

Answer on Question 59578, Physics, Other

Question:

An aircraft travels at 280 ms^{-1} perpendicular to the Earth's magnetic field of $5.0 \cdot 10^{-5} \text{ T}$. If the wing tips are 70 m apart, what is the induced voltage?

Solution:

We can find the induced voltage from the definition of the motional emf:

$$\mathcal{E} = Blv\sin\theta,$$

here, B is the magnetic field, l is the length of the wing, v is the velocity of the wing in a direction perpendicular to the magnetic field, θ is the angle between the magnetic field and the normal to the plane of the wing (since aircraft travels perpendicular to the Earth's magnetic field, $\theta = 90^\circ$).

Therefore, we get:

$$\mathcal{E} = Blv\sin\theta = 5.0 \cdot 10^{-5} \text{ T} \cdot 70 \text{ m} \cdot 280 \text{ ms}^{-1} \cdot \sin 90^\circ = 0.98 \text{ V} \approx 1.0 \text{ V}.$$

Answer:

$$\mathcal{E} = 1.0 \text{ V}.$$