



MNS Department
Spring Semester 2015
Midterm Examination
Course No: PHY 112 (Section-2)
Course Title: Principles of Physics II

Time: 1 hour
Total Marks: 40

Date: March 14, 2015

Part-I: Problem solving. Marks are as indicated.

1. Four charges form a square with edge length D as shown in Figure-1. The charge distributions are also as shown. The points a , b , d and e are the mid-points of the edges, and the c is the centre of the square. Given, $q = 2.10 \mu\text{C}$, $D = 5.00 \text{ cm}$ and $m_e = 9.31 \times 10^{-31} \text{ kg}$. compute:

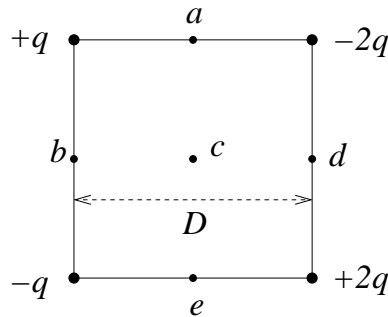


Figure 1

- (a) (6 marks) : the net electric field at the centre of the square.
- (b) (5 marks) : the acceleration of an electron if it is placed at the centre of the square.
2. Consider Figure-1 and the data given in question 1.
- (a) (6 marks) : what is the total potential energy of the system due to the four charges of the square?
- (b) (3 marks) : what is the potential difference between the points of upper right corner and the lower right corner of the square?
- (c) (2 marks) what must be the work done to bring an electron from the upper right corner to the lower right corner of the square?
3. A gaussian cube has edge length of 1.4 m and is oriented in a region of uniform electric field of magnitude 6 N/C in the x-direction. Find:
- (a) (6 marks) : the net flux through the cube.
- (b) (5 marks) : net charge enclosed by the cube.

Part-II: Multiple choice questions. Choose the correct answer.

Marks: _____/7

4. (a) If a charged particle is located inside a shell of uniform charge, there is _____ on the particle from the shell.
A. an electrostatic force **B.** no electrostatic force **C.** an electromagnetic force **D.** none of these
(a) _____
- (b) Object A has a charge of $+2\mu C$, and object B has a charge of $+6\mu C$. Which statement is true about the electric forces on the objects?
A. $\vec{F}_{AB} = -3\vec{F}_{BA}$ **B.** $\vec{F}_{AB} = -\vec{F}_{BA}$ **C.** $3\vec{F}_{AB} = -\vec{F}_{BA}$ **D.** $\vec{F}_{AB} = \vec{F}_{BA}$
(b) _____
- (c) An electron and a proton are held fixed at a distance on the positive x and negative y axes respectively. What is the direction of the net electric field at the origin?
A. in the first quadrant **B.** in the second quadrant **C.** in the third quadrant **D.** in the fourth quadrant
(c) _____
- (d) An isolated charged particle produces an electric field with magnitude E at a distance 1 m away. What will be the magnitude of the field at a point 2 m away?
A. $2E$ **B.** $4E$ **C.** $\frac{E}{2}$ **D.** $\frac{E}{4}$.
(d) _____
- (e) A particle with charge q is located inside a cubical gaussian surface. No other charges are nearby. If the particle is at the centre of the cube, what is the flux through each one of the faces of the cube?
A. 0. **B.** $q/2\epsilon_0$ **C.** $q/6\epsilon_0$ **D.** $q/8\epsilon_0$ **E.** depends on the size of the cube
(e) _____
- (f) A dielectric slab has been inserted between the two plates of a parallel plate capacitor. Which of the following statements is not correct?
A. capacitance will be increased. **B.** electric field inside the capacitor become weaker
C. capacitor can now store more potential energy **D.** the work done to move a charge is same as before
(f) _____
- (g) A parallel plate capacitor can store E amount of energy when it is connected to a 10 V battery. How much energy will it store if it is connected to a 20 V battery?
A. $2E$ **B.** $4E$ **C.** $\frac{E}{2}$ **D.** $\frac{E}{4}$
(g) _____