TERMODİNAMİK SINAV HAZIRLIK SORULARI

BÖLÜM 3

Özellik Tabloları

3-21 Tabloyu su için tamamlayınız

T, ˚C	P, kPa	v, m^3/kg	Faz tanımı
50		7.72	
	400		Doymuş buhar
250	500		
110	350		

3-23 Tabloyu su için tamamlayınız

T, ˚C	P, kPa	h, kJ/kg	x	Faz tanımı
	200		0.7	
140		1800		
	950		0.0	
80	500			
	800	3162.2		

3-24 Tabloyu soğutucu akışkan-134a için tabloyu tamamlayınız.

T, ˚C	P, kPa	v, m^3/kg	Faz tanımı
-12	320		
30		0.0065	
	550		Doymuş buhar
60	600		

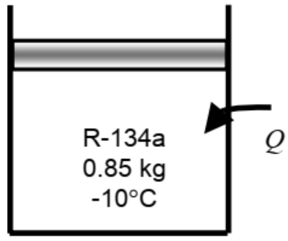
3-25 Eğer yeterli veri sağlanmışsa, aşağıdaki suyun özellikleri tablosundaki boşlukları tamamlayın. Son sütundaki suyun fazını sıkıştırılmış sıvı, doymuş karışım, kızgın buhar ya da eksik bilgi ifadelerini kullanarak tanımlayınız ve eğer mümkünse kuruluk derecesini veriniz.

P, kPa	T, ˚C	v, m^3/kg	h, kJ/kg	Faz tanımı ve kuruluk derecesi
200			2706.3	
	130			0.650
	400		3277.0	
800	30			
450	147.90			

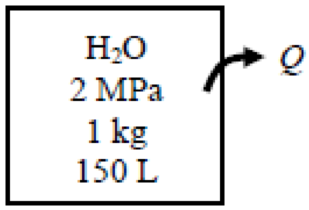
3-26 Tabloyu akışkan-134a için tanımlayınız.

T, ˚C	P, kPa	h, kJ/kg	**x**	Faz tanımı
	600	180		
-10			0.6	
-14	500			
	1200	300.61		
44			1.0	

3-27 Silindir piston düzeneği -10 ˚C de 0.85 kg soğutkan-134a içermektedir. Hareketi serbest olan pistonun kütlesi 12 kg ve çapı 25 cm'dir. Yerel atmosfer basıncı 88 kPa'dır. Sıcaklık 15 ˚C olana kadar soğutucu akışkan-134a'ya ısı aktarılıyor. Buna göre (a) Son basıncı, (b) Silindirin hacmindeki değişimi ve (c) Soğutucu akışkan-134a'nın entalpisindeki değişikliği belirleyiniz.



3-29 2 MPa başlangıç basıncındaki 150 L hacmindeki katı bir kap bir kilogram su ile doldurulmuştur. Sonrasında kap 40 ˚C'ye soğutulmuştur. Suyun başlangıç sıcaklığını ve son durumdaki basıncını hesaplayınız.



3-34 0.1546 m^3 hacimli bir piston-silindir düzeneğinde 350 ˚C sıcaklıkta bir kilogram su bulunmaktadır. Piston-silindir düzeneği sıcaklığı 100 ˚C olana kadar soğutulmuştur. Suyun son durumdaki basıncını kPa ve hacmini m^3 olarak hesaplayınız.

3-22 *Complete the following table for H_2O:*

T, °C	P, kPa	v, m^3 / kg	Phase description
50	***12.35***	7.72	***Saturated mixture***
143.6	400	***0.4624***	Saturated vapor
250	500	***0.4744***	***Superheated vapor***
110	350	***0.001051***	***Compressed liquid***

3-26 *Complete the following table for H_2O*:

T, °C	P, kPa	*h*, kJ / kg	*x*	Phase description
120.21	200	***2045.8***	0.7	***Saturated mixture***
140	***361.53***	1800	***0.565***	***Saturated mixture***
177.66	950	***752.74***	0.0	***Saturated liquid***
80	500	***335.37***	**- - -**	***Compressed liquid***
350.0	800	3162.2	**- - -**	***Superheated vapor***

3-27 *Complete the following table for Refrigerant-134a*:

T, °C	**P, kPa**	**v, m^3 / kg**	**Phase description**
-12	320	***0.000750***	***Compressed liquid***
30	***770.64***	0.0065	***Saturated mixture***
18.73	550	***0.03741***	Saturated vapor
60	600	***0.04139***	***Superheated vapor***

3-28 *Complete the following table for water*:

P, kPa	*T*, °C	*v*, m^3/kg	*h*, kJ/kg	Condition description and quality, if applicable
200	**120.2**	0.8858	2706.3	***x* = 1, Saturated vapor**
270.3	130		1959.3	***x* = 0.650, Two-phase mixture**
201.8	400	1.5358	3277.0	**Superheated vapor**
800	30	**0.001004***	**125.74***	**Compressed liquid**
450	147.90	**-**	**-**	**Insufficient information**

* Approximated as saturated liquid at the given temperature of 30°C

3-29E *Complete the following table for Refrigerant-134a*:

T, °F	P, psia	*h*, Btu / lbm	*x*	Phase description
65.89	80	78	***0.566***	***Saturated mixture***
15	***29.759***	***69.92***	0.6	***Saturated mixture***
10	70	***15.35***	**- - -**	***Compressed liquid***
160	180	129.46	**- - -**	***Superheated vapor***
110	***161.16***	***117.23***	1.0	***Saturated vapor***

3-30 A piston-cylinder device contains R-134a at a specified state. Heat is transferred to R-134a. The final pressure, the volume change of the cylinder, and the enthalpy change are to be determined.

