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Comprehensive Science Cheat Sheet

1. Physics: Mechanics

Newton's Laws of Motion:

- $F_{\text{net}} = 0 \implies \Delta v = 0$ (Inertia)
- $F_{\text{net}} = m \cdot a = \frac{dp}{dt}$
- $F_{A \rightarrow B} = -F_{B \rightarrow A}$

Kinematic Equations (Constant a):

$$v = v_0 + at \quad \Delta x = v_0 t + \frac{1}{2}at^2 \quad v^2 = v_0^2 + 2a\Delta x$$

Work, Energy, and Power:

- Work: $W = \vec{F} \cdot \vec{d} = Fd \cos \theta$
- Kinetic Energy: $K = \frac{1}{2}mv^2$
- Potential Energy: $U = mgh$
- Power: $P = \frac{dW}{dt} = \vec{F} \cdot \vec{v}$

2. Chemistry: Thermodynamics

Ideal Gas Law:

$$PV = nRT$$

where $R \approx 8.314 \text{ J}/(\text{mol} \cdot \text{K})$.

Enthalpy and Entropy:

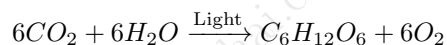
- $\Delta H = \Delta U + P\Delta V$
- Gibbs Free Energy: $\Delta G = \Delta H - T\Delta S$
- Spontaneity: $\Delta G < 0$ (Spontaneous)

3. Biology: Cell Structure

Key Organelles:

- **Nucleus:** Contains DNA, controls cellular activity.
- **Mitochondria:** Site of ATP synthesis via cellular respiration.
- **Ribosomes:** Protein synthesis (Translation).
- **Endoplasmic Reticulum:** Rough (protein processing) and Smooth (lipid synthesis).

Photosynthesis Equation:



4. Electromagnetism

Maxwell's Equations (Differential):

- Gauss's Law: $\nabla \cdot \vec{E} = \frac{\rho}{\epsilon_0}$
- Gauss's Law for Magnetism: $\nabla \cdot \vec{B} = 0$
- Faraday's Law: $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$
- Ampere-Maxwell: $\nabla \times \vec{B} = \mu_0 \vec{J} + \mu_0 \epsilon_0 \frac{\partial \vec{E}}{\partial t}$