

KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

Mark Scored:

Level : B. Tech.
Year : II

Course : ENVE 204
Semester : I

Exam Roll No. : Time: 30 mins.

F. M. : 20

Registration No.:

Date : MAR 18 2018

SECTION "A"
[20 Q. × 1 = 20 marks]

Select the correct answer from the given choices. Attempt all the questions.

- (1) Convert 100 cal/(g mol)(K) to Btu/(lb mol)(°R) if 1 Btu = 252 cal.
(a) 0.0005 (b) 100.1 (c) 180.2 (d) 6356000
- (2) The reference material or time selected to use in making the calculations in a problem is called:
(a) standard (b) limiting component (c) tie component (d) basis
- (3) Which of the following is correct in SI units?
(a) MN/m² (b) °R/M/s (c) Ghz (d) kJ/sec
- (4) The pressure gauge on a tank of gas reads 62.5 psi and the barometer reads 33.0 in. Hg. What is the absolute pressure in the tank in psia?
(a) 63.0 (b) 63.4 (c) 76.3 (d) 95.5
- (5) When you find the percentages of constituents of a mixture of two liquids, what basis is used by default?
(a) volume (b) mole (c) molecules (d) mass
- (6) Which of the following will you use to express concentration of extremely dilute solutions in water?
(a) gmol/m³ (b) ppb by volume (c) gmol/L (d) ppb by mass
- (7) A reactor is fed with 23 kilograms of N₂ gas and 23 kilograms of H₂ gas to form ammonia. What is the limiting reactant?
(a) NH₃ (b) H₂ (c) O₂ (d) N₂
- (8) What is the amount of product generated per amount of the reactant fed?
(a) limiting reactant (b) conversion (c) selectivity (d) yield
- (9) Excess air is calculated under the condition of:
(a) partial combustion (b) complete combustion
(c) rapid combustion (d) slow combustion
- (10) Limiting reactant is defined as the reactant that is
(a) present in the smallest stoichiometric amount
(b) consumed completely in the reaction
(c) supplied in limited amount
(d) present in the largest stoichiometric amount
- (11) If a system produces two or more outputs of same composition as the input entering the system, the system is called:
(a) mixer (b) splitter (c) distillation (d) separator

- (12) Which of the following is an extensive property?
 (a) density (b) enthalpy (c) specific volume (d) pressure
- (13) From the following processes select the closed system.
 (a) the water cycle of the earth (b) the water cycle of a lake
 (c) the motor engine of car (d) the carbon cycle of soil
- (14) In an experiment, air is saturated with water vapor. What will be the state of the water vapor and the air if the mixture is heated at constant pressure?
 (a) both liquid (b) both gas
 (c) some liquid water, and the rest is gas (d) unknown state
- (15) In a test, 20 kg of propane (C_3H_8) is burned with 400 kg of air to produce 44 kg of CO_2 and 12 kg of CO. What is the required oxygen in kg mol?
 (a) 0.091 (b) 0.45 (c) 2.27 (d) 176.0
- (16) The mass of water vapor per mass of bone-dry air is:
 (a) molal humidity (b) absolute humidity (c) humidity (d) relative humidity
- (17) When will the general energy balance reduce to $Q = -W$ for a closed system?
 (a) $\Delta KE=0$ (b) $\Delta PE=0$ (c) $\Delta U=0$ (d) $\Delta KE=0, \Delta PE=0, \Delta U=0$
- (18) What is the corrected or normalized conditions of temperature, pressure and volume, normalized by their respective critical conditions?
 (a) reduced variables (b) pseudocritical variables
 (c) real critical variables (d) compressibility factor
- (19) In the reaction $2 H(g) \rightarrow H_2(g)$ the heat transfer is $Q = -436$ kJ. What is the standard heat of formation of $H_2(g)$?
 (a) zero (b) -436 kJ (c) 436 kJ (d) 218 kJ
- (20) If a liquid chemical is frozen in a container of fixed volume, the simplified energy balance will be:
 (a) $\Delta U = Q$ (b) $\Delta U = Q + W$
 (c) $\Delta U = Q + W - \Delta H$ (d) $\Delta E = Q + W$

Level : B. Tech.
 Year : II
 Time : 2 hrs. 30 mins.

