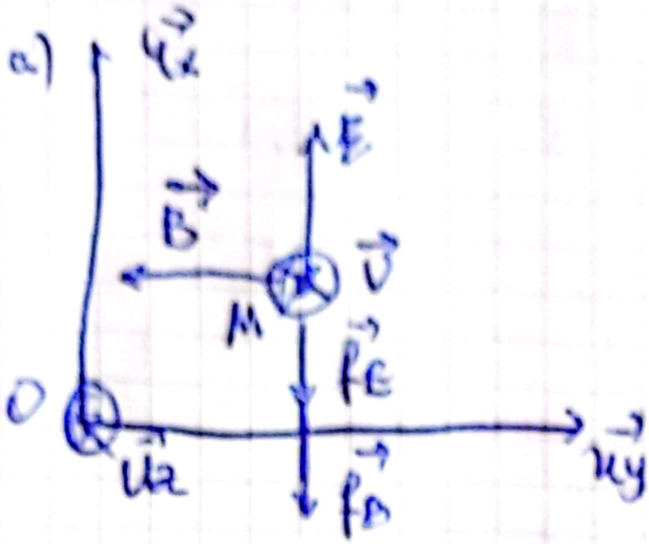
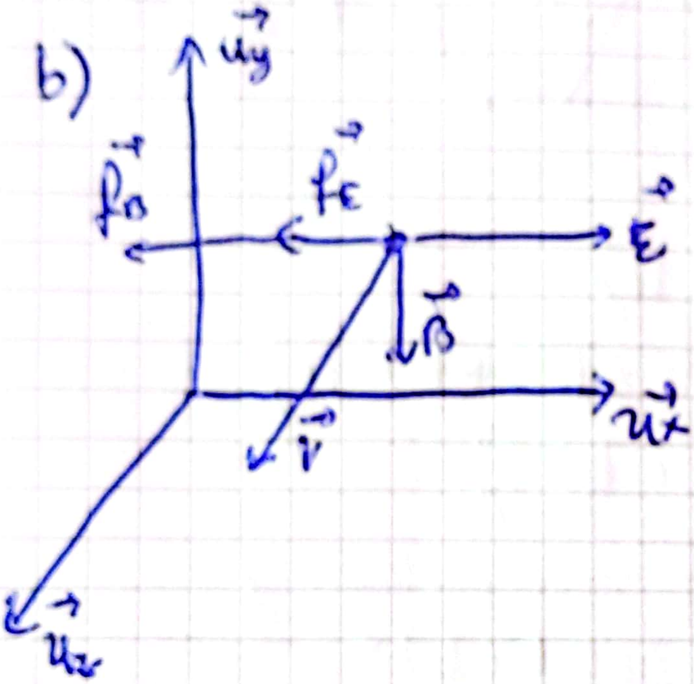
Q1

a)


$\vec{u_x}$
$\vec{E}$
$\vec{B}$
$\vec{v}$
M
$\vec{f_E}$
O
$\vec{u_z}$
$\vec{f_B}$
$\vec{u_y}$

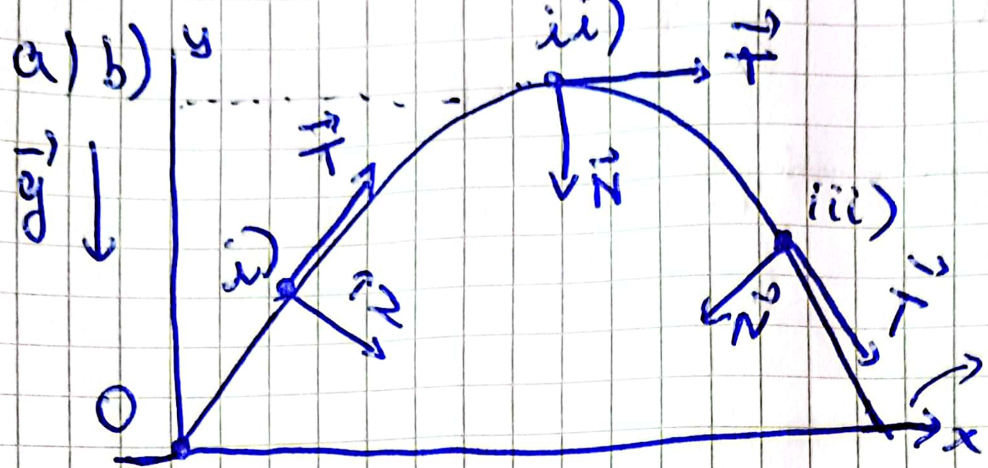
b)


