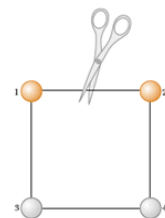**General Physics II Honors (PHYS 102H)**

Problem set # 5 *(due March 8)*

All problems are mandatory, unless marked otherwise. Each problem is 10 points.

Q1 Consider the square arrangement of four identical balls, shown in the picture. Each ball has mass m, and they are connected with non-conducting strings to form a perfect square. The balls 1 and 2 each have charge q, and balls 3 and 4 are uncharged. What is the maximum speed of balls 3 and 4 after the string connecting balls 1 and 2 is cut.
Suggestion: the actual solution of the problem is very simple, but it is crucial to correctly identify in which conditions the speed of the ball is the highest. Start with reasoning what forces act on each ball, and what trajectories each ball takes.

Q2 The circuit on the figure consists of two capacitors $C_1 = 6$ nF and $C_2 = 3$ nF, and a battery providing voltage $\Delta V = 9$V. Capacitor C_1 is first charged by closing switch S_1. Then switch S_1 is opened, and switch S_2 is closed, connecting the capacitor C_1 with the originally uncharged capacitor C_2. Calculate the initial charge acquired by C_1 and the final charge on each capacitor.
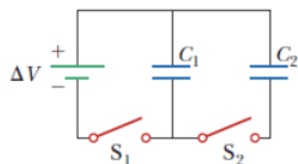
Q3 Wheatstone Bridge (see figure) is one of the most precise methods of measuring unknown resistor R_x. To do that, the value of R_2 is adjusted until the voltage drop between points D and B is zero. If this condition is satisfied, find the value of R_x in terms of known values $R_{1,2,3}$.