

Problem 24.1

A loop of radius .2 meters rotated in an electric field. The maximum electric flux $5 \times 10^5 \text{ N} \cdot \text{m}^2 / \text{C}$. What is the electric field?

In general, the electric flux is:

$$\begin{aligned}\Phi_E &= \vec{E} \cdot \vec{A} \\ &= EA \cos \theta\end{aligned}$$

The flux will be maximum when the cosine is 1, or when the angle between the line of E and the line of the area vector (defined to be perpendicular to the face of the surface, which is to say, normal to the surface) is 0. That is:

$$\begin{aligned}\Phi_E &= E A \cos \theta \\ (5 \times 10^5 \text{ N} \cdot \text{m}^2 / \text{C}) &= E (\pi (.2 \text{ m})^2) \cos 0^\circ \\ \Rightarrow E &= 4.14 \times 10^6 \text{ N} / \text{C}\end{aligned}$$

