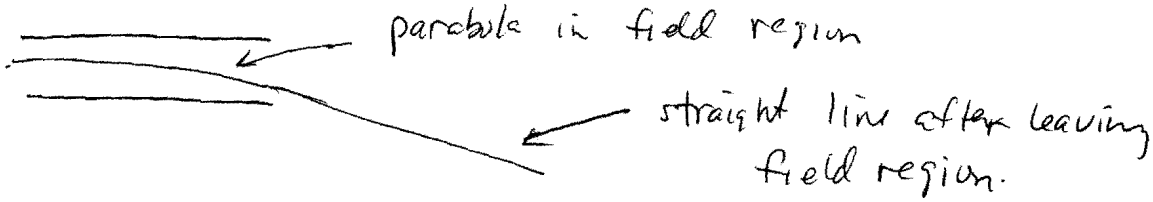
15.P.32

(a) 

(b) $F = ma = qE$

$$a = \frac{qE}{m} = \frac{(1.6\times10^{-19}C)(10^5 N/C)}{9.1\times10^{-31}kg} = 1.76\times10^{16} m/s^2 \text{ downward}$$

(c) $E = \frac{\sigma}{\epsilon_0} = \frac{Q/A}{\epsilon_0}$

$$Q = EA\epsilon_0 = \left(10^5 \tfrac{N}{C}\right)(0.12m \times 0.03m)(8.85\times10^{-12})$$

$$= 3.2\times10^{-9}C. \quad \text{(negative)}$$

15.P.34

(a) $E = 0$ (no field inside spherical charge dist.)

(b) Q_2 and Q_3 have no effect, Q_1 behaves like point charge

$$E = \frac{1}{4\pi\epsilon_0}\frac{Q_1}{r^2} \text{ toward center.}$$

(c) $E = 0$ inside metal

(d) All 3 spherical distributions can be replaced with point charges:

$$E = \frac{1}{4\pi\epsilon_0}\frac{-Q_1}{r^2} + \frac{1}{4\pi\epsilon_0}\frac{Q_2}{r^2} + \frac{1}{4\pi\epsilon_0}\frac{Q_3}{r^2}$$

$$= \frac{1}{4\pi\epsilon_0}\frac{1}{r^2}(Q_2+Q_3-Q_1) \quad \text{radially outward if } Q_2+Q_3-Q_1 > 0$$

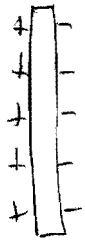
$= Q_3$ because $|Q_2| = |Q_1|$

(e) $Q_2 = +5\ nC$ in order to make $E = 0$ inside metal.

(f) $E = 0$ inside plastic, so there is no polarization of molecules.

15. P. 38

@1



(b) $E = 0$ inside foil

(c) Field due to disk:

$$E = \frac{Q/A}{2\epsilon_0} = \frac{(3\times10^{-5}\,C)/\pi(1.5\,m)^2}{2(8.85\times10^{-12})}$$

$$= 2.40\times10^{5}\,N/C$$

The charges on the faces of the small foil must set up a field that cancels the field of the disk.

$$E = \frac{Q/A}{\epsilon_0} \qquad \text{(foil looks like capacitor)}$$

$$Q = EA\epsilon_0 = \left(2.4\times10^{5}\,\frac{N}{C}\right)(\pi\times(0.02\,m)^2)(8.85\times10^{-12})$$

$$= 2.7\ nC \quad \text{(positive)}$$