

TABLE 2.15A Solar Position and Intensity and Solar Heat Gain Factors for 40° North Latitude

TABLE 2.15A Solar Position and Intensity and Solar Heat Gain Factors for 40° North Latitude															
Solar Date	Solar Time, A.M.	Solar Position		Direct Normal Irradiation, Btuh/ft <sup>2</sup>	Solar Heat Gain Factors, Btuh/ft <sup>2</sup>										Solar Time, P.M.
		Altitude	Azimuth		N	NE	E	SE	S	SW	W	NW	Horizontal		
Jan 21	8	8.1	55.3	141	5	17	111	133	75	5	5	5	13	4	
	9	16.8	44.0	238	11	12	154	224	160	13	11	11	54	3	
	10	23.8	30.9	274	16	16	123	241	213	51	16	16	96	2	
	11	28.4	16.0	289	18	18	61	222	244	118	18	18	123	1	
	12	30.0	0.0	293	19	19	20	179	254	179	20	19	133	12	
Half-Day Totals					59	68	449	903	815	271	59	59	353		
Feb 21	7	4.3	72.1	55	1	22	50	47	13	1	1	1	3	5	
	8	14.8	61.6	219	10	50	183	199	94	10	10	10	43	4	
	9	24.3	49.7	271	16	22	186	245	157	17	16	16	98	3	
	10	32.1	35.4	293	20	21	142	247	203	38	20	20	143	2	
	11	37.3	18.6	303	23	23	71	219	231	103	23	23	171	1	
12	39.2	0.0	306	24	24	25	170	241	170	25	24	180	12		
Half-Day Totals					81	144	634	1035	813	250	81	81	546		
Mar 21	7	11.4	80.2	171	8	93	163	135	21	8	8	8	26	5	
	8	22.5	69.6	250	15	91	218	211	73	15	15	15	85	4	
	9	32.8	57.3	281	21	46	203	236	128	21	21	21	143	3	
	10	41.6	41.9	297	25	26	153	229	171	28	25	25	186	2	
	11	47.7	22.6	304	28	28	78	198	197	77	28	28	213	1	
12	50.0	0.0	306	28	28	30	145	206	15	30	28	223	12		
Half-Day Totals					112	310	849	1100	692	218	112	112	764		
Apr 21	6	7.4	98.9	89	11	72	88	52	5	4	4	4	11	6	
	7	18.9	89.5	207	16	141	201	143	16	14	14	14	61	5	
	8	30.3	79.3	253	22	128	225	189	41	21	21	21	124	4	
	9	41.3	67.2	275	26	80	203	204	83	26	26	26	177	3	
	10	51.2	51.4	286	30	37	153	194	121	32	30	30	218	2	
11	58.7	29.2	292	33	34	81	161	146	52	33	33	244	1		
12	61.6	0.0	294	33	33	36	108	155	108	36	33	253	12		
Half-Day Totals					153	509	969	1003	489	196	146	145	962		
May 21	5	1.9	114.7	1	0	0	0	0	0	0	0	0	0	7	
	6	12.7	105.6	143	35	128	141	71	10	10	10	10	30	6	
	7	24.0	96.6	216	28	165	209	131	20	18	18	18	87	5	
	8	35.4	87.2	249	27	149	220	164	29	25	25	25	146	4	
	9	46.8	76.0	267	31	105	197	175	53	30	30	30	196	3	
10	57.5	60.9	277	34	54	148	163	83	35	34	34	234	2		
11	66.2	37.1	282	36	38	81	130	105	42	36	36	258	1		
12	70.0	0.0	284	37	37	40	82	112	82	40	37	265	12		
Half-Day Totals					203	643	1002	874	356	194	171	170	1083		
					N	NW	W	SW	S	SE	E	NE	Horizontal	↑ ↓ P.M.	

