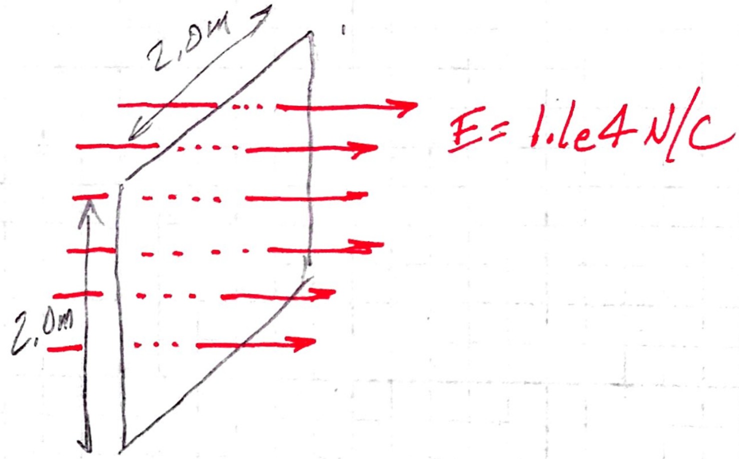
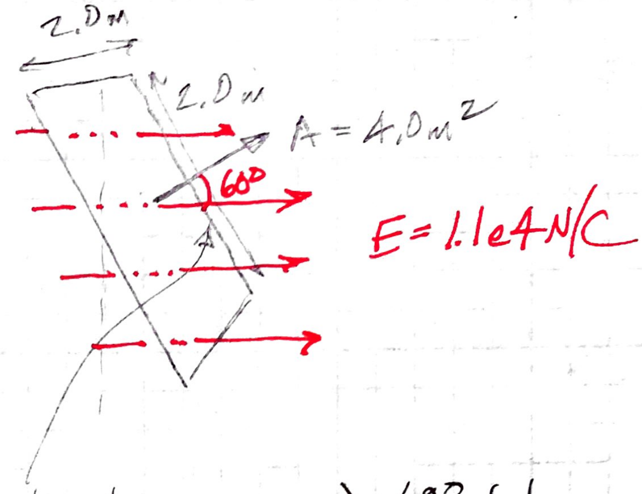
6.20



$$\Phi_e = E \cdot A = EA\cos\theta$$
$$(1.1e4\,N/C)((2m)^2)\cos 0$$
$$= \boxed{4.4e4\ Nm^2/C}$$

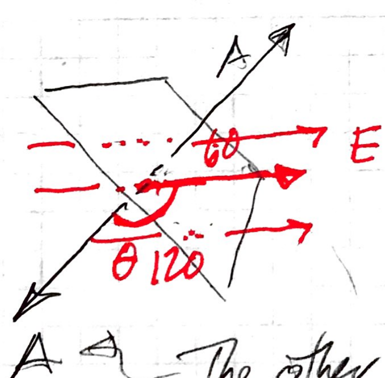
6.21



That's not a very good 60°, but you got the idea.

$$\Phi_e = EA\cos\theta$$
$$= (1.1e4\,N/C)(4.0\,m^2)(\cos 60)$$
$$= \boxed{2.2e4\,Nm^2/C}$$

That's positive for the lines coming out of the sheet



The other direction normal to the sheet.

$$\Phi_e = EA\cos 120$$
$$(1.1e4)(4m^2)(-(\cos 60))$$
$$= \boxed{-2.2e4\,Nm^2/C}$$

6.25

$A = 2\,cm^2 = 2(0.01m)(0.01m)$
$= \underline{\underline{2e{-}4\,m^2}}$

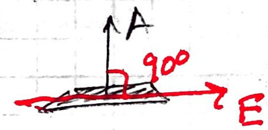
Find electric flux Φ_e
at various orientations
to E field of 10^3 N/C

Be careful on this conversion.
$2\,cm^2 \neq 0.02\,m^2$!

