Answer on Question #59738 – Physics – Electromagnetism

Two parallel plates of 100 cm 2 each are given equal and opposite charges of 8.9 × 10 −7 C. The electric field within the dielectric material filling the space between the plates is 1.4 × 10 6 V/m. Find dielectric constant of the material.

Solution.

These parallel plates can be considered a plane capacitor. Its capacity is

$$C = \varepsilon_0 \varepsilon \frac{A}{d}$$

where

$\boldsymbol{\varepsilon_0}$ - electric constant;

$\boldsymbol{\varepsilon}$ - dielectric constant of the material;

$\boldsymbol{A}$ – area of plate;

$\boldsymbol{d}$ – distance between plates.

On the other hand

$$Q = CU, \qquad U = Ed$$

where

Q – charge of capacitor;

U – voltage of capacitor;

E - electric field between the plates.

So

$$Q = CU = CEd = \boldsymbol{\varepsilon_0 \varepsilon} \frac{\boldsymbol{A}}{\boldsymbol{d}} Ed = \boldsymbol{\varepsilon_0 \varepsilon} AE$$

$$\boldsymbol{\varepsilon} = \frac{Q}{\boldsymbol{\varepsilon_0} AE} = \frac{8.9 * 10^{-7}}{8{,}85 * 10^{-12} * 100 * 10^{-4} * 1{,}4 * 10^{6}} = 7{,}2$$

Answer 7.2.