

Mechanics & Thermal Physics

The Momentum Principle

- Ch. 1: Interactions; 3D vectors; velocity; momentum
- Ch. 2: The Momentum Principle; iterative techniques;

$$\vec{p}_f = \vec{p}_i + \vec{F}_{net}\Delta t$$

- Ch. 3: Fundamental interactions; momentum in collisions
- Ch. 4: Contact interactions; ball-and-spring model of solids;

$$\frac{d\vec{p}}{dt} = \vec{F}_{net}; \text{ harmonic oscillator}$$

- Ch. 5: Determining forces from motion

The Energy Principle

$$E_f = E_i + W + Q + \dots$$

- Ch. 6: Energy in relativistic context
- Ch. 7: Internal energy; dissipative forces
- Ch. 8: Energy quantization
- Ch. 9: Translational, rotational, and vibrational energy; point-particle and extended systems
- Ch. 10: Collisions (momentum and energy conservation)

The Angular Momentum Principle

$$\vec{L}_f = \vec{L}_i + \vec{\tau}_{net}\Delta t \quad \text{or} \quad \frac{d\vec{L}}{dt} = \vec{\tau}_{net}$$

- Ch. 11: Angular momentum; torque; conservation

The Fundamental Assumption of Statistical Mechanics

- Ch. 12: Entropy; temperature; specific heat

Electricity & Magnetism

Stationary Charges

$$q_1 \text{ makes } \vec{E}_1, \vec{E}_1 \text{ affects } q_2$$

- Ch. 13: Electric field (force and energy in Mechanics)
- Ch. 14: Electric fields and matter
- Ch. 15: Electric field of distributed charges
- Ch. 16: Electric potential

Moving Charges

$$q_1 \vec{v}_1 \text{ makes } \vec{B}_1, \vec{B}_1 \text{ affects } q_2 \vec{v}_2$$

- Ch. 17: Magnetic field
- Ch. 18: Electric field and circuits
- Ch. 19: Circuit elements
- Ch. 20: Magnetic force (includes motional emf)

Patterns of Field in Space

- Ch. 21: Gauss's law; Ampere's law

Time-varying Magnetic Field

- Ch. 22: Faraday's law (curly field with nonzero $d\vec{B}/dt$)

Accelerated Charges

$$q_1 \vec{a}_1 \text{ makes } \vec{E}_{rad} \text{ and } \vec{B}_{rad}, \\ \vec{E}_{rad} \text{ and } \vec{B}_{rad} \text{ affect other charges}$$

- Ch. 23: Ampere-Maxwell law; production, propagation, and effects of electromagnetic radiation

For further information:
matterandinteractions.org

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