a) 30°

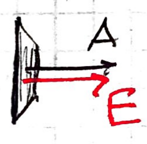
$\Phi = EA\cos 30$
$= (10^3)(2e{-}4)\cos 30$
$= \boxed{0.173\ Nm^2/C}$

b) 90°



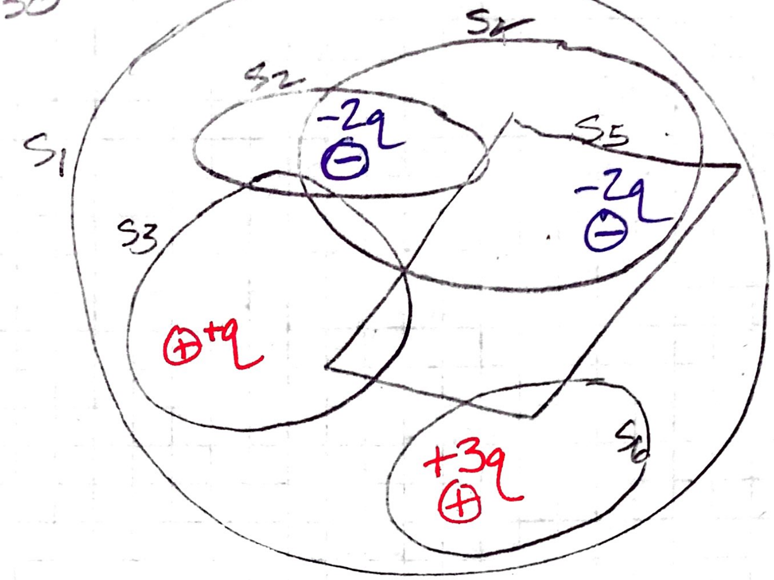
$\Phi = EA\cos 90$
$= EA(0)$
$= \boxed{0}$

c) 0°



$\Phi = EA\cos 0$
$= (10^3 N/C)(2e{-}4m^2)(1)$
$= \boxed{0.20\ Nm^2/C}$

6.30



Electric flux through each surface is only due to q internal.

S1 = all charges internal. $\Phi = \frac{q_{in}}{\varepsilon_0} = \frac{+q+3q-2q-2q}{\varepsilon_0}$ $\boxed{=0}$

S2 only -2q internal $\Phi = \frac{q_{in}}{\varepsilon_0} = \boxed{\frac{-2q}{\varepsilon_0}}$

S3 only +q internal $\Phi_0 = \frac{+q}{\varepsilon_0}$

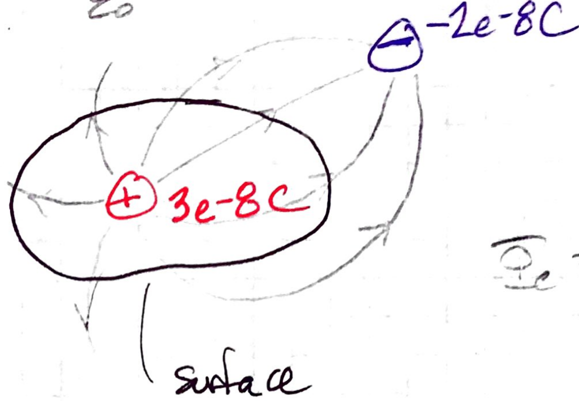
S4 2 charges of -2q internal. $\Phi_0 = \frac{(2)(-2q)}{\varepsilon_0} = \boxed{\frac{-4q}{\varepsilon_0}}$

S5 only -2q internal $\Phi_0 = \boxed{\frac{-2q}{\varepsilon_0}}$

S6 $\Phi_0 = \boxed{\frac{+3q}{\varepsilon_0}}$

6.31 $\Phi_e = \frac{q_{in}}{\varepsilon_0}$

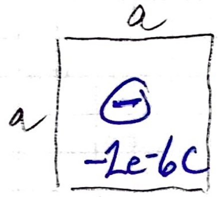
a)



