SOLUZ. III° CLASSICO 01/12/15

1) $Q = \sigma \cdot 4\pi R^2 = 2 \cdot 10^{-6} \frac{C}{m^2} \cdot 4\pi \cdot (5 \cdot 10^{-2} m)^2 \Rightarrow$

$Q = 6{,}3 \cdot 10^{-8} C.$

$E = k \cdot \frac{Q}{(1{,}4 \cdot 10^{-1})^2} \Rightarrow E = 9 \cdot 10^9 \cdot \frac{6{,}3 \cdot 10^{-8}}{(1{,}4 \cdot 10^{-1})^2} \cong \boxed{2{,}9 \cdot 10^4 \frac{N}{C}}$

2) $E = \frac{\sigma}{2\varepsilon_0} \Rightarrow \sigma = 2 \cdot \varepsilon_0 \cdot E = 2 \cdot 8{,}85 \cdot 10^{-12} \cdot 3{,}0 \cdot 10^1 \Rightarrow$

$\boxed{\sigma = 5{,}31 \cdot 10^{-10} C/m^2}.$

3) ⓐ $\Phi = (4 \cdot 10^3) \cdot (3 \cdot 10^{-4}) \cdot \cos(30°) = 12 \cdot 10^{-1} \cdot \frac{\sqrt{3}}{2} \cong \boxed{1{,}04 \frac{N \cdot m^2}{C}}$

3) ⓑ $\Phi = \frac{q_1 + q_2 + q_3}{\varepsilon_0} = 7 \cdot 10^5 \frac{N \cdot m^2}{C} \rightarrow$

$q_3 = \varepsilon_0 \cdot \Phi - q_1 - q_2 \Rightarrow q_3 = (8{,}85 \cdot 10^{-12}) \cdot (7 \cdot 10^5) - 2 \cdot 10^{-6} + 4 \cdot 10^{-6}$

$\Rightarrow \boxed{q_3 \simeq 8{,}2 \cdot 10^{-6} C}$

4) ⓐ $\Delta t = 2{,}8 \cdot 10^{-6} s$; $q = 1{,}6 \cdot 10^{-19} C$; $M = 1{,}67 \cdot 10^{-27} kg$.

$v_i = 0 \, m/s$; $s = 0 + 0 \cdot \Delta t + \frac{1}{2} \cdot \frac{q \cdot E}{M} \cdot (\Delta t)^2 \Rightarrow$

$s = 0{,}5 \cdot \frac{1{,}6 \cdot 10^{-19} \cdot 140}{1{,}67 \cdot 10^{-27}} \cdot (2{,}8 \cdot 10^{-6})^2 \cong \boxed{0{,}053 \, m} \; (5{,}3 \, cm).$

$v_f = v_i + a \cdot \Delta t \Rightarrow v_f = 0 + \frac{q \cdot E}{M} \cdot \Delta t \cong \boxed{3{,}76 \cdot 10^4 \, m/s}.$

4) ⓑ $E_1 = E_2 \rightarrow k \frac{q_1}{x^2} = k \frac{q_2}{(d-x)^2} \Rightarrow \frac{q_1}{q_2} = \frac{x^2}{(d-x)^2} \rightarrow$

$\sqrt{\frac{q_1}{q_2}} = \frac{x}{d-x} \Rightarrow x = (d-x) \cdot \sqrt{\frac{q_1}{q_2}} \rightarrow x^* = \frac{d \cdot \sqrt{q_1/q_2}}{1 + \sqrt{q_1/q_2}}$

$q_1/q_2 = \frac{2 \cdot 10^{-5}}{1{,}8 \cdot 10^{-4}} = 1/9 \rightarrow x^* = \frac{d \cdot 1/3}{1 + 1/3} \Rightarrow \boxed{x^* = d/4}$

QUINDI, essendo $d = 2{,}0 \, m$, sirhe: $x^* = \frac{2{,}0 \, m}{4} = \boxed{0{,}5 \, m}$.

5) $E = \frac{\sigma}{2\varepsilon_0}$; $a = -\frac{q \cdot E}{M}$; $v_i = 4 \, m/s$; $v_f = 0 \, m/s$.

$0^2 - 4^2 = 2 \cdot \left(-\frac{q \cdot E}{M}\right) \cdot (s_f - 0) \rightarrow s_f^* = \frac{-16}{-2qE/M} \cong \boxed{0{,}98 \, m}.$

$s = 0 + 4t - \frac{qE}{2M} \cdot t^2 \Rightarrow 0 = 4t - \frac{qE}{2M} \cdot t^2 \Rightarrow t = \begin{cases} 0 \, s \\ \boxed{0{,}98 \, s} \end{cases}$