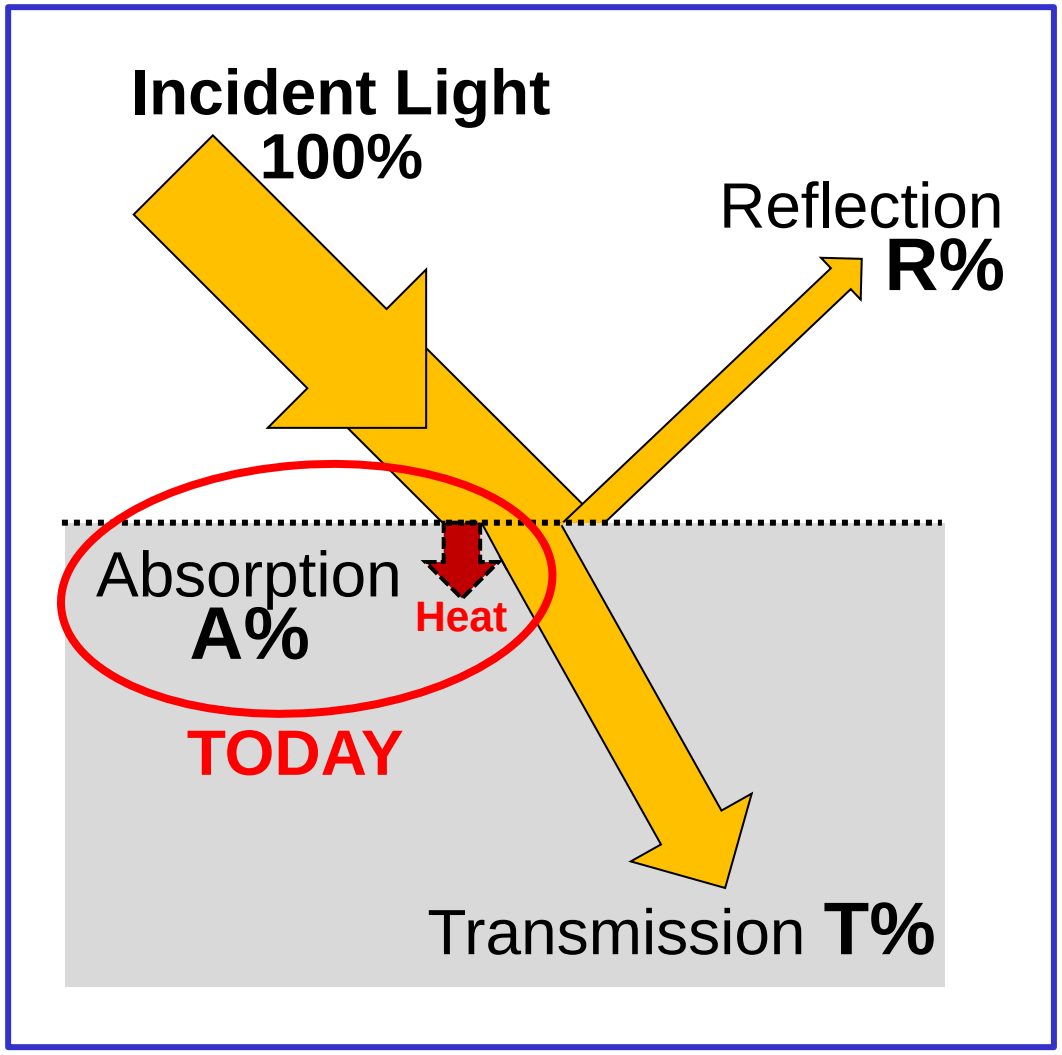
# Light Interaction with Non-Luminescent Matter