Course : ENVE 204
 Semester : I
 F. M. : 55

SECTION "B"

Answer ALL the questions. The data or information not given in the questions should be assumed properly.

- (1) Phosphoric acid is a colorless deliquescent acid used in the manufacture of fertilizers and as a flavoring agent in drinks. For a given 10 wt % phosphoric acid (M.W.: 97.97) solution (in water) having specific gravity 1.10, determine:
 - (a) the mol fraction composition of this mixture. [2]
 - (b) the volume (in gallons) of this solution which would contain 1 g mol H₃PO₄. [2]
 - (c) the concentration of phosphoric acid in ppm. [2]

- (2) In a plant, ammonia is produced by the reaction: N₂ + 3 H₂ → 2 NH₃. After feeding 1900 kg/hr of nitrogen and 466 kg/hr of hydrogen, 1384 kg/hr of ammonia is produced.
 - (a) Find the limiting reactant. [3]
 - (b) Find the percentage of the excess reactant. [2]
 - (c) Find the percent conversion based on the limiting reactant. [2]

- (3) Find the molar volume (in cm³/g mol) of propane at 375 K and 21 atm.
 - (a) assuming propane (MW=44.1) to be an ideal gas, [2]
 - (b) using the compressibility factor method. [3]

Use R = 82.057 (cm³)(atm)/(g mol)(K). Take p_c = 42.0 atm and T_c = 369.9 K.

