Phys102 (Sec # 42) Quiz # 7 (Ch.23&24)

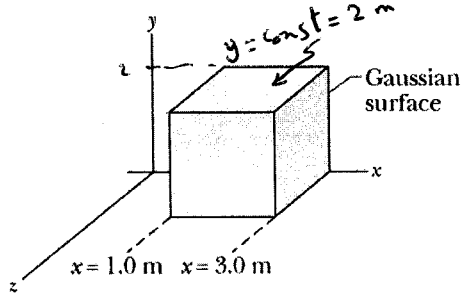
Name: Key ID #

1- A non-uniform electric field given by $E = 4\,i - 3\,(y^2 + 2)\,j$ pierces (penetrates) the Gaussian cube shown in the figure.
What is the electric flux through the top face?

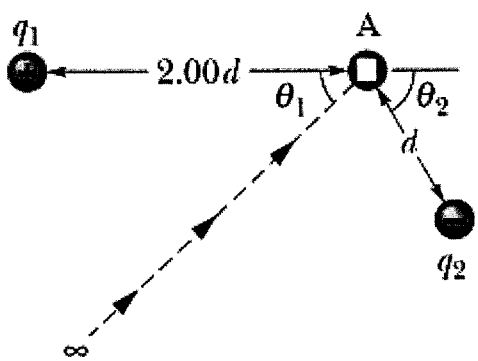
$$\vec{E}_{top} = 4\hat{i} - 3(2^2+2)\hat{j} = 4\hat{i} - 18\hat{j}$$

$$\Phi = \int E \cdot dA = \vec{E}\cdot\vec{A} = (4\hat{i} - 18\hat{j})\cdot 4\hat{j}$$

$$= \boxed{-72}\ \frac{N}{C}\,m^2$$



2- The following figure shows two charges, $q_1 = +4e$ and $q_2 = -1e$,
Where:
e = charge of electron = 1.6×10^{-19} C
d = 1.4 cm
$\theta_1 = 43°$
$\theta_2 = 60°$



a) What is the electric potential at point A?

$$V_A = k\left(\frac{q_1}{2d} + \frac{q_2}{d}\right)$$

$$= 9\times10^9\left(\frac{4}{2(0.014)} - \frac{1}{0.014}\right)\times 1.6\times10^{-19}$$

$$= \boxed{1.03\times10^{-7}}\ V$$

b) Calculate the work we must do in order to bring Q = +16e, initially at rest from infinity to point A along the dashed line?

$$W_{app.} = Q\,\Delta V = Q(V_f - V_i) = Q\,V_A = 16\times1.6\times10^{-19}\times(1.03\times10^{-7})$$

$$= \boxed{2.6\times10^{-25}}\ J$$

or equivalently

$$W_{app.} = \Delta U = U_f - U_i = k\left(\frac{q_1 Q}{2d} + \frac{q_1 q_2}{r_{12}} + \frac{q_2 Q}{d}\right) - k\left(\frac{q_1 q_2}{r_{12}}\right)$$

$$= kQ\left(\frac{q_1}{2d} + \frac{q_2}{d}\right)$$

$$= Q\,\Delta V = 2.6\times10^{-25}\ J$$