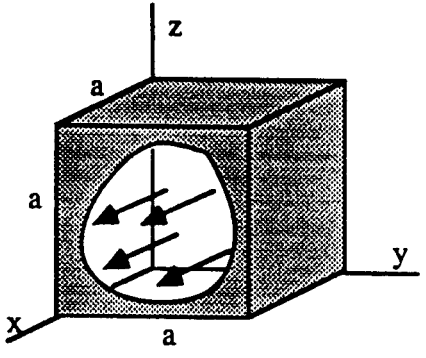
EMSpring95B

A cubic cavity with edge length a is formed of perfectly conducting metal plates. The cube's sides are parallel to the x, y, z axes; one corner of the cube is at the origin, as shown in the figure. An oscillating electric field

$$\vec{E}(x,y,z,t) = E_0 \sin\left(\frac{\pi}{a}y\right)\sin\left(\frac{\pi}{a}z\right)\cos(\omega t)\ \hat{x}$$

(corresponding to one of the cavity's normal modes) is maintained inside the cube. ($\hat{x}$ is the unit vector in the x direction.) There are no electric charges inside the cavity.



(a) Determine the magnetic field, $\vec{B}(x,y,z,t)$, inside the cavity.

(b) Determine the resonant frequency ω.

(c) Determine the charge density as a function of position and time on the interior faces of the cavity. Keep in mind that the electric and magnetic fields inside each metal plate are zero. (Naturally, the fields in the hollow cubic volume between the plates are non-zero.)