Equation Sheet for Exam 3

Magnetic forces

● The Lorentz force is **F** = q **v** × **B.** The direction is determined by the right-hand rule.

● Combined electric and magnetic forces, **F** = q **E** + q **v** × **B.**

● The magnetic force on a current carrying wire is **F** = **I** × **B** L.

● The cyclotron equation. For a charged particle moving on a circle in a uniform magnetic field,

$$\frac{mv^2}{r} = qvB$$

Ampere's Law

● The magnetic field due to a long straight current carrying wire is $B = \frac{\mu_0 I}{2\pi r}$.

● The magnetic field in a solenoid is $B = \frac{\mu_0 N I}{L}$.

● The magnetic constant is $\mu_0 = 4\pi \times 10^{-7}$ Tm/A .

Faraday's Law

● Faraday's law of electromagnetic induction is $\mathcal{E} = -\frac{\Delta\Phi}{\Delta t}$, where $\mathcal{E}$ = electromotive force around a loop, and Φ = the magnetic flux through any surface bounded by the loop; $\Phi = B A_{perp}$.

● Transformer equations

$$\frac{V_2}{V_1} = \frac{N_2}{N_1} \quad \text{and} \quad I_1 V_1 = I_2 V_2$$

Light

● Snell's law is $n_1 \sin\theta_1 = n_2 \sin\theta_2$.

● c = 2.998 × 10^8 m/s

● λ f = c

● $I = \frac{P}{4\pi r^2}$