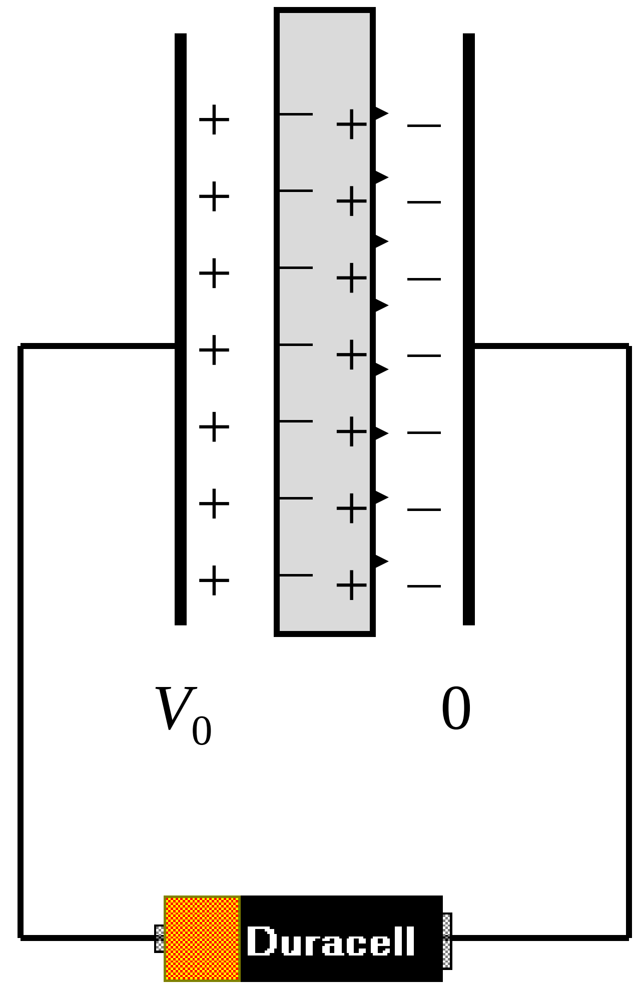


Capacitor with a fixed charge, with a conductor inside

1. The Capacitance is larger
2. The Capacitance is the same
3. The Capacitance is smaller
4. Not enough info

Capacitor with a fixed Voltage diference , with a conductor inside

1. The Charge is larger
2. The Charge is the same
3. The Charge is smaller
4. Not enough info



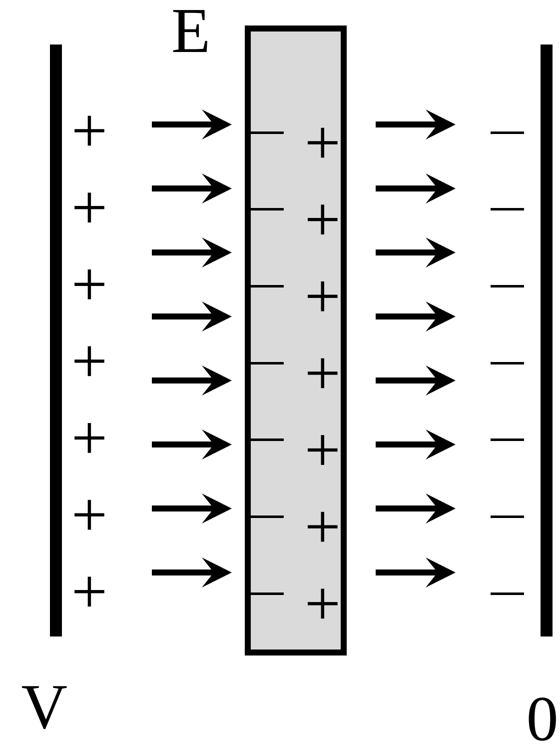
Capacitor with a conductor inside

1. The capacitance C is higher because the electric field is larger
2. The Capacitance C is higher, but the electric field is not larger
3. The capacitance C is the same even though E is larger
4. The Capacitance C is higher, but the electric field is not larger
5. The capacitance C is higher because the electric field is larger
6. The Capacitance C is higher, but the electric field is not larger

Conductors

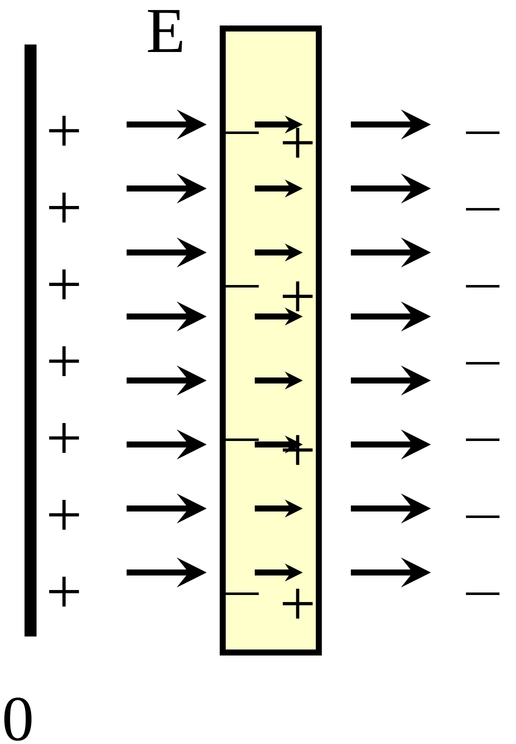
- Putting a conductor inside a capacitor eliminates the electric field inside the conductor.
- The distance, d', used to calculate the Δ*V* is only the place where there is an E field, so putting the conductor in reduces the Δ*V* for a given charge.

$$C = \frac{1}{4\pi k_C}\frac{A}{d'}$$



Consider what happens with an insulator

- We know that charges separate even with an insulator.
- This reduces the field inside the material, just not to 0.
- The field reduction factor is defined to be κ.



$$E_{\text{inside material}} = \frac{1}{k} E_{\text{if no material were there}}$$

Reading question

- What materials **cannot** be placed within a capacitor to measure capacitance?
  1. Metal
  2. Insulator
  3. Neither of the above
  4. All of the above