

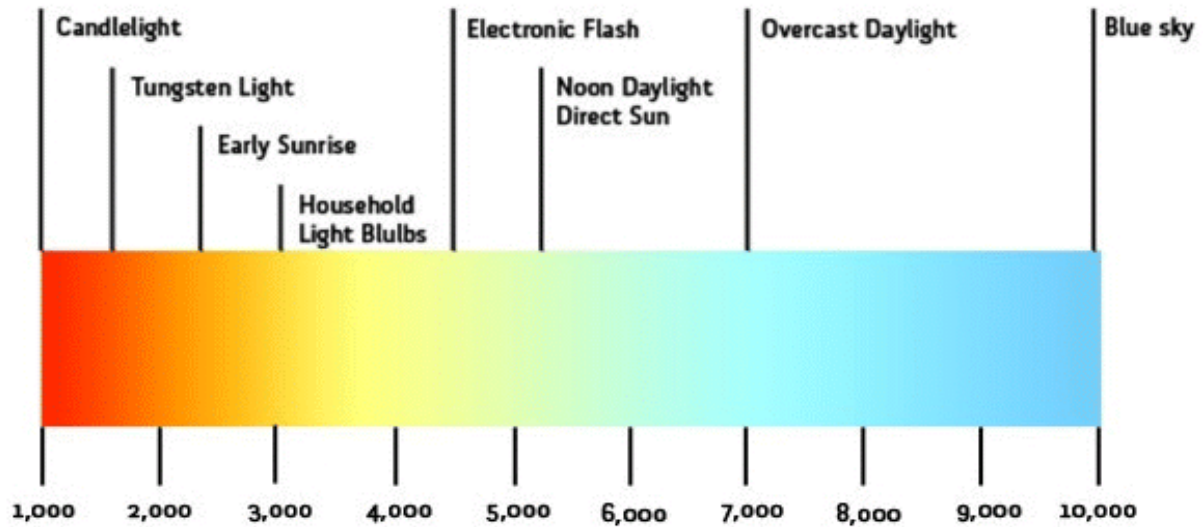
## Sources of Light

Light comes from two fundamentally different sources:

- incandescent source (hot)
  - any hot object will produce visible light
- chemical source (cold)
  - electric discharge
  - fluorescence
  - phosphorescence
  - chemiluminescence
  - bioluminescence

**Incandescent Source:** are any hot object. The object produces electromagnetic radiation as a means of giving off heat energy. The "colour" of the hot object depends on the temperature. If cool the object will glow with infrared. If the object becomes warmer, the wavelength of light will shift into the visible red and then through the visible spectrum towards the blue-violet end of the spectrum.

# Kelvin Color Temperature Scale



Spectral Type	Color	Temperature In degrees Kelvin	Mass	Life expectancy	Death spiral
O	Blue	47,500-31,000	Range from 10-100 solar masses	Shortest life expectancy is 2 million years	Super Nova to neutron star or black hole
B	Blue-white	30,000-10,000	At the low end, about .8 solar masses – the high end, about 10 solar masses	20 million years	
A	White	9,800-7,300		Hundreds of millions	
F	Yellow-white	5,200-5,800		Billions	
G	Yellow	5,700-4,900			Becomes red giant (twice), a planetary nebula, then possibly a white dwarf
K	Orange	4,800-3,900		Tens of billions	
M	Orange-Red	3,800-2,200	Less than half a solar mass	Trillions of years	

**Chemical Sources:** involve some sort of chemical change that will involve electrons in a molecule or atom (cold source)

**Electrical Discharge:** electrons become excited and then unexcited, they give off light as they become unexcited

**Fluorescence:** electromagnetic radiation is first absorbed (particular wavelength), causes an elevated electronic state (excited), light is given off when the elevated state relaxes. Fluorescence is very fast. Ultraviolet can be changed to visible light. Fluorescent dye is used in fluorescent lights. PASSPORT

**Phosphorescence:** like fluorescence except slower. The elevated electron state can last for seconds or even hours.

**Chemiluminescence:** a chemical reaction that produces an elevated electronic state that quickly relaxes to give off light. Light without heat. GLOWSTICK

**Bioluminescence:** any chemiluminescent source produced by a living organism (fire-fly, glow worms, deep sea fish)