

Soal

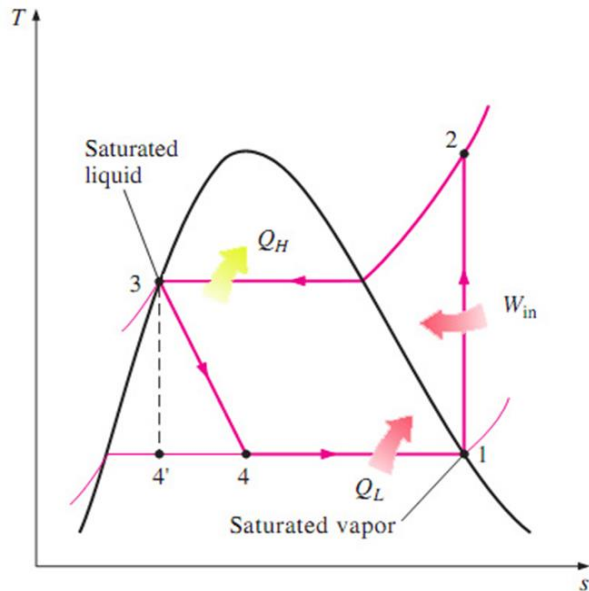
Sebuah refrigerator menggunakan fluida kerja R-134a dan beroperasi dengan siklus kompresi uap ideal antara 0,125 MPa dan 0,9 MPa. Laju aliran massa refrigerant 0,12 kg/s.

- Gambarkan siklusnya dalam diagram T-s.
- Hitung kalor yang diserap dari ruang pendingin
- Hitung daya kompresor
- Hitung kalor yang dibuang ke lingkungan
- Hitung COP – nya.

Penyelesaian:

Diketahui:

P1	0.125	MPa
P2 = P3	0.9	MPa
m	0.12	kg/s



Penyelesaian:

R-134a Property Table

State 1, Saturasi vapor

P1 0.125 MPa
125 kPa

p (kPa)	h_g (kJ/kg)
120	236.97
125	$h1$
140	239.16

$h1$ 237.52 kJ/kg

p (kPa)	s_g (kJ/kg.K)
120	0.94779
125	$s1$
140.0000	0.94456

$s1$ 0.94698 kJ/kg

$h1 = h_g$ 237.52 kJ/kg

$s1 = s_g$ 0.94698 kJ/kg.K

TABLE A-12

Saturated refrigerant-134a—Pressure table

Press., P kPa	Sat. temp., T_{sat} °C	Specific volume, m^3/kg		Internal energy, kJ/kg			Enthalpy, kJ/kg		Entropy, $kJ/kg \cdot K$			
		Sat. liquid, v_f	Sat. vapor, v_g	Sat. liquid, u_f	Evap., u_{fg}	Sat. vapor, u_g	Sat. liquid, h_f	Evap., h_{fg}	Sat. vapor, h_g	Sat. liquid, s_f	Evap., s_{fg}	Sat. vapor, s_g
120	-22.32	0.0007324	0.16212	22.40	195.11	217.51	22.49	214.48	236.97	0.09275	0.85503	0.94779
140	-18.77	0.0007383	0.14014	26.98	192.57	219.54	27.08	212.08	239.16	0.11087	0.83368	0.94456
160	-15.60	0.0007437	0.12348	31.09	190.27	221.35	31.21	209.90	241.11	0.12693	0.81496	0.94190
180	-12.73	0.0007487	0.11041	34.83	188.16	222.99	34.97	207.90	242.86	0.14139	0.79826	0.93965
200	-10.09	0.0007533	0.099867	38.28	186.21	224.48	38.43	206.03	244.46	0.15457	0.78316	0.93773

State 2, Superheated vapor

P2 0.9 Mpa
 s2 0.94698 kJ/kg.K

s_f (kJ/kg.K)	h_f (kJ/kg)
0.9327	274.17
0.94698	h
0.9660	284.77

h2 278.72 kJ/kg

TABLE A-13

Superheated refrigerant-134a (Continued)

T °C	v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/kg · K
$P = 0.90 \text{ MPa } (T_{\text{sat}} = 35.51^\circ\text{C})$				
0.022683	248.85	269.26	0.9169	
0.023375	253.13	274.17	0.9327	
0.024809	262.44	284.77	0.9660	
0.026146	271.60	295.13	0.9976	
0.027413	280.72	305.39	1.0280	
0.028630	289.86	315.63	1.0574	
0.029806	299.06	325.89	1.0860	

State 3, Saturated liquid

P3 0.9 Mpa
900 kPa

h3 = hf 101.61 kJ/kg

TABLE A-12

Saturated refrigerant-134a—Pressure table

Press., P kPa	Sat. temp., T_{sat} °C	Specific volume, m ³ /kg		Internal energy, kJ/kg			Enthalpy, kJ/kg			Entropy, kJ/kg · K		
		Sat. liquid, v_f	Sat. vapor, v_g	Sat. liquid, u_f	Evap., u_{fg}	Sat. vapor, u_g	Sat. liquid, h_f	Evap., h_{fg}	Sat. vapor, h_g	Sat. liquid, s_f	Evap., s_{fg}	Sat. vapor, s_g
900	35.51	0.0008580	0.022683	100.83	148.01	248.85	101.61	167.66	269.26	0.37377	0.54315	0.91692
950	37.48	0.0008641	0.021438	103.69	146.10	249.79	104.51	165.64	270.15	0.38301	0.53323	0.91624
1000	39.37	0.0008700	0.020313	106.45	144.23	250.68	107.32	163.67	270.99	0.39189	0.52368	0.91558
1200	46.29	0.0008934	0.016715	116.70	137.11	253.81	117.77	156.10	273.87	0.42441	0.48863	0.91303
1400	52.40	0.0009166	0.014107	125.94	130.43	256.37	127.22	148.90	276.12	0.45315	0.45734	0.91050

State 4, Throttling process

$h_4 = h_3$

101.61

 kJ/kg

Penyelesaian:

b	Q_L	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>16.309</td></tr></table> kW	16.309
16.309			
c	Q_H	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>21.253</td></tr></table> kW	21.253
21.253			
d	W_{in}	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>4.944</td></tr></table> kW	4.944
4.944			
e	COP	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>3.299</td></tr></table>	3.299
3.299			