Mohamed Khider University of Biskra **Academic year 2025–2026**
Faculty of Medicine
1st Year Medicine

Series 3

Physic-Biophysic : Electrostatic,Electrokenitic,Conductors and Generators…

Circle the letter (a, b, c, d, e, or f) corresponding to the correct answer.

1. Coulomb's law is valid for:
a. Point charges in rapid motion
b. Fixed point charges
c. Well-defined distances between charges
e. Charges with the same sign
f. None of the answers is correct

2. The force exerted on a charge q is:
a. In the same direction as the field if the charge is negative
b. In the opposite direction if the charge is positive
c. In the same direction as the field if the charge is positive
d. In the opposite direction as the field if the charge is positive
f. None of the answers is correct

3. The electric interaction between two point charges is:
a. Proportional to the distance separating the two charges
b. Proportional to the charges
c. Proportional to the square of the distance between the two charges
d. Inversely proportional to the charges
e. None of the answers is correct

4. The electric field:
a. Does not derive from the potential
b. Derives from the potential
c. Is directed from low potentials to higher potentials
d. None of the answers is true

5. The equilibrium of an electric dipole in a uniform electric field is said to be unstable if:
$a.$ ($\vec{P}$.$\vec{E}$) = 0

$b.$ ($\vec{P}$.$\vec{E}$) = π /4
$c.$ ($\vec{P}$.$\vec{E}$) = π/2
d. ($\vec{P}$.$\vec{E}$) = π
$\vee$

6. Consider a region where a uniform electric field $\vec{E}$ exists. The torque $\vec{M}$ exerted on an electric dipole with dipole moment $\vec{P}$ placed in this electric field is given by:

a. $\vec{M}$ = $\vec{P}$ *$\vec{E}$

b. $\vec{M}$ = - $\vec{P}$ *$\vec{E}$

c. $\vec{M}$ = $\vec{P} \wedge \vec{E}$

d. $\vec{M}$ = $\vec{P} \vee \vec{E}$

e) All of the proposals are false

7. Kirchhoff's laws: For a given node where n currents enter and m currents leave, the node law states:

a) The sum of the entering currents equals the sum of the leaving currents
b) The sum of the entering currents multiplied by the sum of the leaving currents
c) The sum of the entering currents plus the sum of the leaving currents
d) The sum of the entering currents minus the sum of the leaving currents
e) All of the proposals are false

Exercise 2:

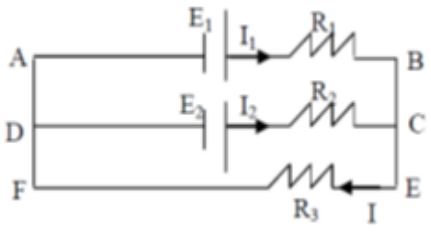
Two electrons are in a vacuum and separated by a distance r.
Compare the gravitational and electric forces acting on these two particles.

Given K= 9X10^9, G= 6,67 X

Exercise 3:

Consider the electrical circuit shown below:

1. Write the equations for loops **ABCDA** and **ABEFA**.
2. Write the equation for node **C**.
3. Calculate the current flowing through **R₂**.
4. Write the equations for loops **ABCDA** and **ABEFA**.
5. Write the equation for node **C**.



Given:

E1 = 5V and E2 = 4V , R1 = R3 = 1Ω and R2 = 2 Ω

Exercise 4:

A charge Q=10 nC is placed at a point **A** in space. Another charge q=5 nC is placed at point **B**, and the distance between A and B is 1 cm.
Determine the force F.

Exercise 5:

Consider a hydrochloric acid solution with a concentration of 10 mmol/L.

The mobilities of the ions H^+ and Cl^- are
respectively 35 µm/s and 7.63 µm/s for an electric field of 1 V/cm at a temperature of 25°C.

- Calculate the **conductivity** and **resistivity** of this solution.
  (Given: F=96500 C/mol)

Exercise 6:

The potential of a membrane is 90 mV, and the concentration of Na^+ ions in the extracellular medium is 144 mmol/L.

- Calculate the **intracellular concentration** at electrical equilibrium.

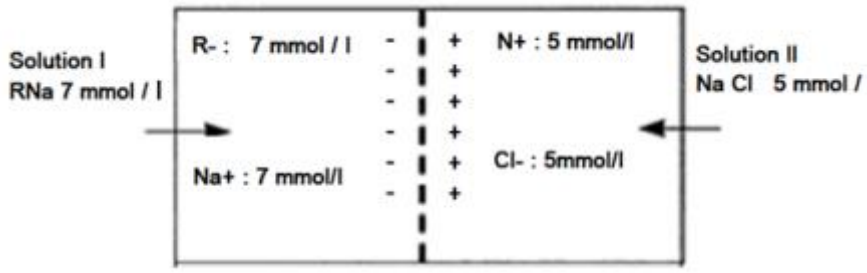
The force applied on a K+ ion inside the membrane is 1.6×10^{-12} N.

- Calculate the **thickness of the cell membrane**
  (Given:

  RT/zF = 60 ml

Exercise 7 (Application of Donnan's Equilibrium):

Consider the following solution:



a. Is there a Donnan effect?

b. Are the Na^+ and Cl^- ions at equilibrium?

c. In which direction will the ions move?

d. Calculate the **concentrations** (Cm) at equilibrium.