24.2  Parallel plate capacitor - vacuum between plates

Area = 12.2 cm²

Q = 4.35 × 10⁻⁶ C

d = 3.28 mm

b) What is capacitance?

\[ C = \frac{Q}{V_{ab}} = \frac{4.35 \times 10^{-6} \text{ C}}{V_{ab}} \]

We don't have \( V_{ab} \) yet so use second part:

\[ C = \frac{\varepsilon_0 A}{d} = \frac{(8.85 \times 10^{-12} \text{ F/m}) (12.2 \text{ cm})^2}{3.28 \text{ mm}} \]

\[ C = 3.29 \times 10^{-11} \text{ F} = 3.29 \text{ pF} \]

b) What is separation between plates?

\[ C = \frac{Q}{V_{ab}} \Rightarrow V_{ab} = \frac{Q}{C} \]

\[ V_{ab} = \frac{4.35 \times 10^{-6} \text{ C}}{3.29 \times 10^{-12} \text{ F}} \]

\[ V_{ab} = 1.32 \times 10^5 \text{ V} = 13.2 \text{ kV} \]

b) What is \( E \)?

\[ V_{ab} = Ed \]

\[ E = \frac{V_{ab}}{d} = \frac{13.2 \times 10^3 \text{ V}}{3.28 \times 10^{-3} \text{ m}} \]

\[ E = 4.02 \times 10^6 \text{ V/m} \]