

**Matter**

**Charles's Law:**  $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$$\frac{\text{volume}_1}{\text{temperature}_1} = \frac{\text{volume}_2}{\text{temperature}_2}$$

**Boyle's Law:**  $P_1V_1 = P_2V_2$

$$\text{pressure}_1 \times \text{volume}_1 = \text{pressure}_2 \times \text{volume}_2$$

**Density:**  $d = \frac{m}{V}$

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

**Force and Motion**

**Average Speed:**  $v = \frac{d}{t}$

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

**Newton's Second Law:**  $F = m \cdot a$

$$\text{force} = \text{mass} \times \text{acceleration}$$

**Force Due to Gravity:**  $F = w = m \cdot g$

$$\text{force} = \text{weight} = \text{mass} \times \text{acceleration due to gravity}$$

**Energy and Momentum**

**Kinetic Energy:**  $KE = \frac{1}{2} m \cdot v^2$

$$\text{kinetic energy} = \frac{1}{2} \text{mass} \times \text{velocity}^2$$

**Gravitational Potential Energy:**  $PE_{\text{gravitational}} = m \cdot g \cdot h$

$$\text{gravitational potential energy} = \text{mass} \times \text{gravity} \times \text{height}$$

**Waves and Light**

**Wave Speed:**  $v = f \cdot \lambda$

$$\text{speed of light} = \text{frequency} \times \text{wavelength}$$

**Wave Energy:**  $E \propto A^2$

$$\text{energy is proportional to amplitude}^2$$

**Units, Constants, and Conversions**

**Energy:** 1 Joule = 1 Newton • meter

**Force:** 1 Newton = 1  $\frac{\text{kilogram} \cdot \text{meter}}{\text{seconds squared}}$

**Hertz:** Hz =  $\frac{\text{cycle}}{\text{s}}$

**Acceleration Due to Gravity:**  $g = 9.8 \frac{\text{m}}{\text{s}^2}$

**Speed of Light in a Vacuum:**  $c = 3.00 \times 10^8 \frac{\text{m}}{\text{s}}$

**Length:** 1 m = 100 cm  
1 km = 1000 m

**Mass:** 1 kg = 1000 g

**Volume:** 1 L = 1000 mL = 1000 cm<sup>3</sup>

**Water at Room Temperature:** 1 mL = 1 cm<sup>3</sup> = 1 g