EngineeringRise

Temperature, zeroth law, heat, work and internal energy

Formulas and units, JEE Main. Status: Reviewed on 2026-11-20.

Result	Formula	Units or note
Linear scale conversion	(X - X0)/(X100 - X0) is the same on all scales; C = (F - 32) x 5/9 Valid when: linear thermometric scales such as Celsius and Fahrenheit	degrees
Kelvin scale	T = C + 273 (273.15 for precision) Valid when: converting Celsius to kelvin; temperature differences are equal in both	K
Heat for temperature change	Q = m s dT = n C dT Valid when: no phase change; specific heat constant over the range	J
Heat for phase change	Q = m L Valid when: at the phase-change temperature; temperature stays constant	J
Calorimetry	heat lost = heat gained (no losses) Valid when: isolated system, no heat loss to surroundings, no phase change unless included	J
Work done by gas	W = integral of P dV; constant P: W = P (V2 - V1) Valid when: W is by the gas; quasi-static process; P in Pa, V in m^3	J
Straight line on P-V	W = (P1 + P2)(V2 - V1)/2 Valid when: P and V change linearly along the line segment (trapezium area)	J
Internal energy, ideal gas	U = (f/2) n R T; dU = n Cv dT, Cv = (f/2) R Valid when: ideal gas, any process; f from degrees of freedom	J (J/(mol K))
Cycle	dU = 0, Q_net = W_net = enclosed area (clockwise: W > 0) Valid when: closed cycle of a gas that returns to its initial state	J
Unit conversions	1 litre = 10^-3 m^3; 1 atm = 1.013 x 10^5 Pa	m^3 (Pa)

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/thermodynamics/temperature-zeroth-law-heat-work-and-internal-energy

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