

PHYS 1112, Summer 2009, sample test 2

The problems below have been given to the students in a previous PHYS1112 course. The questions in the upcoming test may vary in difficulty from the examples given here.

Problem 1: Interference

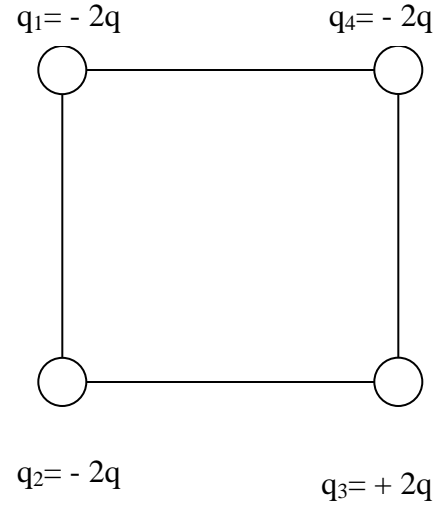
A two-slit experiment illuminated at a wavelength of 546.0 nm produces a *second order minimum* at an angle of 4.697 degree.

- a) Find the separation of the slits.
- b) If the wavelength is increased, but the second order minimum stays at the same angle, does the slit separation increase, decrease, or stay the same? Explain!
- c) If the apparatus is immersed in water ($n = 1.33$), what will be the angle for the *third order minimum* (use the slit separation found in part a)?

Problem 2: Electric Fields

Four charges are located at the corners of a square with a side length $d = 0.1 \text{ m}$ (see figure), with $q = +2.5 \mu\text{C}$.

- Find the electric field (magnitude and direction) at the centre of the square.
- If a fifth charge $q_5 = +3q$ is placed midway between q_2 and q_3 , what is the force (magnitude and direction) on q_5 ?



Problem 3: Gauss' Law

A thin wire of infinite length has a charge per unit length of λ . Using Gauss' Law and the fact that the electric field points radially away from the wire, calculate the electric field at a distance r from the wire.

(Hint 1: use a Gaussian surface in the shape of a cylinder)

(Hint 2: we did this in class.)

Problem 4: Potential

Using the charge arrangement of Problem 2, calculate the

- a) electric potential in the centre of the square.
- b) potential energy of charge q_5 located midway between charge q_2 and q_3 .

