

## Energy Efficient Buildings Windows and Solar Gain Homework

1) (U, G) Calculate the net heat flux (Btu/hrft<sup>2</sup>) into a building for the windows, ambient temperature and solar radiation data in the table below. Assume indoor air temperature is 70 F and SHGCAvg = 0.9 x SHGC. Your solution should be a spreadsheet that looks like the one shown below with all the fields filled in:

Problem 1											
U	SHGC	SHGCAvg	Toa	Sol-E	Sol-S	Sol-W	Sol-N	Qnetin-E	Qnetin-S	Qnetin-W	Qnetin-N
(Btu/hrft <sup>2</sup> F)			(F)	(Btu/ft <sup>2</sup> dy)	(Btu/ft <sup>2</sup> dy)	(Btu/ft <sup>2</sup> dy)	(Btu/ft <sup>2</sup> dy)	(Btu/hrft <sup>2</sup> )	(Btu/hrft <sup>2</sup> )	(Btu/hrft <sup>2</sup> )	(Btu/hrft <sup>2</sup> )
Non-coated											
1.11	0.85	0.765	33.6	446	811	427	278	-26.188	-14.553	-26.793	-31.543
0.49	0.75	0.675	33.6	446	811	427	278	-5.292	4.973	-5.827	-10.017
0.46	0.75	0.675	33.6	446	811	427	278	-4.200	6.065	-4.735	-8.925
0.32	0.68	0.612	33.6	446	811	427	278	-0.275	9.033	-0.759	-4.559
Selective											
0.32	0.41	0.369	33.6	446	811	427	278	-4.791	0.821	-5.083	-7.374
0.27	0.32	0.288	33.6	446	811	427	278	-4.476	-0.096	-4.704	-6.492
0.24	0.41	0.369	33.6	446	811	427	278	-1.879	3.733	-2.171	-4.462
0.24	0.41	0.369	33.6	446	811	427	278	-1.879	3.733	-2.171	-4.462
0.18	0.37	0.333	33.6	446	811	427	278	-0.364	4.701	-0.627	-2.695
0.14	0.34	0.306	33.6	446	811	427	278	0.591	5.244	0.348	-1.552
0.12	0.34	0.306	33.6	446	811	427	278	1.319	5.972	1.076	-0.823
0.08	0.24	0.216	33.6	446	811	427	278	1.102	4.387	0.931	-0.410
Non-selective											
0.28	0.5	0.45	33.6	446	811	427	278	-1.830	5.014	-2.186	-4.980
0.35	0.65	0.585	33.6	446	811	427	278	-1.869	7.028	-2.332	-5.964
0.37	0.73	0.657	33.6	446	811	427	278	-1.259	8.733	-1.779	-5.858
0.26	0.58	0.522	33.6	446	811	427	278	0.236	8.175	-0.177	-3.418
0.21	0.5	0.45	33.6	446	811	427	278	0.719	7.562	0.362	-2.432
0.18	0.47	0.423	33.6	446	811	427	278	1.309	7.742	0.974	-1.652
0.3	0.74	0.666	33.6	446	811	427	278	1.457	11.585	0.929	-3.206
0.27	0.69	0.621	33.6	446	811	427	278	1.712	11.157	1.221	-2.635
0.28	0.71	0.639	33.6	446	811	427	278	1.683	11.401	1.177	-2.790
0.1	0.41	0.369	33.6	446	811	427	278	3.217	8.829	2.925	0.634
0.2	0.62	0.558	33.6	446	811	427	278	3.090	11.576	2.648	-0.817
0.21	0.65	0.585	33.6	446	811	427	278	3.227	12.124	2.764	-0.868
0.14	0.55	0.495	33.6	446	811	427	278	4.103	11.631	3.711	0.638
0.17	0.61	0.549	33.6	446	811	427	278	4.014	12.364	3.580	0.171

\*Solar radiation and ambient temperature data are derived from TMY2 data for Dayton, Ohio over the period November to March by WeaTRAN.

