

Exercice 1 : (Utiliser le diagramme)

Une chambre froide positive est utilisée pour le stockage de jus de fruit en bouteilles. Dans le circuit frigorifique circule le *R134a*. Ce circuit a les caractéristiques suivantes :

- Température d'évaporation : -10°C
- Température de condensation : 30°C
- Une surchauffe de 5°C est constatée à la sortie de l'évaporateur.
- Sous refroidissement de 10°C au condenseur.

Questions :

- A partir des données fournies, tracer sur un diagramme P-h et le cycle frigorifique théorique de cette installation.
- Calculer le COP de l'installation

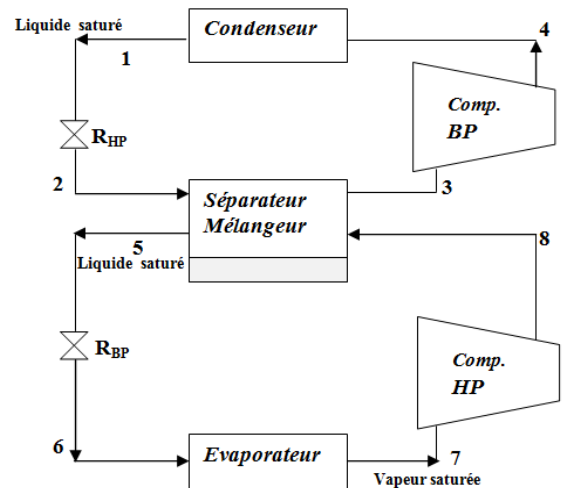
Exercice 2 : (Utiliser les tables)

Pour améliorer la performance d'un système de réfrigération fonctionnant sur une vaste gamme de température, on utilise le principe de la compression étagée. Un système de réfrigération idéal utilisant le *R12* comme fluide frigorigène et fonctionnant sur ce principe est décrit sur la figure ci contre.

On donne :

$$P_1 = 0.9607 \text{ MPa}, \quad P_8 = 0.1509 \text{ MPa}, \quad P_6 = 0.0123 \text{ MPa},$$

$$\dot{m}_1 = 1 \text{ kg} \cdot \text{s}^{-1},$$



Représenter le cycle sur le diagramme enthalpique et calculer le COP de cette installation.

Fréon 12 surchauffé

Temp. °C	0.05 MPa			0.10 MPa			0.15 MPa		
	v m ³ /kg	h kJ/kg	s kJ/kg·K	v m ³ /kg	h kJ/kg	s kJ/kg·K	v m ³ /kg	h kJ/kg	s kJ/kg·K
-20.0	0.341 857	181.042	0.7912	0.167 701	179.861	0.7401			
-10.0	0.356 227	186.757	0.8133	0.175 222	185.707	0.7628	0.114 716	184.619	0.7318
0.0	0.370 508	192.567	0.8350	0.182 647	191.628	0.7849	0.119 866	190.660	0.7543
10.0	0.384 716	198.471	0.8562	0.189 994	197.628	0.8064	0.124 932	196.762	0.7763
20.0	0.398 863	204.469	0.8770	0.197 277	203.707	0.8275	0.129 930	202.927	0.7977
30.0	0.412 959	210.557	0.8974	0.204 506	209.866	0.8482	0.134 873	209.160	0.8186
40.0	0.427 012	216.733	0.9175	0.211 691	216.104	0.8684	0.139 768	215.463	0.8390
50.0	0.441 030	222.997	0.9372	0.218 839	222.421	0.8883	0.144 625	221.835	0.8591
60.0	0.455 017	229.344	0.9565	0.225 955	228.815	0.9078	0.149 450	228.277	0.8787
70.0	0.468 978	235.774	0.9755	0.233 044	235.285	0.9269	0.154 247	234.789	0.8980
80.0	0.482 917	242.282	0.9942	0.240 111	241.829	0.9457	0.159 020	241.371	0.9169
90.0	0.496 838	248.868	1.0126	0.247 159	248.446	0.9642	0.163 774	248.020	0.9354

