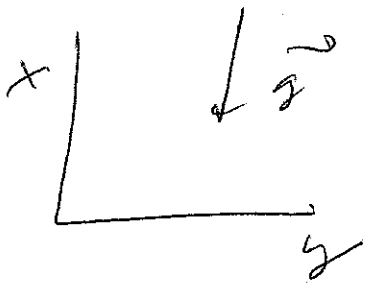
Soln to PS

(1) $\boxed{\vec{\nabla} p = nM\vec{g} \qquad p = nT}$



$\Rightarrow \vec{\nabla} p = -nMg\hat{x}$

$\Rightarrow \left.\begin{array}{l} \partial p/\partial y = 0 \\ \partial p/\partial z = 0 \end{array}\right\} \Rightarrow p(x) \Rightarrow \frac{dp}{dx} = -nMg$

$\Rightarrow n = n(x) \Rightarrow T = T(x)$

(2) Reduced eqns $\quad \vec{\nabla} n \times \vec{g} = 0$

$\Rightarrow \hat{x} \times \vec{\nabla} n = 0 \Rightarrow \begin{array}{l} \partial_y n = 0 \\ \partial_z n = 0 \end{array} \Rightarrow n(x)$

$p = p_0 = \text{const} = nT \Rightarrow T(x)$

(3) $\vec{\nabla} \times nM d_t \vec{u} = \vec{\nabla} n \times \vec{g} M$

$T(x,y) \Rightarrow n(x,y) \quad (p \simeq p_0)$

$\Rightarrow \frac{1}{4} \cancel{M} \cancel{M} \omega u \sim \frac{\cancel{M}}{4} g \cancel{M}$

$\Rightarrow \omega u \sim g. \quad u \sim L/\tau$

$\Rightarrow \frac{L}{\tau^2} \sim g \Rightarrow \boxed{\tau \sim \sqrt{L/g}}$