**TABLE 2.15A (continued)** Solar Position and Intensity and Solar Heat Gain Factors for 40° North Latitude

TABLE 2.15A Continued														
Date	Solar Time, A.M.	Solar Position		Direct Normal Irradiation, Btu/h/ft <sup>2</sup>	Solar Heat Gain Factors, Btu/h/ft <sup>2</sup>								Solar Time, P.M.	
		Altitude	Azimuth		N	NE	E	SE	S	SW	W	NW		Horizontal
June 21	5	4.2	117.3	21	10	21	20	6	1	1	1	1	2	7
	6	14.8	108.4	154	47	142	151	70	12	12	12	12	39	6
	7	26.0	99.7	215	37	172	206	122	21	20	20	20	97	5
	8	37.4	90.7	246	29	156	215	152	29	26	26	26	153	4
	9	48.8	80.2	262	33	113	192	161	45	31	31	31	201	3
	10	59.8	65.8	272	35	62	145	148	69	36	35	35	237	2
	11	69.2	41.9	276	37	40	80	116	88	41	37	37	260	1
	12	73.5	0.0	278	38	38	41	71	95	71	41	38	267	12
Half-Day Totals					242	714	1019	810	311	197	181	180	1121	
July 21	5	2.3	115.2	2	0	2	1	0	0	0	0	0	0	7
	6	13.1	106.1	137	37	125	137	68	10	10	10	10	31	6
	7	24.3	97.2	208	30	163	204	127	20	19	19	19	88	5
	8	35.8	87.8	241	28	148	216	160	29	26	26	26	145	4
	9	47.2	76.7	259	32	106	194	170	52	31	31	31	194	3
	10	57.9	61.7	269	35	56	146	159	80	36	35	35	231	2
	11	66.7	37.9	274	37	39	81	127	102	42	37	37	255	1
	12	70.6	0.0	276	38	38	41	80	109	80	41	38	282	12
Half-Day Totals					211	645	986	850	347	197	177	176	1074	
Aug 21	6	7.9	99.5	80	12	67	82	48	5	5	5	5	11	6
	7	19.3	90.0	191	17	135	191	135	17	15	15	15	62	5
	8	30.7	79.9	236	23	126	216	180	40	22	22	22	122	4
	9	41.8	67.9	259	28	82	197	196	79	28	28	28	174	3
	10	51.7	52.1	271	32	40	149	187	116	34	32	32	213	2
	11	50.3	29.7	277	34	35	81	156	140	52	34	34	238	1
		12	62.3	0.0	279	35	35	38	105	149	105	38	35	247
Half-Day Totals					161	503	936	961	471	202	154	153	945	
Sep 21	7	11.4	80.2	149	8	84	146	121	21	8	8	8	25	5
	8	22.5	69.6	230	16	86	205	199	71	16	16	16	82	4
	9	32.8	57.3	263	22	47	195	226	124	23	22	22	138	3
	10	41.6	41.9	279	26	28	148	221	165	30	26	26	180	2
		12	47.7	22.6	287	29	29	77	192	191	77	29	29	206
Half-Day Totals					116	300	803	1045	672	221	117	116	738	
Oct 21	7	4.5	72.3	48	1	20	45	41	12	1	1	1	3	5
	8	15.0	61.9	203	10	49	173	187	88	10	10	10	43	4
	9	24.5	49.8	257	17	23	180	235	151	18	17	17	96	3
	10	32.4	35.6	280	21	22	139	238	196	38	21	21	140	2
		11	37.6	18.7	290	23	23	70	212	224	100	23	23	167
	12	39.5	0.0	293	24	24	26	165	234	165	26	24	177	12
Half-Day Totals					83	143	610	989	783	245	84	83	535	
					N	NW	W	SW	S	SE	E	NE	Horizontal	↑ P.M.

**TABLE 2.15A (continued)** Solar Position and Intensity and Solar Heat Gain Factors for 40° North Latitude

TABLE 2.15A Continued														
Date	Solar Time, A.M.	Solar Position		Direct Normal Irradiation, Btuh/ft <sup>2</sup>	Solar Heat Gain Factors, Btuh/ft <sup>2</sup>									Solar Time, P.M.
		Altitude	Azimuth		N	NE	E	SE	S	SW	W	NW	Horizontal	
Nov 21	8	0.2	55.4	136	5	17	107	128	72	5	5	5	14	4
	9	17.0	44.1	232	12	13	151	219	156	13	12	12	54	3
	10	24.0	31.0	267	16	16	122	237	209	50	16	16	96	2
	11	28.6	16.1	283	19	19	61	218	240	116	19	19	123	1
	12	30.2	0.0	287	19	19	21	176	250	176	21	19	132	12
Half-Day Totals					61	71	442	884	798	267	62	61	353	
Dec 21	8	5.5	53.0	88	2	7	67	83	49	3	2	2	6	4
	9	14.0	41.9	217	9	10	135	205	151	12	9	9	39	3
	10	20.7	29.4	261	14	14	113	232	210	55	14	14	77	2
	11	25.0	15.2	279	16	16	56	217	242	120	16	16	103	1
	12	26.6	0.0	284	17	17	18	177	253	177	18	17	113	12
Half-Day Totals					49	54	380	831	781	273	50	49	282	
					N	NW	W	SW	S	SE	E	NE	Horizontal	← P.M.

Data shown in table is for 40° north latitude. Solar intensity is given in the Direct Normal column. Solar heat gain factor is the peak heat gain of the hour calculated with clearness factor = 1.0 and ground reflectance = 0.20. Half-day total is the average heat gain based on Simpson's rule on 10-minute interval. See ASHRAE *Handbook of Fundamentals* for data of other latitudes (16, 24, 32, 48, 56, and 64).  
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