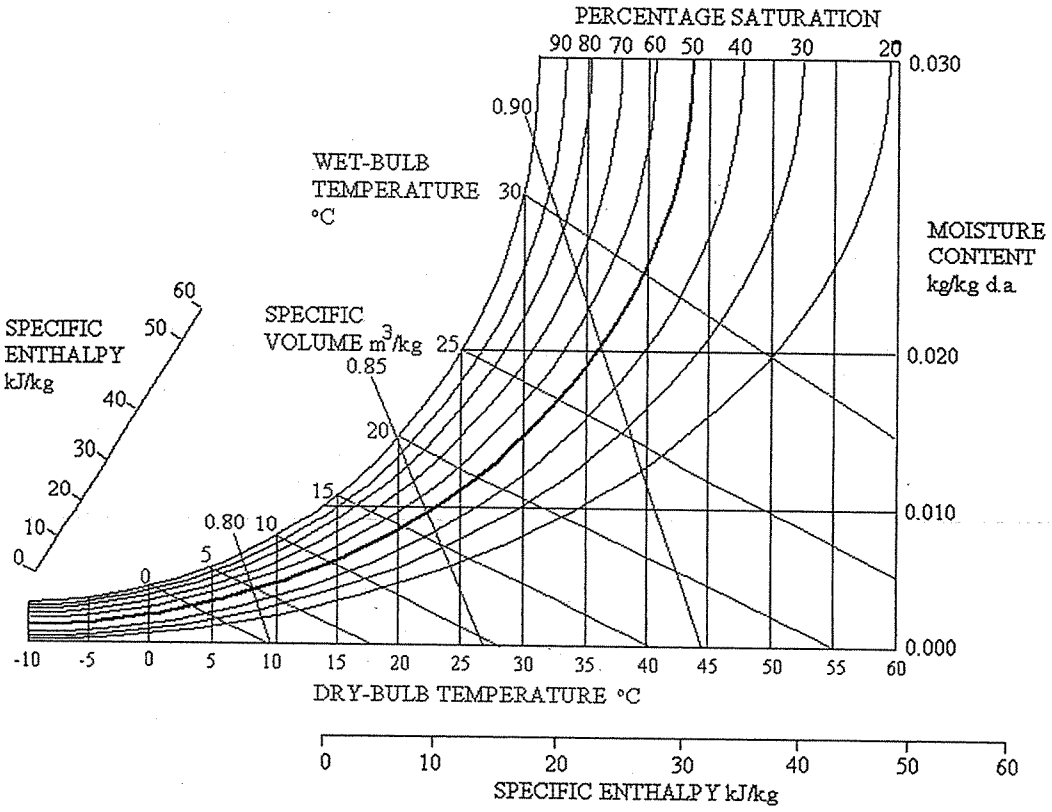
State the conditions you assume, if you consider the given not enough.

1. A plant factory is kept at relative humidity RH=80% and dry bulb temperature= 20 °C. Find out the corresponding (1) wet bulb temperature (2) dew point (3) absolute humidity (4) specific enthalpy under this condition. (24%)



2. (1) An ideal Stirling engine is heated by 100°C hot water and delivered waste heat into an environment of 27°C. The thermal efficiency=? (6%)
   (2) A geothermal heat source is at 300 °C. If an ideal heat engine is developed to convert the geothermal heat source into power at a rate of 10kW and into the surrounding of 150 °C, what is the highest possible power delivered? (6%)
   (3) The ideal heat pump that retrieves heat at a rate of 1kW outdoor and consumes electrical power of 250W. Please find out (a) the heat that the heat pump delivers indoor (b) COP_{HP} (coefficient of performance for heat pumps) (18%)

3. (1) It is requested to cool water of 30 kg from the environment temperature of 30 °C to 20°C. How much energy should be applied or removed? (12%) What is the cooling capacity of the chiller you should use if you want to keep the water at 20 °C in the environment of 30 °C? (14%)
   (2) To increase the boiling point of water to about 110 °C, how heavy (kg) is the lid you should use for a 25 cm (in diameter) pan? (20%)

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Table 3. Compressed Water and Superheated Steam (continued)