$\Phi_e = \frac{3e\text{-}8C}{8.85e\text{-}12} = \boxed{3.39e3\ Nm^2/C}$

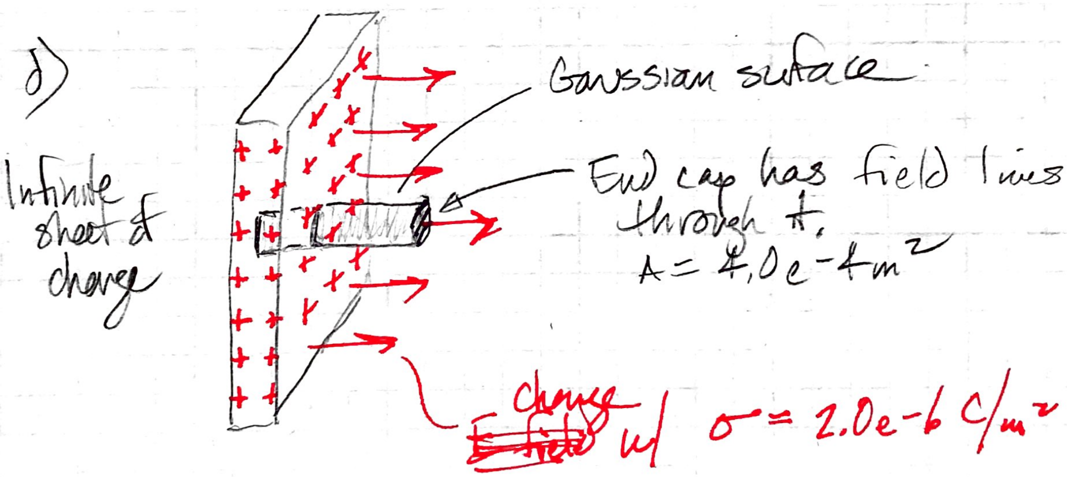
b) No internal charge, so $\boxed{\Phi_e = 0!}$

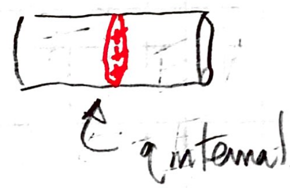
c)



$\Phi_e = \frac{q_{in}}{\varepsilon_0} = \frac{-2e\text{-}6}{8.85e\text{-}12} = \boxed{-2.26e5\ Nm^2/C}$

d)





$\sigma = \frac{q}{A}$

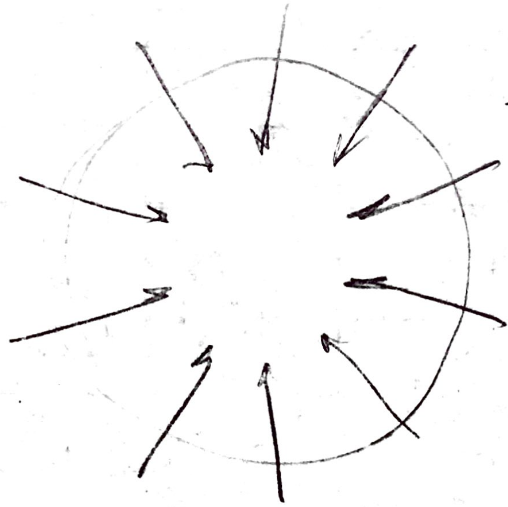
$q = \sigma A$

$= (2.0e\text{-}6)(4e\text{-}4)$

$= 8e\text{-}10C$

$\Phi_e = \frac{q_{in}}{\varepsilon_0} = \frac{8e\text{-}10}{8.85e\text{-}12} = \boxed{90.4\ Nm^2/C}$

6.34



Φ_{net} passing <u>into</u> sphere, so q_{in} must be <u>negative</u>

a) charge = ?

$$\Phi_e = \frac{q_{in}}{\varepsilon_0}, \text{ so}$$

$$q_{in} = \Phi_e \varepsilon_0 = (1e4)(8.85e{-12}) = \boxed{8.85e{-8}\ C}$$

b) We don't know exactly <u>where</u> this charge is in the sphere. We just know that it's in there somewhere!