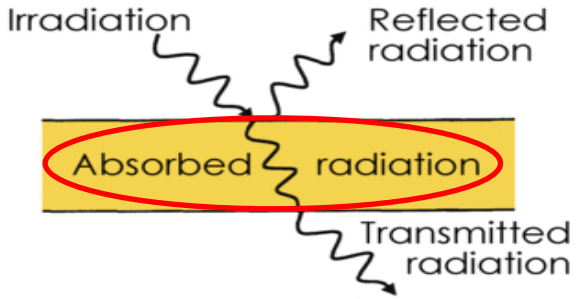

- **<u>Combination</u> of transmission, reflection, and absorption:**

**T%+R%+A%=100%**

- **No material is 100% transparent.**
- **No material is 100% absorbing either.**

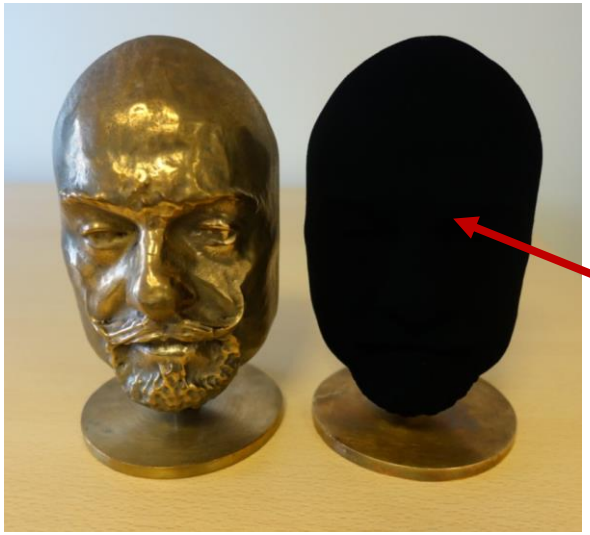
# Absorption

## disappearance of a light wave



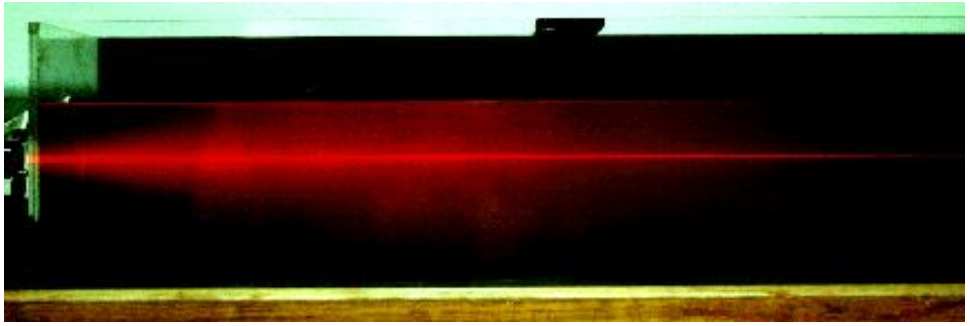

- The <u>energy of a light wave is taken up by matter</u> and in most cases converted into heat.

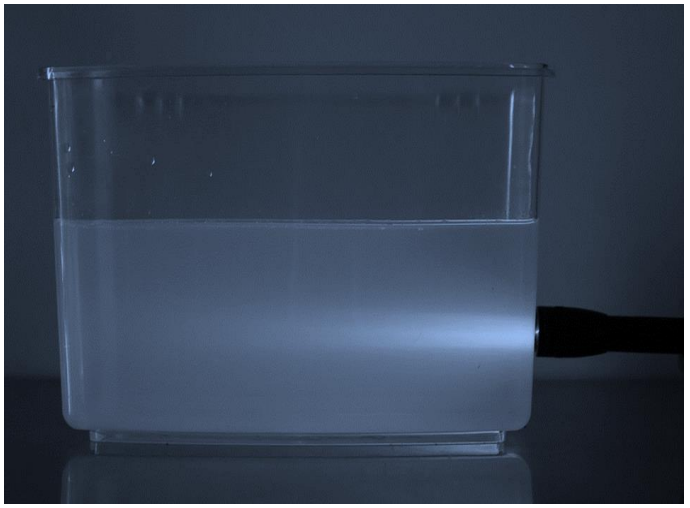
- **Dark opaque** objects **absorb most** of the incident light.



