(1) $\begin{cases} x = 0 + v_0 t \\ y = 0 + \frac{1}{2} a t^2 \end{cases}$

$$Ma = eE$$

$$\boxed{a = \frac{eE}{M}}$$

$$t = \frac{d}{v_0}$$

$$y = \frac{1}{2} a \cdot \frac{d^2}{v_0^2} \Rightarrow \overset{2h}{y} = \frac{1}{2} \frac{eE}{M} \cdot \frac{d^2}{v_0^2}$$

$$2h = \frac{eEd^2}{2Mv_0^2} \longrightarrow v_0^2 = \frac{eEd^2}{4hM}$$

$$\boxed{v_0 = \sqrt{\frac{eEd^2}{4hM}}}$$

<u>NELL'ALTRO CASO:</u>

$$h = \frac{eEd^2}{2Mv_1^2} \longrightarrow v_1^2 = \frac{eEd^2}{2hM}$$

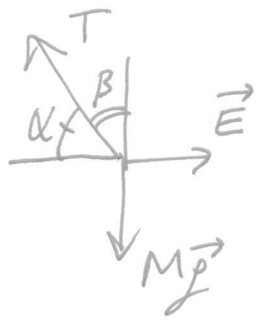
$$v_1 = \sqrt{\frac{eEd^2}{2hM}}$$

$$\frac{v_1}{v_0} = \sqrt{\frac{\cancel{eEd^2}}{\cancel{2}\cancel{hM}}} \cdot \sqrt{\frac{{}^{2}\cancel{4}\cancel{hM}}{\cancel{eEd^2}}} = \sqrt{2}$$

②

$$E\cdot 2\cancel{\pi} d\cdot \cancel{h} = \frac{1}{\varepsilon_0}\cdot\rho\cdot(\cancel{\pi}R^2\cdot h)$$

$$E = \frac{\rho R^2}{2\varepsilon_0}\cdot\frac{1}{d} \qquad (d = R + L\cdot\sin\beta)$$



$$\begin{pmatrix}0\\-Mg\end{pmatrix}+\begin{pmatrix}E\cdot q\\0\end{pmatrix}+\begin{pmatrix}-T\cdot\cos\alpha\\T\cdot\sin\alpha\end{pmatrix}=\begin{pmatrix}0\\0\end{pmatrix}$$

$$\begin{cases} T = \dfrac{E\cdot q}{\cos\alpha} = \dfrac{E\cdot q}{\sin\beta} \\[2ex] T = \dfrac{Mg}{\sin\alpha} = \dfrac{Mg}{\cos\beta} \end{cases}$$

$$\frac{Mg}{\sin\alpha} = \frac{E\cdot q}{\cos\alpha} \Longrightarrow M = \frac{E\cdot q}{g}\cdot\tan\alpha$$

$$M = \left(\frac{\rho\cdot R^2}{2\varepsilon_0}\cdot\frac{1}{d}\right)\cdot\frac{q}{g}\cdot\tan\alpha$$

$$\boxed{M = \frac{\rho R^2\cdot q}{2\varepsilon_0 d g}\cdot\tan\alpha}$$

N.B. $\left(\tan\alpha = \frac{1}{\tan\beta}\right)$

$$\boxed{M = \frac{\rho R^2 q(>0)}{2\varepsilon_0 g d \tan\beta}}$$

$$\boxed{M = \frac{\rho R^2 q}{2\varepsilon_0 g \tan\beta\cdot(R + L\cdot\sin\beta)}}$$

③

$$\frac{1}{2} M v_0^2 + k \frac{Qq}{\sqrt{0^2 + R^2}} + k \frac{Qq}{\sqrt{(2R)^2 + R^2}} =$$

$$= 0 + 0 + 0 \Rightarrow$$

$$\frac{1}{2} M v_0^2 + kQq \cdot \left(\frac{1}{R} + \frac{1}{\sqrt{5R^2}} \right) = 0 \Rightarrow$$

$$\frac{1}{2} M v_0^2 + kQq \cdot \frac{1}{R} \cdot \left(1 + \frac{1}{\sqrt{5}} \right) = 0$$

$$\Rightarrow v_0^2 = -\frac{2}{M} \cdot k \underset{(<0)}{\underbrace{Qq}} \cdot \frac{1}{R} \cdot \left(1 + \frac{1}{\sqrt{5}} \right)$$

$$\boxed{v_0 = \sqrt{\underbrace{-\frac{2kQq}{MR}}_{>0} \cdot \left(1 + \frac{1}{\sqrt{5}} \right)}}$$