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Instructions

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You should hand in your answers, written or typed in standard letter sized papers, in class on the due date (to be posted with the assignment). Make sure to clearly indicate:

1. Your class (PHYS 205/03)
2. The sequence number of the actual assignment (Assignment # 2)
3. The name of your instructor (Nima Nateghi)
4. Your name
5. Your student ID#
6. The due date (Feb. 9th)

In case of multiple pages **you should staple the pages together** properly. We are not held responsible for lost pages of home works due to inadequate grouping of pages.

In case of **late submission**, drop your assignment in the physics department's dropbox (SP building, 3rd floor). There will be a 20% late submission penalty for each day after the due date. No electronic submission will be accepted. After the answers are posted, not assignments will be accepted (under no circumstances).

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Problems

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1. A particle of mass m and charge q is dropped from the height of h towards a point charge Q, which lies on the ground. What is the minimum distance between the charges? Your should be in terms of m, q, Q, h, g) **(5 marks)**
   Hint: Using conservation of energy will make your life easier!

2. Point charges Q and $-2Q$ are at a distance d. At what distances from Q is the electric potential zero? Only consider the points on the line that connects Q_1 and Q_2. **(5 marks)**

3. In the figure below, the rod is uniformly charged (λ). Find the electric potential at point P. **(5 marks)**
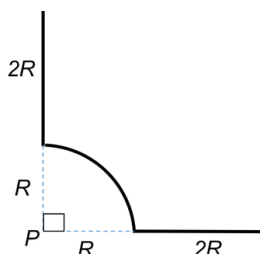
4. We charge a $6\ \mu F$ capacitor with potential difference of 100 V. We then disconnect it from the battery and connect it to an empty of charge capacitor of $4\ \mu F$. Find the charge on each capacitor. **(5 marks)**

5. The capacitors of $C_1 = 2\ \mu F$ and $C_2 = 3\ \mu F$ are each fully charged with potential difference of 30 V. What is the charge on each capacitor if we close switches S_1 and S_2 simultaneously? **(5 marks)**
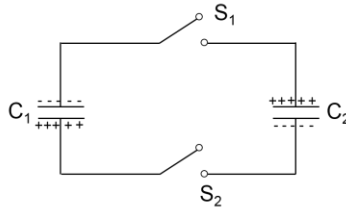
6. In the configuration below, the battery is 50 V. Find the charge and energy stored on capacitor C_2.
   $C_1 = 2\ \mu F, C_2 = 3\ \mu F, C_3 = 4\ \mu F$ **(5 marks)**
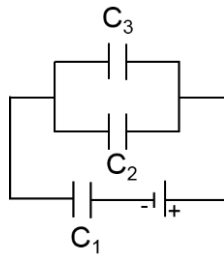
Bonus: In a parallel plate capacitor, the dielectric constant linearly changes from 1.5 ϵ_0 on one plate to 3 ϵ_0 on the other plate. If the surface area of the plates is A and the distance between the plates is d, what is the capacitance in terms of $\epsilon_0 \frac{A}{d}$? **(0 marks)** ☺