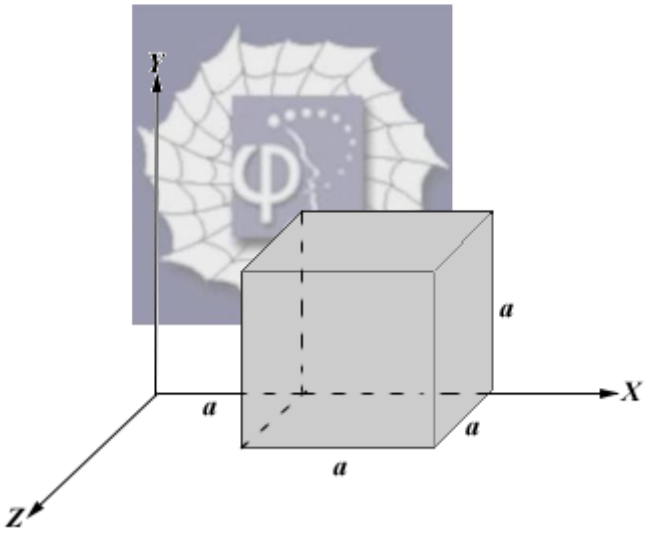
317.

Problem 29.13 (RHK)

The electric field components as shown in the figure are $E_x = bx^{1/2}$, $E_y = E_z = 0$, *in which* $b = 8830\ \text{N C}^{-1}\ \text{m}^{-1/2}$. *We have to calculate* (a) *the flux* Φ_E *through the cube and* (b) *the charge within the cube. We may assume that* $a = 13.0\ \text{cm}$.



Solution:

(a)

The electric field components as shown in the figure are $E_x = bx^{1/2}$, $E_y = E_z = 0$, in which $b = 8830\ \text{N C}^{-1}\ \text{m}^{-1/2}$.

Therefore, the non-zero contributions to the flux due to the electric field to the Gaussian surface of the cube

places with respect to the coordinate axes will be from the *Y*-*Z* faces located at $x = a$ and $x = 2a$, where $a = 13.0$ cm.

Therefore,

$$\Phi_E = 8830 \times \left(-0.13^2 \times 0.13^{1/2} + 0.13^2 \times 0.26^{1/2} \right) \text{ N C}^{-1} \text{ m}^2$$

$$= 22.7 \text{ N C}^{-1} \text{ m}^2.$$

(b)

The charge *q* inside the cube can be calculated using the Gauss' law

$$q = \varepsilon_0 \Phi_E = 8.85 \times 10^{-12} \times 22.27 \text{ C}$$

$$= 1.97 \times 10^{-10} \text{ C}$$

$$= 197 \text{ pC}.$$