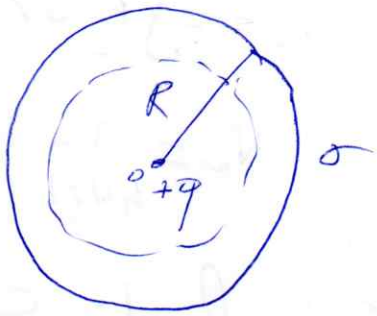
Exo3 :

Le champ E :

En utilisant le théorème de Gauss :

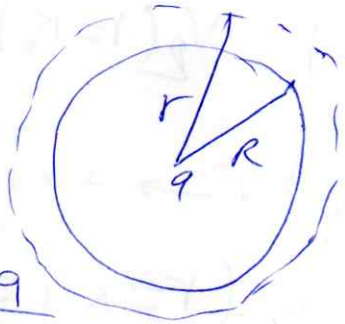


1) $r < R$

$E_1 \cdot S_G = \frac{\sum q_i}{\varepsilon_0} \Rightarrow E_1 \cdot 4\pi r^2 = \frac{q_i}{\varepsilon_0}$

$E_1 = \frac{q}{4\pi\varepsilon_0 r^2}$

2) $r > R$



$E_2 \cdot S_G = \frac{\sum q_i}{\varepsilon_0}$

$E_2 \cdot 4\pi r^2 = \frac{q_1 + q_S}{\varepsilon_0}$

on a : $\sigma = \frac{dq}{ds}$

$\Rightarrow dq = \sigma ds$

$q = \iint \sigma ds$

$S = 4\pi r^2 \Rightarrow ds = 8\pi r dr$

$q = \int_0^R \sigma 8\pi r dr = 4\pi R^2 \sigma$

$\Rightarrow E_2 \cdot 4\pi r^2 = \frac{q_1 + 4\pi R^2 \sigma}{\varepsilon_0} \Rightarrow E_2 = \frac{q_1}{4\pi\varepsilon_0 r^2} + \frac{\sigma R^2}{\varepsilon_0 r^2}$

* Le potentiel V :

1) $r < R$:

$V = -\int E dr \Rightarrow V_1 = -\int E_1 dr = -\int \frac{q}{4\pi\varepsilon_0 r^2} dr$

$V_1 = \frac{q}{4\pi\varepsilon_0 r} + C_1$