gradB :

$$\vec{v} = -c\{B_z + \frac{mc}{q}(\frac{cE_A\sin\{2\pi(\frac{t}{T}-\frac{R_0\theta}{\lambda})+\frac{\pi}{2}\}}{B_z^2}\xi_r)\}^{-1}(E_A\sin\{2\pi(\frac{t}{T}-\frac{R_0\theta}{\lambda})+\frac{\pi}{2}\} - \frac{\mu}{q}\xi_r + \frac{mc^2}{q}\frac{(E_A\sin\{2\pi(\frac{t}{T}-\frac{R_0\theta}{\lambda})+\frac{\pi}{2}\})^2\xi_r}{B_z^3})\vec{e_\theta}$$

so, $v_{grad} = \frac{c}{B_z}\frac{\mu}{q}\xi_r$

assumption $B_z = \frac{B_E}{L^3}$ (in magnetic equator) , $B_E = 3.11\times10^{-5}\mathrm{T} = 3.11\times10^{-1}\mathrm{G}$
if $L = 6$, $B_z = 1.4\times10^{-7}\mathrm{T} = 1.4\times10^{-3}\mathrm{G}$

assumption : $v_\perp = 0.01c = 3.0\times10^8\mathrm{cm/s}$

$$\mu = \frac{mv_\perp^2}{2B_z} = \frac{(9.1\times10^{-28}\mathrm{g})\times(3.0\times10^8\mathrm{cm/s})^2}{2.0\times1.4\times10^{-3}\mathrm{G}}$$

$$\xi_r = \frac{\partial B_z}{\partial r} = \frac{\partial B_z}{\partial L}\frac{\partial L}{\partial r} = -3\frac{B_E}{L^4}\frac{1}{R_0} = \frac{-3\times3.1\times10^{-1}\mathrm{G}}{6^4\times6\times10^8\mathrm{cm}}$$

$$v_{grad} = \frac{c}{B_z}\frac{\mu}{q}\xi_r = \frac{3.0\times10^{10}cm/s}{1.4\times10^{-3}\mathrm{G}}\times\frac{1}{4.8\times10^{-10}\mathrm{statC}}\times\frac{(9.1\times10^{-28}\mathrm{g})\times(3.0\times10^8\mathrm{cm/s})^2}{2.0\times1.4\times10^{-3}\mathrm{G}}\times\frac{-3\times3.1\times10^{-1}\mathrm{G}}{6^4\times6\times10^8\mathrm{cm}}$$

$$v_{grad} = -\frac{3.0\times9.1\times3.0\times3.0\times3\times3.1}{1.4\times4.8\times2.0\times1.4\times6^4\times6}10^5\mathrm{cm}/s \approx 1500\mathrm{cm}/s$$

from basic space plasma physics

$$v_\nabla = \frac{mv_\perp^2}{2qB^3}(\vec{B}\times\nabla B)$$

$$v_\nabla = \frac{9.1\times10^{-31}\mathrm{kg}\times(3.0\times10^6\mathrm{m/s})^2}{2\times(1.6\times10^{-19}\mathrm{C})\times(1.4\times10^{-7}\mathrm{T})^3}(1.4\times10^{-7}\mathrm{T})\times(-3\frac{B_E}{L^4}\frac{1}{R_0})$$

$$v_\nabla = \frac{9.1\times10^{-31}\mathrm{kg}\times(3.0\times10^6\mathrm{m/s})^2}{2\times(1.6\times10^{-19}\mathrm{C})\times(1.4\times10^{-7}\mathrm{T})^3}(1.4\times10^{-7}\mathrm{T})\times(-3\frac{3.11\times10^{-5}\mathrm{T}}{6^4}\frac{1}{6.0\times10^6\mathrm{m}})$$

$$v_\nabla = -\frac{9.1\times9.0\times1.4\times3\times3.11}{2\times1.6\times1.4^3\times6^4\times6}\frac{10^{-31}}{10^{-34}}\mathrm{m/s}$$

$$v_\nabla = -\frac{9.1\times9.0\times1.4\times3\times3.11}{2\times1.6\times1.4^3\times6^4\times6}10^3\mathrm{m/s} = 0.015\times10^3\mathrm{m/s} = 15\mathrm{m/s}$$