Practice Exam #2

Do not flip the page until told to do so.

Name: _____

Problem	Grade	Points Possible
1		5
2		5
3		5
4		15
5		15
6		15
Total		60

Useful Equations

$$x(t) = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$$
$$v_x(t) = v_{0x} + a_x t$$
$$v_{fx}^2 = v_{0x}^2 + 2a_x\Delta x$$
$$a_c = \frac{v^2}{r}$$
$$\sum_i \vec{F}_i = m\vec{a} = \frac{d\vec{p}}{dt}$$
$$\vec{p} = m\vec{v}$$

$$\vec{F}_q = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}\hat{r}$$
$$\vec{E}_q = \frac{1}{4\pi\epsilon_0}\frac{q}{r^2}\hat{r}$$
$$\vec{F}_q = q\vec{E}$$
$$\vec{p} = q\vec{d}$$
$$\vec{\tau}_p = \vec{p}\times\vec{E}$$
$$U_p = -\vec{p}\cdot\vec{E}$$
$$E_p(z) = \frac{1}{2\pi\epsilon_0}\frac{p}{z^3}$$
$$\Phi = q_{enc}/\epsilon_0$$
$$\Phi = \oint \vec{E}\cdot d\vec{A}$$

Question 1: Three positive charges are spaced evenly in an equilateral triangle. Two of the charges have charge q, and the third has charge $2q$. Draw **solid** $\vec{E}$-field lines and **dashed** equipotential lines for this configuration.

Question 2: The capacitance of an ideal capacitor can depend on the following quantities (circle all that apply):

(a) The size of the conducting plates.

(b) The power dissipated by the capacitor.

(c) The distance between the conducting plates.

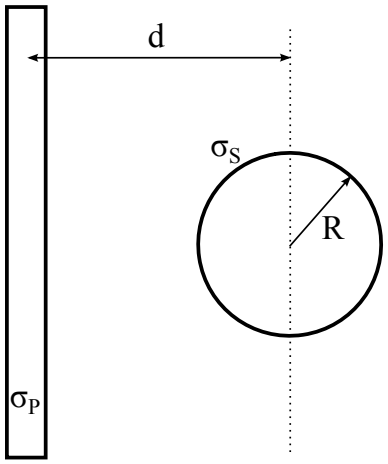
(d) The potential applied to the conducting plates.

(e) None of the above.

Question 3: Current is passed through two lightbulbs using a 9 V battery. Rank the following three circumstances in terms of the brightness of the bulbs, with 1 being the brightest. Two configurations may yield the same results.

- ___ Each bulb by itself.
- ___ The two bulbs in series.
- ___ The two bulbs in parallel.

Question 4: A sphere of radius $R = 1$ m and surface charge density $\sigma_S = 10$ C/m^2 is placed a distance $d = 2$ m from an infinitely large plate of charge density $\sigma_P = 3$ C/m^2, as shown below. Find the potential between the two closest points on the sphere and plate:



Question 5: Two conducting objects (1 and 2) of arbitrary shape hold charges of $\pm q$. At this charge, the electric field in the region is given by $\vec{E} = -A[y^2\hat{i} + (2xy + z^2)\hat{j} + 2yz\hat{k}]$ V/m (with A a constant and ignoring the field inside each conductor). Find the capacitance of this makeshift capacitor by considering the two closest points on the objects, $\vec{r}_1 = (0, 1, 0)$ m and $\vec{r}_2 = (1, 1, 0)$ m.

Question 6: Find the current through each branch of the circuit below, when $V = 9$ V.