1. Mechanics & Motion (Molecular Scale)

- Kinetic Energy:
$$KE = \frac{1}{2}mv^2$$

- Work:
$$W = F \cdot d \cdot \cos\theta$$

- Power:
$$P = \frac{W}{t}$$

- Newton's Second Law:
$$F = ma$$

- Momentum:
$$p = mv$$

- Impulse:
$$J = F\Delta t = \Delta p$$

2. Energy and Heat

- Heat Transfer (Specific Heat):
$$Q = mc\Delta T$$

- Latent Heat:
$$Q = mL$$

- Work done by gas (pressure-volume work):
$$W = -P\Delta V$$

- First Law of Thermodynamics:
$$\Delta U = Q + W$$

- Internal Energy of Ideal Gas (monoatomic):
$$U = \frac{3}{2}nRT$$

3. Oscillations & Waves

- Wave speed:
$$v = f\lambda$$

- Energy of a photon:
$$E = hf$$

- Planck's constant:
$$h = 6.626 \times 10^{-34}\,\text{J} \cdot \text{s}$$

4. Electricity & Magnetism (Electrostatics)

- Coulomb's Law:
$$F = k\frac{|q_1 q_2|}{r^2}, \quad k = 8.99 \times 10^9 \, \text{Nm}^2/\text{C}^2$$

- Electric field:
$$E = \frac{F}{q} = k\frac{Q}{r^2}$$

- Potential energy of charge in electric field:
$$U = qV$$

- Ohm's Law:
$$V = IR$$

5. **Gas Laws (Physics of Gases)**

- Ideal Gas Law:
$$PV = nRT$$

- Root Mean Square Speed of gas molecules:
$$v_{\text{rms}} = \sqrt{\frac{3RT}{M}}$$

- Average kinetic energy per molecule:
$$\langle KE \rangle = \frac{3}{2}k_B T, \quad k_B = 1.38 \times 10^{-23} \, \text{J/K}$$

6. **Thermodynamics & Statistical Physics**

- Entropy:
$$\Delta S = \frac{Q_{\text{rev}}}{T}$$

- Gibbs Free Energy:
$$G = H - TS$$

7. **Optics and Quantum Mechanics**

- de Broglie wavelength:
$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

- Energy levels in hydrogen atom (Bohr model):
$$E_n = -\frac{13.6 \, \text{eV}}{n^2}$$

- Photoelectric equation:
$$KE_{\text{max}} = hf - \phi$$

8. **Fluid Mechanics (occasionally useful)**

- Density:

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

- Pressure:

$$P = \frac{F}{A}$$

- Hydrostatic pressure:

$$P = \rho g h$$