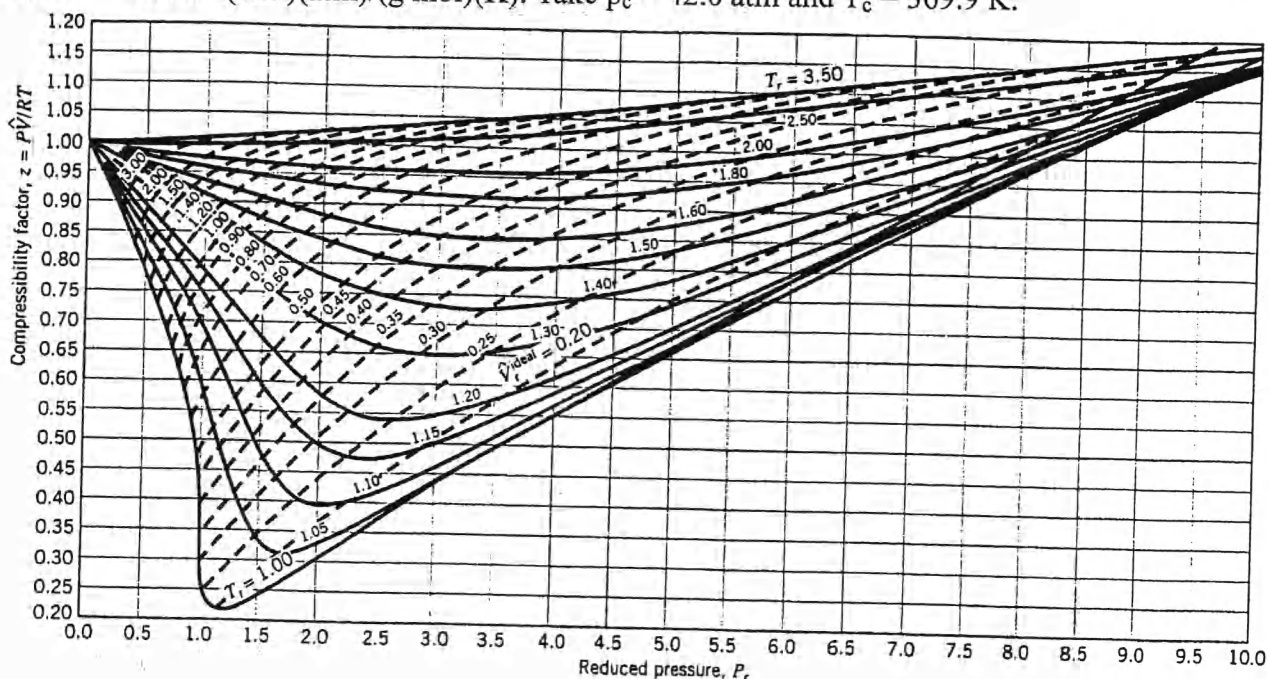


Figure: Generalized compressibility chart.

- (4) An environmental engineer measures the rate at which waste gases are being discharged from a stack. The gases entering the stack contain 3.2% sulfur dioxide (MW=64). Pure SO₂ is fed into the bottom of the stack at a rate of 8.0 kg per minute. The engineer measures the discharge of gases leaving the stack, and finds the concentration of SO₂ to be 5.8%. What is the flow rate of the waste gases coming into the stack in kgmol/minute? Use all the step of mass balance. [6]

- (5) A product contains only two components: X and Y. In a given sample of the product, Y is 75%. It is sent for processing, where 135 kg of Y is removed from the product. It is then found that the product has 25% of Y. Calculate the weight of the original product using the necessary steps of mass balance. [5]
- (6) Moist hydrogen containing 4.8 mole percent water is burnt completely in a furnace with 45% excess air. The reaction is $\text{H}_2 + 0.5 \text{O}_2 \rightarrow \text{H}_2\text{O}$.
 (a) What is the amount of entering air? [3]
 (b) Calculate the Orsat analysis of the resulting flue gas. [6]
- (7) In a city, the percent absolute humidity was found to be 18%. The temperature of air was 35 °C and the total pressure was 102 kPa. Under these conditions, find the following:
 (a) the partial pressure of the water vapor in the air [2]
 (b) the percent relative humidity [1]
 (c) the humidity. [2]
 (d) What is the dew point of the air? [1]
- (8) Steam at the rate of 32 kg per second is used in a turbine rated at 4.5 MW. The inlet conditions for the steam are 2800 kPa and 500 °C. The outlet has saturated vapor at 600 kPa. The inlet steam has velocity of 285 m/s and the outlet has velocity of 33 m/s. Using steam table, find the heat transfer if the turbine is taken as the system. [7]
- (9) Write the simplified energy balance equations for the following conditions:
 (a) closed system [1]
 (b) no accumulation, no mass transfer [1]
 (c) no accumulation, but with mass flow [1]
 (d) no accumulation, no heat transfer and no work done. [1]

MAR 10 2018

CONVERSION FACTORS

VOLUME EQUIVALENTS

	in. ³	ft ³	U.S. gal	liters	m ³
in. ³	1	5.787×10^{-4}	4.329×10^{-3}	1.639×10^{-2}	1.639×10^{-5}
ft ³	1.728×10^3	1	7.481	28.32	2.832×10^{-2}
U.S. gal	2.31×10^2	0.1337	1	3.785	3.785×10^{-3}
liters	61.03	3.531×10^{-3}	0.2642	1	1.000×10^{-3}
m ³	6.102×10^4	35.31	264.2	1000	1

MASS EQUIVALENTS

	avoir oz	pounds	grains	grams
avoir oz	1	6.25×10^{-2}	4.375×10^1	28.35
pounds	16	1	7×10^3	4.536×10^2
grains	2.286×10^{-3}	1.429×10^{-4}	1	6.48×10^{-2}
grams	3.527×10^{-2}	2.20×10^{-3}	15.432	1

LINEAR MEASURE EQUIVALENTS

	meter	inch	foot	mile
meter	1	39.37	3.2808	6.214×10^{-4}
inch	2.54×10^{-2}	1	8.333×10^{-2}	1.58×10^{-5}
foot	0.3048	12	1	1.8939×10^{-4}
mile	1.61×10^3	6.336×10^4	5280	1

