Instructor(s): *P. Kumar*

PHYSICS DEPARTMENT

PHY 2049 Exam 1 June 9, 2014

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.

(1) **Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number)**. Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY**. Code your UFID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
(4) **Blacken the circle of your intended answer completely, using a #2 pencil or blue or black ink**. Do not make any stray marks or some answers may be counted as incorrect.
(5) **The answers are rounded off. Choose the closest to exact. There is no penalty for guessing. If you believe that no listed answer is correct, leave the form blank.**
(6) Hand in the answer sheet separately.

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1. Three identical conducting spheres A and B are located at the vertices of an equilateral triangle. A and B are charged with the same charge while C is uncharged. Sphere C is first touched to A, then to B, and then put back at its original place. Spheres A and B are then brought into contact and then put back at their original places. If the original force between A and B was F, what is the force between A and C at the end in terms of F?

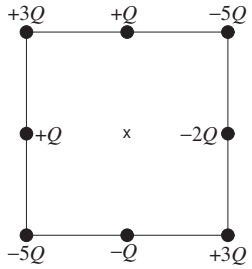
   (1) 15F/32 (2) F/2 (3) F/4 (4) 25F/64 (5) 3F/8

2. A particle with charge 2μC is placed at the origin, an identical particle, with the same charge, is placed 2m from the origin on the x axis, and a third identical particle, with the same charge, is placed 2m from the origin on the y axis. The magnitude of the force on the particle at the origin is:

   (1) 1.3×10^{-2} N (2) 2.9×10^{-2} N (3) 2.0×10^{-2} N (4) 4.0×10^{-2} N (5) 8.1×10^{-2} N

3. Charges are arranged on a square of side d as shown in the diagram. In what direction is the electric field at the center of the square?

   (1) Fourth quadrant
   (2) First quadrant
   (3) Second quadrant
   (4) Third quadrant
   (5) $E = 0$



4. Refer to the previous problem. What is the potential at the center of the square (in units of kQ/d), assuming $V = 0$ at infinity?

   (1) −7.7 (2) +1.3 (3) −9.5 (4) −0.50 (5) +0

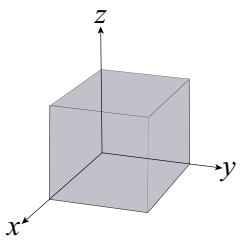
5. You have a wire with of length L and resistance $R = 36\Omega$. You turn it into a ring and then connect the two terminals of an ohmmeter at two points on the circumference of the ring that make an angle of 60° at the center of the ring. What is the resistance, in Ω, measured by the ohmmeter?

   (1) 5 (2) 0.36 (3) 0.22 (4) 2 (5) none of these

6. A 50 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 50 V, what is the capacitance of this second capacitor?

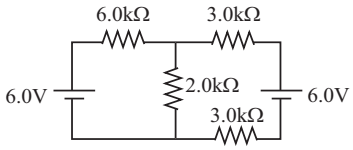
(1) 10 pF (2) 20 pF (3) 15 pF (4) 35 pF (5) none of these

7. A non-uniform electric field given by $E = (5.5\hat{i} - 2.1\hat{j} + (4.6z^2 - 3)\hat{k})$N/C pierces a cube with sides 3 m, as shown in the figure. The cube has its rear corner at the origin. What is the total charge inside the cube?



(1) +3.3 nC
(2) −3.3 nC
(3) +1.5 nC
(4) −1.5 nC
(5) none of these

8. In the multi-loop circuit shown the current through the 6.0kΩ resistor is (in mA),



(1) 0.6 (2) 0.4 (3) 2.4 (4) 1.4 (5) not enough information

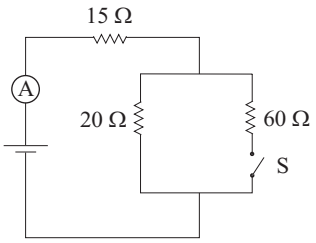
9. A proton is located at $x = 0$ and electron is located at $x = 2$ m. There is a uniform electric field of $E = 5V/m\,\hat{\imath}$. If at $t = 0$ they are released from rest, at what time would they reach the same x-position? (Do not include the attaction between the proton and the electron.)

(1) $2.1\mu s$ (2) $3.3\mu s$ (3) $5.7\mu s$ (4) $4.5\mu s$ (5) $1.5\mu s$

10. A certain capacitor, in series with a 720Ω resistor, is being charged. At the end of 10 ms, its charge is half the final value. The capacitance is about:

(1) $20\mu F$ (2) $14\mu F$ (3) $9.6\mu F$ (4) $7.2F$ (5) $10F$

11. When switch S is open, the ammeter in the circuit shown reads 2.0 A. When S is closed, the ammeter reading:



(1) increases slightly
(2) remains the same
(3) decreases slightly
(4) doubles
(5) halves

12. A parallel plate capacitor has a plate area of 0.15 m^2 and a plate separation of 0.2 mm. If the charge on each plate has a magnitude of 5×10^{-6} C, then the force exerted by one plate on the other has a magnitude of about:

(1) 9 N (2) 0 (3) 5 N (4) 1×10^4 N (5) 9×10^5 N

THE FOLLOWING QUESTIONS, NUMBERED IN THE ORDER OF THEIR APPEARANCE ON THE ABOVE LIST, HAVE BEEN FLAGGED AS CONTINUATION QUESTIONS: 4