I) 2) a) $R_L = \sqrt{\dfrac{M_L \cdot K}{G_L}} = \sqrt{\dfrac{5,98 \cdot 10^{24} \cdot 6,67 \cdot 10^{-11}}{81 \cdot 1,6}}\ m = 1,754 \cdot 10^6\ m$

$\rightarrow d_L = 3508\ Km$

b) $\gamma = \sqrt[3]{G_L \left(\dfrac{T \cdot R_L}{2\pi}\right)^2} - R_L = \sqrt[3]{1,6 \cdot \left(\dfrac{7150 \cdot 1,754 \cdot 10^6}{2\pi}\right)^2} - 1,754 \cdot 10^6 = 10^5\ m$

$= 100\ Km$

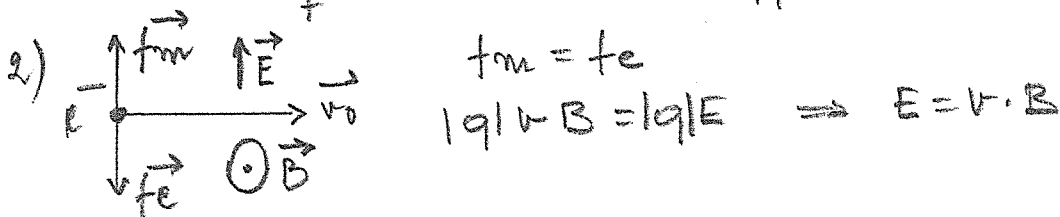II) 2) a) $T_0 = 2\pi \sqrt{\dfrac{m}{|k|}} = 0,567\ \text{s}$; $\omega_0 = \dfrac{2\pi}{T_0} = 11,08\ \dfrac{rad}{s}$

b) $E = \dfrac{kx^2}{2} = \dfrac{12,3 \cdot 0,03^2}{2}\ J = 0,00554\ J$

$x = 0,03 \cos 11,08t \Rightarrow x(0,5A) = 0,022\ m$

$v = -0,03 \cdot 11,08 \sin 11,08t \Rightarrow v(0,5A) = 0,225\ \dfrac{m}{s}$

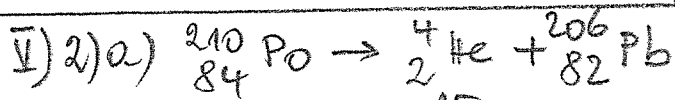$a = -0,03 \cdot 11,08^2 \cos 11,08t \Rightarrow a(0,5A) = -2,71\ \dfrac{m}{s^2}$

III) 1) $n = 2fL\sqrt{\dfrac{\mu}{F}}$ et $n' = 2 \cdot 4f \cdot L \sqrt{\dfrac{\mu}{4F}} = 2n \Rightarrow n$ double

2)

$f_m = f_e$

$|q| v \cdot B = |q| E \Rightarrow E = v \cdot B$

IV) 3) a) $0 = -\dfrac{gt^2}{2} + v_0 \sin\alpha \cdot t + h \Rightarrow 4,905t^2 - 2,89t - 6 = 0$

$\Rightarrow t = \dfrac{2,89 \pm \sqrt{2,89^2 + 4 \cdot 4,905 \cdot 6}}{2 \cdot 4,905} \Rightarrow t = 1,44\ s$

b) $v = \sqrt{v_x^2 + v_y^2}$ avec $v_x = v_0 \cos\alpha = 3,45\ \text{m/s}$

$v_y = -gt + v_0 \sin\alpha = -9,81 \cdot 1,44 + 4,5 \sin 40° = -11,23\ \text{m/s}$

$v = 11,75\ \dfrac{m}{s}$ et $tg\beta = \dfrac{v_y}{v_x} = -3,25 \Rightarrow |\beta| = 73°$

V) 2) a) $^{210}_{84}Po \rightarrow ^{4}_{2}He + ^{206}_{82}Pb$

b) $A_0 = 1,88 \cdot 10^{15}/360 = 5,22 \cdot 10^{12}\ Bq$

c) $N_0 = \dfrac{A_0}{\lambda} = \dfrac{5,22 \cdot 10^{12} \cdot 138 \cdot 86400}{Ln\ 2} = 8,98 \cdot 10^{19}\ \text{noyaux}$

d) $N_0 = \dfrac{m_0}{M} \cdot N_A \Rightarrow m_0 = \dfrac{N_0 M}{N_A} = \dfrac{8,98 \cdot 10^{19} \cdot 210}{6,022 \cdot 10^{23}}\ g = 0,031\ g$

e) $8000 = 5,22 \cdot 10^{12} \cdot e^{-\lambda t} \Rightarrow -\lambda t = \ln \dfrac{8000}{5,22 \cdot 10^{12}} = -20,3$

$\Rightarrow t = \dfrac{20,3}{\lambda} = \dfrac{20,3 \cdot T_{1/2}}{Ln\ 2} = 4041\ \text{jours} \simeq 11\ \text{ans}$