

REFLECTANCE AND TRANSMITTANCE PROBLEMS

More difficult problems are indicated with an asterisk.

1. The illuminance of a diffusing surface is 50 lm/m^2 . An illuminance meter held close to and parallel to the surface reads 30 lx . What is the reflectance of the surface?
2. A 100 cd light source is placed on a table 5 ft from a wall. The luminance of a point on the wall 2 ft from the intersection of the wall and the normal to the wall passing through the light source is 0.8 ft-L . What is the reflectance of the wall?
3. A filter absorbs 20% of the light incident on it uniformly across the visible spectrum. What is the neutral density value of the filter.
4. An optometrist's wall chart has an 80% luminous reflectance. If the illuminance of the chart is 20 lm/ft^2 , what is the luminance of the chart?
- 5.* If two neutral density filters of ND numbers ND_1 and ND_2 are superimposed, prove that the ND number of the combination is just $\text{ND}_1 + \text{ND}_2$.
- 6.* The sole light source in a room is a 200 cd light bulb suspended two meters above a table. The illuminance of the table two meters directly below the light bulb is 60 lm/sq m when the walls of the room have 20% reflectance. What will the illuminance be if the walls are repainted to have 80% reflectance?
- 7.* A beam of unpolarized light passes through an ordinary plane polarizer. What is the effective ND value of the polarizer?

ANSWERS

1. 60%
2. 25%
3. ND 0.097
4. 16 ft-L=5 ft-cd
5. Designating the luminous transmittances of the two filters τ_1 and τ_2 , the transmittance of the superimposed filters is $\tau=\tau_1\tau_2$ and from the definition of neutral density and the properties of logarithms $ND\equiv\log(1/\tau)=\log[1/(\tau_1\tau_2)]=\log(1/\tau_1)+\log(1/\tau_2)=ND_1+ND_2$.
6. 90 lm/sq m
7. Half the light in the unpolarized beam is intercepted by the polarizer giving it a 50% transmittance corresponding to ND 0.3.