

Parallel Plate Capacitor and Pith Ball

These activities will improve your conceptual understanding if you predict the outcome you expect at each step below BEFORE performing the activities.

Go to the Physics Exploration Center. Enter through the resource room in 311/312 Thaw Hall. Go to the electrostatic setup which consists of two conducting plates (capacitor plates) separated by a distance (resting on insulating stands), a light conducting sphere suspended from a thread and an electrophorus (insulating surface and metal plate with insulating handle).

(a) Charge the metal plate (electrophorus) by using the procedure used in the last exploration as follows: Rub the insulating surface with the blue cloth. Negative charges appear on the insulating surface. Now put the metal plate (which has an insulating handle) on the insulating surface that you just "charged" by rubbing with the cloth. Charge separation will take place on the surface of the metal plate by induction due to its proximity with the insulating surface. Now touch the surface of the metal plate with your fingers while the plate is still on the insulating surface. Then remove your fingers. Then, lift the metal plate by holding it with the insulating handle.

(b) Now touch one of the nearby conducting plates of the capacitor (that is NOT grounded) with the charged metal plate (electrophorus). What type of charge should develop on the plate that is grounded? Explain. Is there an electric field between the two conducting plates of the capacitor? Draw the direction of the field between the plates especially marking the conducting plate that you touched with the metal plate earlier.

(c) Touch the conducting sphere hanging on the thread to remove any excess charges on it. What should happen if you bring this uncharged sphere in between the plates of the capacitor? Explain your reasoning. Does it matter if the sphere is located midway between the two plates rather than closer to one of the plates? Explain. Verify your predictions by putting the sphere between the plates (Be careful NOT to touch the plates). Reconcile any differences in your earlier prediction and observations if any.

(d) Now hold the thread and touch the metal sphere with the conducting plate of capacitor that you charged with the electrophorus. What do you predict should happen to the conducting sphere if you then place it right in the middle of the plates of the capacitor after charging it? Why? Will your predictions change if the sphere is located midway between the two plates rather than closer to one of the plates? Explain. Verify your predictions by performing the experiments. Reconcile any differences in your earlier prediction and observations if any. (Note that the plate of the capacitor that you did not touch will have opposite charge induced on it because it has been grounded).

(e) In part (d) after you place the sphere between the plates of the capacitor and watch its motion for sometime why does it stop at the end? What is the charge distribution (roughly) on the sphere and the plates?