HEAT, ENERGY, OR WORK EQUIVALENTS

	(ft)(lb _f)	kWh	(hp)(hr)	Btu	calorie*	joule
(ft)(lb _f)	1	3.766×10^{-7}	5.0505×10^{-7}	1.285×10^{-3}	0.3241	1.356
kWh	2.655×10^6	1	1.341	3.4128×10^3	8.6057×10^5	3.6×10^6
(hp)(hr)	1.98×10^6	0.7455	1	2.545×10^3	6.4162×10^5	2.6845×10^6
Btu	7.7816×10^2	2.930×10^{-4}	3.930×10^{-4}	1	2.52×10^2	1.055×10^3
calorie*	3.086	1.162×10^{-6}	1.558×10^{-6}	3.97×10^{-3}	1	4.184
joule	0.7376	2.773×10^{-7}	3.725×10^{-7}	9.484×10^{-4}	0.2390	1

*The thermochemical calorie = 4.184 J.

PRESSURE EQUIVALENTS

	mm Hg	in. Hg	bar	atm	kPa	psia
mm Hg	1	3.937×10^{-1}	1.333×10^{-1}	1.316×10^{-1}	0.1333	1.934×10^{-2}
in. Hg	25.40	1	3.386×10^1	3.342×10^{-2}	3.386	0.4912
bar	750.06	29.53	1	0.9869	100.0	14.51
atm	760.0	29.92	1.013	1	101.3	14.696
kPa	7.502	0.2954	1.000×10^{-2}	9.872×10^{-3}	1	0.1451
psia	51.71	2.036	6.893×10^{-2}	6.805×10^{-2}	6.893	1

Table 4. Properties of Saturated Water and Steam (Temperature)

