Name .....

**Quiz 14**
**PH361**

$\vec{p} = \int \vec{r'} \rho(r') d\tau'$
*solenoid* $B = \mu_0 n I$
$\vec{F} = (\vec{p} \cdot \vec{\nabla}) \vec{E}$
$E = \frac{1}{4\pi\epsilon_0} \frac{1}{r^3} (3\vec{p} \cdot \hat{r}\ \hat{r} - \vec{p})$
$\vec{\nabla} t = \frac{\partial t}{\partial r} \hat{r} + \frac{1}{r} \frac{\partial t}{\partial \theta} \hat{\theta} + \frac{1}{r \sin\theta} \frac{\partial t}{\partial \phi} \hat{\phi}$
$\hat{r} = \sin\theta \cos\phi\ \hat{x} + \sin\theta \sin\phi\ \hat{y} + \cos\theta\ \hat{z}$
$\hat{\theta} = \cos\theta \cos\phi\ \hat{x} + \cos\theta \sin\phi\ \hat{y} - \sin\theta\ \hat{z}$
$\hat{\phi} = -\sin\phi\ \hat{x} + \cos\phi\ \hat{y}$
$\vec{D} = \epsilon_0 \vec{E} + \vec{P}$
$\vec{D} = \epsilon \vec{E}$
$\vec{F} = q\vec{v} \times \vec{B}$
$d\vec{F} = I d\vec{l} \times \vec{B} = \vec{K} \times \vec{B} da = \vec{J} \times \vec{B} d\tau$
$\vec{dA} = \frac{\mu_0}{4\pi} \int \frac{I}{|\vec{r} - \vec{r'}|} d\vec{l'} = \frac{\mu_0}{4\pi} \int \frac{J(\vec{r'})}{|\vec{r} - \vec{r'}|} d\tau'$
$W = \frac{1}{2\mu_0} \int_{all\ space} B^2 d\tau$

1. What are the fundamental relationships that govern the motion of space charge in a vacuum diode?

(1) From Maxwell's eqns in potential form

$$\nabla^2 V = -\rho/\epsilon_0$$

(2) Conservation of charge

$$\vec{\nabla} \cdot \vec{J} = -\frac{\partial \rho}{\partial t}$$

(3) Conservation of energy

$$\Delta(KE + PE) = 0$$

(4) Bndry conditions

$$V(x=0) = 0$$

$$\left.\frac{dV}{dx}\right|_{x=0} = 0$$