

55. (a) The potential would be

$$\begin{aligned} V_e &= \frac{Q_e}{4\pi\epsilon_0 R_e} = \frac{4\pi R_e^2 \sigma_e}{4\pi\epsilon_0 R_e} = 4\pi R_e \sigma_e k \\ &= 4\pi(6.37 \times 10^6 \text{ m})(1.0 \text{ electron/m}^2)(-1.6 \times 10^{-19} \text{ C/electron}) \left(8.99 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2} \right) \\ &= -0.12 \text{ V} . \end{aligned}$$

(b) The electric field is

$$E = \frac{\sigma_e}{\epsilon_0} = \frac{V_e}{R_e} = -\frac{0.12 \text{ V}}{6.37 \times 10^6 \text{ m}} = -1.8 \times 10^{-8} \text{ N/C} ,$$

where the minus sign indicates that \vec{E} is radially inward.