Temp. t (°C)	Pressure MPa	Volume, m ³ /kg		Enthalpy, kJ/kg		Entropy, kJ/(kg·K)		Temp. t (°C)
		v _L	v _V	h _L	h _V	s _L	s _V	
0.01	0.0006117	0.0010002	206.00	0.001	2500.9	0.0000	9.1555	0.01
5	0.0008726	0.0010001	147.02	21.019	2510.1	0.0763	9.0249	5
10	0.001228	0.0010003	106.31	42.021	2519.2	0.1511	8.8998	10
15	0.001706	0.0010009	77.881	62.984	2528.4	0.2245	8.7804	15
20	0.002339	0.0010018	57.761	83.920	2537.5	0.2965	8.6661	20
25	0.003170	0.0010030	43.341	104.84	2546.5	0.3673	8.5568	25
30	0.004247	0.0010044	32.882	125.75	2555.6	0.4368	8.4521	30
35	0.005629	0.0010060	25.208	146.64	2564.6	0.5052	8.3518	35
40	0.007384	0.0010079	19.517	167.54	2573.5	0.5724	8.2557	40
45	0.009594	0.0010099	15.253	188.44	2582.5	0.6386	8.1634	45
50	0.012351	0.0010121	12.028	209.34	2591.3	0.7038	8.0749	50
55	0.015761	0.0010145	9.5649	230.24	2600.1	0.7680	7.9899	55
60	0.019946	0.0010171	7.6677	251.15	2608.8	0.8312	7.9082	60
65	0.025041	0.0010199	6.1938	272.08	2617.5	0.8935	7.8296	65
70	0.031201	0.0010228	5.0397	293.02	2626.1	0.9550	7.7540	70
75	0.038595	0.0010258	4.1291	313.97	2634.6	1.0156	7.6812	75
80	0.047415	0.0010290	3.4053	334.95	2643.0	1.0754	7.6110	80
85	0.057867	0.0010324	2.8259	355.95	2651.3	1.1344	7.5434	85
90	0.070182	0.0010359	2.3591	376.97	2659.5	1.1927	7.4781	90
95	0.084609	0.0010396	1.9806	398.02	2667.6	1.2502	7.4150	95
100	0.10142	0.0010435	1.6719	419.10	2675.6	1.3070	7.3541	100
105	0.12090	0.0010474	1.4185	440.21	2683.4	1.3632	7.2951	105
110	0.14338	0.0010516	1.2094	461.36	2691.1	1.4187	7.2380	110
115	0.16918	0.0010559	1.0359	482.55	2698.6	1.4735	7.1827	115
120	0.19867	0.0010603	0.89130	503.78	2705.9	1.5278	7.1291	120
125	0.23222	0.0010649	0.77011	525.06	2713.1	1.5815	7.0770	125
130	0.27026	0.0010697	0.66808	546.39	2720.1	1.6346	7.0264	130
135	0.31320	0.0010747	0.58180	567.77	2726.9	1.6872	6.9772	135
140	0.36150	0.0010798	0.50852	589.20	2733.4	1.7393	6.9293	140
145	0.41563	0.0010850	0.44602	610.69	2739.8	1.7909	6.8826	145
150	0.47610	0.0010905	0.39250	632.25	2745.9	1.8420	6.8370	150
155	0.54342	0.0010962	0.34650	653.88	2751.8	1.8926	6.7926	155
160	0.61814	0.0011020	0.30682	675.57	2757.4	1.9428	6.7491	160
165	0.70082	0.0011080	0.27246	697.35	2762.8	1.9926	6.7066	165
170	0.79205	0.0011143	0.24262	719.21	2767.9	2.0419	6.6649	170
175	0.89245	0.0011207	0.21660	741.15	2772.7	2.0909	6.6241	175
180	1.0026	0.0011274	0.19386	763.19	2777.2	2.1395	6.5841	180
185	1.1233	0.0011343	0.17392	785.32	2781.4	2.1878	6.5447	185
190	1.2550	0.0011414	0.15638	807.57	2785.3	2.2358	6.5060	190
195	1.3986	0.0011488	0.14091	829.92	2788.9	2.2834	6.4679	195
200	1.5547	0.0011565	0.12722	852.39	2792.1	2.3308	6.4303	200
205	1.7240	0.0011645	0.11509	874.99	2794.9	2.3779	6.3932	205
210	1.9074	0.0011727	0.10430	897.73	2797.4	2.4248	6.3565	210
215	2.1055	0.0011813	0.094689	920.61	2799.4	2.4714	6.3202	215
220	2.3193	0.0011902	0.086101	943.64	2801.1	2.5178	6.2842	220

MAR 18 2018

Table 5. Properties of Saturated Water and Steam (Pressure)