Fréon 12 saturé

Temp. °C	Pres. abs. MPa P	Volume massique m ³ /kg			Enthalpie kJ/kg			Entropie kJ/kg·K		
		Liquide sat. v_f	Évap. v_{fg}	Vapeur sat. v_g	Liquide sat. h_f	Évap. h_{fg}	Vapeur sat. h_g	Liquide sat. s_f	Évap. s_{fg}	Vapeur sat. s_g
		-90	0.0028	0.000 608	4.414 937	4.415 545	-43.243	189.618	146.375	-0.2084
-85	0.0042	0.000 612	3.036 704	3.037 316	-38.968	187.608	148.640	-0.1854	0.9970	0.8116
-80	0.0062	0.000 617	2.137 728	2.138 345	-34.688	185.612	150.924	-0.1630	0.9609	0.7979
-75	0.0088	0.000 622	1.537 030	1.537 651	-30.401	183.625	153.224	-0.1411	0.9266	0.7855
-70	0.0123	0.000 627	1.126 654	1.127 280	-26.103	181.640	155.536	-0.1197	0.8940	0.7744
-65	0.0168	0.000 632	0.840 534	0.841 166	-21.793	179.651	157.857	-0.0987	0.8630	0.7643
-60	0.0226	0.000 637	0.637 274	0.637 910	-17.469	177.653	160.184	-0.0782	0.8334	0.7552
-55	0.0300	0.000 642	0.490 358	0.490 000	-13.129	175.641	162.512	-0.0581	0.8051	0.7470
-50	0.0391	0.000 648	0.382 457	0.383 105	-8.772	173.611	164.840	-0.0384	0.7779	0.7396
-45	0.0504	0.000 654	0.302 029	0.302 682	-4.396	171.558	167.163	-0.0190	0.7519	0.7329
-40	0.0642	0.000 659	0.241 251	0.241 910	-0.000	169.479	169.479	-0.0000	0.7269	0.7269
-35	0.0807	0.000 666	0.194 732	0.195 398	4.416	167.368	171.784	0.0187	0.7027	0.7214
-30	0.1004	0.000 672	0.158 703	0.159 375	8.854	165.222	174.076	0.0371	0.6795	0.7165
-25	0.1237	0.000 679	0.130 487	0.131 166	13.315	163.037	176.352	0.0552	0.6570	0.7121
-20	0.1509	0.000 685	0.108 162	0.108 847	17.800	160.810	178.610	0.0730	0.6352	0.7082
-15	0.1826	0.000 693	0.090 326	0.091 018	22.312	158.534	180.846	0.0906	0.6141	0.7046
-10	0.2191	0.000 700	0.075 946	0.076 646	26.851	156.207	183.058	0.1079	0.5936	0.7014
-5	0.2610	0.000 708	0.064 255	0.064 963	31.420	153.823	185.243	0.1250	0.5736	0.6986
0	0.3086	0.000 716	0.054 673	0.055 389	36.022	151.376	187.397	0.1418	0.5542	0.6960
5	0.3626	0.000 724	0.046 761	0.047 485	40.659	148.859	189.518	0.1585	0.5351	0.6937
10	0.4233	0.000 733	0.040 180	0.040 914	45.337	146.265	191.602	0.1750	0.5165	0.6916
15	0.4914	0.000 743	0.034 671	0.035 413	50.058	143.586	193.644	0.1914	0.4983	0.6897
20	0.5673	0.000 752	0.030 028	0.030 780	54.828	140.812	195.641	0.2076	0.4803	0.6879
25	0.6516	0.000 763	0.026 091	0.026 854	59.653	137.933	197.586	0.2237	0.4626	0.6863
30	0.7449	0.000 774	0.022 734	0.023 508	64.539	134.936	199.475	0.2397	0.4451	0.6848
35	0.8477	0.000 786	0.019 855	0.020 641	69.494	131.805	201.299	0.2557	0.4277	0.6834
40	0.9607	0.000 798	0.017 373	0.018 171	74.527	128.525	203.051	0.2716	0.4104	0.6820
45	1.0843	0.000 811	0.015 220	0.016 032	79.647	125.074	204.722	0.2875	0.3931	0.6806
50	1.2193	0.000 826	0.013 344	0.014 170	84.868	121.430	206.298	0.3034	0.3758	0.6792
55	1.3663	0.000 841	0.011 701	0.012 542	90.201	117.565	207.766	0.3194	0.3582	0.6777

