Quiz on Magnetic Fields and Forces
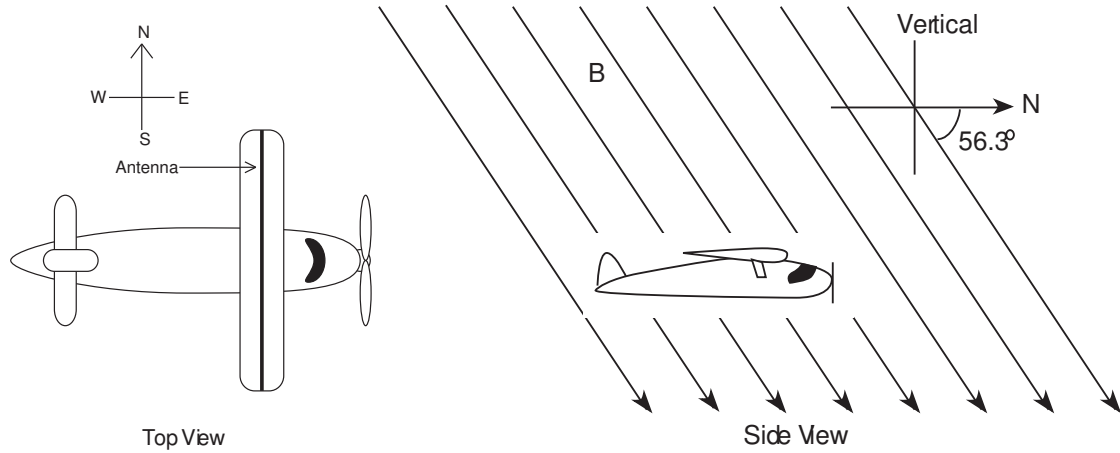

Top View   Side View

An airplane has a copper antenna attached to its wing that extends 20 m from wingtip to wingtip. The plane is traveling north at 95 m/s in a region where Earth's magnetic field has a vertical component and a northward component. The magnitude of the magnetic field is at an angle of $56.3°$ from the horizontal and has a magnitude of 6.5×10^{-5} T.

1. Using the diagram below, indicate the direction of the magnetic force on the electrons in the antenna. Find the magnitude of this force. Justify your answer.
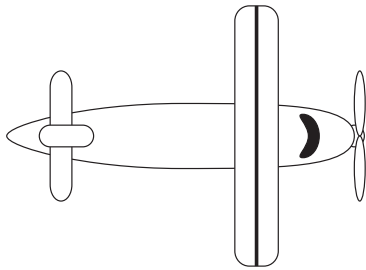
2. The electrons in the antenna will quickly reach equilibrium, and cease to accelerate Explain why this happens and draw a free body diagram of an electron in the antenna labeling all forces.

3. Determine the magnitude of the electric field generated in the antenna.

4. Determine the potential difference between the ends of the antenna. Label which end of the antenna is at a higher potential on the figure below:
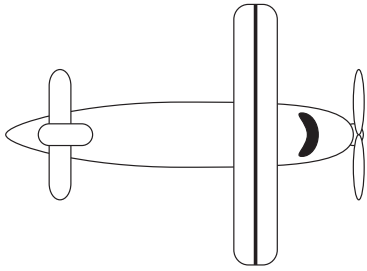
5. What would happen to the potential difference if the plane began to gain altitude? What would happen if the plane began to lose altitude? Justify your answer.