Name_____

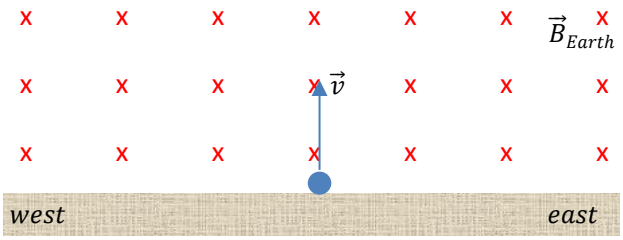
Physics 111 Quiz #4, February 7, 2025

Please show all work, thoughts and/or reasoning to receive partial credit. The quiz is worth 10 points total, and all parts may not be of equal weight.

I affirm that I have carried out my academic endeavors with full academic honesty.

_____

1. An electron is accelerated vertically upwards away from the Earth's surface and passes perpendicularly through the Earth's magnetic field ($B_{Earth} = 5.2 \times 10^{-5} T$) which points north with a speed $v = 7.2 \times 10^{6} \frac{m}{s}$ as shown below. Explain in detail in which direction the electrons move in the magnetic field?



2. What is the radius of the electron's orbit?

3. In the presence of the magnetic field, the electron experiences a magnetic force. Suppose that you wanted the electron to travel perpendicularly away from the surface of the Earth at a constant speed. To do this you decide to introduce an electric field. What magnitude and direction for this electric field would you need if the electron's velocity to remain constant? To earn full credit, in addition to calculating the magnitude of the electric field, you need to explain why the direction is as you state.

4. Suppose that you turn off the electric field and that the electron does not leave the Earth's surface vertically, perpendicular to the magnetic field, but rather that the velocity of the electron is pointed into the plane of the paper in the direction of the magnetic field by an angle of $\theta = 40^0$ measured from the vertical. What is the radius and pitch of the electron's orbit.

5. What is the period of the electron's orbit for the case in part 4?