Unit 6 - Week 5: The second law of thermodynamics and entropy

Week 5 assignment

The due date for submitting this assignment has passed. Due on 2017-02-28, 23:59 IST.
As per our records you have not submitted this assignment.

1) A room is heated with a 1500 W electric heater. How much power can be saved if a heat pump with a COP of 2.0 is used instead?

- 500 W
- 450 W
- 750 W
- 800 W

No, the answer is incorrect.
Score: 0
Accepted Answers:
750 W

2) A large stationary diesel engine produces 15 MW with a thermal efficiency of 40%. The exhaust gas, which we assume is air, flows out at 800 K and the intake is 290 K. How large a mass flow rate is that if that accounts for half the rate of $Q_L$?

- 21.16 kg/s
- 25.5 kg/s
- 15.15 kg/s
- 24.5 kg/s

No, the answer is incorrect.
Score: 0
Accepted Answers:
21.16 kg/s

3) A farmer runs a heat pump with a 2 kW motor. It should keep a chicken hatchery at 30°C, which loses energy at a rate of 10 kW to the colder ambient $T_{amb}$. What is the minimum coefficient of performance that will be acceptable for the heat pump?

- 2
- 4
- 5
- 8

No, the answer is incorrect.
Score: 0
4) An air-conditioner with a power input of 1.2 kW is working as a refrigerator (COP= 3) or as a heat pump (COP= 4). It maintains an office at 20°C year round which exchanges 0.5 kW per degree temperature difference with the atmosphere. Find the maximum and minimum outside temperature for which this unit is sufficient.

- 12.2 °C and 25.3 °C
- 10.4 °C and 27.2 °C
- 13.3 °C and 34.5 °C
- 18.4 °C and 28.4 °C

No, the answer is incorrect.
Score: 0

Accepted Answers:
10.4 °C and 27.2 °C

5) Two 5 kg blocks of steel, one at 250°C the other at 25°C, come in thermal contact. What is the total entropy generation in the process?

- 0.18 kJ/K
- 0.34 kJ/K
- 0.45 kJ/K
- 0.41 kJ/K

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.18 kJ/K

6) A window air conditioner that consumes 1 kW of electricity when running and has a coefficient of performance of 3 is placed in the middle of a room, and is plugged in. The rate of cooling or heating this air conditioner will provide to the air in the room when running is

- 3 kJ/s, cooling
- 1 kJ/s, cooling
- 1 kJ/s, heating
- 0.33 kJ/s heating

No, the answer is incorrect.
Score: 0

Accepted Answers:
1 kJ/s, heating

7) An insulated piston-cylinder device contains 5 L of saturated liquid water at a constant pressure of 150 kPa. An electric resistance heater inside the cylinder is now turned on, and 2200 kJ of energy is transferred to the steam. Determine the entropy change of the water during this process.

- 6.75 kJ/K
- 5.72 kJ/K
- 4.85 kJ/K
- 2.68 kJ/K

No, the answer is incorrect.
Score: 0

Accepted Answers:
5.72 kJ/K
8) Helium gas is compressed steadily from 90 kPa and 25°C to 800 kPa at a rate of 2 kg/min by an adiabatic compressor. If the compressor consumes 80 kW of power while operating, the isentropic efficiency of this compressor is

- 54.0%
- 80.5%
- 90.1%
- 100%

No, the answer is incorrect.
Score: 0
Accepted Answers:
90.1%

9) Liquid water enters an adiabatic piping system at 15°C at a rate of 8 kg/s. If the water temperature rises by 0.2°C during flow due to friction, the rate of entropy generation in the pipe is

- 23 W/K
- 55 W/K
- 68 W/K
- 220 W/K

No, the answer is incorrect.
Score: 0
Accepted Answers:
23 W/K

10) An insulated rigid tank is divided into two equal parts by a partition. Initially, one part contains 5 kmol of an ideal gas at 250 kPa and 40°C, and the other side is evacuated. The partition is now removed, and the gas fills the entire tank. Determine the total entropy change during this process.

- 28.81 kJ/K
- 22.81 kJ/K
- 20.67 kJ/K
- 23.45 kJ/K

No, the answer is incorrect.
Score: 0
Accepted Answers:
28.81 kJ/K