Physics I

Laws of thermodynamics

Carnot cycle

2^{nd} law of thermodynamics

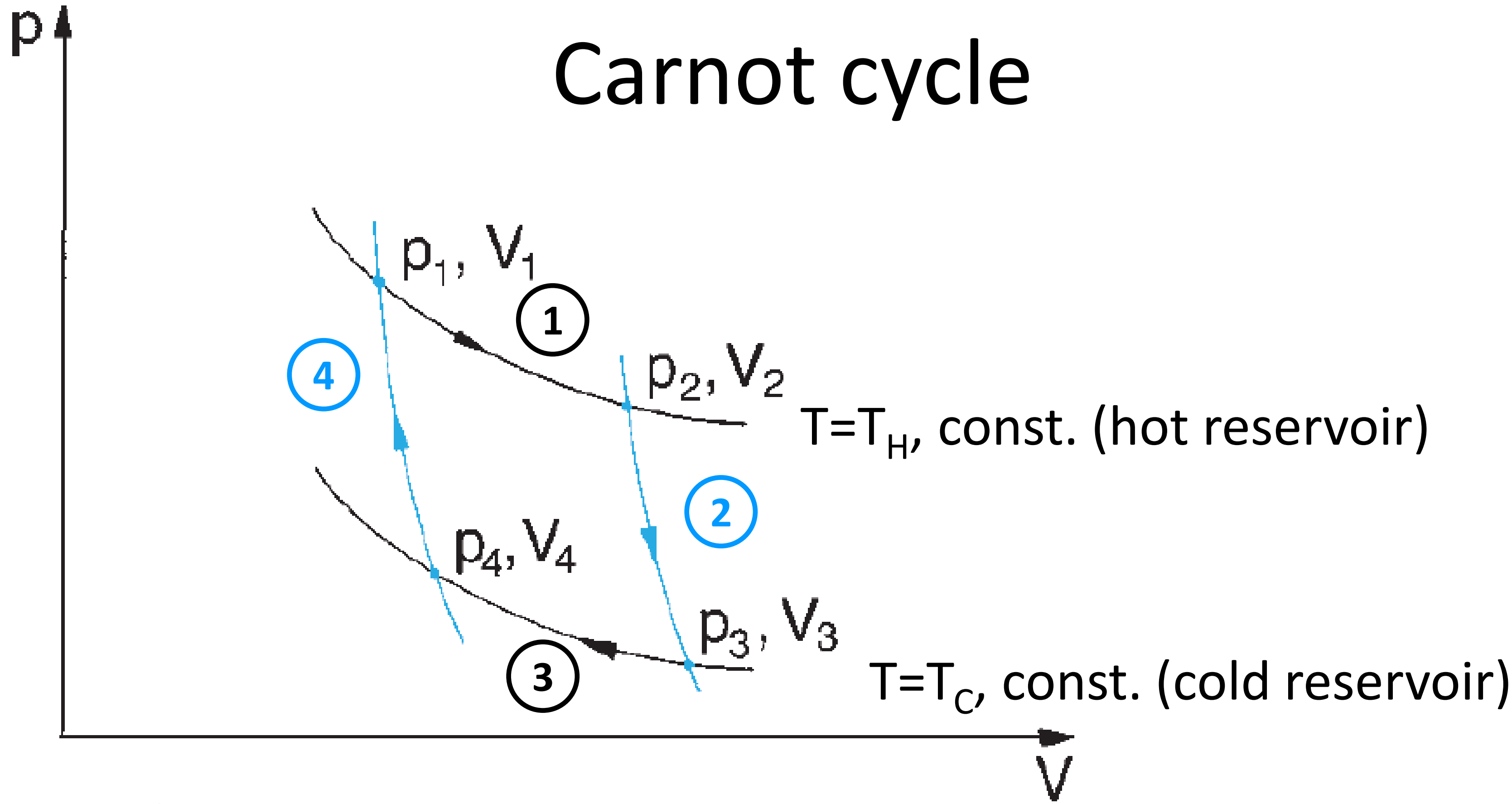
energy balance

heat machines

Introduction to Physics I

For Biologists, Geoscientists, & Pharmaceutical Scientists

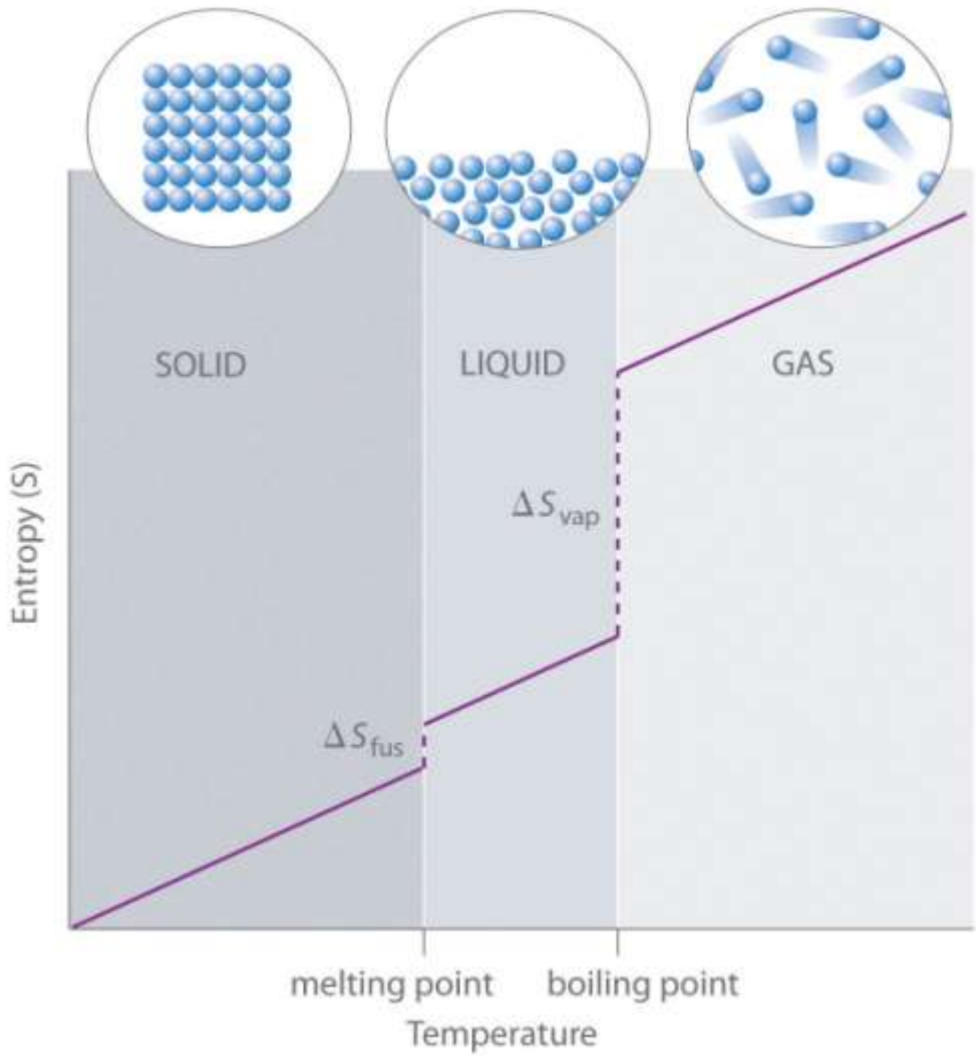
reversible heat-work transformation
Carnot cycle



1. quasi-static, isothermal absorption of heat from a hot reservoir
2. quasi-static, adiabatic expansion to a lower temperature
3. quasi-static, isothermal release of heat to a cold reservoir
4. quasi-static, adiabatic compression back to the original state

