PHYSICS 231 – TEST # 1

NAME:

STUDENT ID #:

USEFUL CONSTANTS

$$\epsilon_0 = 8.85 \times 10^{-12} C^2/(N \cdot m^2)$$

$$k = \frac{1}{4\pi\epsilon_0} = 8.988 \times 10^9 \ N \cdot m^2/C^2$$

$$e = 1.6 \times 10^{-19} C$$

$$m_e = 9.1 \times 10^{-31} kg$$

USEFUL FORMULAS

Coulomb's law:

$$F = k \frac{|q_1 q_2|}{r^2}$$

Electric field:

$$\vec{E} = \frac{\vec{F}}{q}$$

due to point charge:

$$\vec{E} = k \frac{q}{r^2} \hat{\mathbf{r}}$$

Electric dipole:

- dipole moment: $p = qd$
- torque: $\vec{\tau} = \vec{p} \times \vec{E}$
- energy: $U = -\vec{p} \cdot \vec{E}$

Electric flux:

$$\Phi_E = \int \vec{E} \cdot d\vec{A}$$

Gauss's law:

$$\Phi_E = \frac{Q_{enc}}{\epsilon_0}$$

Electric field

- due to infinite wire:

$$E = \frac{1}{2\pi\epsilon_0} \frac{\lambda}{r}$$

- inside uniformly charged sphere:

$$E = k \frac{Qr}{R^3}$$

- due to infinite sheet:

$$E = \frac{\sigma}{2\epsilon_0}$$

Potential energy of two point charges:

$$U = k \frac{q_1 q_2}{r}$$

Potential:

$$V = \frac{U}{q}$$

Potential difference:

$$V_a - V_b = \int_a^b \vec{E} \cdot d\vec{l}$$

Electric field:

$$\vec{E} = -\vec{\nabla} V$$