

ENERGY CONSERVATION LAWS SUMMARY

| PRINCIPLE | DEFINITION | MATHEMATICAL REPRESENTATION |
|------------------------------------|--|---|
| First Law of Thermodynamics | Energy cannot be created or destroyed, only transformed from one form to another. Total energy in an isolated system remains constant. | $\Delta U = Q - W$ |
| Mechanical Energy | In the absence of dissipative forces (like friction), the sum of potential and kinetic energy remains constant. | $KE_i + PE_i = KE_f + PE_f$ |
| Mass-Energy Equivalence | Mass and energy are interchangeable; a loss in mass results in a proportional release of energy. | $E = mc^2$ |
| Bernoulli's Principle | In a fluid system, an increase in speed occurs simultaneously with a decrease in pressure or potential energy. | $P + \frac{1}{2}\rho v^2 + \rho gh = \text{constant}$ |
| Kirchhoff's Voltage Law | The directed sum of electrical potential differences (voltage) around any closed network is zero. | $\sum \mathcal{E} = 0$ |