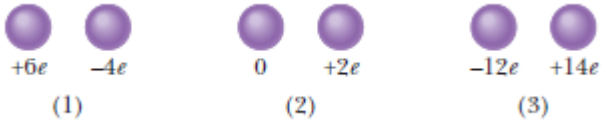
Assignment Practice Problem (For Final Exam: PHY-105: Fall 2020)

1. The nucleus in an iron atom has a radius of about 4.0×10^{-15} m and contains 26 protons. (a) What is the magnitude of the repulsive electrostatic force between two of the protons that are separated by 4.0×10^{-15} m? (b) What is the magnitude of the gravitational force between those same two protons? (c) What is the magnitude of Electric field? [Ans. (a) 14N, (b) 1.2×10^{-35}N, (c) $2.34x10^{21}$ N/m.]

2. Figure below shows three pairs of identical spheres that are to be touched together and then separated. The initial charges on them are indicated. Rank the pairs according to (a) the magnitude of the charge transferred during touching and (b) the charge left on the positively charged sphere, greatest first.

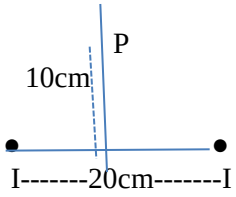


[Ans. (a) (3)>(1)>(2), (b) The same positive charge (+e) left on all sphere.]

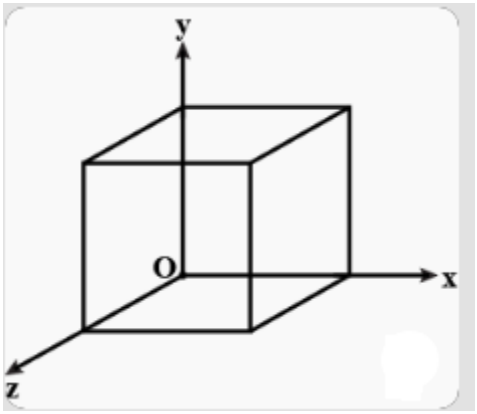
3. What must be the distance between point charge $q1$ = 26.0 μC and point charge $q2$ = 47.0 μC for the electrostatic force between them to have a magnitude of 5.70 N? [Ans.1.46m]

4. Two equally charged particles are held 3.2×10^{-3} m apart and then released from rest. The initial acceleration of the first particle is observed to be 7.0 m/s^2 and that of the second to be 9.0 m/s^2. If the mass of the first particle is 6.3×10^{-7} kg, what are (a) the mass of the second particle and (b) the magnitude of the charge of each particle? [Ans. (a) 4.9×10^{-7}kg, (b) $6.9x10^{-11}$ C]
5. In the return stroke of a typical lightning bolt, a current of 2.5×10^{4} A exists for 20 μs. How much charge is transferred in this event? [Ans. 0.5C]

6. Two point charges +4q and +q are placed 30 cm apart. At what point on the line joining them the electric field is zero?
7. A dipole is placed in a uniform electric field with its axis parallel to the field. What is Torque on it?
8. Two charges 10×10^{-9} C and 20×10^{-9}C are placed at the two corners of an equilateral triangles. The length of the arms is 0.03 m. calculate the electric field out the third corner of the triangles.
9. Two equal charges of 10×10^{-5} C are shown in fig below; each produces an electric field at point *P* on Y axis. (a) What is the magnitudes of the fields at *P*? (b) What is direction of field? (c) Find the X and Y components of the field vector, and (d) What is the direction of the net field?



10. A point charge causes an electric flux of -6×10^3 Nm^2 C^{-1} to pass through a spherical Gaussian surface of 10 cm radius centered on the charge. (i) If the radius of the Gaussian surface is doubled, how much flux will pass through the surface? (ii) What is the value of charge?
11. What is the net charge enclosed by the Gaussian cube of side is shown in Fig below. Which lies in the electric $\vec{E} = 4\hat{i} - 5\hat{j}$ field?



12. A surface has the area vector $\vec{A} = (4\hat{i} + 5\hat{j})m^2$. What is the flux of a uniform electric field through the area if the field is (a) $\vec{E} = 2i$ N/C and (b) $\vec{E} = 3\hat{k}$ N/C ?

13. A uniform electric field of magnitude E =3.0 mN/C is passing through a circular area of radius, a = 11 cm. The rim of the circular area is aligned perpendicular to the field. The net contains no net charge. Find the electric flux through the netting.

14. In Fig. below, a proton is a distance $d/2$ directly above the center of a square of side d. What is the magnitude of the electric flux through the square?