0.07 MPa (t_s = 89.932 °C)					0.08 MPa (t_s = 93.486 °C)					0.09 MPa (t_s = 96.687 °C)				
v	ρ	h	s	t, °C	v	ρ	h	s	t, °C	v	ρ	h	s	t, °C
1.035 90	965.34	376.75	1.1921	t_s(L)	1.038 50	962.93	391.71	1.2330	t_s(L)	1.040 91	960.70	405.20	1.2696	t_s(L)
2364.8	0.422 87	2659.4	7.4790	t_s(V)	2087.1	0.479 14	2665.2	7.4339	t_s(V)	1869.4	0.534 94	2670.3	7.3943	t_s(V)
1.000 17	*999.83*	*0.03*	*-0.000 15*	0	*1.000 17*	*999.83*	*0.04*	*-0.000 15*	0	*1.000 16*	*999.84*	*0.05*	*-0.000 15*	0
1.000 05	999.95	21.09	0.076 25	5	1.000 04	999.96	21.10	0.076 25	5	1.000 04	999.96	21.11	0.076 25	5
1.000 31	999.69	42.09	0.151 08	10	1.000 31	999.69	42.10	0.151 08	10	1.000 30	999.70	42.11	0.151 08	10
1.000 91	999.09	63.05	0.224 45	15	1.000 91	999.09	63.06	0.224 45	15	1.000 90	999.10	63.07	0.224 45	15
1.001 81	998.19	83.98	0.296 47	20	1.001 81	998.20	83.99	0.296 47	20	1.001 80	998.20	84.00	0.296 47	20
1.002 98	997.03	104.89	0.367 21	25	1.002 97	997.04	104.90	0.367 21	25	1.002 97	997.04	104.91	0.367 20	25
1.004 38	995.64	125.79	0.436 73	30	1.004 38	995.64	125.80	0.436 73	30	1.004 37	995.64	125.81	0.436 73	30
1.006 02	994.02	146.69	0.505 11	35	1.006 01	994.02	146.70	0.505 10	35	1.006 01	994.03	146.71	0.505 10	35
1.007 86	992.20	167.59	0.572 38	40	1.007 85	992.21	167.60	0.572 37	40	1.007 85	992.21	167.61	0.572 37	40
1.009 90	990.20	188.49	0.638 59	45	1.009 89	990.20	188.50	0.638 58	45	1.009 89	990.21	188.51	0.638 58	45
1.012 12	988.02	209.39	0.703 78	50	1.012 12	988.03	209.40	0.703 78	50	1.012 11	988.03	209.41	0.703 77	50
1.014 53	985.68	230.30	0.768 00	55	1.014 52	985.68	230.31	0.767 99	55	1.014 52	985.69	230.32	0.767 99	55
1.017 11	983.18	251.22	0.831 27	60	1.017 10	983.19	251.23	0.831 26	60	1.017 10	983.19	251.24	0.831 26	60
1.019 85	980.54	272.15	0.893 63	65	1.019 84	980.54	272.16	0.893 62	65	1.019 84	980.55	272.17	0.893 62	65
1.022 76	977.75	293.10	0.955 11	70	1.022 75	977.76	293.11	0.955 10	70	1.022 75	977.76	293.11	0.955 10	70
1.025 82	974.83	314.06	1.0157	75	1.025 82	974.83	314.06	1.0157	75	1.025 81	974.84	314.07	1.0157	75
1.029 04	971.78	335.03	1.0756	80	1.029 04	971.78	335.04	1.0756	80	1.029 03	971.79	335.05	1.0756	80
1.032 42	968.60	356.02	1.1346	85	1.032 42	968.60	356.03	1.1346	85	1.032 41	968.61	356.04	1.1346	85
2365.3	0.422 79	2659.6	7.4794	90	1.035 95	965.30	377.05	1.1929	90	1.035 94	965.30	377.05	1.1929	90
2399.9	0.416 69	2669.7	7.5072	95	2096.3	0.477 03	2668.3	7.4424	95	1.039 63	961.88	398.09	1.2504	95
2434.3	0.410 79	2679.8	7.5344	100	2126.7	0.470 22	2678.5	7.4699	100	1887.4	0.529 84	2677.1	7.4126	100
2468.7	0.405 08	2689.8	7.5611	105	2156.9	0.463 63	2688.6	7.4969	105	1914.4	0.522 36	2687.4	7.4399	105
2502.9	0.399 54	2699.8	7.5874	110	2187.0	0.457 25	2698.7	7.5233	110	1941.3	0.515 11	2697.5	7.4665	110
2537.0	0.394 17	2709.8	7.6132	115	2217.0	0.451 06	2708.7	7.5493	115	1968.1	0.508 10	2707.6	7.4927	115
2571.0	0.388 95	2719.7	7.6385	120	2246.9	0.445 05	2718.7	7.5749	120	1994.8	0.501 29	2717.7	7.5185	120