Press. MPa	Temp. t (°C)	Volume, m ³ /kg		Enthalpy, kJ/kg		Entropy, kJ/(kg·K)		Press. MPa
		v _L	v _V	h _L	h _V	s _L	s _V	
0.001	6.97	0.0010001	129.18	29.298	2513.7	0.1059	8.9749	0.001
0.002	17.50	0.0010014	66.990	73.435	2532.9	0.2606	8.7227	0.002
0.003	24.08	0.0010028	45.655	100.99	2544.9	0.3543	8.5766	0.003
0.004	28.96	0.0010041	34.792	121.40	2553.7	0.4224	8.4735	0.004
0.005	32.88	0.0010053	28.186	137.77	2560.8	0.4763	8.3939	0.005
0.006	36.16	0.0010064	23.734	151.49	2566.7	0.5209	8.3291	0.006
0.007	39.00	0.0010075	20.525	163.37	2571.8	0.5591	8.2746	0.007
0.008	41.51	0.0010085	18.099	173.85	2576.2	0.5925	8.2274	0.008
0.009	43.76	0.0010094	16.200	183.26	2580.3	0.6223	8.1859	0.009
0.010	45.81	0.0010103	14.671	191.81	2583.9	0.6492	8.1489	0.010
0.012	49.42	0.0010119	12.359	206.91	2590.3	0.6963	8.0850	0.012
0.014	52.55	0.0010133	10.691	219.99	2595.8	0.7366	8.0312	0.014
0.016	55.31	0.0010147	9.4309	231.55	2600.7	0.7720	7.9847	0.016
0.018	57.80	0.0010160	8.4433	241.95	2605.0	0.8035	7.9437	0.018
0.020	60.06	0.0010171	7.6482	251.40	2608.9	0.8320	7.9072	0.020
0.025	64.96	0.0010198	6.2034	271.93	2617.4	0.8931	7.8302	0.025
0.030	69.10	0.0010222	5.2286	289.23	2624.6	0.9439	7.7675	0.030
0.035	72.68	0.0010244	4.5252	304.25	2630.7	0.9876	7.7146	0.035
0.040	75.86	0.0010264	3.9931	317.57	2636.1	1.0259	7.6690	0.040
0.045	78.71	0.0010282	3.5761	329.55	2640.9	1.0601	7.6288	0.045
0.05	81.32	0.0010299	3.2401	340.48	2645.2	1.0910	7.5930	0.05
0.06	85.93	0.0010331	2.7318	359.84	2652.9	1.1452	7.5311	0.06
0.07	89.93	0.0010359	2.3649	376.68	2659.4	1.1919	7.4790	0.07
0.08	93.49	0.0010385	2.0872	391.64	2665.2	1.2328	7.4339	0.08
0.09	96.69	0.0010409	1.8695	405.13	2670.3	1.2694	7.3942	0.09
0.10	99.61	0.0010431	1.6940	417.44	2674.9	1.3026	7.3588	0.10
0.12	104.78	0.0010473	1.4284	439.30	2683.1	1.3608	7.2976	0.12
0.14	109.29	0.0010510	1.2366	458.37	2690.0	1.4109	7.2460	0.14
0.16	113.30	0.0010544	1.0914	475.34	2696.0	1.4549	7.2014	0.16
0.18	116.91	0.0010576	0.97753	490.67	2701.4	1.4944	7.1620	0.18
0.20	120.21	0.0010605	0.88574	504.68	2706.2	1.5301	7.1269	0.20
0.25	127.41	0.0010672	0.71870	535.35	2716.5	1.6072	7.0524	0.25
0.30	133.53	0.0010732	0.60579	561.46	2724.9	1.6718	6.9916	0.30
0.35	138.86	0.0010786	0.52420	584.31	2732.0	1.7275	6.9401	0.35
0.40	143.61	0.0010836	0.46239	604.72	2738.1	1.7766	6.8954	0.40
0.45	147.91	0.0010882	0.41390	623.22	2743.4	1.8206	6.8560	0.45
0.50	151.84	0.0010926	0.37480	640.19	2748.1	1.8606	6.8206	0.50
0.55	155.46	0.0010967	0.34259	655.88	2752.3	1.8972	6.7885	0.55
0.60	158.83	0.0011006	0.31558	670.50	2756.1	1.9311	6.7592	0.60
0.65	161.99	0.0011044	0.29258	684.22	2759.6	1.9626	6.7321	0.65
0.70	164.95	0.0011080	0.27276	697.14	2762.7	1.9921	6.7070	0.70
0.80	170.41	0.0011148	0.24033	721.02	2768.3	2.0460	6.6615	0.80
0.90	175.36	0.0011212	0.21487	742.72	2773.0	2.0944	6.6212	0.90
1.00	179.89	0.0011272	0.19435	762.68	2777.1	2.1384	6.5850	1.00
1.10	184.07	0.0011330	0.17744	781.20	2780.7	2.1789	6.5520	1.10

