19. The membrane surrounding a living cell consists of an inner and an outer wall that are separated by a small space. Assume that the membrane acts like a parallel plate capacitor in which the effective charge density on the inner and outer walls has a magnitude of 7.1 x 10^{-6} C/m^2. **(a)** What is the magnitude of the electric field within the cell membrane? **(b)** Find the magnitude of the electric force that would be exerted on a potassium ion (K+; charge = +*e*) placed inside the membrane.

For a parallel plate capacitor or a set of parallel charges the electric field is found from the expression

$$E = \frac{\sigma}{\varepsilon_0} = \frac{7.1\ x\ 10^{-6}\ {}^{C}/_{m^2}}{8.85\ x\ 10^{-12}\ {}^{C^2}/_{(Nm^2)}} = 8.023\ x10^{5}\ {}^{N}/_{C}$$

Force comes from

$$F = qE = (1.6\ x\ 10^{-19}C)\left(8.023\ x\ 10^{5}\ {}^{N}/_{C}\right) = 1.284\ x\ 10^{-13}N$$

$$\boxed{\begin{aligned} E &= 8.0\ x10^{5}\ {}^{N}/_{C} \\ F &= 1.3\ x\ 10^{-13}N \end{aligned}}$$