Trautwein, Tipler

Entropy during phase transitions



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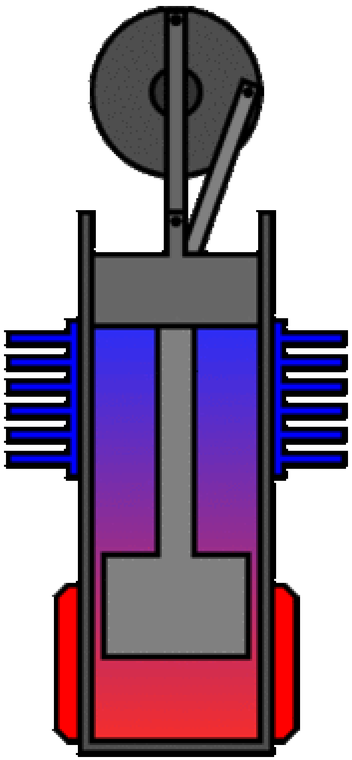
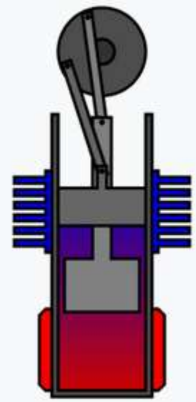
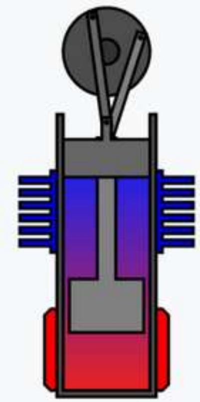
Stirling engine

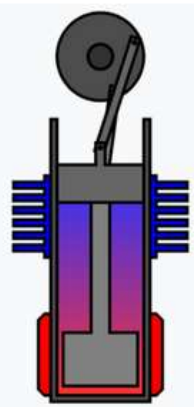




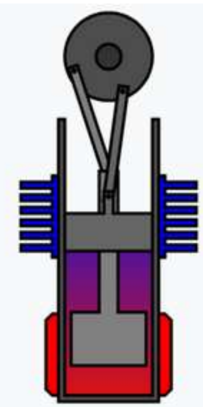
1. Power piston (dark grey) has compressed the gas, the displacer piston (light grey) has moved so that most of the gas is adjacent to the hot heat exchanger.



2. The heated gas increases in pressure and pushes the power piston to the farthest limit of the **power stroke**.



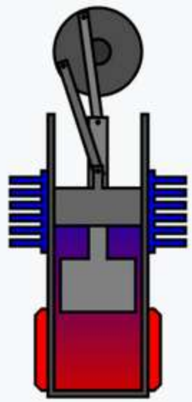
3. The displacer piston now moves, shunting the gas to the cold end of the cylinder.



4. The cooled gas is now compressed by the flywheel momentum. This takes less energy, since its pressure drops when it is cooled.

wiki

Stirling engine



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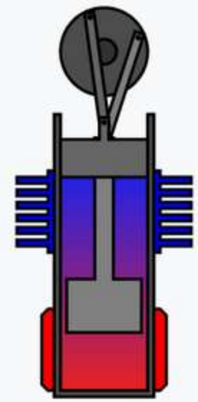

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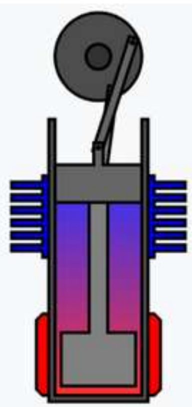

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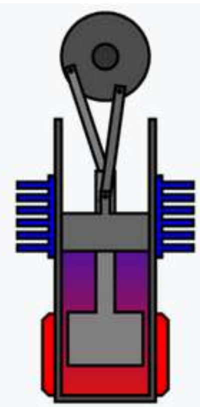

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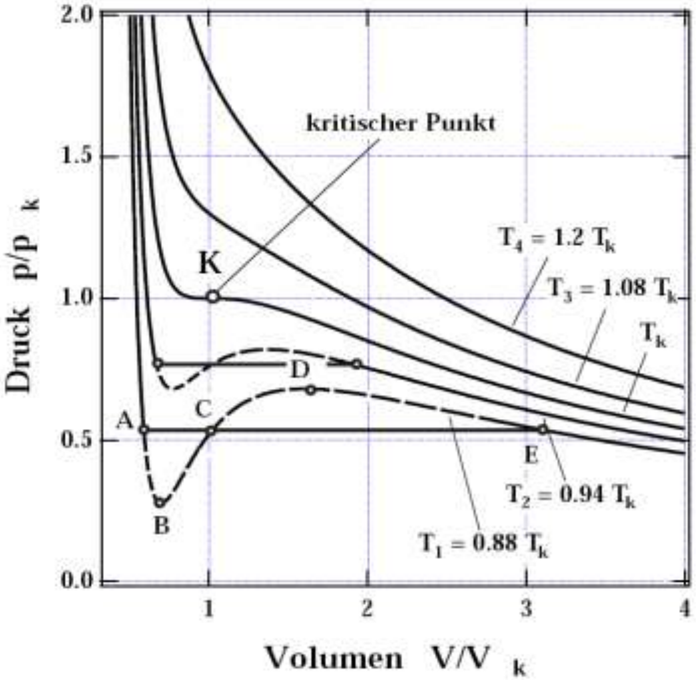
real gas law: van der Waals



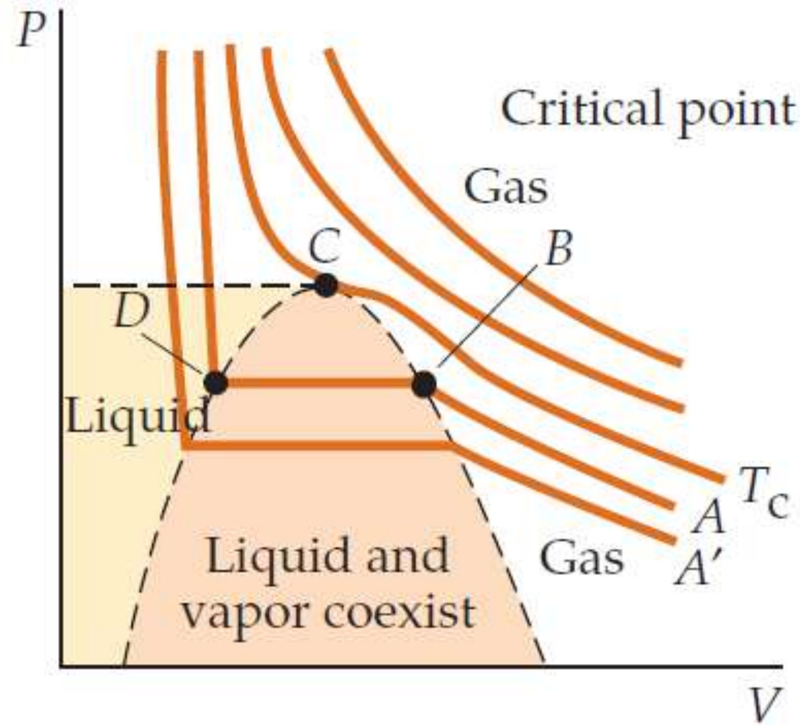


FIGURE 20-5 Isotherms on the *PV* diagram for a substance. For temperatures above the critical temperature T_c, the substance remains a gas at all pressures. Except for the region where the liquid and vapor coexist, these curves are described quite well by the van der Waals equation. The pressure for the horizontal portions of the curves in the shaded region is the vapor pressure which is the pressure at which the vapor and liquid are in equilibrium. In the region shaded yellow, to the left of the region shaded pink, the substance is a liquid and is nearly incompressible.

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