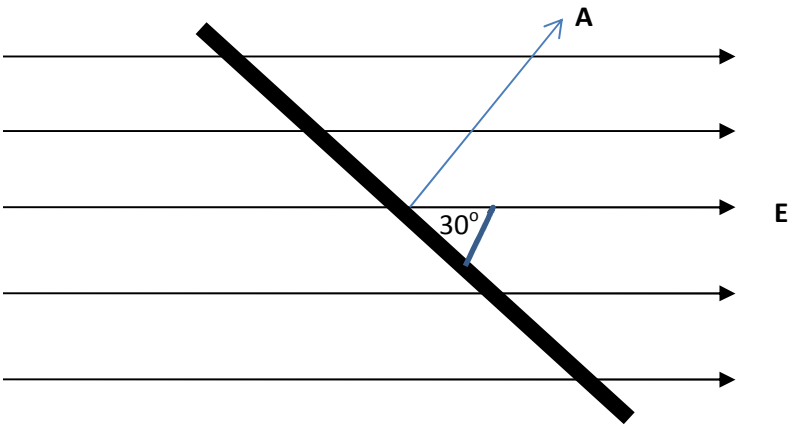
Chapter 22 Homework

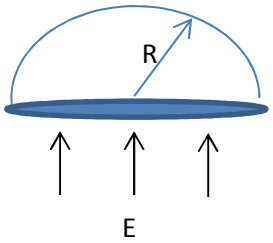
Electric Flux

Qu. 1 A circular plate has a radius of 12 cm. The plane of the plate is set at a 30^o angle to a uniform field **E** = 450 **i** N/C as shown. What is the flux φ through the plate?

(Answer φ=10.17 Nm^2/C)



Qu. 2 A uniform electric field E is parallel to the central axis of a hemisphere of radius R. What is the flux, φ through the hemisphere? (Answer $\varphi = \pi R^2 E$)



Gauss' Law

Qu. 3 Two charges q_1 = 6 μC and q_2 = - 8 μC are within a spherical surface of radius 5 cm. What is the net flux through the surface? (Answer φ = 2 μC/ε_o , Note: the answer is totally independent of the shape of the surface, only that it encloses both charges. The answer is also totally independent of the location of the charges within the surface.)

Qu. 4 The flux through each face of a cubic Gaussian surface of side 10 cm is 3×10^4 N m^2/C. What is the net enclosed charge? (Answer 1.59 μC)

Qu. 5 Show that the electric field strength at the surface of a uniformly charged spherical shell is $E = \sigma/\varepsilon_o$ where σ is the surface charge density.

Qu. 6 Two infinite and parallel plates of charge have the same charge surface density σ C/m^2.

a) What is the electric field strength in the region between the plates? (Answer E = 0 N/C)

b) What is the electric field strength in the regions not between the plates? (Answer $E = \sigma/\varepsilon_o$). Compare this solution to the one obtained in Qu 3 of the Ch 21b homework. It's much easier using Gauss' Law!

Qu. 7 A long, straight coaxial cable has an inner wire of radius a and surface charge density σ and an outer cylindrical shell with radius b with surface charge density $-\sigma$.

a) Find the electric field strength in the regions $a < r < b$ (Answer $E = \sigma a/\varepsilon_o r$)

b) Find the electric field strength in the regions $r > b$ (Answer $E = \sigma(a-b)/\varepsilon_o r$)

Qu. 8 A non-conducting sphere of radius R has a uniform charge density ρ C/m^3 throughout its volume. Determine the electric field strength at a distance r from the center for

a) $r < R$ (Answer $E = r\rho/3\varepsilon_o$)

b) $r > R$ (Answer $E = R^3\rho / 3r^2 \varepsilon_o$)

c) $r = R$ (Answer $E = = R\rho/3\varepsilon_o$)