Instructor: *P. Kumar*

PHYSICS DEPARTMENT

PHY 2049 Midterm I June 1, 2007

Name (print, last first): _____ Signature: _____

On my honor, I have neither given nor received unauthorized aid on this examination.

YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.

DIRECTIONS

(1) **Code your test number on your green answer sheet (use 76–80 for the 5-digit number)**. Code your name on your answer sheet. **Darken circles completely (errors can occur if too light)**. Code your student number on your answer sheet.
(2) **Blacken the circle of your intended answer completely, using a number 2 pencil**. Do not make any stray marks or the answer sheet may not read properly.
(3) The answers are rounded off. Choose the closest to exact. There is no penalty for guessing.

>>>>>>>>**WHEN YOU FINISH** <<<<<<<<
Hand in the green answer sheet separately.

1. The total negative charge on the electrons in 1 mol of helium (atomic number 2, molar mass 4 g/mole) is:

(1) 1.9×10^5C (2) 4.8×10^4C (3) 9.6×10^4C (4) 3.8×10^5C (5) 7.7×10^5C

2. Two identical conducting spheres A and B carry equal charge. They are separated by a distance much larger than their diameters. A third identical conducting sphere C is uncharged. Sphere C is first touched to A, then to B, and finally removed. As a result, the electrostatic force between A and B, which was originally F, becomes:

(1) $3F/8$ (2) $F/2$ (3) $F/4$ (4) $F/16$ (5) 0

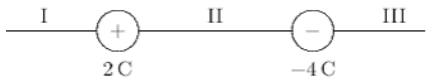
3. Particles 1, with charge q_1, and 2, with charge q_2, are on the x axis, with particle 1 at $x = a$ and particle 2 at $x = -2a$. For the net force on a third charged particle, at the origin, to be zero, q_1 and q_2 must be related by $q_2 =$:

(1) $4q_1$ (2) $2q_1$ (3) $-2q_1$ (4) $-4q_1$ (5) $\frac{-q_1}{4}$

4. A charged oil drop with a mass of 2×10^{-4} kg is held suspended by a downward electric field of 300N/C. The charge on the drop is: ($g = 9.80$ m/s^2)

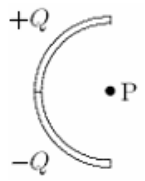
(1) -6.5×10^{-6}C (2) $+1.5 \times 10^{-6}$C (3) -1.5×10^{-6}C (4) $+6.5 \times 10^{-6}$C (5) 0

5. Two charged particles are arranged as shown. In which region could a third particle, with charge +1 C, be placed so that the net electrostatic force on it is zero?



(1) I only (2) I and II only (3) III only (4) I and III only (5) II only

6. Positive charge +Q is uniformly distributed on the upper half a semicircular rod and negative charge –Q is uniformly distributed on the lower half. What is the direction of the electric field at point P, the center of the semicircle?



(1) ↓ (2) ↑ (3) ← (4) → (5) ↗

7. A hollow conductor is positively charged. A small uncharged metal ball is lowered by a silk thread through a small opening in the top of the conductor and allowed to touch its inner surface. After the ball is removed, it will have:

   (1) no appreciable charge
   (2) a positive charge
   (3) a negative charge
   (4) a charge whose sign depends on what part of the inner surface it touched
   (5) a charge whose sign depends on where the small hole is located in the conductor

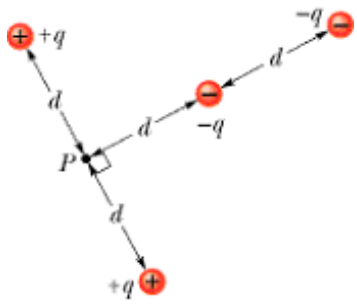
8. Positive charge Q is placed on a conducting spherical shell with inner radius $R1$ and outer radius $R2$. A particle with charge q is placed at the center of the cavity. The magnitude of the electric field at a point in the cavity, a distance r from the center, is:

   (1) zero (2) $Q/4\pi\epsilon_0 R_1^2$ (3) $q/4\pi\epsilon_0 r^2$ (4) $(q+Q)/4\pi\epsilon_0 r^2$ (5) $(q+Q)/4\pi\epsilon_0(R_1^2 - r^2)$

9. A point particle with charge q is at the center of a Gaussian surface in the form of a cube. The electric flux through any one face of the cube is:

   (1) $q/6\epsilon_0$ (2) q/ϵ_0 (3) $q/4\pi\epsilon_0$ (4) $q/3\epsilon_0$ (5) $q/12\epsilon_0$

10. What is the net electric potential at point P due to the four particles, if $V = 1$ mV at infinity, $q = 7.00$ fC, and $d = 2.00$ cm?



   (1) 2.6 mV
   (2) 1.6 mV
   (3) 3.2 mV
   (4) −1.6 mV
   (5) none of these

11. A 140 pF capacitor is charged to a potential difference of 60 V, and the charging battery is disconnected. The capacitor is then connected in parallel with a second (initially uncharged) capacitor. If the potential difference across the first capacitor drops to 48 V, what is the capacitance of this second capacitor?

   (1) 35 pF (2) 20 pF (3) 10 pF (4) 15 pF (5) none of these

12. The electric potential at points in an xy plane is given by $V = (3.0\text{V/m}^2)x^2 - (4.0\text{V/m}^2)y^2$. What is the electric field at the point (3.0 m, 3.0 m)? (E_x, E_y in V/m)

   (1) (−18,24) (2) (18,−24) (3) (27,−36) (4) (−27,36) (5) none of these