ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY

Electricity and Magnetism (Phys 206) Work Sheet I

1. Table salt (sodium chloride) is a crystal with a simple cubic structure with Na^+ ions and Cl^- ions alternating at adjacent lattice sites. The distance between ions is $2.82 \times 10^{-10} m$. What force does Na^+ ion experience due to one of its nearest Cl^- neighbors?

2. Two protons in an atomic nucleus are 2×10^{-15} m apart. What is the magnitude of the repulsive electric force between them? **What keeps the nucleus from bursting apart?**

3. An object having a net charge of $24.0 \mu C$ is placed in a uniform electric field of 610 N/C directed vertically. What is the mass of this object if it "floats" in the field?

4. A proton accelerates from rest in a uniform electric field of 640 N/C. At some later time, its speed is $1.20 \times 10^6 m/s$.(a) Find its acceleration. (b) How long does it take to reach at this speed? (c) How far has it moved in this time? (d)What is its kinetic energy at this time?

5. In Figure 1, determine the point (other than infinity) at which the electric field is zero.

6. Three point charges are arranged as in Figure 2. (a) Find the electric field that the 6.00 nC and -3.00 nC charges together create at the origin. (b) Find the force on the 5.00 nC charge.

7. Three point charges are aligned along the x axis as shown in Figure 3. Find the electric field at (a) the position (2.0, 0) and (b) the position (0, 2.0).

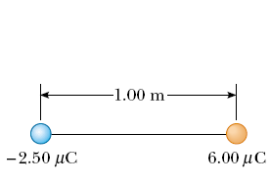

Fig. 1

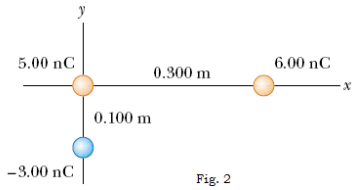

Fig. 2

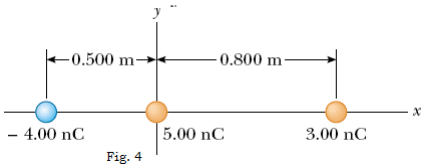

Fig. 4

8. Consider the electric dipole shown in the Figure 4. Show that the electric field at a distant point along the x axis is $E_x = 4k_e qa/x^3$.

9. Three point charges are located at the corners of an equilateral triangle as shown in Figure 5. Calculate the resultant electric force on the $7.0 \mu C$ charge.

10. A rod of length L has a uniform positive charge per unit length λ and a total charge Q. Calculate the electric field at a point P that is located along the long axis of the rod and a distance a from one end (see the Figure 6).

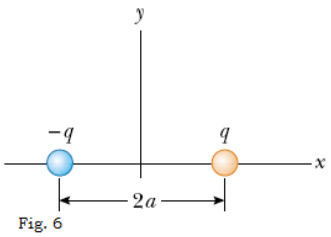

Fig. 6

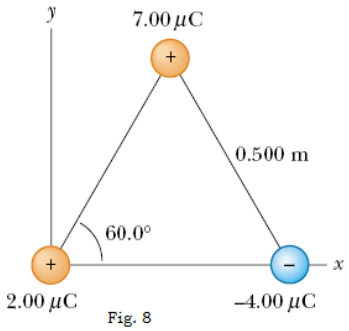

Fig. 8

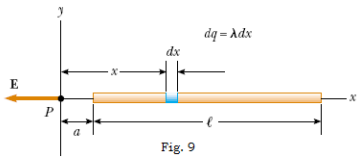

Fig. 9

11. An insulating solid sphere of radius a has a uniform volume charge density ρ and carries a total positive charge Q (Fig. 7). (a) Calculate the magnitude of the electric field at a point outside the sphere. (b)Find the magnitude of the electric field at a point inside the sphere.

12. Find the electric field a distance r from a line of positive charge of infinite length and constant charge per unit length λ (Fig. 8).

13. Find the electric field due to an infinite plane of positive charge (Fig. 9) with uniform surface charge density σ.

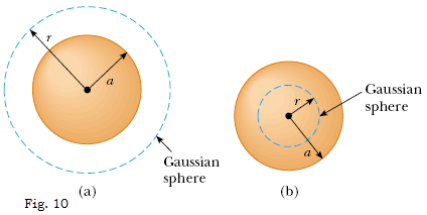

Fig. 10

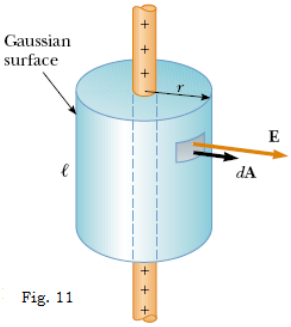

Fig. 11

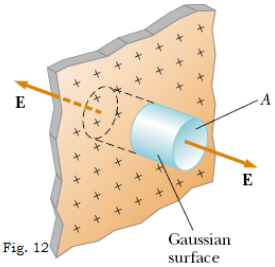

Fig. 12

14. Find an expression for the electric field at a point P located on the perpendicular central axis of a uniformly charged ring of radius a and total charge Q.(Fig. 10)

15. A uniformly charged disk has radius a and surface charge density σ. Find the magnitude of the electric field along the perpendicular central axis of the disk. (Fig. 11)

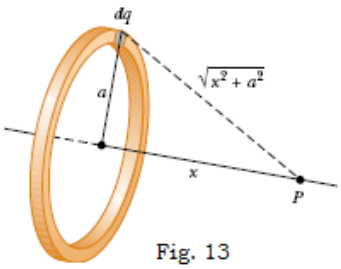

Fig. 13

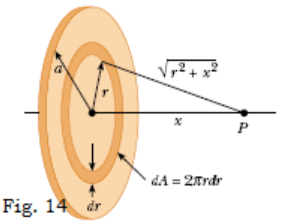

Fig. 14