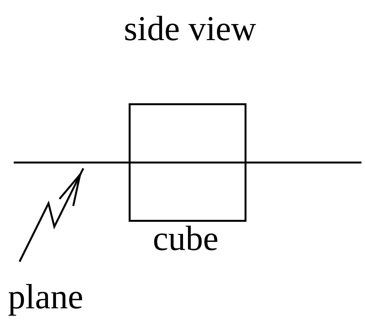
1. A very large, non-conducting plane has a surface charge density of $\sigma = 2.5\ \mu\text{C/m}^2$.

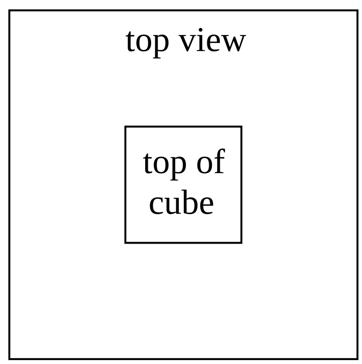
a) Find the total charge enclosed within a cubic box of side $L = 0.2$ m which intersects the plane as shown.

b) Using Gauss's law, find an expression for the electric flux through the cube in terms of the magnitude of the electric field E and the length of the side of the box.

c) Find the electric field (magnitude and direction, up or down) both above and below the plane.

d) A second non-conducting plane of charge density $-2.5\ \mu\text{C/m}^2$ is placed 10 cm above and parallel to the first plane. What is the electric field at the midpoint between the two planes?





2. A point charge of -5 μC is located at $x = 4$ m, $y = -2$ m. A second point charge of 12 μC is located at $x = 1$ m, $y = 2$ m.

a) Find the potential at $x = -1$ m, $y = 0$.

b) Calculate the work required to bring an electron to $x = -1$ m, $y = 0$.

c) Find the magnitude and direction of the electric field at $x = -1$ m, $y = 0$.

d) Calculate the magnitude and direction of the force on an electron at $x = -1$ m, $y = 0$.

3. A very long, straight conductor with a circular cross section of radius R carries a current I. Inside the conductor is a cylindrical hole of radius a whose axis is parallel to the axis of the conductor but offset a distance b from the axis of the conductor. The current I is uniformly distributed across the cross section of the conductor and is directed out of the page. Find the magnetic field everywhere outside the conductor.