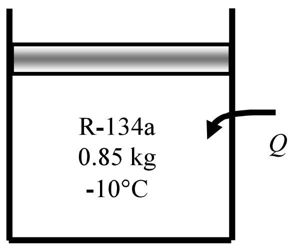
Analysis (a) The final pressure is equal to the initial pressure, which is determined from

$$P_2 = P_1 = P_{atm} + \frac{m_p g}{\pi D^2/4} = 88\text{ kPa} + \frac{(12\text{ kg})(9.81\text{ m/s}^2)}{\pi(0.25\text{ m})^2/4}\left(\frac{1\text{ kN}}{1000\text{ kg.m/s}^2}\right) = \mathbf{90.4\ kPa}$$

(b) The specific volume and enthalpy of R-134a at the initial state of 90.4 kPa and -10°C and at the final state of 90.4 kPa and 15°C are (from EES)

$v_1 = 0.2302\text{ m}^3/\text{kg}$ $\quad h_1 = 247.76\text{ kJ/kg}$

$v_2 = 0.2544\text{ m}^3/\text{kg}$ $\quad h_2 = 268.16\text{ kJ/kg}$



The initial and the final volumes and the volume change are

$$V_1 = mv_1 = (0.85\text{ kg})(0.2302\text{ m}^3/\text{kg}) = 0.1957\text{ m}^3$$

$$V_2 = mv_2 = (0.85\text{ kg})(0.2544\text{ m}^3/\text{kg}) = 0.2162\text{ m}^3$$

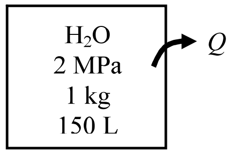
$$\Delta V = 0.2162 - 0.1957 = \mathbf{0.0205\ m^3}$$

(c) The total enthalpy change is determined from

$$\Delta H = m(h_2 - h_1) = (0.85\text{ kg})(268.16 - 247.76)\text{ kJ/kg} = \mathbf{17.4\ kJ/kg}$$

3-32 A rigid container that is filled with water is cooled. The initial temperature and the final pressure are to be determined.

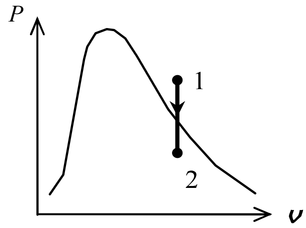
Analysis This is a constant volume process. The specific volume is



$$v_1 = v_2 = \frac{V}{m} = \frac{0.150\ \text{m}^3}{1\ \text{kg}} = 0.150\ \text{m}^3/\text{kg}$$

The initial state is superheated vapor. The temperature is determined to be

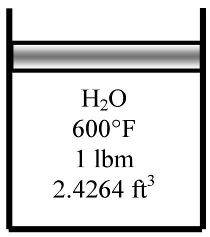
$$\left.\begin{array}{l} P_1 = 2\ \text{MPa} \\ v_1 = 0.150\ \text{m}^3/\text{kg} \end{array}\right\} T_1 = \mathbf{395°C} \quad \text{(Table A-6)}$$



This is a constant volume cooling process ($v = V/m$ = constant). The final state is saturated mixture and thus the pressure is the saturation pressure at the final temperature:

$$\left.\begin{array}{l} T_2 = 40°\text{C} \\ v_2 = v_1 = 0.150\ \text{m}^3/\text{kg} \end{array}\right\} P_2 = P_{\text{sat @ 40°C}} = \mathbf{7.385\ kPa} \quad \text{(Table A-4)}$$

3-38E A piston-cylinder device that is filled with water is cooled. The final pressure and volume of the water are to be determined.

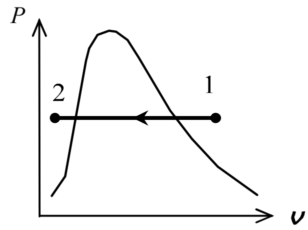


Analysis The initial specific volume is

$$v_1 = \frac{V_1}{m} = \frac{2.4264\ \text{ft}^3}{1\ \text{lbm}} = 2.4264\ \text{ft}^3/\text{lbm}$$

This is a constant-pressure process. The initial state is determined to be superheated vapor and thus the pressure is determined to be

$$\left.\begin{array}{l} T_1 = 600°\text{F} \\ v_1 = 2.4264\ \text{ft}^3/\text{lbm} \end{array}\right\} P_1 = P_2 = \mathbf{250\ psia} \quad \text{(Table A-6E)}$$



The saturation temperature at 250 psia is 400.1°F. Since the final temperature is less than this temperature, the final state is compressed liquid. Using the incompressible liquid approximation,

$$v_2 = v_{f\,@\,200°\text{F}} = 0.01663\ \text{ft}^3/\text{lbm} \quad \text{(Table A-4E)}$$

The final volume is then

$$V_2 = m v_2 = (1\ \text{lbm})(0.01663\ \text{ft}^3/\text{lbm}) = \mathbf{0.01663\ ft^3}$$