0.13 MPa (t_s = 107.109 °C)					0.14 MPa (t_s = 109.292 °C)					0.15 MPa (t_s = 111.349 °C)				
v	ρ	h	s	t, °C	v	ρ	h	s	t, °C	v	ρ	h	s	t, °C
1.049 17	953.13	449.19	1.3868	t_s(L)	1.050 99	951.49	458.42	1.4110	t_s(L)	1.052 73	949.92	467.13	1.4337	t_s(L)
1325.3	0.754 53	2686.6	7.2709	t_s(V)	1236.6	0.808 69	2690.0	7.2461	t_s(V)	1159.3	0.862 60	2693.1	7.2230	t_s(V)
1.000 14	*999.86*	*0.09*	*-0.000 15*	0	1.000 14	999.86	0.10	-0.000 15	0	1.000 13	999.87	0.11	-0.000 14	0
1.000 02	999.98	21.15	0.076 25	5	1.000 01	999.99	21.16	0.076 25	5	1.000 01	999.99	21.17	0.076 25	5
1.000 28	999.72	42.15	0.151 07	10	1.000 28	999.72	42.16	0.151 07	10	1.000 27	999.73	42.17	0.151 07	10
1.000 88	999.12	63.10	0.224 44	15	1.000 88	999.12	63.11	0.224 44	15	1.000 88	999.13	63.12	0.224 44	15
1.001 78	998.22	84.03	0.296 46	20	1.001 78	998.22	84.04	0.296 45	20	1.001 77	998.23	84.05	0.296 45	20
1.002 95	997.06	104.95	0.367 19	25	1.002 94	997.07	104.96	0.367 19	25	1.002 94	997.07	104.97	0.367 19	25
1.004 36	995.66	125.85	0.436 72	30	1.004 35	995.67	125.86	0.436 71	30	1.004 35	995.67	125.87	0.436 71	30
1.005 99	994.05	146.75	0.505 09	35	1.005 99	994.05	146.75	0.505 08	35	1.005 98	994.05	146.76	0.505 08	35
1.007 83	992.23	167.64	0.572 35	40	1.007 83	992.23	167.65	0.572 35	40	1.007 82	992.24	167.66	0.572 35	40
1.009 87	990.23	188.54	0.638 56	45	1.009 87	990.23	188.55	0.638 56	45	1.009 86	990.23	188.56	0.638 55	45
1.012 10	988.05	209.44	0.703 75	50	1.012 09	988.05	209.45	0.703 75	50	1.012 09	988.06	209.46	0.703 74	50
1.014 50	985.71	230.35	0.767 97	55	1.014 50	985.71	230.36	0.767 96	55	1.014 49	985.71	230.37	0.767 96	55
1.017 08	983.21	251.27	0.831 23	60	1.017 07	983.21	251.28	0.831 23	60	1.017 07	983.22	251.29	0.831 22	60
1.019 82	980.56	272.20	0.893 59	65	1.019 82	980.57	272.21	0.893 59	65	1.019 81	980.57	272.22	0.893 58	65
1.022 73	977.78	293.15	0.955 07	70	1.022 72	977.78	293.15	0.955 07	70	1.022 72	977.79	293.16	0.955 06	70
1.025 79	974.86	314.10	1.0157	75	1.025 79	974.86	314.11	1.0157	75	1.025 78	974.86	314.12	1.0157	75
1.029 01	971.80	335.08	1.0755	80	1.029 01	971.81	335.09	1.0755	80	1.029 01	971.81	335.09	1.0755	80
1.032 39	968.62	356.07	1.1346	85	1.032 39	968.63	356.08	1.1345	85	1.032 38	968.63	356.09	1.1345	85
1.035 92	965.32	377.09	1.1928	90	1.035 92	965.33	377.09	1.1928	90	1.035 91	965.33	377.10	1.1928	90
1.039 61	961.90	398.12	1.2504	95	1.039 60	961.91	398.13	1.2504	95	1.039 60	961.91	398.14	1.2503	95
1.043 45	958.36	419.19	1.3072	100	1.043 44	958.37	419.20	1.3072	100	1.043 44	958.37	419.20	1.3072	100
1.047 44	954.71	440.28	1.3633	105	1.047 43	954.71	440.29	1.3633	105	1.047 43	954.72	440.30	1.3633	105
1336.4	0.748 30	2692.7	7.2868	110	1239.1	0.807 04	2691.5	7.2500	110	1.051 58	950.95	461.42	1.4188	110
1355.3	0.737 82	2703.2	7.3138	115	1256.8	0.795 65	2702.0	7.2773	115	1171.4	0.853 65	2700.8	7.2430	115
1374.2	0.727 68	2713.5	7.3403	120	1274.5	0.784 65	2712.4	7.3039	120	1188.0	0.841 77	2711.4	7.2699	120

* Property (Unit): v (m^3/kg), ρ (kg/m^3), h (kJ/kg), s (kJ/kg)

試題隨卷繳回