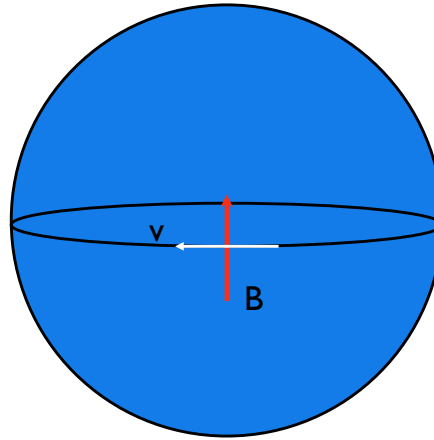


Problem 19.7

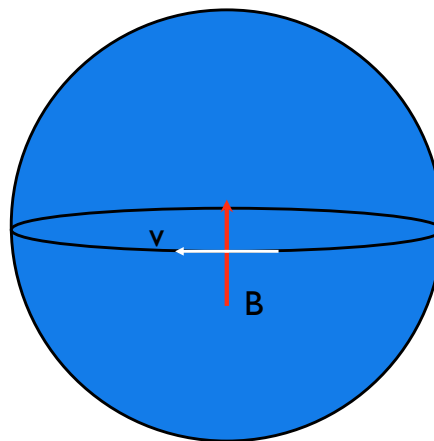
If the earth's magnetic field is equal to 4×10^{-8} teslas, what is the velocity needed for a proton moving 1000 km above the earth's surface to circle?



1.

Looking at the sketch, it should be obvious that the magnetic force will be center-seeking. With that, we can write:

$$\begin{aligned}qvB \sin\theta &= m \frac{v^2}{R} \\ \Rightarrow v &= \frac{qBR}{m} \sin\theta \\ \Rightarrow v &= \frac{(1.6 \times 10^{-19} \text{ C})(4 \times 10^{-8} \text{ T})(7.38 \times 10^6 \text{ m} + 1 \times 10^6 \text{ m})}{6.67 \times 10^{-27} \text{ kg}} \sin 90^\circ \\ \Rightarrow v &= 8 \times 10^6 \text{ m/s}\end{aligned}$$



2.