

APPROACH 2: Semantic Global Coloring

Strategy

Colors assigned by physics MEANING across all domains.

Guarantee: Same concept = same color everywhere.

Trade-off:

- + Consistent mental model across all physics
- + "Cyan always means rate/flow"
- Some equations may have related concepts with same color
- Overloaded symbols get one canonical meaning

Semantic Color Categories

SPACE/POSITION

$d, x, r, h, L, A, V, \lambda, s$

FLOW/RATE

v, ω, I (current), f

INTENSITY

a, T, E (field), P (pressure)

COUNT/PROGRESS

t, N, n, q (charge)

FORCE/CAUSE

F, p (momentum), τ

TRANSFER

Q (heat), W (work), P (power)

STORED

U, KE, PE, S, C

CONSTANT/PROPERTY

g, k, c, μ, ρ, m, R

Note

Some symbols (P, E) are overloaded. Context determines category.

CH1-3: Kinematics

Definitions:

$$v = \frac{\Delta d}{\Delta t} \quad a = \frac{\Delta v}{\Delta t}$$

Kinematic Equations:

$$v = v_0 + at$$

$$d = d_0 + v_0 t + \frac{1}{2} at^2$$

$$v^2 = v_0^2 + 2a(d - d_0)$$

Semantic reading: Rate depends on intensity over time, changing position.

CH4-6: Dynamics & Circular Motion

Newton's Laws:

$$F_{\text{net}} = ma \quad W = mg \quad F_f = \mu N$$

Circular Motion:

$$a_c = \frac{v^2}{r} = r\omega^2 \quad F_c = m\frac{v^2}{r}$$

Semantic reading: Force causes intensity of change in objects with mass.

CH8: Momentum

Definitions:

$$p = mv$$

Impulse-Momentum:

$$\Delta p = F_{\text{net}} \Delta t$$

Conservation:

$$m_1 v_1 + m_2 v_2 = m_1 v'_1 + m_2 v'_2$$

Semantic reading: Momentum combines mass with flow/velocity.

CH9: Work, Energy, Power

Definitions:

$$W = Fd \quad KE = \frac{1}{2}mv^2 \quad P = \frac{W}{t}$$

Conservation:

$$KE_1 + PE_1 = KE_2 + PE_2$$

Semantic reading: Work transfers energy, KE/PE stores it. Power is transfer rate.

Note: Same Color

W and P are both red because both are energy transfer mechanisms.

CH11: Thermal Physics

Heat Transfer:

$$Q = mc\Delta T$$

Phase Change:

$$Q = mL_f \quad Q = mL_v$$

Density:

$$\rho = \frac{m}{V}$$

Semantic reading: Heat transfers based on mass/properties and temperature intensity.

CH12: Thermodynamics

First Law:

$$\Delta U = Q - W \quad W = P\Delta V$$

Ideal Gas:

$$PV = NkT$$

Entropy & Efficiency:

$$\Delta S = \frac{Q}{T} \quad \text{Eff} = \frac{W}{Q_h}$$

Semantic reading: Stored energy U changes via Q and W transfers.
 P ressure is intensity.

CH13-14: Waves & Sound

Wave Equation:

$$v = f\lambda \quad T = \frac{1}{f}$$

Intensity:

$$I = \frac{P}{A} \quad \beta = 10 \log_{10} \left(\frac{I}{I_0} \right)$$

Standing Waves:

$$f_n = n \frac{v}{2L} \text{ (open)} \quad f_n = n \frac{v}{4L} \text{ (closed)}$$

Note: T (period) is orange/count here, not temperature.

CH18: Electric Fields & Potential

Coulomb's Law:

$$F = k \frac{q_1 q_2}{r^2} \quad E = \frac{k|Q|}{r^2}$$

Potential:

$$V = \frac{kQ}{r} \quad U_E = \frac{kQq}{r}$$

Capacitance:

$$C = \frac{Q}{V} \quad U_E = \frac{1}{2} CV^2$$

Semantic reading: Charges create fields, store potential energy.

Definitions:

$$I = \frac{\Delta Q}{\Delta t} \quad V = IR$$

Power:

$$P = IV = I^2 R = \frac{V^2}{R}$$

Combinations:

$$R_{\text{series}} = R_1 + R_2 + \dots$$

Semantic reading: Current flows, voltage stores potential, power transfers energy.

Approach 2 Summary

Result: Consistent Meaning

Same color = same physics concept across ALL domains.

Cross-Domain Consistency:

- **Cyan** = flow/rate: velocity, current, frequency, angular velocity
- **Blue** = space: displacement, radius, wavelength, volume, area
- **Vermillion** = intensity: acceleration, temperature, pressure, field
- **Red** = transfer: heat Q , work W , power P

Best for:

- Building unified physics intuition
- Seeing connections across domains
- Long-term conceptual understanding