

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) $V = \pi r^2\ell$