Principles of Physics II (PHY 104)

Practice Exam 1

Question 1 (4 points) Consider the electric potential produced by two point charges, one positive and the other negative, separated by 3 cm. Where is the electric potential higher—near the positive charge or near the negative charge? Explain how you know.

Question 2 (4 points) If the electric field is zero in some *region* of space, does that imply that the electric potential is zero in that region? If so, why? If not, what does it imply about the electric potential?

Question 3 (4 points) Consider a parallel-plate capacitor with charge $+Q$ on one plate and charge $-Q$ on the other plate. If you pull the plates apart slightly, so that the distance between them increases, what happens to the electric field, the potential difference between the plates, and the capacitance? Explain how you know.

Question 4 (4 points) For his birthday, my son Carl asked for a parallel-plate capacitor that acquires a charge of 1 C when a voltage of 1 V is applied. Explain why it would be very difficult to make such a capacitor.

Problem 1 (8 points) A 2 nC charge is held fixed. A proton is released from rest at a point 1 m away from the 2 nC charge. How fast is the proton moving when it reaches a point 10 m away?

Problem 2 (8 points) Two flat circular metal plates, each with radius 0.5 m, are separated by 1 mm. One plate has a charge of 3 nC on it and the other has an equal and opposite charge. If we choose the zero of electric potential to be at the center of the negative plate (the plate with the negative charge), what is the electric potential at the center of the positive plate?

Problem 3 (8 points) Find the magnitude and direction of the electric field at point P in the figure below.

$Q_2 = -8.0\mu C$

2 cm

4 cm

P

$Q_1 = +4.0\mu C$