Problem 1

a) What must be the charge on the surface of a metallic sphere 20 cm in radius if the magnitude of the electric field just above its surface in free space is 10 MV/m?
b) The electric field in the region between a pair of oppositely charged parallel plates is 10 kV/m. If the area of each plate is 25 cm^2, and the separation between them is 1 mm, find the surface charge density and the total charge on each plate. Assume ε_r = 3.6 between the plates.

Problem 2

Three charges are situated at the corners of a square which has side length a.

a) How much work does it take to bring another charge, +q, from far away and place it in the fourth corner of the square?
b) How much work does it take to assemble the whole configuration of four charges?

Problem 3

Determine the amount of work done in carrying a charge of 0.5 mC along the arc of a circle of radius 2 m from $\phi = 0$ to $\phi = \pi/4$. The electric field intensity in the region is $\vec{E} = 10y\hat{x} + 10x\hat{y} + 2z\hat{z}$ kV/m. Does $\vec{E}$ represent a physical field? If yes, what is the potential difference between the two ends of the path?