Physics Courses

V A P E N A T I O N

EPITA S3 [2017]

Contents

Chapter 1

Electrostatics

1.1 Discrete distribution of charges

1.1.1 Definitions

• Discrete distribution : We are for the moment only considering point like charges $q_i,\ i = 1, .., n\ q > 0$ or $q < 0$

Remember that charge has a unit of Coulomb (C).

• The elementary charge $e = 1,6 * 10^{-19}C$, this corresponds to the electric monopole, the so-called electron : $q_{e-} = -e$

1.1.2 Electric field and force

a)Electric field $\vec{E}$

• Any charge q_i creates an electric field at point M :
$\vec{E_i}(M)$, which reads:
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$$\vec{E_i}(M) = k\frac{q_i}{r^2}\vec{u_i} = k\frac{q_i}{||O_iM||^3}\vec{O_iM}$$

• If we now consider all charges, the total electric field is just given by superposition theorem:

$$\vec{E_{tot}}(M) = \sum_{i=0}^{n} \vec{E_i}(M) = \sum_{i=0}^{n} k\frac{q_i}{r^2}\vec{u_i}$$

• k is the constant $\frac{1}{4\pi\epsilon_0}$ and $\vec{u_i}$ depends on the point O_i.

$$\vec{E_{tot}} = k\sum \frac{q_i}{r^2}\vec{u_i}$$

b)Induced force (s)

Let's introuce charge q_m at point M. The distribution acts on charge q_m and this force reads :

$$\vec{F_{tot}}(M) = q_m E_{tot}(M) = \sum \vec{F_i}(M)$$

1.1.3 Electric potential

$q_i,\ i = 1, .., n$ Charge q_i creates at point M a potential : $V(M) = k\frac{q_i}{r_i}$ And total potential $V_{tot}(M) = \sum V_i(M)$

1.1.4 Units

- [Potential] Volt (V)
- [Electric field] Volt/Meter $(V.m^{-2})$
- [Electric force] Newton $(N) = (C.V.m^{-1}) = [k][C]^2[m]^{-2} = (kg.m.s^{-2})$
- [Energy] Joule (J) Newton * Meter $(N.m)$
- [k] $= (kg.m^3.C^{-2}.s^{-2}) = [\epsilon_0]^{-1}$
- [g] $= (m.s^2)$

1.1.5 Field lines

Consider two charges q_i and q_j
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For instance $q_i > 0$,
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Chapter 2

Continuous state

Chapter 3

Gauss'Theorem

Chapter 4

Electrokinetics