

Chapter 9, Problem 16.

An air-standard cycle is executed in a closed system and is composed of the following four processes:

1-2 Isentropic compression from 100 kPa and 27°C to 1 MPa



2-3 $P = \text{constant}$ heat addition in amount of 2800 kJ/kg

3-4 $v = \text{constant}$ heat rejection to 100 kPa

4-1 $P = \text{constant}$ heat rejection to initial state



- (a) Show the cycle on P - v and T - s diagrams.
- (b) Calculate the maximum temperature in the cycle.
- (c) Determine the thermal efficiency.

Assume constant specific heats at room temperature.

* Problems designated by a “C” are concept questions, and students are encouraged to answer them all. Problems designated by an “E” are in English units, and the SI users can ignore them. Problems with the  are solved using EES, and complete solutions together with parametric studies are included on the enclosed DVD. Problems with the  are comprehensive in nature and are intended to be solved with a computer, preferably using the EES software that accompanies this text.



Chapter 9, Problem 37.

The compression ratio of an air-standard Otto cycle is 9.5. Prior to the isentropic compression process, the air is at 100 kPa, 35°C, and 600 cm³. The temperature at the end of the isentropic expansion process is 800 K. Using specific heat values at room temperature, determine (a) the highest temperature and pressure in the cycle; (b) the amount of heat transferred in, in kJ; (c) the thermal efficiency; and (d) the mean effective pressure.

* Problems designated by a “C” are concept questions, and students are encouraged to answer them all. Problems designated by an “E” are in English units, and the SI users can ignore them. Problems with the  are solved using EES, and complete solutions together with parametric studies are included on the enclosed DVD. Problems with the  are comprehensive in nature and are intended to be solved with a computer, preferably using the EES software that accompanies this text.



Chapter 9, Problem 56.

The compression ratio of an ideal dual cycle is 14. Air is at 100 kPa and 300 K at the beginning of the compression process and at 2200 K at the end of the heat-addition process. Heat transfer to air takes place partly at constant volume and partly at constant pressure, and it amounts to 1520.4 kJ/kg. Assuming variable specific heats for air, determine (a) the fraction of heat transferred at constant volume and (b) the thermal efficiency of the cycle.

* Problems designated by a “C” are concept questions, and students are encouraged to answer them all. Problems designated by an “E” are in English units, and the SI users can ignore them. Problems with the  are solved using EES, and complete solutions together with parametric studies are included on the enclosed DVD. Problems with the  are comprehensive in nature and are intended to be solved with a computer, preferably using the EES software that accompanies this text.



Chapter 9, Problem 65.

Consider an ideal Ericsson cycle with air as the working fluid executed in a steady-flow system. Air is at 27°C and 120 kPa at the beginning of the isothermal compression process, during which 150 kJ/kg of heat is rejected. Heat transfer to air occurs at 1200 K. Determine (a) the maximum pressure in the cycle, (b) the net work output per unit mass of air, and (c) the thermal efficiency of the cycle.

* Problems designated by a “C” are concept questions, and students are encouraged to answer them all. Problems designated by an “E” are in English units, and the SI users can ignore them. Problems with the  are solved using EES, and complete solutions together with parametric studies are included on the enclosed DVD. Problems with the  are comprehensive in nature and are intended to be solved with a computer, preferably using the EES software that accompanies this text.

Chapter 9, Problem 66.

An ideal Stirling engine using helium as the working fluid operates between temperature limits of 300 and 2000 K and pressure limits of 150 kPa and 3 MPa. Assuming the mass of the helium used in the cycle is 0.12 kg, determine (a) the thermal efficiency of the cycle, (b) the amount of heat transfer in the regenerator, and (c) the work output per cycle.

* Problems designated by a “C” are concept questions, and students are encouraged to answer them all. Problems designated by an “E” are in English units, and the SI users can ignore them. Problems with the  are solved using EES, and complete solutions together with parametric studies are included on the enclosed DVD. Problems with the  are comprehensive in nature and are intended to be solved with a computer, preferably using the EES software that accompanies this text.