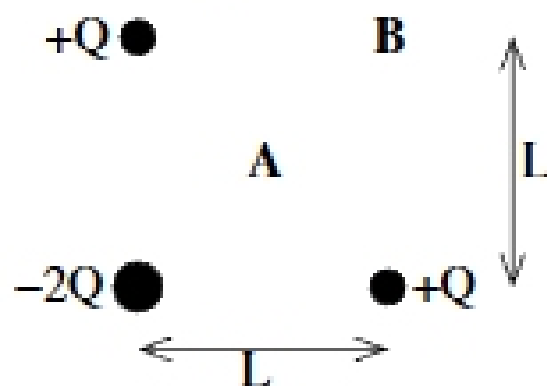


Problems for Physics 2020 recitation (week 4)

1. The charge configuration shown below consists of 3 charges at 3 corners of a square with side length L .
 - (a) What is the electric field at the center of the square (point **A**)
 - (b) What is the electric field at the 4th corner (point **B**)?
 - (c) What is the electric potential at the center of the square (point **A**)
 - (d) What is the electric potential at the 4th corner (point **B**)?
 - (e) Given that $Q = 1 \mu\text{C}$ and $L = 1 \text{ cm}$, what is the magnitude of the acceleration on a particle at point **A** with a mass of 1 kg and charge of $2 \mu\text{C}$? How much work would be required to move the particle from point **A** to point **B**?



2. At the end of the first lab you were able to make a soda can move using a charged plastic rod. Explain how this works including necessary charge distributions and force diagrams
3. A large conducting plate has a surface charge density of $+1 \times 10^{-5} \text{ C/cm}^2$.
 - (a) What is the voltage difference between a point 1 cm from the plate and 10 cm from the plate?
 - (b) What is the magnitude of the acceleration of a 1 g mass with $+2 \text{ mC}$ located 1 cm from the plate?
 - (c) What is the magnitude of the acceleration of a 1 g mass with $+2 \text{ mC}$ located 10 cm from the plate?
 - (d) If the 1 g , $+2 \text{ mC}$ mass is released from rest one centimeter from the plate, how much kinetic energy will it have when it is 10 cm from the plate?
4. A metal rod is resting on top of glass plate and is grounded via a wire. A positively charged insulated rod is brought close to the metal rod, the grounding wire is cut, and the rod is removed.
 - (a) Is there a charge on the metal rod before the insulated rod is brought close?
 - (b) Is there a charge on the metal rod after the insulated rod is removed? If so, what is the sign?
5. Four balls hang from insulating nylon strings. Balls 1 and 2 attract, balls 1 and 4 repel, and balls 2 and 3 feel no force between them. Which balls are charged and of the charged balls, which have the same sign and which have opposite signs?

6. A solid copper sphere with a radius of 5 cm has a net charge of $+1\ \mu\text{C}$.
 - (a) What is the electric field in the center of the sphere?
 - (b) What is the electric potential in the center of the sphere?
 - (c) What is the electric field at a radius of $r/2$ from the center of the sphere?
 - (d) What is the electric potential at a radius of $r/2$ from the center of the sphere?
 - (e) What is the electric field on the surface of the sphere?
7. One charge is placed at the origin of the coordinate system, the other one with the same charge is placed at $(5\text{ m}, 0\text{ m})$.
 - (a) Are there positions where the electric field is zero? If so, find those special positions. If not, explain why.
 - (b) Are there positions where the electric potential is zero? If so, find those special positions. If not, explain why.
8. Understanding electric fields and potential
 - (a) What is an electric field? Try to explain in just words what a “field” is and why we make use of this concept when we talk about electric forces.
 - (b) What is electric potential? Here you can be a little more technical: What is the relationship between electric potential and electric potential energy (you can supplement your explanation with an equation if you so choose)? What is the relationship between electric potential and the electric field at a point?
9. There are the following charges on a line: 1 C at the origin, 1 C at $x = 2\text{ m}$, and -2 C at $x = 3\text{ m}$. Find the coordinate(s) where the electric potential is 0.