Answer on Question #45160, Physics, Electromagnetism

A horizontal, straight wire carrying 16 A current from west to east is in the earths magnetic field at a place where B is parallel to the surface and points to north with a magnitude of 0.04 mT. (i) Determine the magnetic force on a 1 m length of the wire. (ii) If mass of the wire is 50 g, then what current will allow the wire to be magnetically supported, that is, magnetic force balances the weight.

Solution

(i)We use Ampere's force law

$$F = IBl = 16 \cdot 0.04 \cdot 1 = 0.64\,N$$

(ii) Now we want magnetic force to be equal to gravitational. Hence current should be.

$$mg = IBl$$

$$I = \frac{mg}{Bl} = \frac{0.05 \cdot 9.8}{1 \cdot 0.04} = 12.25\,A$$