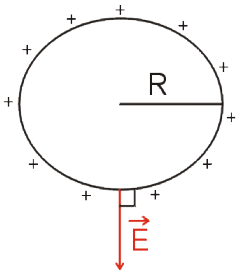
University of Tlemcen
Faculty of Sciences
Department of Mathematics

A.Y: 2024/2025
1st year LMD-M and MI

SW N° 03 of Electricity
Conductors and Capacitors

Exercise 1



Rubbing an ebonite stick produces a charge of 10 nC. This charge is transferred by contact to a metal sphere of radius R=10 cm.

What is the field strength in the vicinity of the sphere?

Exercise 2

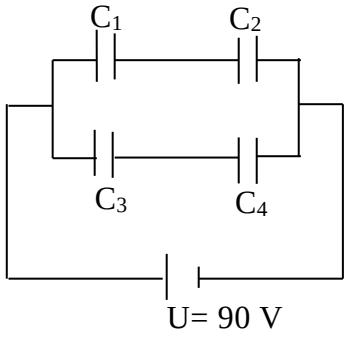
Consider a spherical conductor (C) of center O and radius R connected to ground (its potential is zero). This conductor is brought into contact with a conductive sphere (S) with center A such that OA= d and charge (+Q). Neglecting the influence of the conductor (C) on the sphere (S), calculate the charge q of (C).

Exercise 3 :

Consider two conductive spheres, with radius R_1=2cm and R_2=3cm, which are far apart. They carry electric charges Q_1=10µC and Q_2=15µC, respectively. The two spheres are connected by a thin conducting wire. If we neglect the charge carried by the wire:

1. Calculate the new charges Q_1' and Q_2' of the two spheres.
2. Calculate the amount of charge passing through the wire. Comment on the result.

Exercise 4

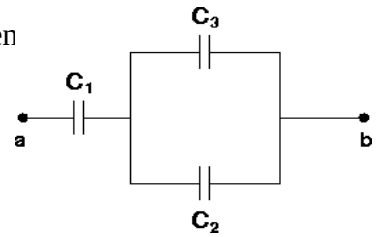


Consider the following group of capacitors.

1- Determine the equivalent capacitance of the assembly.
2- Calculate the voltage between the armatures of each capacitors.
3- Calculate the electrical charge carried by each capacitor.

We give: C_1 =3 µF; C_2 = 6 µF; C_3=2 µF; C_4=4 µF et U=90V.

Exercise 5



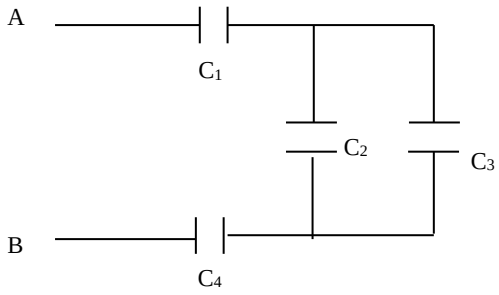
1) What is the equivalent capacitance of the following segmen
$C_1 = C_2 = C_3 = 3.0\ 10^{-3}$ F
2) If a voltage V_{ab} = 6.0 V is applied, what is the charge of each capacitor?
3) What is the voltage across each capacitor?
4) Consider two plates separated by d = 1.5 cm, where the electric field between them is 100 V / m, and the charge on the plates is $30.0\ 10^{-3}$C. What is the capacitance of the capacitor formed?

5) A capacitor has a charge of $3.0\ 10^{-9}$C when the voltage across the capacitor is 12 V. How much energy is stored in the capacitor?

Supplementary exercises

Exercise 1

A. Consider the capacitor bank shown in figure 2.
1- Determine the equivalent capacitance between points A and B.
2- Find the charge carried by each capacitor when the voltage between A and B is 12 V.
3- Calculate the potential difference across each capacitor.
We give : C_1 =2 µF; C_2 = 10 µF; C_3=4 µF; etC_4=7µF



B. Consider two plates separated by d = 1.5 cm,
where the electric field between them is 100 V/m,
and the charge on the plates is 30 10^{-3}Cb.
What is the capacitance of the capacitor formed?

C. A capacitor has a charge of 3.0 10^{-9}C when
the voltage across the capacitor is 12 V. How much energy is stored in the capacitor?

Exercise 2

Consider the circuit below.

1- Knowing that capacitor C_1 carries charge Q_1=10µC, what will be the voltage V_{AD} between points A and D?

2- Determine the charges Q_2 and Q_3 of capacitors C_2 and C_3 respectively.

3- Since the voltage between B and D is equal to 2V, calculate the charges Q_4 and Q_5 of capacitors C_4 and C_5.

4- What is the equivalent capacitance C_{eq} of the entire circuit?

5- Calculate the energy stored by capacitor C_1.

We give : C_1=4µF, C_2=3.5µF, C_3=2.5µF, C_4= C_5= C_7= C_8=5µF, C_6=10µF.