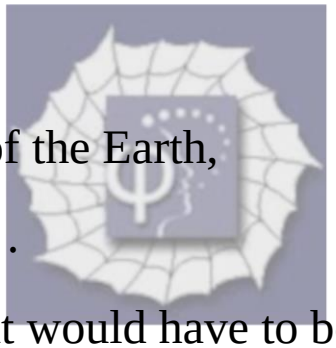
512.

Problem 37.27 (RHK)

The Earth has a magnetic dipole moment of 8.0×10^{22} J T^{-1}. *We have to estimate the current that would have to be set up in a single turn of wire going around the Earth at its magnetic equator to set up such a dipole.*

Solution:



The mean radius of the Earth,

$R_E = 6.37\times10^6$ m .

Let the current that would have to be set up in a single turn of wire going around the Earth at its magnetic equator to set up a magnetic dipole moment of 8.0×10^{22} J T^{-1} be i A.

We thus have the relation

$\left(\pi R^2{}_E\right) i = 8.0\times10^{22}$ J T^{-1},

$$\therefore\ i = \frac{8.0\times10^{22}}{\pi\times\left(6.37\times10^6\right)^2}\ \text{A} = 6.27\times10^8\ \text{A} = 627\ \text{MA}.$$