Chapter 9, Problem 14.

An air-standard cycle with variable specific heats 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 800 kPa

2-3 ***v*** = *constant* heat addition to 1800 K

3-4 Isentropic expansion to 100 kPa

4-1 *P* = *constant* heat rejection to initial state

(*a*) Show the cycle on *P*-***v*** and *T*-*s* diagrams.

(*b*) Calculate the net work output per unit mass.

(*c*) Determine the thermal efficiency.

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 = *constant* heat addition in amount of 2800 kJ/kg
3-4 $\mathbf{v}$ = *constant* heat rejection to 100 kPa
4-1 P = *constant* heat rejection to initial state

(*a*) Show the cycle on P-$\mathbf{v}$ 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 EES icon are solved using EES, and complete solutions together with parametric studies are included on the enclosed DVD. Problems with the computer icon 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 20.

An air-standard cycle with variable specific heats is executed in a closed system with 0.003 kg of air and consists of the following three processes:

1-2 ***v*** = *constant* heat addition from 95 kPa and 17°C to 380 kPa

2-3 Isentropic expansion to 95 kPa

3-1 *P* = *constant* heat rejection to initial state

(*a*) Show the cycle on *P*-***v*** and *T*-*s* diagrams.

(*b*) Calculate the net work per cycle, in kJ.

(*c*) Determine the thermal efficiency.

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Chapter 9, Problem 22.

Consider a Carnot cycle executed in a closed system with 0.003 kg of air. The temperature limits of the cycle are 300 and 900 K, and the minimum and maximum pressures that occur during the cycle are 20 and 2000 kPa. Assuming constant specific heats, determine the net work output per cycle.

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Chapter 9, Problem 34.

An ideal Otto cycle has a compression ratio of 8. At the beginning of the compression process, air is at 95 kPa and 27°C, and 750 kJ/kg of heat is transferred to air during the constant-volume heat-addition process. Taking into account the variation of specific heats with temperature, determine (*a*) the pressure and temperature at the end of the heat-addition process, (*b*) the net work output, (*c*) the thermal efficiency, and (*d*) the mean effective pressure for the cycle.

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Chapter 9, Problem 36.

Repeat Problem 9–34 using constant specific heats at room temperature.

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Chapter 9, Problem 47.

An air-standard Diesel cycle has a compression ratio of 16 and a cutoff ratio of 2. At the beginning of the compression process, air is at 95 kPa and 27°C. Accounting for the variation of specific heats with temperature, determine (*a*) the temperature after the heat-addition process, (*b*) the thermal efficiency, and (*c*) the mean effective pressure.

Chapter 9, Problem 49E.

An air-standard Diesel cycle has a compression ratio of 18.2. Air is at 80°F and 14.7 psia at the beginning of the compression process and at 3000 R at the end of the heat-addition process. Accounting for the variation of specific heats with temperature, determine (*a*) the cutoff ratio, (*b*) the heat rejection per unit mass, and (*c*) the thermal efficiency.

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