$\vec{u_y}$
$\vec{f_B}$
$\vec{f_E}$
$\vec{E}$
$\vec{B}$
$\vec{v}$
$\vec{u_x}$
$\vec{u_z}$

$\boxed{Q2}$ $x(t) = ct$, c

$y(t) = at^2 + bt$, $a<0$, $b>0$, $c>0$

a) b)



c) $\vec{V}(t) = \dot{x}(t)\,\vec{u_x} + \dot{y}(t)\,\vec{u_y}$

$= (ct)^{\circ}\,\vec{u_x} + (at^2+bt)^{\circ}\,\vec{u_y}$

$= c\,\vec{u_x} + (2at+b)\,\vec{u_y}$

d) $\dot{s}(t) = \|\vec{V}(t)\| = \sqrt{c^2 + (2at+b)^2}$

$\ddot{s} = \frac{d}{dt}\dot{s}(t) = \frac{2.(2at+b).2a}{2\sqrt{c^2+(2at+b)^2}} = \frac{2a(2at+b)}{\sqrt{c^2+(2at+b)^2}}$

e) $\vec{P} = P_T\vec{T} + P_N\vec{N}$, $\vec{f} = f\vec{T}$, $\vec{R_N} = -R_N\vec{N}$

$\begin{cases} m\ddot{s} = P_T + f \\ m\frac{\dot{s}^2}{R_c} = P_N - R_N \end{cases}$ $\xRightarrow{ii)}$ $\begin{cases} m\ddot{s} = f \\ m\frac{\dot{s}^2}{R_c} = mg - R_N \end{cases}$

f) $R_N \geq 0$ $\left(\begin{array}{l}\text{si } R_N < 0 \text{ cela veut dire que} \\ \text{le skieur décolle}\end{array}\right)$ (1)

à ii) $\vec{v} \cdot \vec{u_y} = 0 \Rightarrow (2at+b) = 0$.

$\dot{s} = \sqrt{c^2 + \underbrace{(2at+b)^2}_{=0}} = c$ (2)

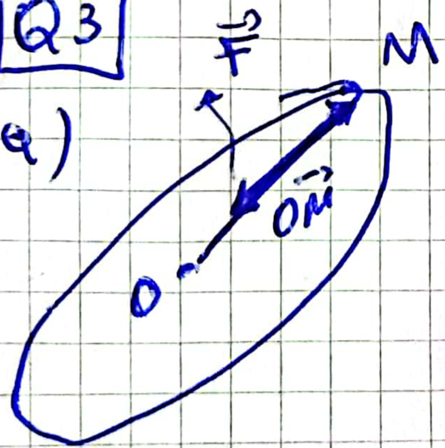
de (1) et (2) et du PFD sur $\vec{N}$, on a :

$R_N = -m\dfrac{\dot{s}^2}{R_c} + mg \geq 0 \Rightarrow -\cancel{m}\dfrac{c^2}{R_c} + \cancel{m}g \geq 0$

$\Rightarrow \dfrac{c^2}{R_c} \leq g \Rightarrow \boxed{c \leq \sqrt{gR_c}}$

Q3

a)



Comme la force de Coulomb est colinéaire avec $\vec{OM}$, son moment $M_O(\vec{F})$ est nulle. Du théorème du moment cinétique, le moment cinétique sera conservé, car la somme de moment appliqué sur l'électron sera nulle.

b) $L_O(t=0s) = m_e v_0 r_0$. $\left(\begin{array}{l}\text{comme le moment se conserve} \\ L_O(t=0) = L_O(t=t_1)\end{array}\right)$

b) $L_O(t=0) = L_O(t=t_1)$

$m_E r_0 V_0 = m_E r_1 V_1$

$\Rightarrow \frac{V_1}{V_0} = \frac{r_0}{r_1} < 1$ car $r_1 > r_0$

donc $\boxed{V_1 < V_0}$.