Week 1: Combinatorics, Newton's Laws, and Quantum Foundations

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Weekly Focus

This week launched the interdisciplinary study with three foundational pillars:

- **Combinatorics & Probability** – *Asimow & Maxwell*, Ch. 1–2
- **Classical Mechanics (Newton's Laws)** – *Halliday & Resnick*, Vol. 1, Ch. 4
- **Quantum Wavefunctions & Normalization** – *Griffiths*, Ch. 1

Key Concepts & Formulas

Probability & Counting Principles

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
$$P(A \cap B) = P(A) \cdot P(B)$$
$$P(n, r) = \frac{n!}{(n-r)!}, \quad C(n, r) = \binom{n}{r} = \frac{n!}{r!(n-r)!}$$

Newton's Second Law of Motion

$$\vec{F}_{\text{net}} = m\vec{a}$$

Applied to free-body diagrams, inclined plane problems, friction, and tension systems.

Wavefunction Normalization

$$\int_{-\infty}^{\infty} |\psi(x)|^2 \, dx = 1$$

This ensures the wavefunction defines a total probability of 1 over all space.

Problems Reviewed

- **Asimow & Maxwell**: 1.5, 1.8, 2.7
- **Halliday & Resnick**: 4.8, 4.10
- **Griffiths**: 1.1, 1.4

Weekly Reflection

This week bridged discrete math, Newtonian force modeling, and quantum probability. Combinatorics laid a foundation for understanding quantum measurements, while Newton's laws helped reinforce mechanical intuition. This intersection will be crucial for advanced modeling and deeper theoretical work in quantum systems.