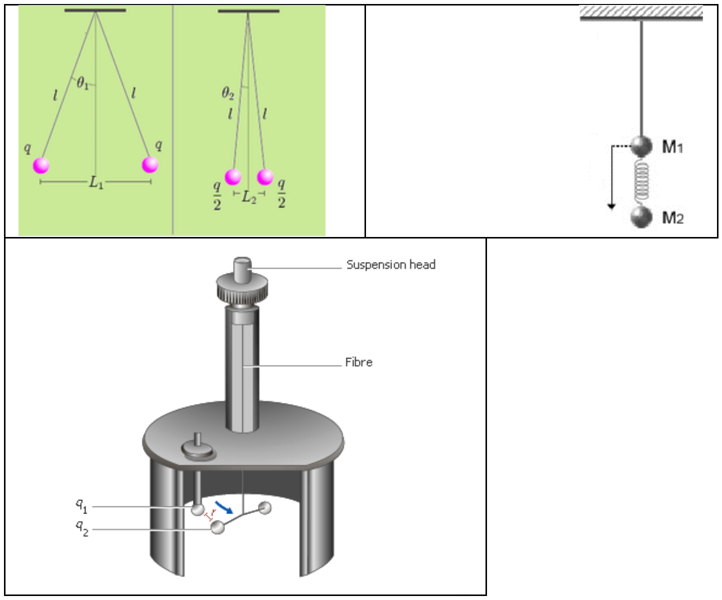
➢ Coulomb's Law:

$$\vec{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{|\overrightarrow{r_2}-\overrightarrow{r_1}|^3}(\overrightarrow{r_2}-\overrightarrow{r_1}) \quad (1)$$



➢ Electric Field:

$$\vec{E}(\vec{r}) = \lim_{\Delta q \to 0}\frac{\vec{F}_{\Delta q}(\vec{r})}{\Delta q} \quad (2)$$

$$\vec{E}(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\sum_{i=1}^{N}\frac{q_i}{|\vec{r}-\vec{r_i}|^3}(\vec{r}-\vec{r_i}) \quad (3)$$

$$\vec{E}(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\int\frac{\rho(\vec{r}\,')}{|\vec{r}-\vec{r}\,'|^3}(\vec{r}-\vec{r}\,')d^3r' \quad (4)$$

➢ Delta Dirac Function:

$$\int_{x_1}^{x_2} f(x)\delta(x-a)dx = \begin{cases} f(a) & a \in [x_1, x_2] \\ 0 & Else \end{cases} \quad (5)$$

$$\delta(ax) = \frac{1}{|a|}\delta(x) \quad (6)$$

$$\int_{\Delta V} f(\vec{r}\,')\delta(\vec{r}\,'-\vec{r})d^3r' = \begin{cases} f(\vec{r}) & \vec{r} \in \Delta V \\ 0 & Else \end{cases} \quad (7)$$

Charge distribution of an array of charges:

$$\rho(\vec{r}\,') = \sum_{i=1}^{N} q_i\delta(\vec{r}\,'-\vec{r}_i) \quad (8)$$

HW:

Prove the following equations representing the Dirac delta function:

$$\delta(x) = \lim_{\sigma \to 0} \frac{e^{-\left(\frac{x}{\sqrt{2}\sigma}\right)^2}}{\sqrt{2\sigma}\pi}$$

$$\delta(x) = \lim_{\sigma \to 0} \frac{1}{\pi\sigma\left(1 + \left(\frac{x}{\sigma}\right)^2\right)}$$

$$\delta(x) = \lim_{\sigma \to 0} \frac{Sin\left(\frac{x}{\sigma}\right)}{\pi x}$$

$$\delta(x) = \lim_{\sigma \to 0} \frac{e^{-\left|\frac{x}{\sigma}\right|}}{2\sigma}$$

HW:

Find an expression for $\delta\big(f(x)\big)$.