PHY 212 HOMEWORK 3 SOLUTIONS

1. (21.52) $E = \sigma/2\epsilon_0 \Rightarrow \sigma = 2\epsilon_0 E = 300\,\epsilon_0 = 2.66 \times 10^{-9}\ C/m^2$

2. (21.54) a) $E = 0$

b) $E = 0$

c) $E = 2\sigma/2\epsilon_0 = \dfrac{\sigma}{\epsilon_0}$

(a) ↑ ↓

(c) ↓ ↓

(b) ↓ ↑

3. (22.2) a) $\Phi = \vec{E}\cdot\vec{A} = EA\cos\theta, \quad \vec{A} = A\,\hat{n}$

$\Phi_{S1} = -EA\cos(90-36.9°)$

$\Phi_{S2} = 0, \quad \Phi_{S3} = EA\cos(90-36.9°)$

$\Phi_{S4} = 0, \quad \Phi_{S5} = EA\cos 36.9°$

$\Phi_{S6} = -EA\cos 36.9°$

b) The total flux through the cube must be zero, since it encloses no charge.

(22.4)

4. $\Phi = \vec{E}\cdot\vec{A} = (75\ N/C)(0.24\ m^2)\cos 70° = 6.16\ Nm^2/C$

5. (22.5) a) $\Phi = \vec{E}\cdot\vec{A} = \dfrac{\lambda}{2\pi\epsilon_0 r}(2\pi r l) = \dfrac{\lambda l}{\epsilon_0} = 2.71\times10^5\ Nm^2/C$

b) same flux.

c) flux would increase by a factor of two:

$\Phi = 5.42\times10^5\ Nm^2/C$