Vapeur Surchauffée R12

	0.20 MPa			0.25 MPa			0.30 MPa		
	v	h	s	v	h	s	v	h	s
0.0	0.088 608	189.669	0.7320	0.069 752	188.644	0.7139	0.057 150	187.583	0.6984
10.0	0.092 550	195.878	0.7543	0.073 024	194.969	0.7366	0.059 984	194.034	0.7216
20.0	0.096 418	202.135	0.7760	0.076 218	201.322	0.7587	0.062 734	200.490	0.7440
30.0	0.100 228	208.446	0.7972	0.079 350	207.715	0.7801	0.065 418	206.969	0.7658
40.0	0.103 989	214.814	0.8178	0.082 431	214.153	0.8010	0.068 049	213.480	0.7869
50.0	0.107 710	221.243	0.8381	0.085 470	220.642	0.8214	0.070 635	220.030	0.8075
60.0	0.111 397	227.735	0.8578	0.088 474	227.185	0.8413	0.073 185	226.627	0.8276
70.0	0.115 055	234.291	0.8772	0.091 449	233.785	0.8608	0.075 705	233.273	0.8473
80.0	0.118 690	240.910	0.8962	0.094 398	240.443	0.8800	0.078 200	239.971	0.8665
90.0	0.122 304	247.593	0.9149	0.097 327	247.160	0.8987	0.080 673	246.723	0.8853
100.0	0.125 901	254.339	0.9332	0.100 238	253.936	0.9171	0.083 127	253.530	0.9038
110.0	0.129 483	261.147	0.9512	0.103 134	260.770	0.9352	0.085 566	260.391	0.9220

	0.70 MPa			0.80 MPa			0.90 MPa		
40.0	0.026 761	207.580	0.7148	0.022 830	205.924	0.7016	0.019 744	204.170	0.6982
50.0	0.028 100	214.745	0.7373	0.024 068	213.290	0.7248	0.020 912	211.765	0.7131
60.0	0.029 387	221.854	0.7590	0.025 247	220.558	0.7469	0.022 012	219.212	0.7358
70.0	0.030 632	228.931	0.7799	0.026 380	227.766	0.7682	0.023 062	226.564	0.7575
80.0	0.031 843	235.997	0.8002	0.027 477	234.941	0.7888	0.024 072	233.856	0.7785
90.0	0.033 027	243.066	0.8199	0.028 545	242.101	0.8088	0.025 051	241.113	0.7987
100.0	0.034 189	250.146	0.8392	0.029 588	249.260	0.8283	0.026 005	248.355	0.8184
110.0	0.035 332	257.247	0.8579	0.030 612	256.428	0.8472	0.026 937	255.593	0.8376
120.0	0.036 458	264.374	0.8763	0.031 619	263.613	0.8657	0.027 851	262.839	0.8562
130.0	0.037 572	271.531	0.8943	0.032 612	270.820	0.8838	0.028 751	270.100	0.8745
140.0	0.038 673	278.720	0.9119	0.033 592	278.055	0.9016	0.029 639	277.381	0.8923
150.0	0.039 764	285.946	0.9292	0.034 563	285.320	0.9189	0.030 515	284.687	0.9098
	1.00 MPa			1.20 MPa			1.40 MPa		
50.0	0.018 366	210.162	0.7021	0.014 483	206.661	0.6812	0.012 579	211.457	0.6876
60.0	0.019 410	217.810	0.7254	0.015 463	214.805	0.7060	0.013 448	219.822	0.7123
70.0	0.020 397	225.319	0.7476	0.016 368	222.687	0.7293	0.014 247	227.891	0.7355
80.0	0.021 341	232.739	0.7689	0.017 221	230.398	0.7514	0.014 997	235.766	0.7575
90.0	0.022 251	240.101	0.7895	0.018 032	237.995	0.7727	0.015 710	243.512	0.7785
100.0	0.023 133	247.430	0.8094	0.018 812	245.518	0.7931	0.016 393	251.170	0.7988
110.0	0.023 993	254.743	0.8287	0.019 567	252.993	0.8129	0.017 053	258.770	0.8183
120.0	0.024 835	262.053	0.8475	0.020 301	260.441	0.8320	0.017 695	266.334	0.8373
130.0	0.025 661	269.369	0.8659	0.021 018	267.875	0.8507	0.018 321	273.877	0.8558
140.0	0.026 474	276.699	0.8839	0.021 721	275.307	0.8689	0.018 934	281.411	0.8738
150.0	0.027 275	284.047	0.9015	0.022 412	282.745	0.8867	0.019 535	288.946	0.8914
160.0	0.028 068	291.419	0.9187	0.023 093	290.195	0.9041			

