

Undergrads and Grads do all problems

Attached is a table of various colorimetric functions that you will need for this homework. There is also an electronic copy on my web site that you can download. The columns of the data are: the wavelength in 10 nm steps, a spectral reflectance for a white patch, a spectral reflectance for an unknown color patch, the spectral distribution for Illuminant C, and the CIE 1931 2 degree color matching functions $\bar{x}(\lambda)$, $\bar{y}(\lambda)$, and $\bar{z}(\lambda)$ (labeled xbar, ybar and zbar). In the notes, I have labeled these x' , y' and z' , but the bar notation is more universal.

1. Plot the x,y chromaticity coordinates for spectrally pure colors (i.e. $P(\lambda) = \delta(\lambda - \lambda_o)$ where λ_o ranges from 380 nm to 780 nm in 10 nm steps).
2. Calculate the Tristimulus values X, Y and Z and X_w , Y_w and Z_w for the color patch and the white patch respectively. Assume that Illuminant C is used to illuminate these patches for this calculation.
3. Calculate the x,y chromaticity coordinates for the color patch and the white patch and plot them on the plot from question 1.
4. What are the approximate values of the Dominant Wavelength, the Complementary Color and the Excitation Purity assuming the white patch represents the White Point of the system?
5. Calculate L^* , a^* and b^* in the CIELAB color space for the color patch and the white patch. Again, assume the white patch is the white point for the system.
6. Calculate ΔE between the white patch and the color patch.

wavelength	White	Color	Illum C	xbar	ybar	zbar
380	0.153	0.118	31.3	0.001368	0.000039	0.006450001
390	0.245	0.179	45	0.004243	0.00012	0.02005001
400	0.409	0.283	60.1	0.01431	0.000396	0.06785001
410	0.671	0.343	76.5	0.04351	0.00121	0.2074
420	0.84	0.359	93.2	0.13438	0.004	0.6456
430	0.878	0.35	106.7	0.2839	0.0116	1.3856
440	0.883	0.327	115.4	0.34828	0.023	1.74706
450	0.886	0.298	117.8	0.3362	0.038	1.77211
460	0.887	0.267	116.9	0.2908	0.06	1.6692
470	0.888	0.239	117.6	0.19536	0.09098	1.28764
480	0.888	0.209	117.7	0.09564	0.13902	0.8129501
490	0.888	0.182	114.6	0.03201	0.20802	0.46518
500	0.887	0.163	106.5	0.0049	0.323	0.272
510	0.887	0.146	97.2	0.0093	0.503	0.1582
520	0.887	0.124	92	0.06327	0.71	0.07824999
530	0.887	0.106	93.1	0.1655	0.862	0.04216
540	0.887	0.102	97	0.2904	0.954	0.0203
550	0.886	0.107	99.9	0.4334499	0.9949501	0.008749999
560	0.887	0.106	100	0.5945	0.995	0.0039
570	0.888	0.112	97.2	0.7621	0.952	0.0021
580	0.887	0.141	92.9	0.9163	0.87	0.001650001
590	0.886	0.198	88.5	1.0263	0.757	0.0011
600	0.887	0.279	85.2	1.0622	0.631	0.0008
610	0.889	0.394	84	1.0026	0.503	0.00034
620	0.891	0.522	83.7	0.8544499	0.381	0.00019
630	0.891	0.628	83.6	0.6424	0.265	0.00005
640	0.89	0.696	83.4	0.4479	0.175	0.00002
650	0.889	0.742	83.8	0.2835	0.107	0
660	0.889	0.766	83.5	0.1649	0.061	0
670	0.888	0.78	82	0.0874	0.032	0
680	0.888	0.791	79.8	0.04677	0.017	0
690	0.888	0.798	76.2	0.0227	0.00821	0
700	0.888	0.804	72.5	0.01135916	0.004102	0
710	0.886	0.807	68.8	0.005790346	0.002091	0
720	0.886	0.807	64.9	0.002899327	0.001047	0
730	0.885	0.813	61.2	0.001439971	0.00052	0
740	0.884	0.813	58.4	0.000690079	0.0002492	0
750	0.883	0.808	56.2	0.000332301	0.00012	0
760	0.882	0.814	55.2	0.000166151	0.00006	0
770	0.88	0.785	55.3	8.30753E-05	0.00003	0
780	0.879	0.752	55.3	4.15099E-05	0.00001499	0