Calculation

C_0

x_0

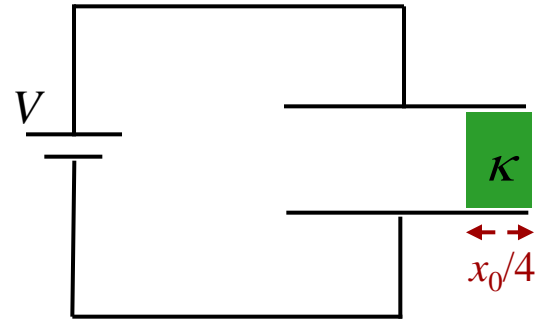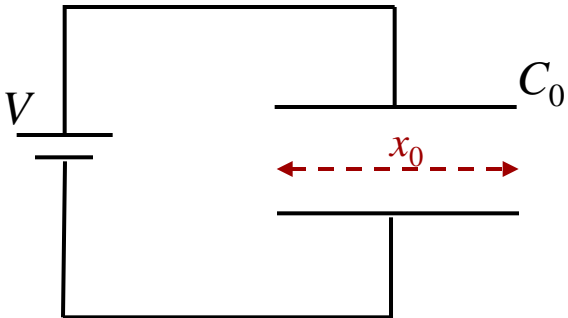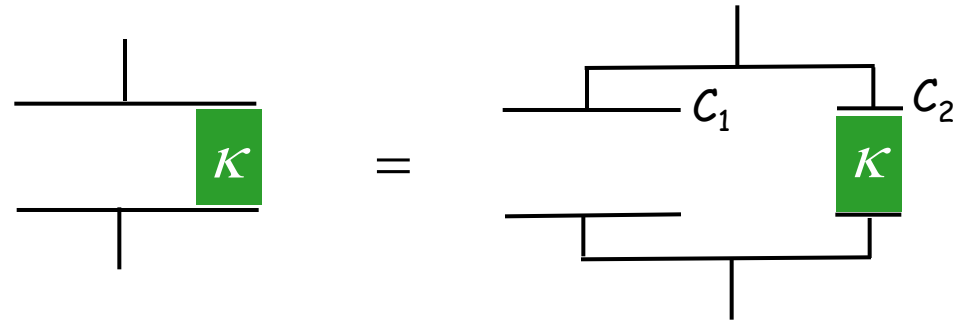V

V

κ

$x_0/4$

An air-gap capacitor, having capacitance C_0 and width x_0 is connected to a battery of voltage V.

A dielectric (κ) of width $x_0/4$ is inserted into the gap as shown.

What is Q_f, the final charge on the capacitor?

Can consider capacitor to be two capacitances, C_1 and C_2, in parallel

κ

$=$

C_1 C_2

κ

What is C_1 ?

A) $C_1 = C_0$ B) $C_1 = {}^3/_4 C_0$ C) $C_1 = {}^4/_3 C_0$ D) $C_1 = {}^1/_4 C_0$

In general. For parallel plate capacitor: $C = \varepsilon_0 A/d$

$A = {}^3/_4 A_0$
$d = d_0$ $\longrightarrow$ $C_1 = {}^3/_4 (\varepsilon_0 A_0/d_0)$ $\longrightarrow$ $C_1 = {}^3/_4 C_0$