

# PHYSICS 2220

## Equation Sheet #1

1. Coulomb's law:  $F = k \frac{|q_1||q_2|}{r^2}$        $k = \frac{1}{4\pi\epsilon_0}$

2.  $\mathbf{F} = q\mathbf{E}$       For point charge,  $E = k \frac{|q|}{r^2}$

3. Electric flux:  $\Phi = \int \mathbf{E} \cdot d\mathbf{A} = \int E dA \cos \theta$

4. Gauss' law:  $\Phi_c = \oint \mathbf{E} \cdot d\mathbf{A} = \oint E dA \cos \theta = \frac{q_{\text{enc}}}{\epsilon_0}$

5.  $\Delta V = V_B - V_A = - \int_A^B \mathbf{E} \cdot d\mathbf{s} = - \int_A^B E ds \cos \theta$

6.  $\Delta U = U_B - U_A = q(V_B - V_A) = q\Delta V$

$$\Delta U = U_B - U_A = -q \int_A^B \mathbf{E} \cdot d\mathbf{s} = -q \int_A^B E ds \cos \theta$$

7. For point charge,  $V = k \frac{q}{r}$       and       $U = k \frac{q_1 q_2}{r}$

8.  $k = 8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$   
 $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N}\cdot\text{m}^2$   
 $e = 1.60 \times 10^{-19} \text{ C}$   
 $1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$   
 $g = 9.8 \text{ m/s}^2$   
 $c = 3 \times 10^8 \text{ m/s}$

9. electron mass  $m_e = 9.11 \times 10^{-31} \text{ kg}$   
 proton mass  $m_p = 1.67 \times 10^{-27} \text{ kg}$

10. Circle:  $C = 2\pi r$        $A = \pi r^2$

11. Sphere:  $A = 4\pi r^2$        $V = \frac{4}{3}\pi r^3$

12. Cylinder:  $A = \pi r^2$  (end)       $A = 2\pi r\ell$  (side)       $V = \pi r^2\ell$