

## Understanding Modern Lighting Terms

### Watt's a Lumen?

Brightness (lm)	220	375	500	1000	6000
Incandescent	15 W	25 W	33 W	67 W	400 W
Halogen	11 W	19 W	25 W	50 W	300 W
Compact Fluorescent	4 W	6 W	8 W	17 W	100 W
LED	2.5W	4 W	5.5 W	11 W	67 W

### Correlated Colour Temperature (CCT)

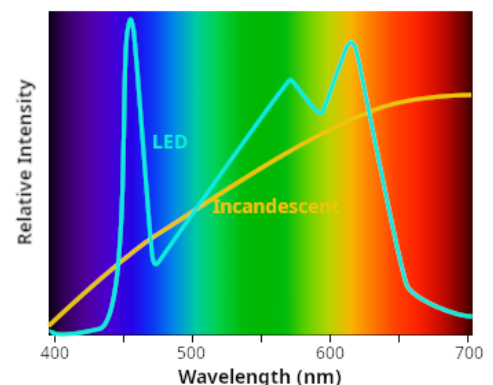
**CCT** indicates the colour of a light. It is very approximately the same colour as would be emitted by a tungsten filament heated to that temperature.



It is a poor metric for LED lighting because an LED spectrum is unlike that of a glowing filament. For example, a 4000K filament would have a peak output at a wavelength of about 725 nm, but that of an LED could be around 450 nm.

**Spectral Power Distribution (SPD)**, which measures light output as a function of wavelength, is a better metric, but it is rarely given by lighting suppliers.

### LED and Incandescent Spectra



## ***Colour Rendering Index (CRI)***

CRI indicates colour fidelity under the given light.

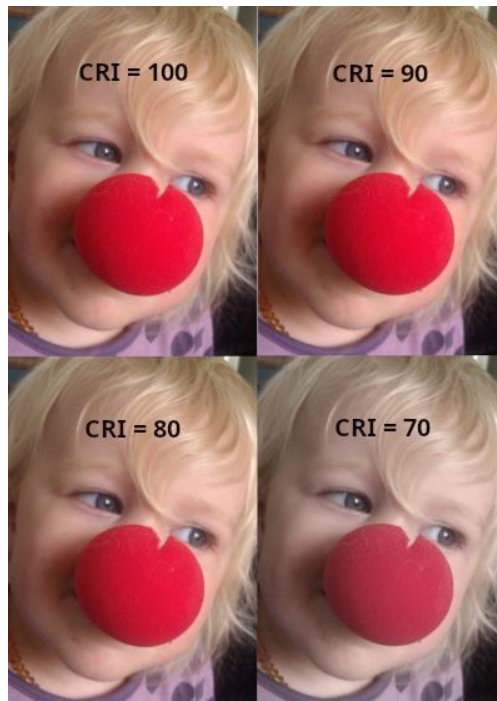
100 – Perfect

95 – Super-Excellent – only needed for distinguishing subtle differences of hue

90 – Excellent; most people can't distinguish this from 100

80 – Acceptable for general purpose use

< 80 – Colours begin to look “washed out”



### CRI of some common lamps

Incandescent, halogen: 100

Standard fluorescent: 75 – 80

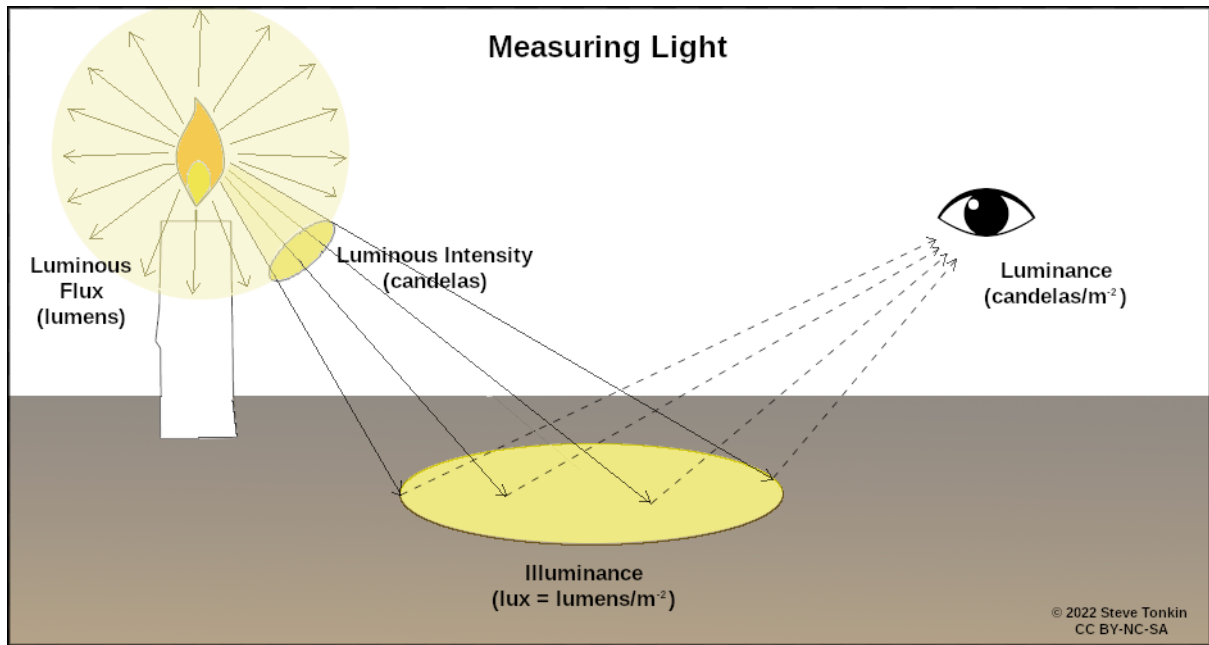
Tri-phosphor fluorescent: 85

Modern LEDs: 70 – 98

HPS/SOx: 25

LPS/SOx: 4

## Measurements of brightness



**Luminous intensity** is the perceived (by the human eye and visual cortex) brightness of a light. It is measured in candelas (**cd**). Because it is an anthropocentric measure, it tells us nothing about how other species perceive, or respond to, that light.

Not all the output from a light source goes into your eye. The total light output is called the **Luminous flux**. It is measured in lumens (**lm**).

1 lm = 1 cd sr.

*The steradian (sr) is the measure of a solid – i.e. 3-dimensional – angle.*

*A complete sphere is  $4\pi$  sr.*

**Illuminance** is the intensity of light falling on (illuminating) a surface. It is measured in lux (**lx**).

1 lx = 1 lm m<sup>-2</sup>

**Luminance** is the amount of light reflected from (or emitted by) a surface. It is measured in candelas per square meter (**cd m<sup>-2</sup>**). It is dependent on the nature of the surface. It is luminance that enables us to see illuminated surfaces.

*(If you forget the difference between illuminance and luminance:*

**Illuminance = Incoming; Luminance = Leaving)**