

- Here is our model of electrostatics

Diagram illustrating electrostatics:

- Charge element: $dq = \rho d\tau$
- Potential: $V = \int \frac{k dq}{r}$
- Electric field: $\vec{E} = \int \frac{k dq \hat{r}}{r^2}$
- Equation: $\oint \vec{E} \cdot d\vec{a} = \int \frac{dq}{\epsilon_0}$
- Equation: $\nabla^2 V = -\rho/\epsilon_0$
- Equation: $\nabla \cdot \vec{E} = \rho/\epsilon_0$
- Equation: $\vec{E} = -\nabla V$
- Equation: $\nabla \times \vec{E} = 0$
- Equation: $\Delta V = - \oint \vec{E} \cdot d\vec{r}$

$$\vec{F} = q \vec{E} \quad \omega_{nc} = \Delta (KE + PE)$$

$$\omega_{me} = \int V dq = APPE \quad \text{or} \quad = \frac{1}{2} \int V dq$$

To assemble a charge distribution

$$\omega = \frac{\epsilon_0}{2} \left[\int E^2 d\tau + \oint V \vec{E} \cdot d\vec{a} \right]$$

Here is our model of magnetostatics:

Diagram illustrating magnetostatics:

- Magnetic field: $\vec{B} = \frac{\mu_0}{4\pi} \int \frac{\vec{J} \times \hat{r}}{r^2} d\tau$
- Equation: $\oint \vec{B} \cdot d\vec{r} = \mu_0 \int \vec{J} \cdot d\vec{a}$
- Equation: $\nabla \times \vec{B} = \mu_0 \vec{J}$
- Equation: $\nabla \cdot \vec{B} = 0$
- Equation: $\vec{B} = \vec{J} \times \vec{A}$
- Equation: $\nabla \cdot \vec{A} = 0$
- Equation: $\vec{F} = q \vec{E} + q \vec{v} \times \vec{B}$

$$\omega = \frac{1}{2\mu_0} \left[\int B^2 d\tau - \underset{\text{Surface}}{\int} (\vec{A} \times \vec{B}) \cdot d\vec{a} \right]$$