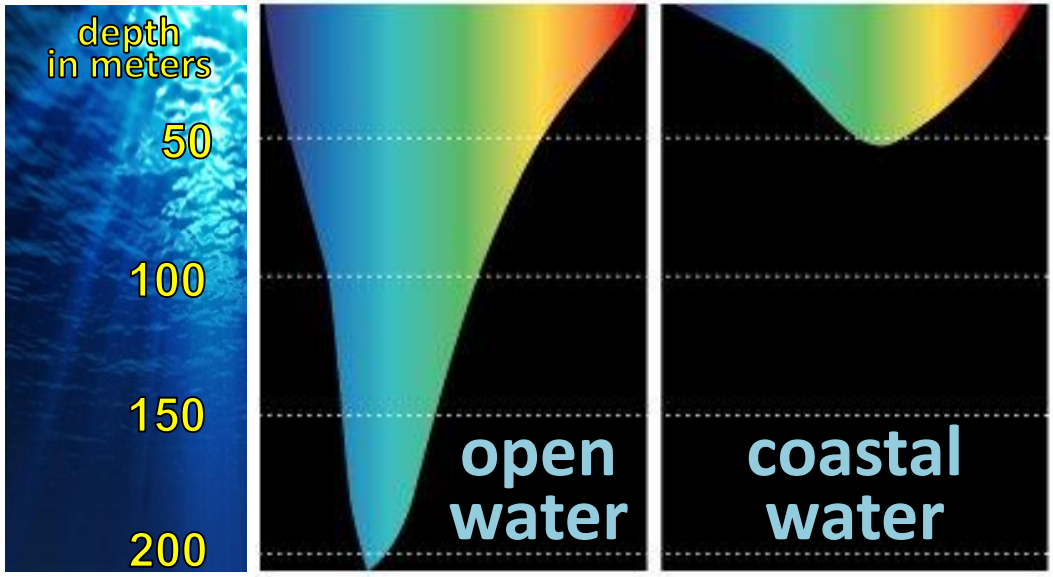
**Vantablack** – one of the darkest substances known, absorbing up to 99.965% of visible light!