2) (U, G) Repeat problem 1, but modify U to account for closing R=2 (hrft<sup>2</sup>/Btu) shades for 12 hours each night.

Problem 2											
Unew	SHGC	SHGCAvg	Toa	Sol-E	Sol-S	Sol-W	Sol-N	Qnetin-E	Qnetin-S	Qnetin-W	Qnetin-N
(Btu/hrft <sup>2</sup> F)			(F)	(Btu/ft <sup>2</sup> dy)	(Btu/ft <sup>2</sup> dy)	(Btu/ft <sup>2</sup> dy)	(Btu/ft <sup>2</sup> dy)	(Btu/hrft <sup>2</sup> )	(Btu/hrft <sup>2</sup> )	(Btu/hrft <sup>2</sup> )	(Btu/hrft <sup>2</sup> )
Non-coated											
0.73	0.85	0.765	33.6	446	811	427	278	-12.260	-0.625	-12.865	-17.615
0.37	0.75	0.675	33.6	446	811	427	278	-0.878	9.387	-1.413	-5.603
0.35	0.75	0.675	33.6	446	811	427	278	-0.189	10.077	-0.723	-4.914
0.26	0.68	0.612	33.6	446	811	427	278	1.998	11.305	1.513	-2.286
Selective											
0.26	0.41	0.369	33.6	446	811	427	278	-2.518	3.094	-2.810	-5.101
0.22	0.32	0.288	33.6	446	811	427	278	-2.753	1.627	-2.981	-4.769
0.20	0.41	0.369	33.6	446	811	427	278	-0.462	5.150	-0.754	-3.045
0.20	0.41	0.369	33.6	446	811	427	278	-0.462	5.150	-0.754	-3.045
0.16	0.37	0.333	33.6	446	811	427	278	0.503	5.568	0.240	-1.828
0.12	0.34	0.306	33.6	446	811	427	278	1.148	5.802	0.906	-0.994
0.11	0.34	0.306	33.6	446	811	427	278	1.741	6.395	1.499	-0.401
0.07	0.24	0.216	33.6	446	811	427	278	1.303	4.588	1.132	-0.209
Non-selective											
0.23	0.5	0.45	33.6	446	811	427	278	0.000	6.844	-0.356	-3.150
0.28	0.65	0.585	33.6	446	811	427	278	0.754	9.651	0.291	-3.341
0.29	0.73	0.657	33.6	446	811	427	278	1.605	11.597	1.085	-2.994
0.22	0.58	0.522	33.6	446	811	427	278	1.855	9.794	1.442	-1.799
0.18	0.5	0.45	33.6	446	811	427	278	1.849	8.693	1.493	-1.301
0.16	0.47	0.423	33.6	446	811	427	278	2.176	8.609	1.841	-0.785
0.24	0.74	0.666	33.6	446	811	427	278	3.504	13.633	2.977	-1.158
0.22	0.69	0.621	33.6	446	811	427	278	3.435	12.880	2.944	-0.912
0.23	0.71	0.639	33.6	446	811	427	278	3.512	13.230	3.006	-0.961
0.09	0.41	0.369	33.6	446	811	427	278	3.521	9.132	3.228	0.938
0.17	0.62	0.558	33.6	446	811	427	278	4.130	12.616	3.688	0.224
0.18	0.65	0.585	33.6	446	811	427	278	4.358	13.255	3.895	0.263
0.12	0.55	0.495	33.6	446	811	427	278	4.660	12.188	4.268	1.195
0.15	0.61	0.549	33.6	446	811	427	278	4.799	13.149	4.365	0.956

3) (U, G) Comment on the statement: "Windows are net heat losers." and discuss the results.

No, I disagree this statement. Because  $Q_{netin} > 0$ , this mean: Although we lose some heat, we can gain heat from sun through the windows. Overall, the Q is increase.