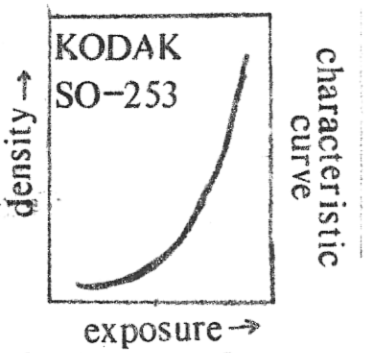
DENSITY

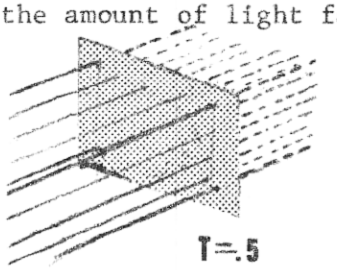
Density is a term used to measure how dark a transparent object is. The lower the number, the lighter and more transmissive the object is, and the higher the number the darker it is. The system is logarithmic; density of 2.0 is not twice as dark as 1.0 but ten times as dark. This scale is used because it is convenient in graphing the relationship of exposure to developed darkness in the characteristic curve of a silver halide based photosensitive material.

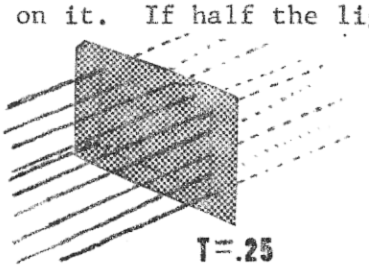


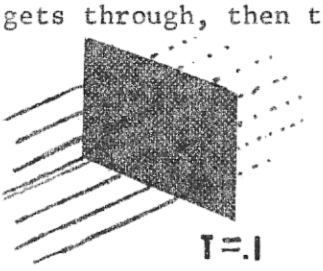
The most important idea to know about density is when to use it. Holograms are developed to match different densities for different applications, like usually .8 density for transmission, 1.0 or 2.0 for reflection holograms. Using a standardized calibrated step wedge for comparison will help when developing holograms by inspection.

Density is defined as the logarithm of opacity which is the inverse of transmission. Don't panic -- here are the terms one step at a time.

TRANSMISSION is the ratio of light that passes through an object to the to the amount of light falling on it. If half the light gets through, then the







transmission is ½ or .5 or 50%. If one fourth the incident light gets through, then transmission = ¼ = .25 = 25%; one tenth of the light passing through gives transmission of 1/10 = .1 = 10%.

OPACITY is the inverse or reciprocal of the transmission. Transmission of 50% or ½ means opacity of 2, while transmission of 10% or 1/10 would equal an opacity of 10.

DENSITY takes the opacity number and changes it to a logarithm of base 10. An opacity of 10, (which was a transmission of 1/10), changed to density is $\log_{10}10 = 1.0$. A transmission of only 1% or 1/100 is opacity of 100 which then becomes density of 2.0 because $\log_{10}100 = 2.0$.

To change a transmission of 25% to a density on a pocket calculator you would first enter .25, push the inverse button, 1/x, to get the opacity, (display will show 4), then punch the log x key. You should get the density of .60205999 which rounds to .6. Try completing this table.

TRANSMISSION	OPACITY	DENSITY
.1	10	1
.3	3.3	.52
.5	2	.3
.125	8	.9
100%	1	0