# Transparent and translucent objects absorb some part of the incident light.



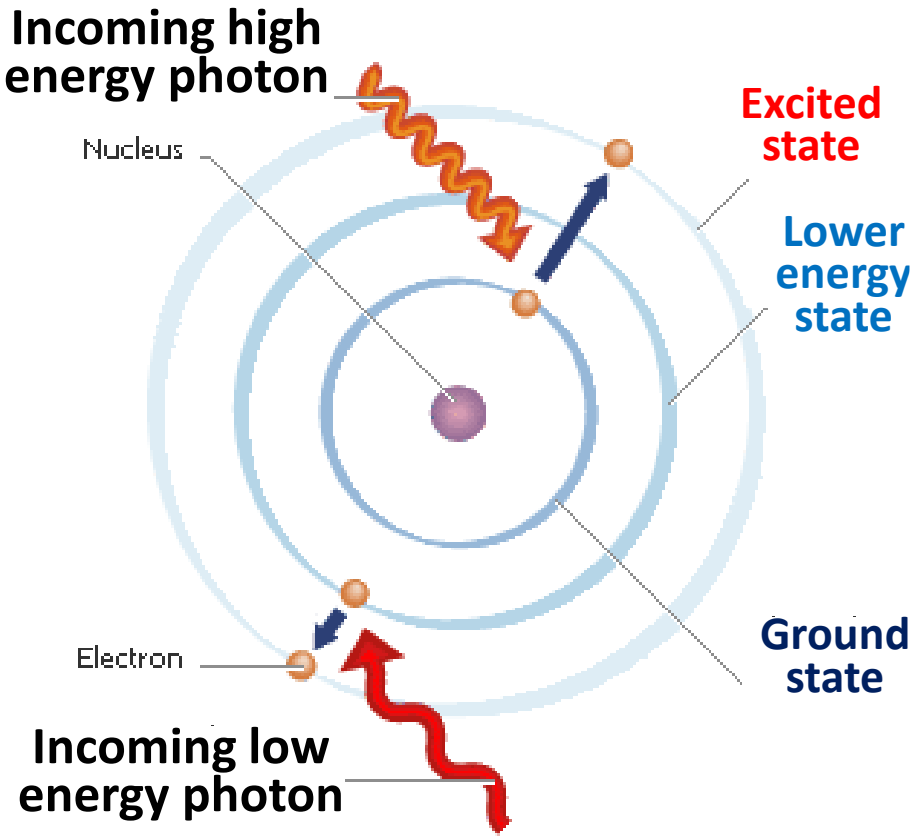


## Absorption of Sunlight by Water




# Absorption Spectrum

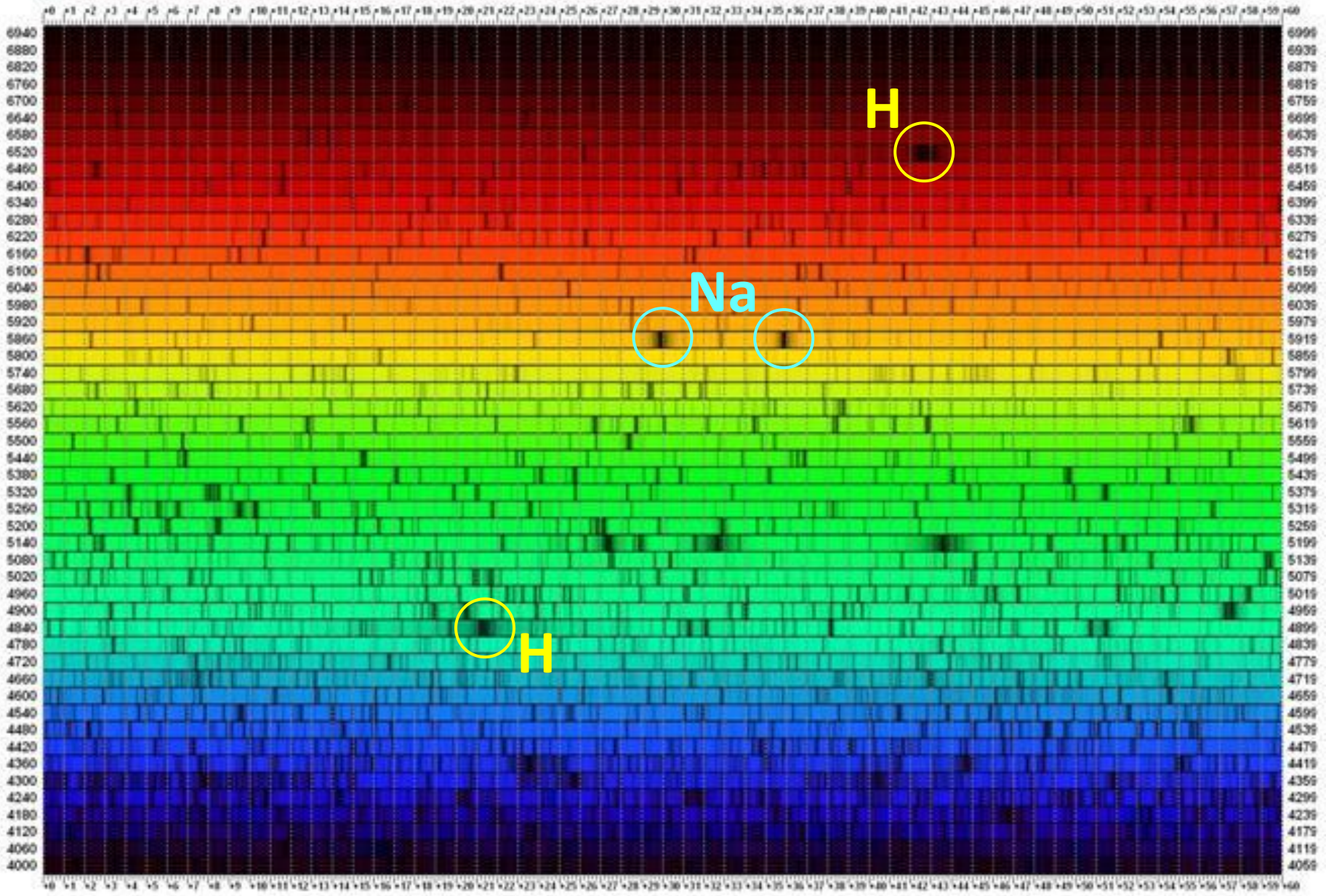
**Absorption of light can happen when the photon energy (i.e. *frequency*) matches one of the allowed transitions between energy levels of that particular atom.**




