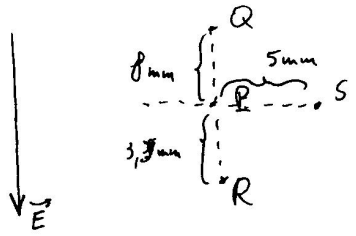
9.44



$V(P) = 135\,V$

$E = 3 \cdot 10^3 \frac{V}{m}$

a). $E = \frac{\Delta V}{d} \Rightarrow \Delta V = E \cdot d = 3000 \cdot 0{,}008 = 24\,V$

$V(Q) > V(P)$

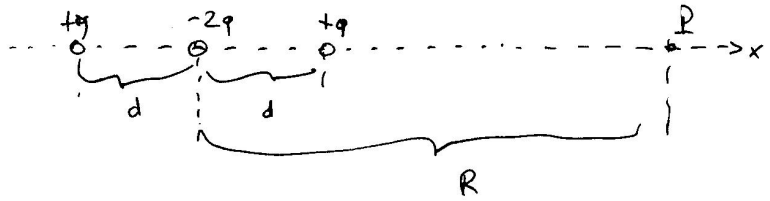
$\Rightarrow V(Q) = V(P) + \Delta V = \underline{159\,V}$

b). $\Delta V = E \cdot d = 3000 \cdot 0{,}0033 = 9{,}9\,V$

$V(R) < V(P) \Rightarrow V(R) = V(P) - \Delta V = 135 - 9{,}9 = \underline{125{,}1\,V}$

c). PS est une équipotentielle, $\Rightarrow V(S) = \underline{135\,V}$

9.45



- $V \propto k\frac{q}{x}$: $V \to 0$ si $x \to \infty$
- $R \gg d$

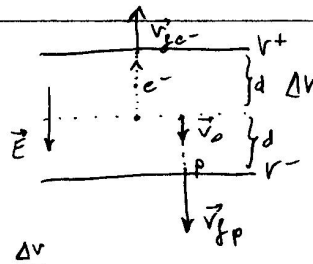
$$V(P) = k\frac{q}{R+d} - 2k\frac{q}{R} + k\frac{q}{R-d} = kq\left(\frac{1}{R+d} + \frac{1}{R-d}\right) - k\frac{2q}{R} = kq\left(\frac{R-d+R+d}{(R+d)(R-d)}\right) - k\frac{2q}{R}$$

$$= kq\left(\frac{2R}{R^2-d^2}\right) - k\frac{2q}{R} = 2kq\left[\frac{R}{R^2-d^2} - \frac{1}{R}\right]$$

$$= 2kq\left(\frac{R^2 - R^2 + d^2}{R(R^2-d^2)}\right) = 2kq\left(\frac{d^2}{R(R^2-d^2)}\right) = 2kq \cdot \frac{d^2}{R \cdot R^2\left(1-\left(\frac{d}{R}\right)^2\right)} \to 0$$

$$V(P) \simeq 2kq\,\frac{d^2}{R^3}$$

9.46



$E = \frac{\Delta V}{2d}$

* accélération :

- électron : $a_e = \frac{|q_e|}{m_e} E = \frac{|q_e|}{m_e} \cdot \frac{\Delta V}{2d}$ (1)
- proton : $a_p = \frac{q_p}{m_p} E = \frac{q_p}{m_p} \cdot \frac{\Delta V}{2d}$ (2)

* cinématique :

- électron : $d = \frac{1}{2} a_e t^2 \Rightarrow t^2 = \frac{2d}{a_e}$; $t = \sqrt{\frac{2d}{a_e}}$; $\frac{a_p}{a_e} = \frac{a_p}{m_p} \cdot \frac{\Delta V}{2d} \cdot \frac{m_e}{|q_e|} \cdot \frac{2d}{\Delta V}$
- proton : $d = \frac{1}{2} a_p t^2 + v_0 t \Rightarrow d = \frac{1}{2} a_p \frac{2d}{a_e} + v_0 \cdot \sqrt{\frac{2d}{a_e}}$; $= \frac{q_p}{m_p} \cdot \frac{m_e}{|q_e|}$

$$\Rightarrow v_0 = \frac{d - \frac{1}{2} a_p \frac{2d}{a_e}}{\sqrt{\frac{2d}{a_e}}} = \frac{d - d \cdot \frac{a_p}{a_e}}{\sqrt{\frac{2d}{a_e}}} = d \cdot \frac{\left(1 - \frac{a_p}{a_e}\right)}{\sqrt{2d \cdot \frac{2d\,m_e}{|q_e|\,\Delta V}}} = \frac{d}{2d} \cdot \frac{\left(1 - \frac{a_p}{a_e}\right)}{\sqrt{\frac{m_e}{|q_e|} \frac{1}{\Delta V}}} = \frac{1}{2} \cdot \frac{\left(1 - \frac{q_p}{m_p} \cdot \frac{m_e}{|q_e|}\right)}{\sqrt{\frac{m_e}{|q_e|} \cdot \frac{1}{\Delta V}}}$$

$\simeq \underline{2{,}77 \cdot 10^6\ m/s}$