Practice Exam #1

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

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

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

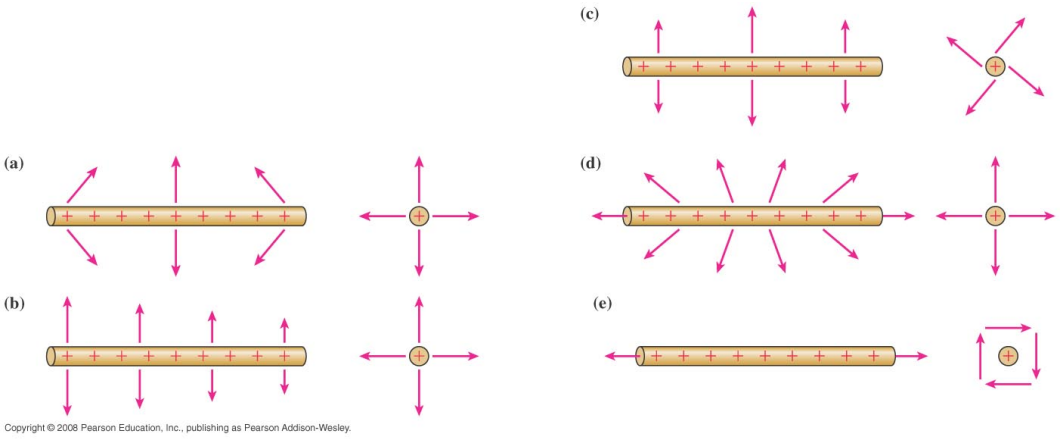
Question 1: A positively charged ball is brought close to a fixed, electrically neutral conductor.

(a) What happens to the charge in the conductor?

(b) The conductor is then grounded with a wire while the ball is kept close. When the wire is then disconnected, what is the charge state (+, - or neutral) of the conductor?

(c) If the conductor stays connected to the ground wire while the charged ball is removed, how does the situation differ?

Question 2: Below is a uniformly charged rod of *finite* length L. Which of the following are possible electric fields for the charged rod?



Question 3: Two different and arbitrary Gaussian surfaces are drawn enclosing a single negative charge $-q$. Circle all that apply.

(a) The flux through both surfaces is positive.

(b) The flux through both surfaces is negative.

(c) The flux through each surface is equal.

(d) The electric field is perpendicular to the surfaces.

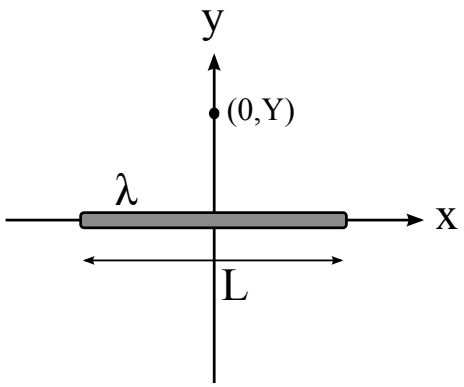
(e) The Gaussian surfaces must intersect.

Question 4: Three charges are dispersed in the plane:

- $q_1 = +10$ nC at (0.0, 0.0) cm,
- $q_2 = -10$ nC at (1.0, 1.0) cm,
- $q_3 = +5$ nC at (1.0, -1.0) cm.

What is the Electric Field at (1.0, 0.0) cm? What is the *force* on an electron placed at this location? (you can give magnitude and direction or component form.)

Question 5: A uniformly charged rod of length L and charge density λ sits on the x-axis. Its center is at $x = 0$ so that the y-axis bisects the rod. Set up *but do not solve* the integral for the electric field $\vec{E}$ at point (0,Y).



Question 6: A uniformly charged cylinder of radius R and charge density ρ sits inside a hollow cylinder that is uniformly charged with charge density of $-\rho$ and has inner and outer radii of R_i and R_o, respectively. Find the electric field in all four regions:

I:	$0 \leq r \leq R$
II:	$R \leq r \leq R_i$
III:	$R_i \leq r \leq R_o$
IV:	$R_o \leq r \leq \infty$

Cross Section View: