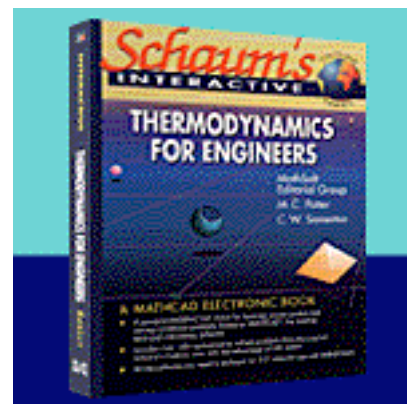


Schaums Interactive Outline Series: Thermodynamics for Engineers

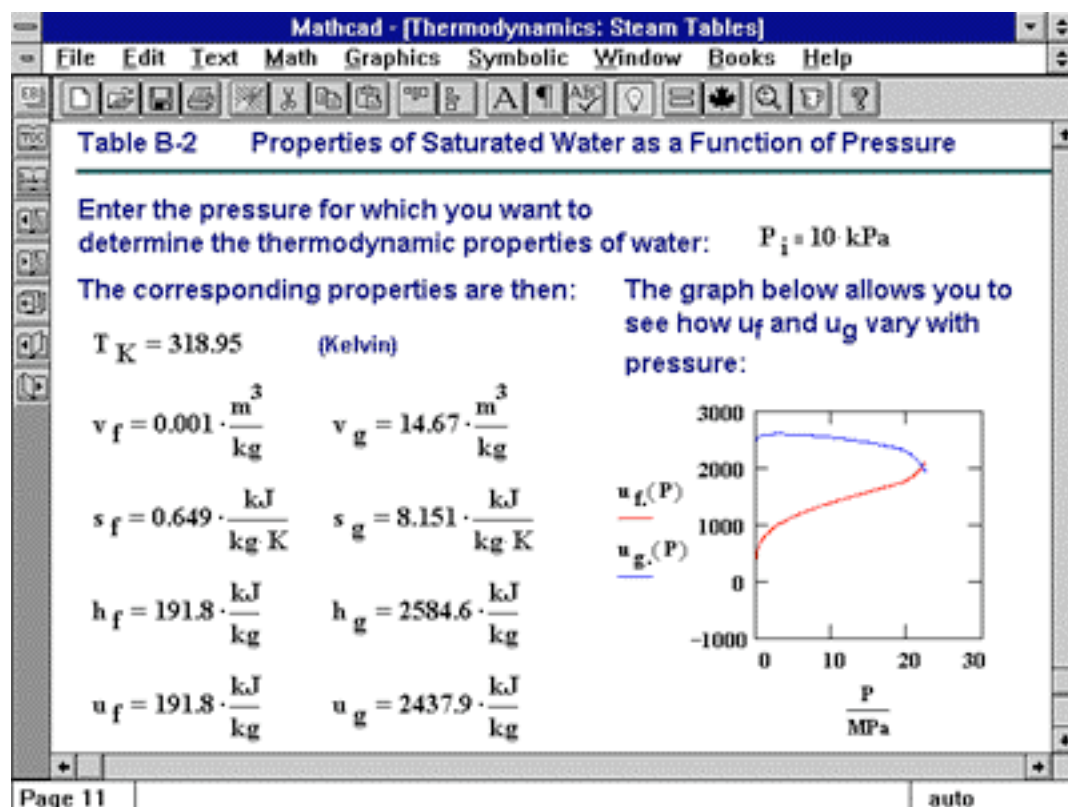


Platform: Windows

Includes the Mathcad Engine; requires 4 MB hard disk space

Available for ground shipment

This Electronic Book presents and solves over 90 diverse thermodynamic problems as they apply to mechanical systems and emphasizes the connections between related problems. It summarizes key theoretical points and provides tabulated data for reference, including interpolated forms of common steam tables. Students will learn and explore the laws of thermodynamics as applied to engineering and the relationships between thermodynamic properties. The comprehensive lab and homework exercises will help educators with course material. And professionals can review theory and applications or refer to tabular data on basic elements.

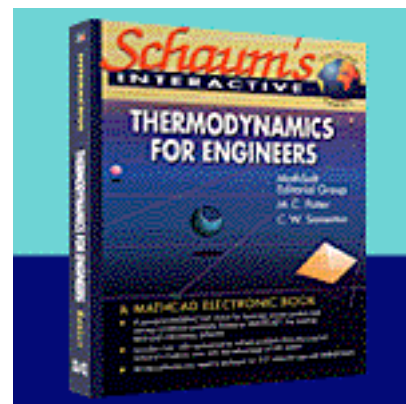
[Table of Contents](#)[Product Sample](#)[Back to Product List](#)

Determine the thermodynamic properties of water as a function of pressure.

Topics include: Properties of Ideal and Real Gases, The First and Second Laws of Thermodynamics, Entropy and Enthalpy, Reversible Work, Irreversibility and Availability, Power and Refrigeration Vapor Cycles, Power and Refrigeration Gas Cycles, Combustion, and much more.

Schaums Interactive Outline Series: Thermodynamics for Engineers

TABLE OF CONTENTS (page 1 of 6)



Chapter 1 Concepts, Definitions and Basic Principles

Thermodynamic Equilibrium (Schaum's Problem 1.2)
Newton's Second Law (Schaum's Problem 1.4)
Mass and Weight (Schaum's Problem 1.6)
Summation of Extensive Properties (Schaum's Problem 1.7)
Computation of Properties (Schaum's Problem 1.9)
Gauge Pressure (Schaum's Problem 1.11)
Absolute Pressure (Schaum's Problem 1.12)
Conservation of Energy (Schaum's Problem 1.15)

Chapter 2 Properties of Pure Substances

Computation of Quality of Steam (Schaum's Problem 2.1)
Computation of Specific Volume of Water (Schaum's Problem 2.2)
Computation of Final Volume with Constant Pressure (Schaum's Problem 2.4)
Computation of Partial Masses (Vapor and Liquid) (Schaum's Problem 2.5)
Computation of Final Temperature (Schaum's Problem 2.8)
Temperature vs. Pressure for Constant Volume (Schaum's Problem 2.10)
Ideal and Nonideal gas equations (Schaum's Example 2.7)

Chapter 3 Work and Heat

Computation of Work with Constant PV (Schaum's Example 3.3)
Work for a Constant-Pressure Process (Schaum's Problem 3.1)
Work on a Frictionless Piston (Schaum's Problem 3.2)
Work for an Isothermal Process (Schaum's Problem 3.3)
Work on a Piston with Spring (Schaum's Problem 3.4)
Work in a Three-Process Cycle (Schaum's Problem 3.5)
Nonequilibrium Work (Schaum's Problem 3.6)

Chapter 4a The First Law of Thermodynamics

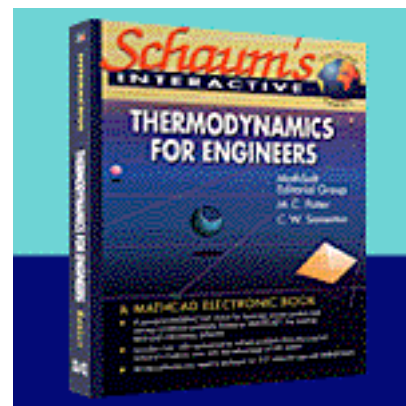
The First Law of Thermodynamics (Schaum's Problem 4.1)
Specific Heats (Schaum's Problem 4.9)
Enthalpy (Schaum's Problem 4.10)
The First Law Applied to the Constant-Temperature Process
(Schaum's Problem 4.13)
The First Law Applied to the Constant-Volume Process
(Schaum's Problem 4.6)

[Product Sample](#)

[Back to Product List](#)

Schaums Interactive Outline Series: Thermodynamics for Engineers

TABLE OF CONTENTS (page 2 of 6)



The First Law Applied to the Constant-Pressure Process(Schaum's Problem 4.7)
The First Law Applied to the Adiabatic Process(Schaum's Problem 4.15)
The First Law Applied to the Polytropic Process(Schaum's Problem 4.16)

Chapter 4b The First Law of Thermodynamics for Control Volumes

The First Law Applied to a Throttling Device (Schaum's Example 4.13)
The First Law Applied to a Turbine(Schaum's Example 4.14)
The First Law Applied to a Pump (Schaum's Example 4.15)
The First Law Applied to a Nozzle (Schaum's Example 4.16)
The First Law Applied to a Heat Exchanger (Schaum's Example 4.17)
The First Law Applied to a Steam Power Cycle (Schaum's Example 4.18)

Chapter 5 The Second Law of Thermodynamics

Equivalence of the Clausius Statement and the Kelvin-Planck Statement
(Schaum's Example 5.1)
Size of Electric Motor Required for Refrigerator(Schaum's Problem 5.1)
Rate of Heat Transfer in Carnot Heat Engine (Schaum's Problem 5.2)
Maximum Power Output of Heat Engine (Schaum's Problem 5.4)
Reservoir Temperatures of a Carnot Engine (Schaum's Problem 5.6)
COP for a Heat Engine(Schaum's Problem 5.7)
Minimum Mass Flux of Groundwater and Minimum Power in Heat Pump
(Schaum's Problem 5.9)

Chapter 6 Entropy

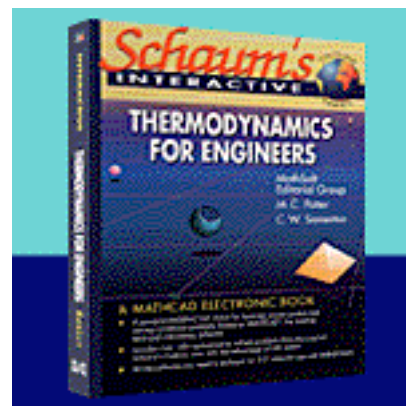
Entropy Change for Constant and Variable Specific Heats (Schaum's
Examples 6.1 and 6.3)
Entropy Change for a Constant-Pressure Process (Schaum's Problem 6.2)
Entropy Change for a Constant-Temperature Process (Schaum's Problem 6.4)
Freon 12 in Carnot Refrigerator (Schaum's Problem 6.12)
The Inequality of Clausius Applied to a Carnot Engine (Schaum's Problem 6.13)
Entropy Change of Universe due to Temperature Equilibration
(an Irreversible Process)(Schaum's Problem 6.14)
The Efficiency of Steam Turbine (Schaum's Problem 6.19)

[Product Sample](#)

[Back to Product List](#)

Schaums Interactive Outline Series: Thermodynamics for Engineers

TABLE OF CONTENTS (page 3 of 6)



Chapter 7 Reversible Work, Irreversibility and Availability

The Air Intake Process in the Cylinder of an Internal Combustion Engine
(Schaum's Problem 7.1)

Supply Pump for a Power Plant(Schaum's Problem 7.2)

Availability of Water in Reservoir(Schaum's Problem 7.4)

Second-law Effectiveness for an Ideal Isentropic Nozzle(Schaum's Example 7.6)

Second-law Analysis of a Rankine Cycle(Schaum's Example 7.7)

Chapter 8 Power and Refrigeration Vapor Cycles

Rankine Cycle(Schaum's Example 8.1)

Reheat Cycle(Schaum's Problem 8.4)

Regenerative Cycle(Schaum's Problem 8.7)

Supercritical Reheat-Regeneration Cycle(Schaum's Example 8.8)

Effect of Losses on Rankine Cycle Efficiency(Schaum's Example 8.9)

Ideal Vapor Refrigeration Cycle(Schaum's Example 8.10)

Two-Stage Vapor Refrigeration Cycle(Schaum's Problem 8.13)

Heat Pump(Schaum's Example 8.13)

Chapter 9 Power and Refrigeration Gas Cycles

Compressor Power Requirement(Schaum's Problem 9.1)

Otto Cycle(Schaum's Problem 9.8)

Diesel Cycle(Schaum's Problem 9.9)

Dual Cycle(Schaum's Problem 9.10)

Stirling Cycle(Schaum's Example 9.7)

Brayton Cycle(Schaum's Problems 9.12 and 9.13)

Regenerative Gas-Turbine Cycle(Schaum's Problem 9.14)

Turbojet Engine(Schaum's Problem 9.16)

Gas Refrigeration Cycle(Schaum's Example 9.15)

Chapter 10 Thermodynamic Relations

Differential Change in Specific Volume(Schaum's Example 10.1)

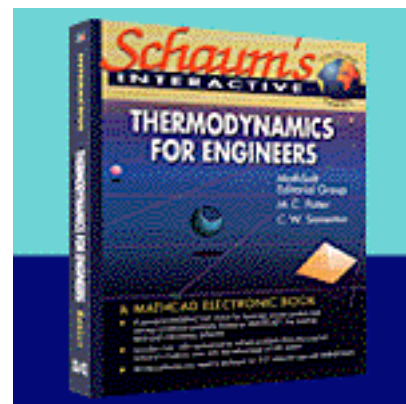
Extrapolation from the Steam Tables Using the
Clausius-Clapeyron Equation(Schaum's Example 10.4)

[Product Sample](#)

[Back to Product List](#)

Schaums Interactive Outline Series: Thermodynamics for Engineers

TABLE OF CONTENTS (page 4 of 6)



Evaluation of the Specific Heat at Constant Pressure Using the
Joule-Thomson Coefficient(Schaum's Problem 10.8)
Enthalpy, Internal-Energy, and Entropy Changes of Gases(Schaum's Example 10.10)

Chapter 11 Mixtures and Solutions

Basic Definitions of a Mixture(Schaum's Problem 11.1)
Specific Volume of a Mixture(Schaum's Problem 11.2)
Heat Addition to a Mixture(Schaum's Problem 11.3)
Air-Vapor Mixture(Schaum's Example 11.5)
Dry-Bulb and Wet-Bulb Temperature(Schaum's Example 11.7)
Heat Removal from Humid Air(Schaum's Problem 11.11)

Chapter 12 Combustion

Combustion of Ethane(Schaum's Problem 12.1)
Combustion of an Unknown Hydrocarbon(Schaum's Problem 12.5)
Methane Combustion in a Control Volume(Schaum's Problem 12.7)
Octane Combustion in Jet Engine(Schaum's Example 12.7)
Propane Combustion in a Rigid Volume(Schaum's Problem 12.9)
Adiabatic Flame Temperature(Schaum's Example 12.10)

Appendix A Material Properties

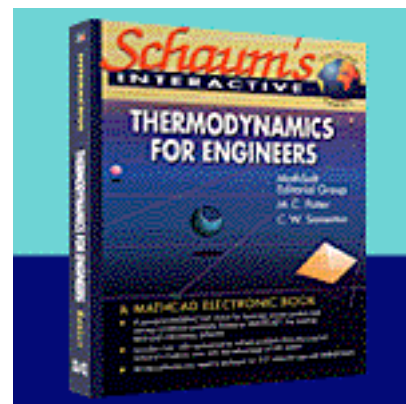
Table A-1 Properties of the U.S. Standard Atmosphere as a Function of Altitude
Table A-2 Properties of Various Ideal Gases
Table A-3 Critical Constants
Table A-4 Specific Heats of Liquids and Solids
Table A-5 Constant-Pressure Specific Heats of Various Ideal Gases
Table A-6 Enthalpies of Formation and Vaporization
Table A-7 Enthalpies of Combustion and Vaporization
Table A-8 Constants for the van der Waals and the Redlich-Kwong Equations
of State

[Product Sample](#)

[Back to Product List](#)

Schaums Interactive Outline Series: Thermodynamics for Engineers

TABLE OF CONTENTS (page 5 of 6)



Appendix B Thermodynamic Properties of Water

- Table B-1 Properties of Saturated Water as a Function of Temperature
- Table B-2 Properties of Saturated Water as a Function of Pressure
- Table B-3 Properties of Superheated Steam as a Function of Temperature and Pressure
- Table B-3a Table of Properties of Superheated Steam as a Function of Temperature and Pressure
- Table B-4 Properties of Compressed Liquid Water as a Function of Temperature and Pressure
- Table B-4a Table of Properties of Compressed Liquid Water as a Function of Temperature and Pressure
- Table B-5 Properties of Saturated Solid-Vapor as a Function of Temperature

Appendix C Thermodynamic Properties of Freon 12

- Table C-1 Properties of Saturated Freon 12 as a Function of Temperature
- Table C-2 Properties of Saturated Freon 12 as a Function of Pressure
- Table C-3 Properties of Superheated Freon 12 as a Function of Temperature and Pressure
- Table C-3a Table of Properties of Superheated Freon 12 as a Function of Temperature and Pressure

Appendix D Thermodynamic Properties of Ammonia

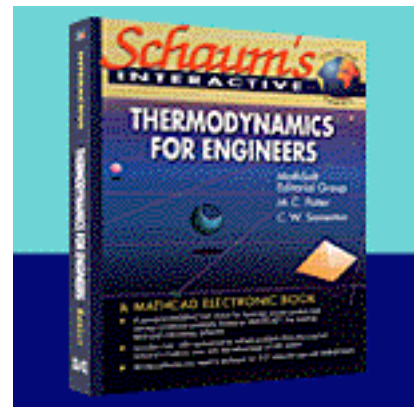
- Table D-1 Properties of Saturated Ammonia as a Function of Temperature
- Table D-2 Properties of Superheated Ammonia as a Function of Temperature and Pressure
- Table D-2a Table of Properties of Superheated Ammonia as a Function of Temperature and Pressure

[Product Sample](#)

[Back to Product List](#)

Schaums Interactive Outline Series: Thermodynamics for Engineers

TABLE OF CONTENTS (page 6 of 6)



Appendix E Ideal-Gas Tables

Table E-1 Properties of Air as a Function of Temperature

Table E-2 Molar Properties of Nitrogen as a Function of Temperature

Table E-3 Molar Properties of Oxygen as a Function of Temperature

Table E-4 Molar Properties of Carbon Dioxide as a Function of Temperature

Table E-5 Molar Properties of Carbon Monoxide as a Function of Temperature

Table E-6 Molar Properties of Water as a Function of Temperature

Appendix F Compressibility Chart

Table F-1 Compressibility Chart

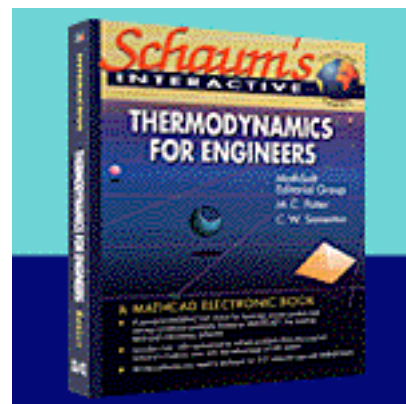
Index

[Product Sample](#)

[Back to Product List](#)

Schaums Interactive Outline Series: Thermodynamics for Engineers

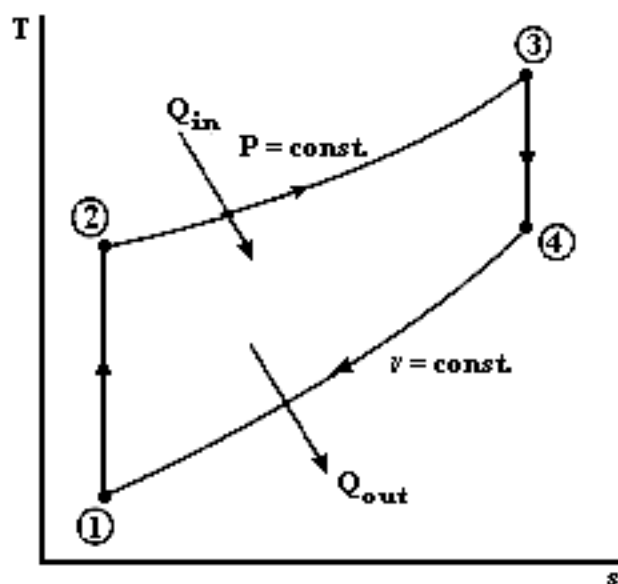
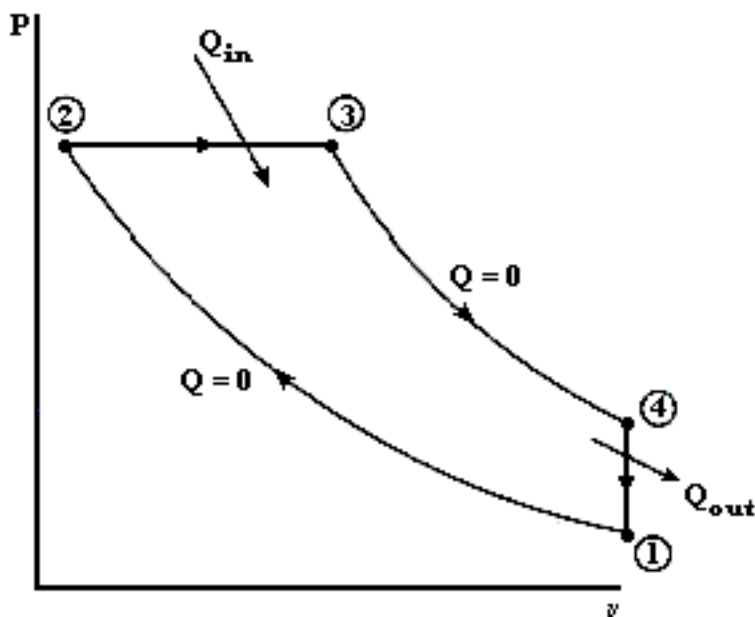
SAMPLE PAGE (page 1 of 3)



Diesel Cycle

Statement

A diesel engine intakes atmospheric air at temperature T_1 and adds q_{in} of energy. If the maximum pressure is P_2 and the air mass flow rate is m' , calculate the cutoff ratio r_c , the thermal efficiency η , and the power output W'_{out} .



System Parameters

Inlet air pressure: $P_1 := 14.7 \cdot \text{psi}$

Inlet air temperature: $T_1 := 520 \cdot \text{R}$

Maximum air pressure: $P_2 := 1200 \cdot \text{psi}$

Specific energy input: $q_{in} := 800 \cdot \frac{\text{BTU}}{\text{lb}}$

Mass flow rate: $m' := 0.2 \cdot \frac{\text{lb}}{\text{sec}}$

Units: $R \equiv \frac{\text{K}}{1.8}$

[Table of Contents](#)

[Back to Product List](#)

Schaums Interactive Outline Series: Thermodynamics for Engineers

SAMPLE PAGE (page 2 of 3)

Constants

Specific heat ratio for air: $k := 1.4$

Gas constant for air: $R_{\text{air}} := 53.34 \frac{\text{ft} \cdot \text{lbf}}{\text{lb} \cdot \text{R}}$

Solution

To determine the cutoff ratio and the thermal efficiency, it is first necessary to find the pressure, temperature and specific volumes at the various states.

Since the compression process 1 --> 2 is isentropic ($Ds = 0$),

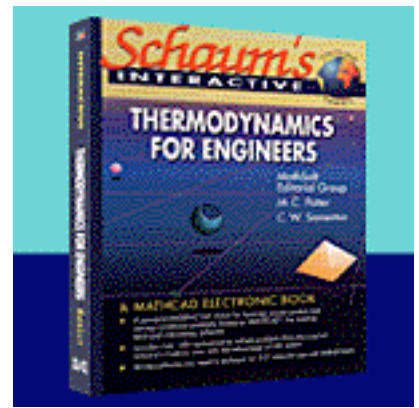
$$T_2 := T_1 \cdot \left(\frac{P_2}{P_1} \right)^{\frac{k-1}{k}} \quad T_2 = 1829 \cdot \text{R}$$

and the temperature at state 3 is found from the **first law** (Chapter 4a):

$$q_{\text{in}} = c_p \cdot (T_3 - T_2) = \frac{R_{\text{air}} \cdot k}{k-1} \cdot (T_3 - T_2)$$
$$T_3 := T_2 + \frac{q_{\text{in}} \cdot (k-1)}{R_{\text{air}} \cdot k} \quad T_3 = 5164 \cdot \text{R}$$

The pressure remains constant between states 2 and 3, giving

$$P_3 := P_2 \quad P_3 = 1200 \cdot \text{psi}$$

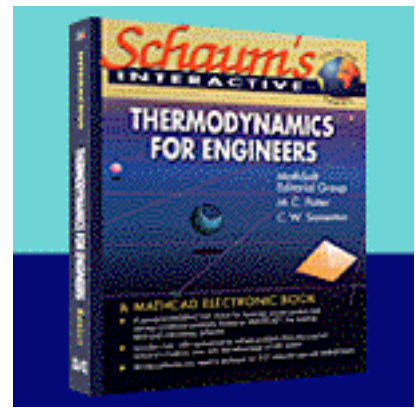


[Table of Contents](#)

[Back to Product List](#)

Schaums Interactive Outline Series: Thermodynamics for Engineers

SAMPLE PAGE (page 3 of 3)



The specific volumes of the three states are found from the **ideal-gas equation of state** $Pv = RT$ (Chapter 2)

$$v_1 := \frac{R_{\text{air}} \cdot T_1}{P_1} \quad v_1 = 13.103 \cdot \frac{\text{ft}^3}{\text{lb}}$$

$$v_2 := \frac{R_{\text{air}} \cdot T_2}{P_2} \quad v_2 = 0.565 \cdot \frac{\text{ft}^3}{\text{lb}}$$

$$v_3 := \frac{R_{\text{air}} \cdot T_3}{P_3} \quad v_3 = 1.594 \cdot \frac{\text{ft}^3}{\text{lb}}$$

The cutoff ratio is then

$$r_c := \frac{v_3}{v_2} \quad r_c = 2.823$$

and the compression ratio is

$$r := \frac{v_1}{v_2} \quad r = 23.207$$

Thus the thermal efficiency is

$$\eta := 1 - r^{1-k} \cdot \frac{r_c^k - 1}{k \cdot (r_c - 1)} \quad \eta = 0.635$$

and the power output is

$$\dot{W}_{\text{out}} := \eta \cdot \dot{m} \cdot q_{\text{in}} \quad \dot{W}_{\text{out}} = 143.78 \cdot \text{hp}$$

Try inputting r into 9.2 Otto Cycle to compare the efficiency of the two cycles.

[Table of Contents](#)

[Back to Product List](#)