

Homework 5

1. An alpha particle with a charge of 3.20×10^{-19} C and a mass of 6.68×10^{-27} kg rests just above a horizontal plane of vast extent having a charge density of 6.21×10^{-9} C/m². The electric field generated by the plane will accelerate the particle upward. How high above the plane will the particle be after 2.15×10^{-3} s?
2. A vertical, infinite, nonconducting plane has uniform positive charge. A weightless thread is attached to the plane, and at the end of the thread there is a small spherical ball with a charge of $+78.6 \mu\text{C}$, and a mass of 0.954 kg. The angle that the thread makes with the plane is 37.3° . What is the charge density σ of the plane?
3. An alpha particle ($m = 6.68 \times 10^{-27}$ kg, $q = 3.20 \times 10^{-19}$ C) circularly orbits a charged sphere at a radius of 5.00 cm from the sphere's center. The electric attraction between the two objects provides the centripetal force to keep the particle in orbit. The orbital speed of the particle is 6.56×10^4 m/s. What is the charge on the sphere?