Table 6. Superheated Steam – SI Units

Pressure		Temperature—Degrees Celsius												
MPa	(Sat. T)	225	250	300	350	400	450	500	550	600	650	700	750	800
2.2 (217.26)	v	0.0931	0.1004	0.1134	0.1255	0.1371	0.1484	0.1595	0.1704	0.1813	0.1921	0.2028	0.2136	0.2242
	h	2824.5	2894.5	3018.5	3133.4	3244.9	3355.4	3465.9	3577.0	3689.1	3802.4	3917.1	4033.1	4150.7
	s	6.3531	6.4903	6.7168	6.9091	7.0813	7.2396	7.3873	7.5266	7.6588	7.7850	7.9059	8.0222	8.1344
2.4 (221.80)	v	0.0842	0.0911	0.1034	0.1146	0.1253	0.1357	0.1459	0.1560	0.1660	0.1760	0.1858	0.1957	0.2055
	h	2812.1	2885.5	3012.6	3129.1	3241.6	3352.7	3463.7	3575.2	3687.6	3801.1	3915.9	4032.1	4149.8
	s	6.2926	6.4365	6.6588	6.8638	7.0375	7.1967	7.3450	7.4848	7.6173	7.7437	7.8648	7.9813	8.0936
2.6 (226.05)	v	0.0833	0.0948	0.1053	0.1153	0.1250	0.1345	0.1439	0.1531	0.1623	0.1714	0.1805	0.1896	0.1986
	h	2876.2	3006.6	3124.8	3238.3	3350.0	3461.5	3573.3	3686.0	3799.7	3914.7	4031.1	4148.9	4267.9
	s	6.3854	6.6238	6.8216	6.9968	7.1570	7.3060	7.4461	7.5790	7.7056	7.8269	7.9435	8.0559	8.1644
2.8 (230.06)	v	0.0765	0.0875	0.0974	0.1068	0.1158	0.1247	0.1334	0.1420	0.1506	0.1591	0.1676	0.1760	0.1844
	h	2866.5	3000.5	3120.5	3234.9	3347.4	3459.3	3571.5	3684.4	3798.4	3913.5	4030.0	4148.0	4266.9
	s	6.3365	6.5814	6.7821	6.9589	7.1200	7.2696	7.4102	7.5434	7.6703	7.7918	7.9085	8.0210	8.1296
3.0 (233.86)	v	0.0706	0.0812	0.0906	0.0994	0.1079	0.1162	0.1244	0.1324	0.1405	0.1484	0.1563	0.1642	0.1721
	h	2856.5	2994.3	3116.1	3231.6	3344.7	3457.0	3569.6	3682.8	3797.0	3912.3	4029.0	4147.0	4265.9
	s	6.2893	6.5412	6.7449	6.9233	7.0853	7.2356	7.3767	7.5102	7.6373	7.7590	7.8759	7.9885	8.0971
3.2 (237.46)	v	0.0655	0.0756	0.0845	0.0929	0.1009	0.1088	0.1165	0.1240	0.1316	0.1390	0.1465	0.1539	0.1613
	h	2846.2	2988.0	3111.6	3228.2	3341.9	3454.8	3567.7	3681.2	3795.6	3911.2	4028.0	4146.1	4264.9
	s	6.2434	6.5029	6.7097	6.8897	7.0527	7.2036	7.3451	7.4790	7.6064	7.7283	7.8453	7.9581	8.0667
3.4 (240.90)	v	0.0609	0.0707	0.0792	0.0872	0.0948	0.1022	0.1095	0.1166	0.1237	0.1308	0.1378	0.1448	0.1518
	h	2835.3	2981.6	3107.1	3224.8	3339.2	3452.6	3565.9	3679.3	3794.3	3910.0	4026.9	4145.2	4263.9
	s	6.1986	6.4662	6.6762	6.8579	7.0219	7.1735	7.3154	7.4496	7.5773	7.6993	7.8165	7.9294	8.0380
3.6 (244.19)	v	0.0568	0.0663	0.0745	0.0821	0.0893	0.0964	0.1033	0.1101	0.1168	0.1234	0.1301	0.1367	0.1433