## Example: Hydrogen

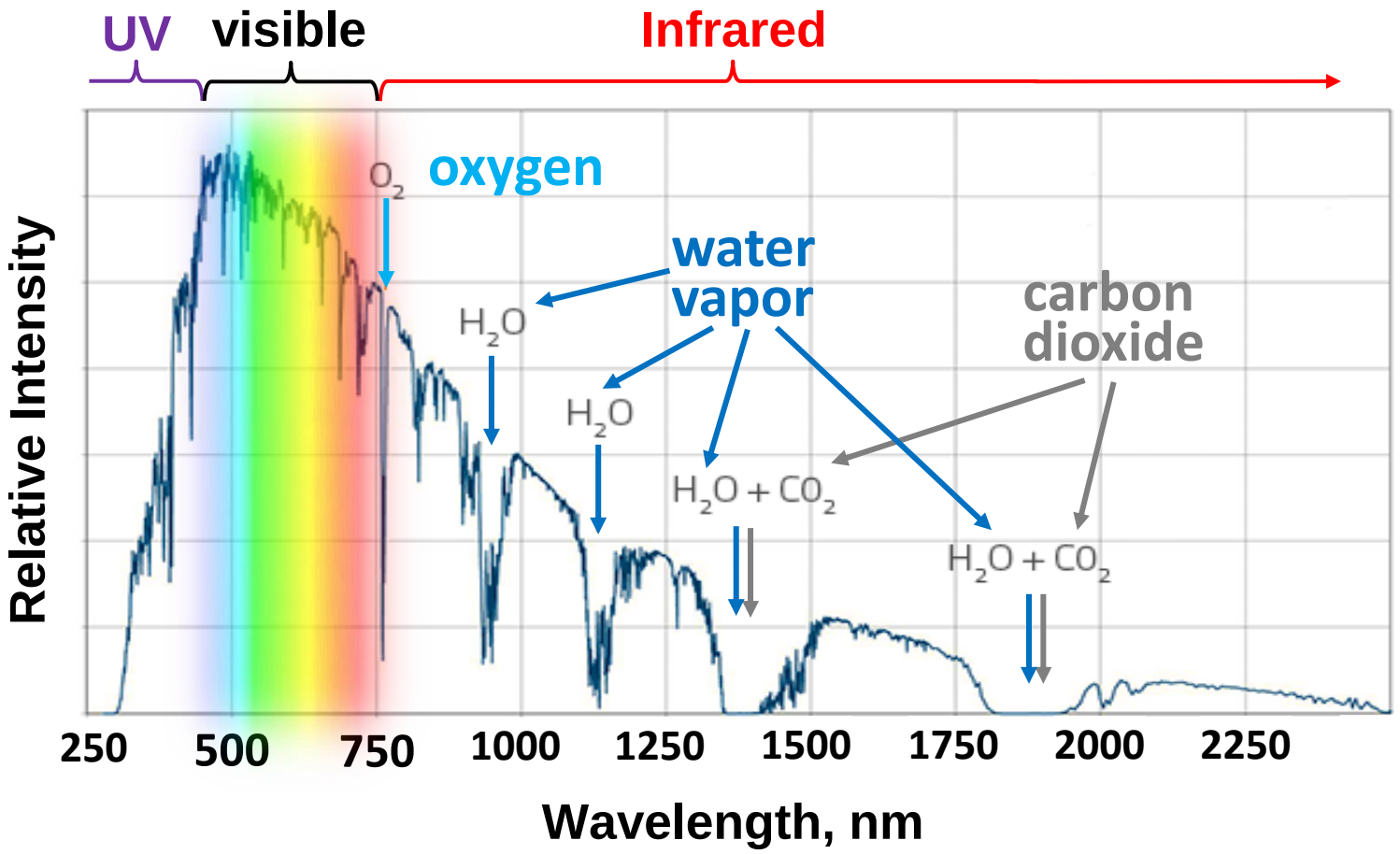

**A star will create an absorption line spectrum because the continuous spectrum emitted by the dense, opaque gas that makes up most of the star passes through the cooler, transparent atmosphere of the star.**

# Absorption Spectrum of the Sun



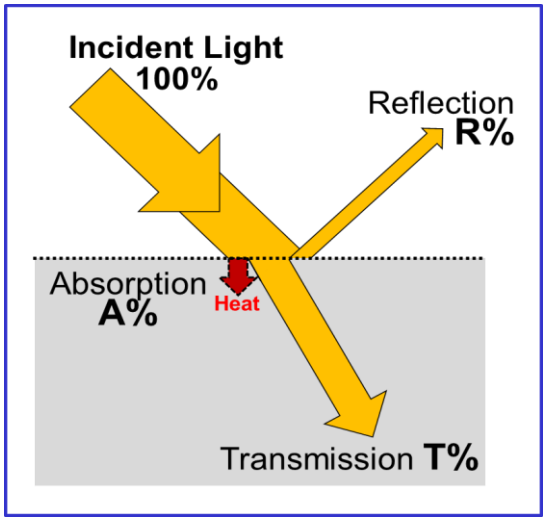
# Sunlight Filtered through Atmosphere

**Absorption of sunlight by various gas molecules that are present in the Earth's atmosphere is seen as absorption bands in the Sun spectrum.