Weber-Fechner law in CIE 230:2019 for threshold colour differences of surface colours and two ranges $0{,}2 <= L_r <=1$ and $1 <= L_r <=5$

The *Weber-Fechner* law describes the lightness L^*_r as ***logarithmic*** function of L_r.
The *Stevens* law describes the lightness L^*_{CIELAB} as ***potential*** function of $L_r=Y/5$.
IEC 61966-2-1 uses a similar potential function $L^*_{IEC} = m\, L_r^{\,1/2,4}$.
The *Weber-Fechner* law is equivalent to the linear equation: $\Delta L_r = c_i L_r$ *(i=0,1)* [1]
Integration leads to the logarithmic equation: $L^*_r = k_i \log(L_r)$ *(i=0,1)* [2]
Derivation leads for $\Delta L^*_r=1$ to the linear equation: $L_r/\Delta L_r = k_i$ (k_0=46, k_1=63) [3]
For colours in offices the **standard contrast range** is **25:1**=90:3,6.

Table 1: CIE tristimulus value *Y*, luminance *L*, and lightnesses *L**

Colour (matte)	**Tritimulus value**	**office luminance**	**relative luminance**	**CIE lightness**	**relative lightness**
(contrast) **(25:1=90:3,6)**	***Y***	***L*** **[cd/m²]**	L_r $=L/L_u$	L^*_{CIELAB} $\sim m\, L_r^{1/2,4}$	L^*_r $=k \log(L_r)$
White W (paper)	90 =18*5	142 =28,2*5	5	94 =50+44	44 $=k_1 \log(5)$
Grey Z (paper)	18	28,2	1	50	0 $=k_0 \log(1)$
Black N (paper)	3,6 =18/5	5,6 28,2/5	0,2	18 50−32	−32 $=k_0 \log(0{,}2)$

For the two lightness ranges it is k_0=−32/log(0,2)=46 and k_1=44/log(5)=63.

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