	h	2824.0	2975.1	3102.6	3221.3	3336.5	3450.3	3564.0	3678.0	3792.9	3908.8	4025.9	4144.3	4262.9
	s	6.1545	6.4309	6.6443	6.8276	6.9927	7.1449	7.2873	7.4219	7.5498	7.6720	7.7893	7.9023	8.0110
3.8 (247.33)	v	0.0531	0.0624	0.0703	0.0775	0.0844	0.0911	0.0977	0.1042	0.1105	0.1169	0.1232	0.1294	0.1356
	h	2812.1	2968.4	3098.0	3217.9	3333.7	3448.1	3562.1	3676.4	3791.5	3907.6	4024.8	4143.4	4261.9
	s	6.1107	6.3968	6.6137	6.7988	6.9649	7.1178	7.2607	7.3955	7.5237	7.6461	7.7636	7.8767	7.9854
4.0 (250.36)	v	0.0589	0.0665	0.0734	0.0800	0.0864	0.0927	0.0989	0.1049	0.1110	0.1170	0.1229	0.1288	0.1346
	h	2961.7	3093.3	3214.4	3331.0	3445.8	3560.2	3674.8	3790.2	3906.4	4023.8	4142.5	4261.5	4380.5
	s	6.3638	6.5843	6.7712	6.9383	7.0919	7.2353	7.3704	7.4989	7.6215	7.7391	7.8523	7.9610	8.0652
4.5 (257.44)	v	0.0514	0.0584	0.0648	0.0708	0.0765	0.0821	0.0877	0.0931	0.0985	0.1038	0.1092	0.1145	0.1198
	h	2944.1	3081.5	3205.6	3324.0	3440.2	3555.5	3670.8	3786.7	3903.4	4021.2	4140.2	4259.2	4378.2
	s	6.2852	6.5153	6.7069	6.8767	7.0320	7.1765	7.3126	7.4416	7.5647	7.6827	7.7962	7.9052	8.0097
5.0 (263.94)	v	0.0453	0.0520	0.0578	0.0633	0.0686	0.0737	0.0787	0.0836	0.0885	0.0933	0.0982	0.1030	0.1078
	h	2925.6	3069.3	3196.6	3317.0	3434.5	3550.8	3666.8	3783.3	3900.5	4018.6	4137.9	4257.9	4377.9
	s	6.2109	6.4515	6.6481	6.8208	6.9778	7.1235	7.2604	7.3901	7.5137	7.6321	7.7459	7.8552	7.9599
5.5 (269.97)	v	0.0404	0.0467	0.0522	0.0572	0.0621	0.0668	0.0714	0.0759	0.0803	0.0848	0.0891	0.0935	0.0978
	h	2906.2	3056.8	3187.5	3309.9	3428.7	3546.0	3662.8	3779.8	3897.5	4016.0	4135.6	4255.9	4376.1
	s	6.1396	6.3919	6.5938	6.7693	6.9282	7.0751	7.2129	7.3432	7.4673	7.5861	7.7002	7.8097	7.9146
6.0 (275.59)	v	0.0362	0.0423	0.0474	0.0522	0.0567	0.0610	0.0653	0.0694	0.0735	0.0776	0.0816	0.0856	0.0896
	h	2885.5	3043.9	3178.2	3302.8	3422.9	3541.2	3658.8	3776.4	3894.5	4013.4	4133.3	4253.9	4374.5
	s	6.0702	6.3356	6.5431	6.7216	6.8824	7.0306	7.1692	7.3002	7.4248	7.5439	7.6583	7.7681	7.8734
6.5 (280.86)	v	0.0326	0.0385	0.0434	0.0479	0.0521	0.0561	0.0601	0.0640	0.0678	0.0716	0.0753	0.0791	0.0828
	h	2863.5	3030.6	3168.7	3295.5	3417.1	3536.4	3654.7	3772.9	3891.5	4010.7	4131.0	4251.9	4372.9
	s	6.0018	6.2819	6.4953	6.6771	6.8397	6.9892	7.1287	7.2603	7.3854	7.5050	7.6196	7.7294	7.8346

v = specific volume, m³/kg h = enthalpy, kJ/kg s = entropy, kJ/(kg•K)