**



# Guess an object !

T=0
R~70%
A~30%




T=0
R~5%
A~95%

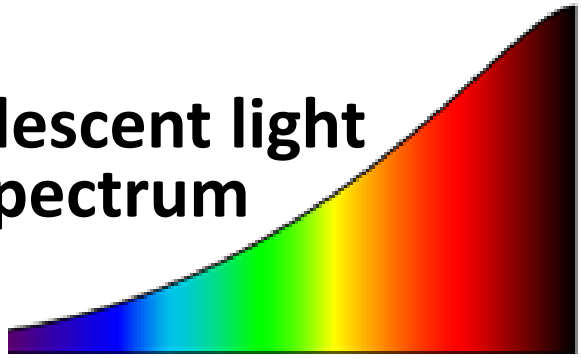
T~95%
R~5%
A~0%

**Transmitted%+Reflected%+Absorbed%=100%**

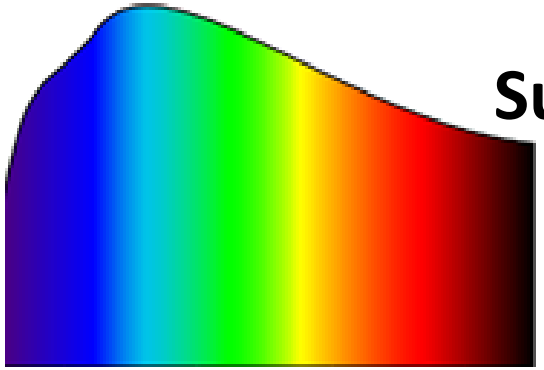
# What color is this tulip? And why?

**Indoor and outdoor *lighting* can be quite different!**

**Incandescent light bulb spectrum**



**much more red+yellow than blue**



**Sunlight spectrum**

**red and blue components are similar**