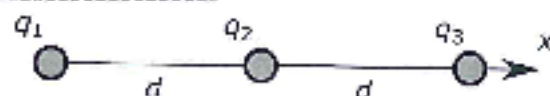Name: **Solutions**

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Instructions: Show your work. Unjustified or unsupported answers will not get credit even if correct. You do not need to justify true/false or multiple-choice questions.

Equations: $V = \dfrac{kq}{r}$ $\mathrm{EPE} = V q_0$ $\Phi_E = Q/\epsilon_0$

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1) What is total electric potential energy (EPE) of the system for $q_1 = q_2 = q_3 = +q$ given the distance d?

Just $q_1 \rightarrow EPE = 0$

q_1 and $q_2 \rightarrow EPE_{q_1 q_2} = \dfrac{kq_1 q_2}{d} = \dfrac{kq^2}{d}$

q_1 and $q_3 \rightarrow EPE_{q_1 q_3} = kq_1 q_3 /2d = \dfrac{kq^2}{2d}$

q_2 and $q_3 \rightarrow EPE_{q_2 q_3} = kq_2 q_3 /d = \dfrac{kq^2}{d}$

Total $\Rightarrow 0 + \dfrac{kq^2}{d}\left(1 + \dfrac{1}{2} + 1\right) = \boxed{\dfrac{kq^2 \, 5}{2}}$

2) What is electric field at point p for $q_1 = q_2 = q_3 = +q$ given the distance d?   find force on q_0 at p
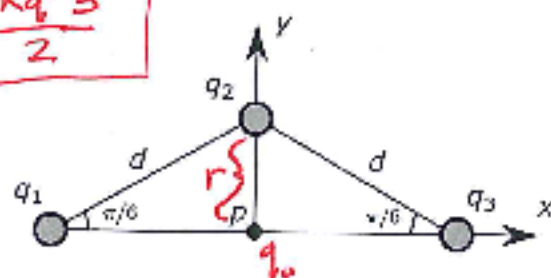

$F_{net}^x = 0$

$F_{net}^y = \dfrac{-k|q_2||q_0|}{r^2}$ $r = d \sin \dfrac{\pi}{6} = d\,\dfrac{1}{2}$

$F_{net}^y = \dfrac{-kq\,q_0}{d^2/4}$ $\vec{E} = \dfrac{\vec{E}}{q_0} = \boxed{\dfrac{-kq\,4}{d^2}\,\hat{y}}$

2) What is electric flux through the sphere?

$\overline{\Phi}_E = \dfrac{Q}{\epsilon_0} = \dfrac{+q - q}{\epsilon_0} = \boxed{0}$