

REVIEW PROBLEMS

MIDTERM PREP
THERMODYNAMICS 1

Lengkapi tabel untuk H2O berikut:

T (°C)	P (kPa)	h (kJ/kg)	v (m³/kg)	x	Fasa
	225	1000			
150	800				

Lengkapi tabel untuk Refrigerant-134a berikut:

T (°F)	P (Psia)	h (Btu/lbm)	v (ft³/lbm)	x	Fasa
110				1	
160					Superheated vapor

3–31 Complete this table for refrigerant-134a:

$T, ^\circ\text{C}$	P, kPa	$\nu, \text{m}^3/\text{kg}$	Phase description
–8	320		
30		0.015	
	180		Saturated vapor
80	600		

Sebuah piston yang berisi 3 kg refrigerant-134a pada suhu 70°C dan tekanan 800 kPa didiamkan di udara terbuka pada tekanan konstan hingga suhunya turun menjadi 16°C . Hitung besarnya kalor yang dilepas dari sistem ke lingkungan dan gambarkan proses tersebut dalam diagram P-v. (*Jawaban = -669.45 kJ*)

Berapa besar perubahan energi internal 10 kg gas karbon monoksida yang dipanaskan dari suhu 500 K ke 800 K?

(Jawaban: 2413.5 kJ)

Determine the change of enthalpy of *oxygen* in kJ/kg as it is heated from 600 to 800 K, using:

- a. Average heat capacity (Table A-2b)
- b. Heat capacity as a function of temperature (Table A-2c)
- c. Ideal-gas properties of oxygen (Table A-19)

3–59 A piston–cylinder device initially contains 50 L of liquid water at 40°C and 200 kPa. Heat is transferred to the water at constant pressure until the entire liquid is vaporized.

- (a) What is the mass of the water?
- (b) What is the final temperature?
- (c) Determine the total enthalpy change.
- (d) Show the process on a T - v diagram with respect to saturation lines.

Answers: (a) 49.61 kg, (b) 120.21°C, (c) 125,943 kJ

A mass of 15 kg of air in a piston–cylinder device is heated from 25 to 77°C by passing current through a resistance heater inside the cylinder. The pressure inside the cylinder is held constant at 300 kPa during the process, and a heat loss of 60 kJ occurs. Determine the electric energy supplied, in kWh and plot the process on a P-v diagram. (*Ans. 845 kJ or 0.235 kWh*)

Consider an ordinary shower where hot water at 60°C is mixed with cold water at 10°C . If it is desired that a steady stream of warm water at 45°C be supplied, determine the ratio of the mass flow rates of the hot to cold water. Assume the heat losses from the mixing chamber to be negligible and the mixing to take place at a pressure of 150 kPa.

5-209 Steam is compressed by an adiabatic compressor from 0.2 MPa and 150°C to 2.5 MPa and 250°C at a rate of 1.30 kg/s. The power input to the compressor is

- | | |
|------------|------------|
| (a) 144 kW | (d) 717 kW |
| (b) 234 kW | (e) 901 kW |
| (c) 438 kW | |

5–210 Refrigerant-134a is compressed by a compressor from the saturated vapor state at 0.14 MPa to 1.2 MPa and 70°C at a rate of 0.108 kg/s. The refrigerant is cooled at a rate of 1.10 kJ/s during compression. The power input to the compressor is

- | | |
|-------------|-------------|
| (a) 5.54 kW | (d) 7.74 kW |
| (b) 7.33 kW | (e) 8.13 kW |
| (c) 6.64 kW | |

4–160 3 kg of liquid water initially at 12°C is to be heated at 95°C in a teapot equipped with a 1200-W electric heating element inside. The specific heat of water can be taken to be $4.18 \text{ kJ/kg} \cdot ^{\circ}\text{C}$, and the heat loss from the water during heating can be neglected. The time it takes to heat water to the desired temperature is

- (a) 4.8 min
- (b) 14.5 min
- (c) 6.7 min
- (d) 9.0 min
- (e) 18.6 min