Electric and gravitational forces.

a) Consider two 0.5 kg point masses separated by 50 cm. Calculate the magnitude and direction of the gravitational force on each mass due to the presence of the other.

b) Consider that both of these masses have a 0.5 C positive charge. Calculate the direction and magnitude of the electric force acting between these charges.

2 Consider two positive charges and two negative charges placed at the four corners of a square such that the like charges occupy diagonally opposite corners. Place a positive test charge in the plane at 3 different locations, including the center, and discuss the magnitude and direction of the force on the test charge for each of these test charge locations.

3 Consider that you place a positively charged insulator near two metallic spheres that are in contact and then separate the two spheres. Discuss the charge on each of the two spheres.

Figure 1:

4 Two equal and opposite charges $Q$ are separated by a distance $d$.

a) Discuss the electric field along the line through the two charges at distances $r > d$.

b) Discuss the electric field in the plane through the center between the two charges and perpendicular to the axis.

c) Discuss the electric flux through any closed surface enclosing these two charges. Is this inconsistent with the results of parts a and b.

5 An uncharged metal sphere hangs from a nylon thread. When a positively charged glass rod is brought close to the metal sphere, the sphere is drawn towards the rod. But if the sphere touches rod, it suddenly flies away from the rod. Explain why the sphere is first attracted, and then repelled.