Chapter 19 Homework

Due: 9:00am on Wednesday, December 9, 2009

Note: To understand how points are awarded, read your instructor's Grading Policy.

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Problem 19.1

A heat engine with a thermal efficiency of 45.0% does 140 J of work per cycle.

Part A

How much heat is extracted from the hot reservoir per cycle?

ANSWER: 311 J *Correct*

Part B

How much heat is exhausted to the cold reservoir per cycle?

ANSWER: 171 J *Correct*

Problem 19.8

1.0 L of 20°C water is placed in a refrigerator. The refrigerator's motor must supply an extra 8.0 W power to chill the water to 5°C in 1.0 hr.

Part A

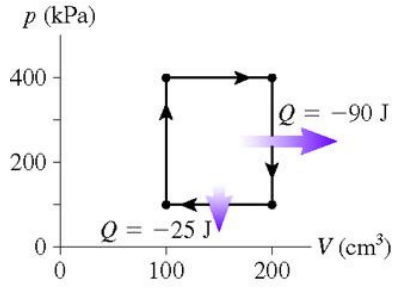
What is the refrigerator's coefficient of performance?

ANSWER: 2.18 *Correct*

Problem 19.14

Part A

What is W_out for the heat engine shown in the figure?



ANSWER: W_{out} = 30.0 J *Correct*

Part B

What is Q_H for the heat engine shown in the figure?

ANSWER: Q_H = 145 J *Correct*

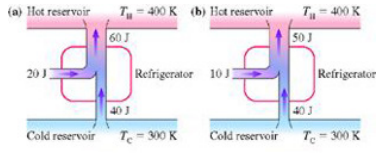
Part C

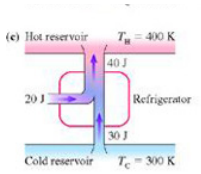
What is the thermal efficiency for the heat engine shown in the figure?

ANSWER: η = 0.207 *Correct*

Problem 19.20

Which, if any, of the refrigerators in the figure violate (a) the first law of thermodynamics or (b) the second law of thermodynamics?





Part A

ANSWER:

- The c refrigerator violate the first law of thermodynamics and b refrigerator violate the second law of thermodynamics
- The a refrigerator violate the first law of thermodynamics and b refrigerator violate the second law of thermodynamics
- The b refrigerator violate the first law of thermodynamics and c refrigerator violate the second law of thermodynamics
- The c refrigerator violate the first law of thermodynamics and a refrigerator violate the second law of thermodynamics
- The a refrigerator violate the first law of thermodynamics and c refrigerator violate the second law of thermodynamics

Correct

Problem 19.21

Part A

At what cold-reservoir temperature (in °C) would a Carnot engine with a hot-reservoir temperature of 415 °C have an efficiency of 40.0 %?

ANSWER: 140 °C
Correct

Problem 19.48

A nuclear power plant generates 2000 MW of heat energy from nuclear reactions in the reactor's core. This energy is used to boil water and produce high-pressure steam at 300°C. The steam spins a turbine, which produces 700 MW of electric power, then the steam is condensed and the water is cooled to 30°C before starting the cycle again.

Part A

What is the maximum possible thermal efficiency of the power plant?

ANSWER: 47.1 %
Correct

Part B

What is the plant's actual efficiency?

ANSWER: 35.0 %
Correct

Part C

Cooling water from a river flows through the condenser (the low-temperature heat exchanger) at the rate of 1.2×10^8 L/hr (≈ 30 million gallons per hour). If the river water enters the condenser at 18°C, what is its exit temperature?

ANSWER: 27.3 °C
Correct

Score Summary:

Your score on this assignment is 99.9%.
You received 29.97 out of a possible total of 30 points.