273.

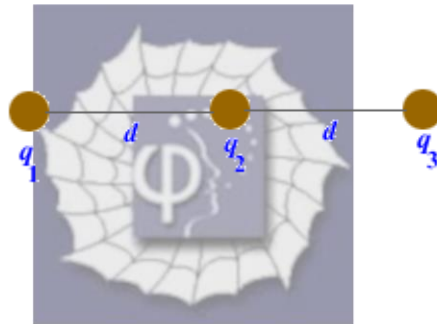**Problem 27.7 (RHK)**

Three charged particles lie on a straight line and are separated by a distance d as shown in the Figure. Charges q_1 and q_2 are held fixed. Charge q_3, which is free to move, is found to be in equilibrium under the action of electric forces. We have to find q_1 in terms of q_2.

Solution:

Applying Coulomb's law we note that the force on charge q_3 due to charges q_1 and q_2 will be

$$F = \frac{1}{4\pi\varepsilon_0}\left(\frac{q_1 q_3}{4d^2} + \frac{q_2 q_3}{d^2}\right).$$

Direction of forces on q_3 due to q_1 and q_2 as are being determined by the product of their signs, we therefore have not shown them by affixing vector signs. As the

charge q_3 is in equilibrium, the net force on it has to be zero.

Therefore,

$$\frac{q_1 q_3}{4d^2} + \frac{q_2 q_3}{d^2} = 0.$$

This equation gives

$$q_1 = -4q_2 \ .$$