

คณะวิศวกรรมศาสตร์  
มหาวิทยาลัยสงขลานครินทร์

การสอบปลายภาค ประจำภาคการศึกษาที่ 1

วันที่ 7 ตุลาคม 2555

วิชา 215-231 Engineering Thermodynamic I

ประจำปีการศึกษา 2555

เวลา 09.00-12.00 น.

ห้อง S817

คำสั่ง

1. ข้อสอบมีทั้งสิ้น 6 ข้อ ให้ทำในข้อสอบ
2. อนุญาตให้นำเครื่องคิดเลขเข้าห้องสอบได้
3. อนุญาตให้นำกระดาษจก A4 เข้าห้องสอบ

รศ.กำพล ประทีปชัยกูร

ผู้ออกข้อสอบ

ชื่อ-สกุล..... รหัส.....

ชื่อ-สกุล..... รหัส.....

- 1) Air flows steadily in a pipe at 300 kPa, 77°C, and 25 m/s at a rate of 18 kg/min. Determine  
a) the diameter of the pipe, b) the rate of flow energy c) the rate of energy transport by mass  
and d) the error involved in part (c) if the kinetic energy is neglected.

Given: The properties of air:  $R = 0.287 \frac{\text{kJ}}{\text{kg}\cdot\text{K}}$ ,  $c_p = 1.008 \frac{\text{kJ}}{\text{kg}\cdot\text{K}}$  (20 marks)

ชื่อ-สกุล..... รหัส.....

2) Carbon dioxide enters an adiabatic compressor at 100 kPa and 300 K at a rate of 0.5 kg/s and leaves at 600 kPa and 450 K. Neglecting kinetic energy change, determine a) the volume flow rate of the carbon dioxide at the compressor inlet and b) the power input to the compressor.

Given: for carbon dioxide:  $R = 0.1889 \frac{\text{kPa}\cdot\text{m}^3}{\text{kg}\cdot\text{K}}$ , molar mass  $M = 44 \frac{\text{kg}}{\text{kmol}}$

(15 marks)

ชื่อ-สกุล..... รหัส.....

3) Refrigerant-134a enters the evaporator coils placed at the back of the freezer section of a household refrigerator at 100 kPa with a quality of 20 % and leaves at 100 kPa and  $-26^{\circ}\text{C}$ . If the compressor consumes 600 W of power and the COP of the refrigerator is 1.2, determine

- the mass flow rate of the refrigerant
- the rate of heat rejection.

(10 marks)

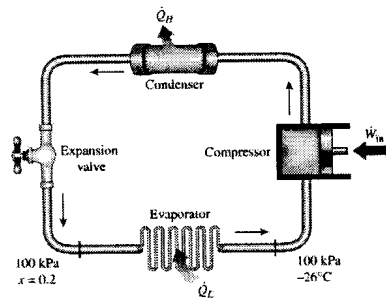


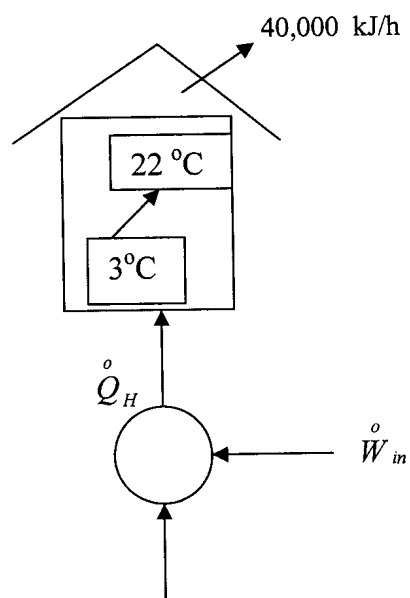
FIGURE P6-55

ชื่อ-สกุล..... รหัส.....

4) A heat pump with a COP of 2.4 is used to heat a house. When running, the heat pump consumes 8 kW of electric power. If the house is losing heat to the outside at an average rate of 40,000 kJ/h and the temperature of the house is 3°C when the heat pump is turned on, determine how long it will take for the temperature in the house to rise to 22°C. Assume the house is well sealed (i.e; no air leaks) and take the entire mass within the house (air, furniture, etc) to be equivalent to 2000 kg of air. Given: the constant volume specific heat of air at room temperature

$$c_v = 0.718 \frac{\text{kJ}}{\text{kg}^\circ\text{C}}$$

(15 marks)



ชื่อ-สกุล..... รหัส.....

- 5) A completely reversible heat pump produces heat at a rate of 300 kW to warm a house maintained at 24°C . The exterior air, which is at 7°C, serves as the source. Calculate the rate of entropy change of the two reservoirs and determine if this heat pump satisfies the second law according to the increase of entropy principle. (20 marks)

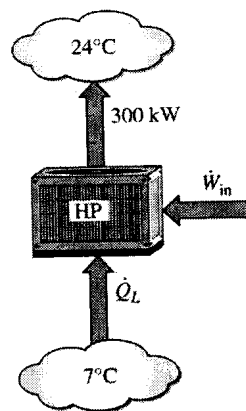


FIGURE P7-25

ชื่อ-สกุล..... รหัส.....

6) Two kilograms of saturated water vapor at 600 kPa are contained in a piston-cylinder device. The water expands adiabatically until the pressure is 100 kPa and is said to produce 700 kJ of work output.

- a) Determine the entropy change of the water in kJ/kg.K
- b) Is this process realistic ? Using the T-s diagram for the process and the concept of second law, support the answer.

(20 marks)