㊱ 學年度 國立成功大學碩士班招生考試 物理 所 電磁學 試題 共 1 頁 第 1 頁

(1).(a)Show that the electric field of a dipole can be written as

10% $\vec{E}=\frac{1}{4\pi\varepsilon_0}\cdot\frac{1}{r^3}[3(\vec{P}\cdot\hat{r})\hat{r}-\vec{P}]$

(b)Show that the energy of a dipole in an electric field is given
5% by $U=-\vec{p}\cdot\vec{E}$ [hint: $\vec{N}=\vec{P}\times\vec{E}$]

(c)Show that the interaction energy of two diople separated by a
5% displacement $\vec{r}$ is given by ;

$$U=\frac{1}{4\pi\varepsilon_0}\cdot\frac{1}{r^3}[\vec{P}_1\cdot\vec{P}_2-3(\vec{P}_1\cdot\hat{r})(\vec{P}_2\cdot\hat{r})]$$

(2) In magnetostatics , there are equations giving the relations
20% between $\vec{J}$, $\vec{B}$, and $\vec{A}$. For example, one of them is the Biot-Savart's Law , which tells us how to calculate $\vec{B}$ from $\vec{J}$, i.e.

$$\vec{B}=\frac{\mu_0}{4\pi}\int\frac{\vec{J}\times\hat{\Omega}}{\Omega^2}d\tau----(1)$$

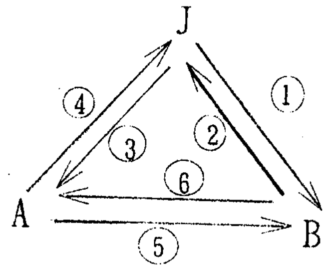

Fig.A

can you tell us the rest of them?
[hint; see Fig.A]

(3)A point charge q is situated a distance s from the center of a grounded conducting sphere of radius R.
15% (a)Find the potential everywhere? [hint:using methed of image]
5% (b)What is the attractive force between q and the conducting sphere?

(4)10%(a)Write down Maxwell's equations for regions where there is no charge or current.
10%(b)Derive the wave equations of $\vec{E}$-field and $\vec{B}$-field , and verify that it's propagation velocity is $c=\frac{1}{\sqrt{\mu_0\varepsilon_0}}$

(5)10% Give a simple model to explain the diamagnetism of a diamagnetic material.

(6)10% A sphere of linear dieletric material with susceptibility χ_E is placed in an originally uniform electric field $\vec{E}_c$, Find the new field inside the sphere.