Q- Two charges are placed between the plates of a parallel plate capacitor. One charge is $+q_1$ and the other is $q_2 = +6.58\ \mu C$. charge per unit are on each plate has a magnitude of $\sigma = 1.39*10^{-4}\ C/m^2$. If the magnitude of force on q_1 due to q_2 is equal to that on q_1 due to the electric field of the capacitor, what is the distance between the two charges?

If the distance between the two charges is r then the force on q_1 due to q2 is given by Coulomb's law as

$$F = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}$$

The field between the capacitor plates (flux per unit area) is given by

$$E = \frac{\sigma}{\epsilon_o}$$

Hence force on charge q1 due to the field is given by

$$F = q_1 E = q_1\ \frac{\sigma}{\epsilon_o}$$

Equating the two forces we get

$$q_1\ \frac{\sigma}{\epsilon_o} = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}$$

Gives $r^2 = \frac{1}{4\pi}\frac{q_2}{\sigma}$

Or $r = \sqrt{\frac{1}{4\pi}\frac{q_2}{\sigma}} = \sqrt{\frac{6.58*10^{-6}}{4*3.14*1.39*10^{-4}}} = 6.14 * 10^{-2}\ m$