**Physics Department** | **Physics 211** Quiz I | **March 11, 2002** Time: 1 hour

**Name:** .....

**ID number:**.....

**Major:**.....

***Remark:*** **A correct answer without a solution is not counted**

**Given :** $k_e = 1/(4\pi\varepsilon_o) = 9\times10^9$ SI

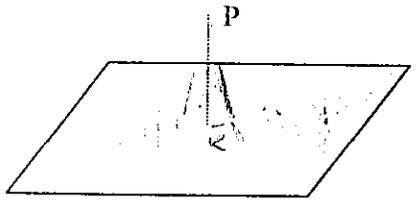
*Try to do this test in one hour once only.*

1.
2.
3. A particle ( $m = 50\ g$, $q = 5.0\ \mu C$ ) is released from rest when it is 50 *cm* from a second particle ( $Q = -20\ \mu C$ ). Determine the magnitude of the initial acceleration of the 50 *g*.

a. 54 $m/s^2$ b. 90 $m/s^2$ c. 72 $m/s^2$ d. 65 $m/s^2$ e. 36 $m/s^2$ F=

4. A large, flat, non-conducting surface has a uniform charge density $\sigma$ . A small circular hole of radius R has been cut in the middle of the surface, as shown in the figure. Ignore finging of the field lines around all edges, and calculate ( using the superposition principle) the electric field at point P , a distance *z* from from the center of the hole along its axis.

Solution:



5. A long non-conducting cylinder ( radius = 6.0 *mm* ) has a non-uniform volume charge density given by $\alpha r^2$ , where $\alpha = 6.0\ mC/m^5$ and $r$ is the distance from the axis of the cylinder. What is the magnitude of the electric field at a point 2.0 *mm* from the axis? ( The answers are given with two significant figures )

a. 1.4 *N/C* b. 1.6 *N/C* c. 1.8 *N/C* d. 2.0 *N/C* e. 5.4 *N/C*

Solution:

6. A long cylindrical shell (radius = 6.0 *cm* ) has a charge uniformly distributed on its surface. If the magnitude of the electric field at a point 8.0 *cm* radially outward from the axis of the shell is 85 *N/C* , how much charge is distributed on a 2.0 *m* length of the charged cylindrical surface?

a. 0.38 *nC* b. 0.76 *nC* c. 0.19 *nC* d. 0.57 *nC* e. 0.98 *nC*

Solution

7. A proton ( mass = $1.67 \times 10^{-27}$ kg , charge = $1.60 \times 10^{-19}$ *C* ) moves from a point A to point B under the influence of an electrostatic force only. At point A the proton moves with a speed of 60 *km/s* . At point B the speed of the proton is 80 *km/s* . Determine the potential difference $V_B - V_A$.

a. +15 *V* b. -15 *V* c. -33 *V* d. +33 *V* e. -20 *V*

Solution:

8. An isolated conductor of arbitrary shape has a net charge of + 10 $\mu C$ . Inside the conductor is a cavity within which is a point charge $q$ = + 3.0 $\mu C$. What is the charge (a) on the cavity wall and (b) on the outer surface of the conductor? ( Give your solution)

9. Two particles, each having a mass of 3.0 *mg* and having equal but opposite charges of magnitude of 6.0 *nC*, are released simultaneously from rest when they are a very large distance apart. What distance separates the two at the instant when each has a speed of 5.0 *m/s*.

a. 4.3 *mm* b. 8.6 *mm* c. 7.3 *mm* d. 5.6 *mm* e. 2.2 *mm*

Solution;

**10.** ge of uniform density 12 $nC/m$ is distributed along $x$ axis from $x = 2.0\ m$ to $x = 5.0\ m$. What is the electric potential (relative to zero at infinity) at the origine ($x = 0.0\ m$) ?

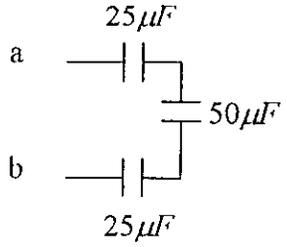
a. 91 $V$ b. 82 $V$ c. 74 $V$ d. 99 $V$ e. 101 $V$

Solution:

**11.** In the figure, if $V_a - V_b = 22\ V$, how much energy is the 50 $\mu F$ capacitor?

a. 0.78 $mJ$ b. 0.58 $mJ$ c. 0.68 $mJ$ d. 0.48 $mJ$ e. 0.28 $mJ$

Solution:




**12.** A 30 $\mu F$ capacitor is charged to 40 $V$ and then connected across an initially uncharged 20 $\mu F$ capacitor. What is the final potential difference across the 30 $\mu F$ capacitor?

a. 15 $V$ b. 40 $V$ c. 18 $V$ d. 21 $V$ e. 24 $V$

Solution: