BAGIAN I : CAHAYA

PERAN CAHAYA

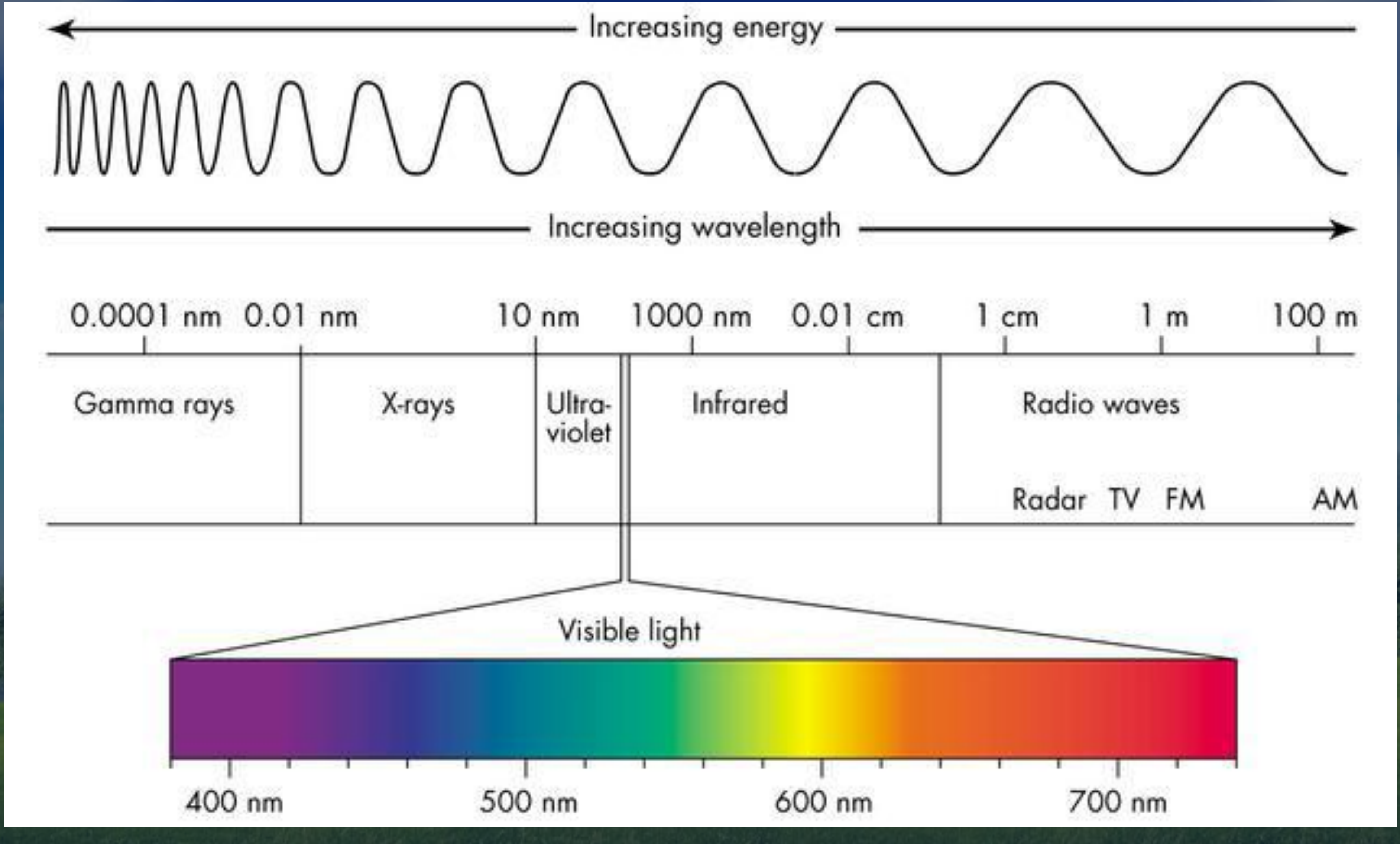
Peran Cahaya

- Penerangan
- Kesehatan
- Kenyamanan
- Keamanan
- Dekorasi, prestise
- Estetika
- Kondisi : romantis, ramai (kilat lampu pesta)
- Ilusi

SPEKTRUM CAHAYA

Spektrum Cahaya

- Cahaya berada pada daerah panjang gelombang 400 nm s.d. 800 nm (atau 380 nm s.d. 780 nm) yang disebut visible light
- Di luar daerah tersebut, mata manusia tidak sensitif -> di bawah 400 nm disebut ultraviolet, di atas 800 nm disebut inframerah

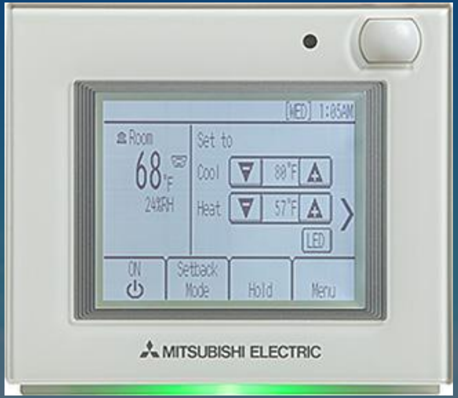

Increasing energy
Increasing wavelength
0.0001 nm
0.01 nm
10 nm
1000 nm
0.01 cm
1 cm
1 m
100 m
Gamma rays
X-rays
Ultra-
violet
Infrared
Radio waves
Radar
TV
FM
AM
Visible light
400 nm
500 nm
600 nm
700 nm

- CAHAYA TAMPAK : 400 nm - 700 nm
- 400 nm - 450 nm → Ungu
- 450 nm - 500 nm → Biru
- 500 nm - 570 nm → Hijau
- 570 nm - 590 nm → Kuning
- 590 nm - 630 nm → Jingga
- 630 nm - 700 nm → Merah
- CAHAYA TAK TAMPAK :
- << 400 nm → cahaya ultra
- >> 700 nm → cahaya infra

Beberapa aplikasi Infra red

- Sensor infra merah

European Round Plug
UK Plug
USA Plug
GD WHOLESALE
CHINA TRADE ONLINE

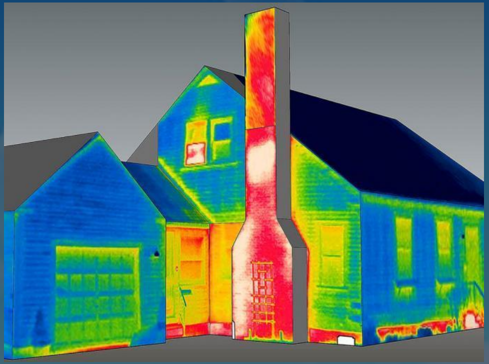

WED 1:05AM
Room
68°F
24%RH
Set to
Cool 80°F
Heat 57°F
LED
ON
Setback Mode
Hold
Menu
MITSUBISHI ELECTRIC

- Komunikasi jarak dekat

DIR
TEMP
SWING
POWER
FAN
KT-518
A/C PILOT

Beberapa aplikasi infra red (lanjutan)

- Mengetahui zona panas pada suatu gedung



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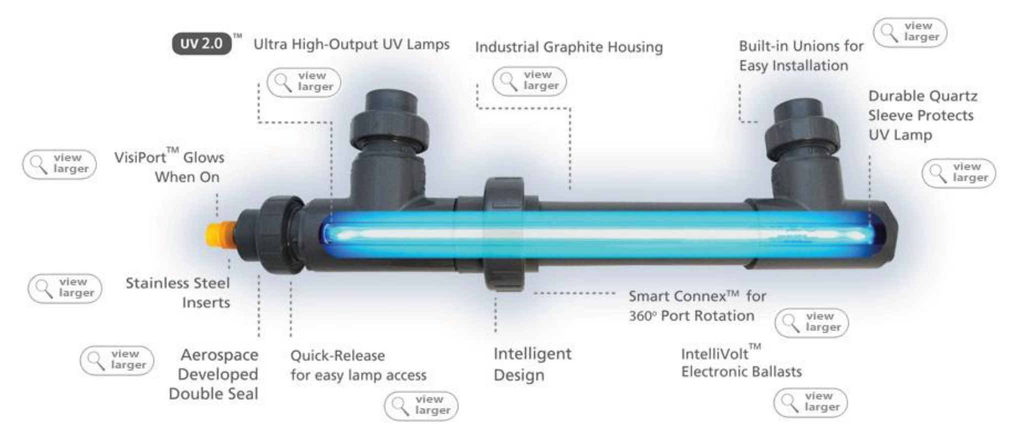
- Melakukan proses pemanasan

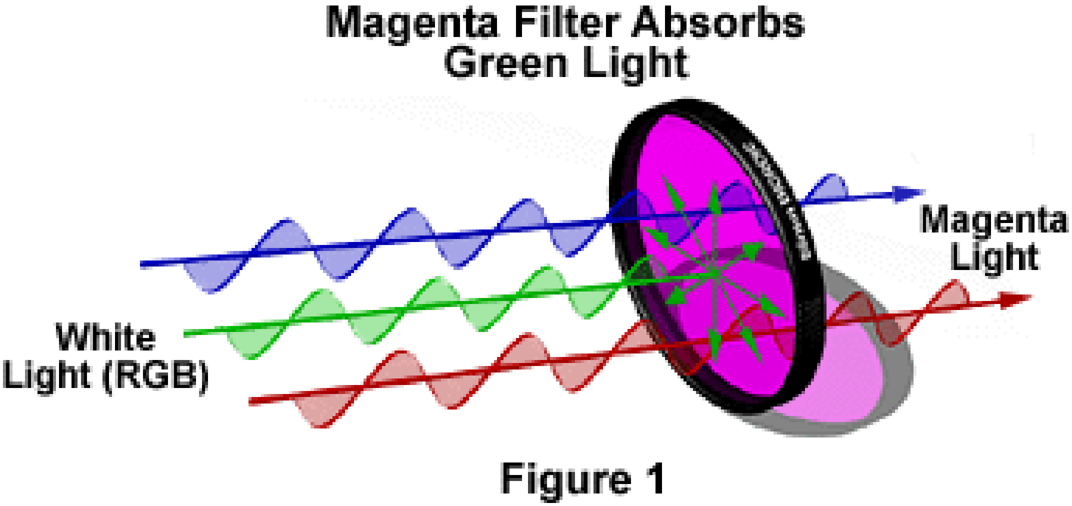
Contoh aplikasi UV

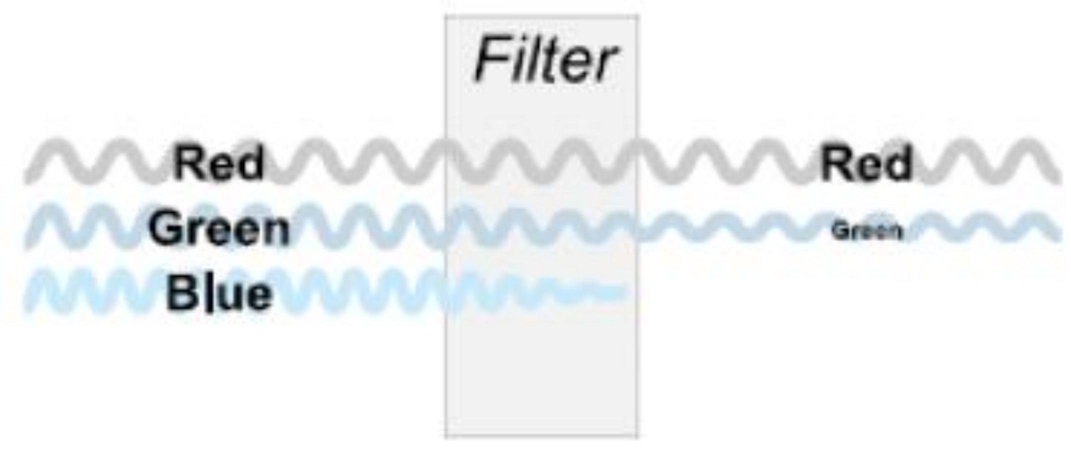
- UV Pool Systems


UV 2.0™
Ultra High-Output UV Lamps
view larger
Industrial Graphite Housing
view larger
Built-in Unions for Easy Installation
view larger
Durable Quartz Sleeve Protects UV Lamp
view larger
view larger
VisiPort™ Glows When On
view larger
Stainless Steel Inserts
Smart Connex™ for 360° Port Rotation
view larger
view larger
Aerospace Developed Double Seal
Quick-Release for easy lamp access
view larger
Intelligent Design
IntelliVolt™ Electronic Ballasts
view larger

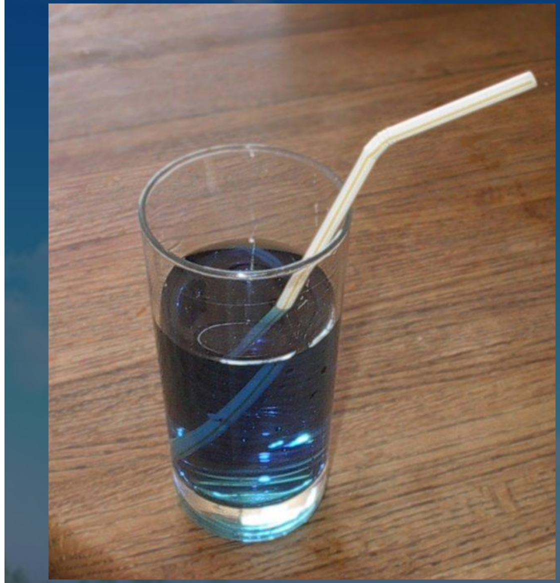
SIFAT-SIFAT CAHAYA

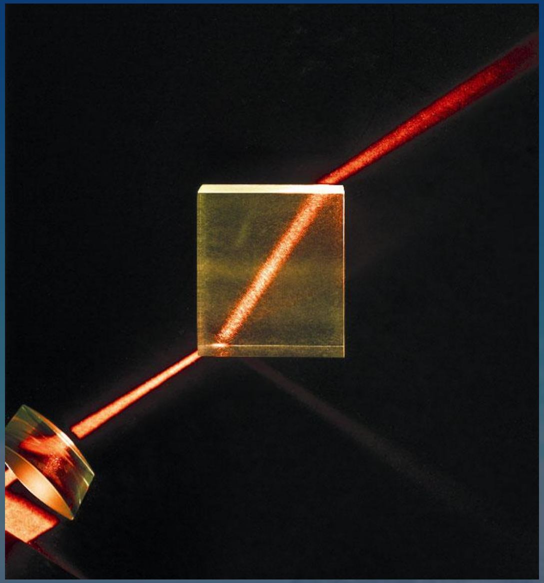
Absorsi Cahaya

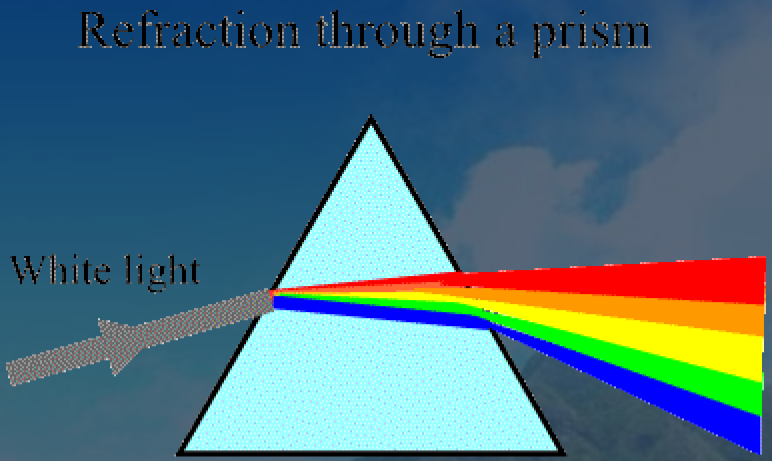

Magenta Filter Absorbs Green Light
White Light (RGB)
Magenta Light
Figure 1


Filter
Red
Green
Blue
Red
Green

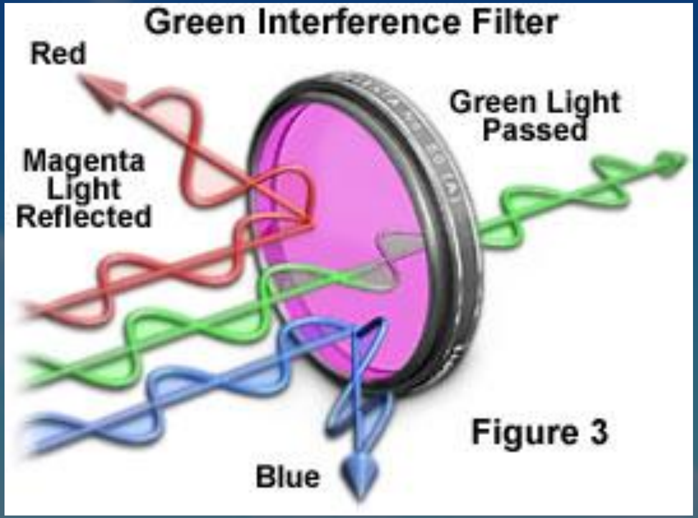
Pembiasan Cahaya

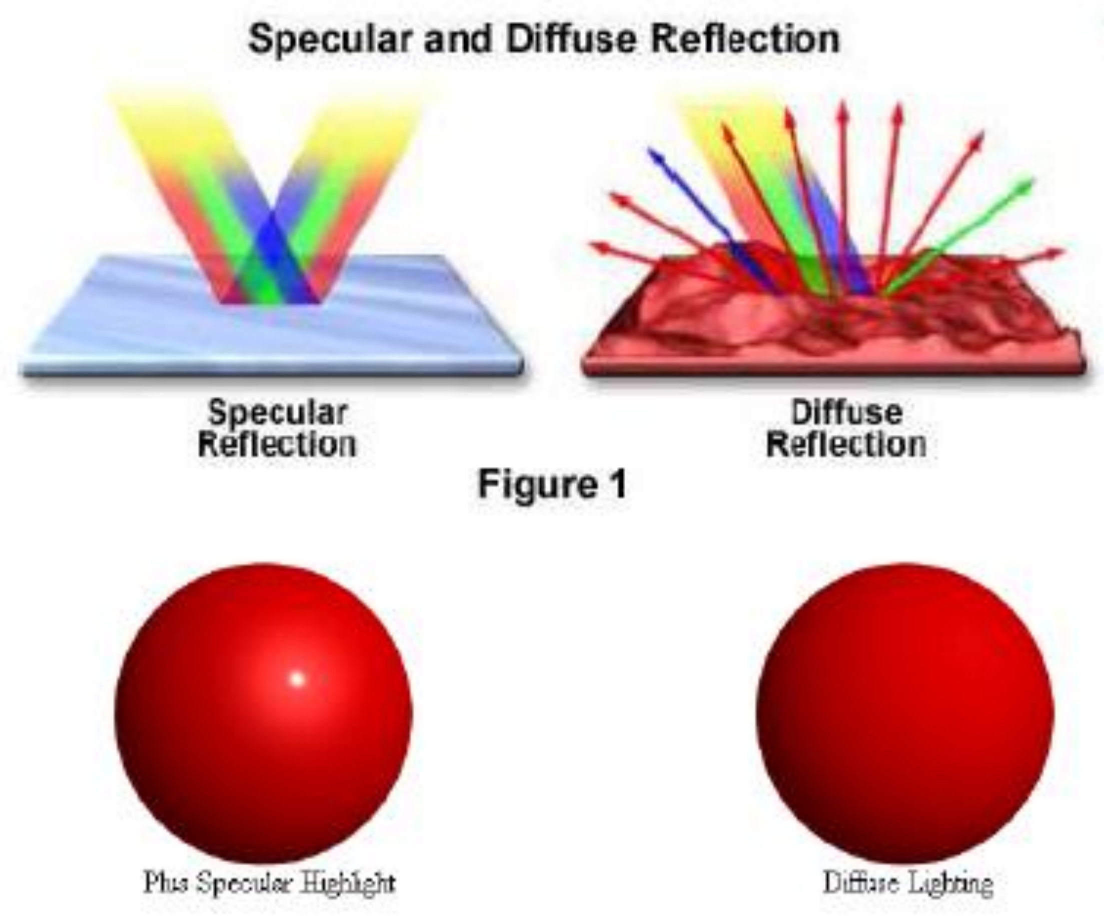





Refraction through a prism
White light

Pemantulan cahaya


Green Interference Filter
Red
Magenta Light Reflected
Green Light Passed
Blue
Figure 3

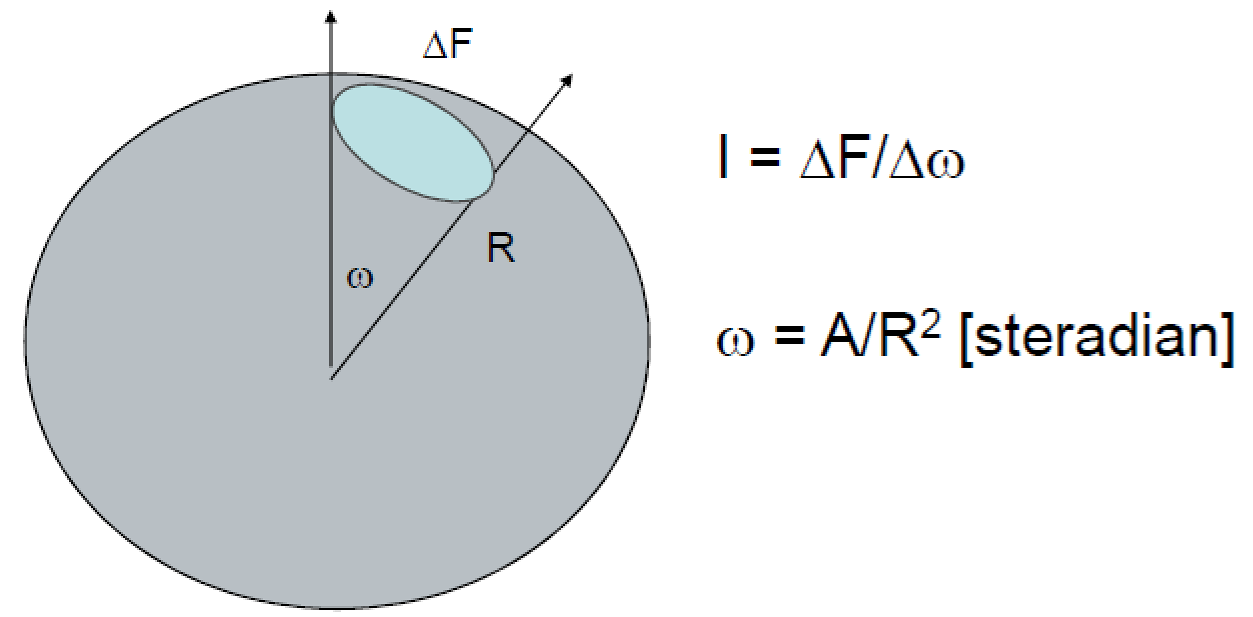

Specular and Diffuse Reflection
Specular Reflection
Diffuse Reflection
Figure 1
Plus Specular Highlight
Diffuse Lighting

BESARAN KUANTITATIF CAHAYA

Besaran Kuantitatif Cahaya

- Fluks radian (satuannya Watt, notasi P) : Energi radian yang sampai pada suatu permukaan per satuan waktu.
- Fluks Luminous (satuannya lumen, notasi F) : Fluks radian yang dinilai terhadap kemampuannya untuk menimbulkan rangsangan terang
- Intensitas Cahaya (satuannya Candela, Notasi I) : Kuat cahaya yang dikeluarkan oleh sebuah sumber cahaya ke arah tertentu. Sebuah sumber cahaya berintensitas 1 Candela (1 lilin) mengeluarkan cahaya total ke segala arah sebanyak 12,57 lumen.

- 12,57 adalah luas kulit bola berjari-jari 1 meter dengan sumber cahaya sebagai titik pusatnya. Jadi 1 Candela = 1 lumen / steradian


ΔF
ω
R
$I = \Delta F/\Delta\omega$
$\omega = A/R^2$ [steradian]

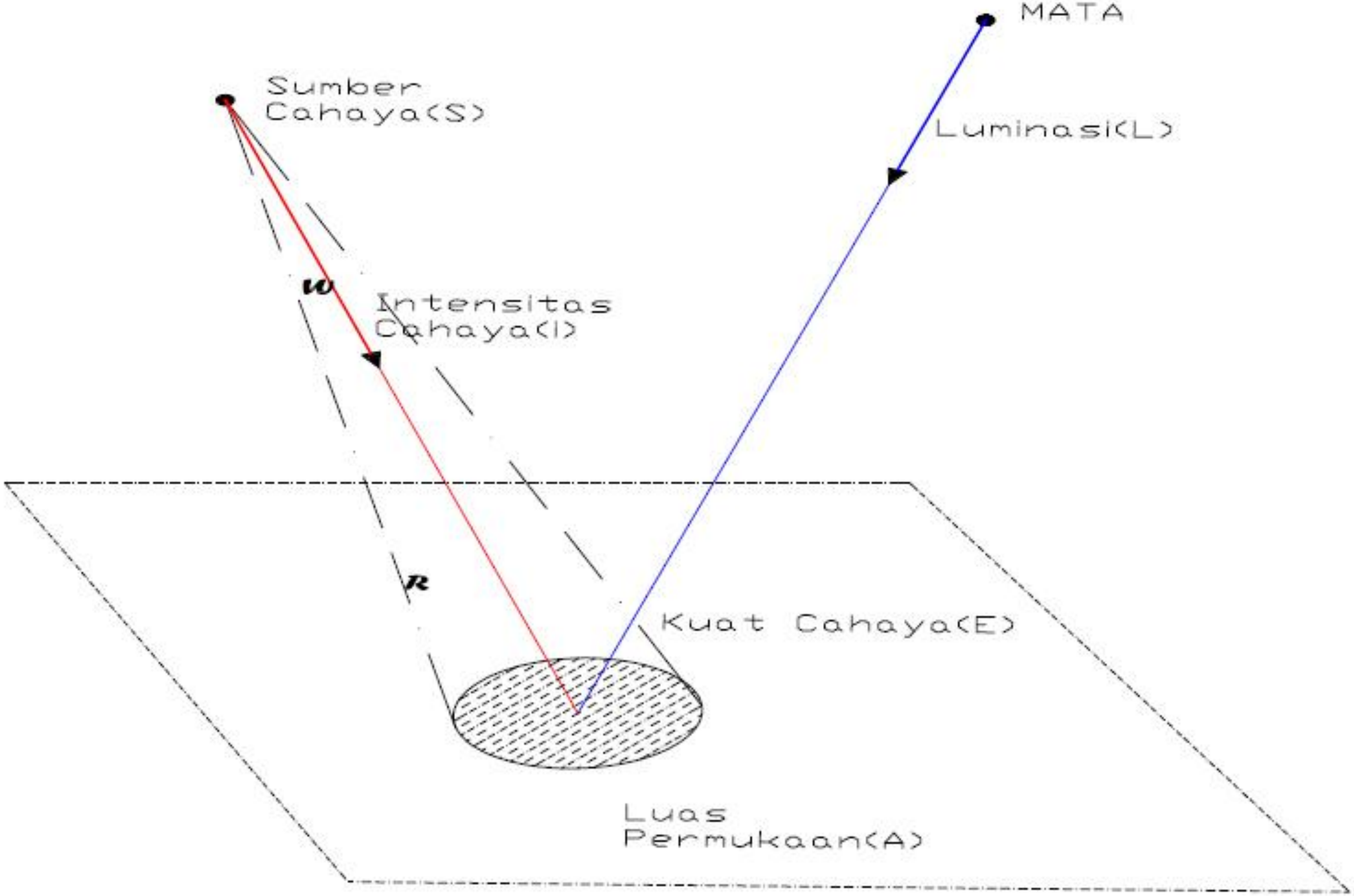
- Distribusi Intensitas : Pola Intensitas di setiap arah sudut pencahayaan (ϴ) sehingga intensitas ditulis I(ϴ)

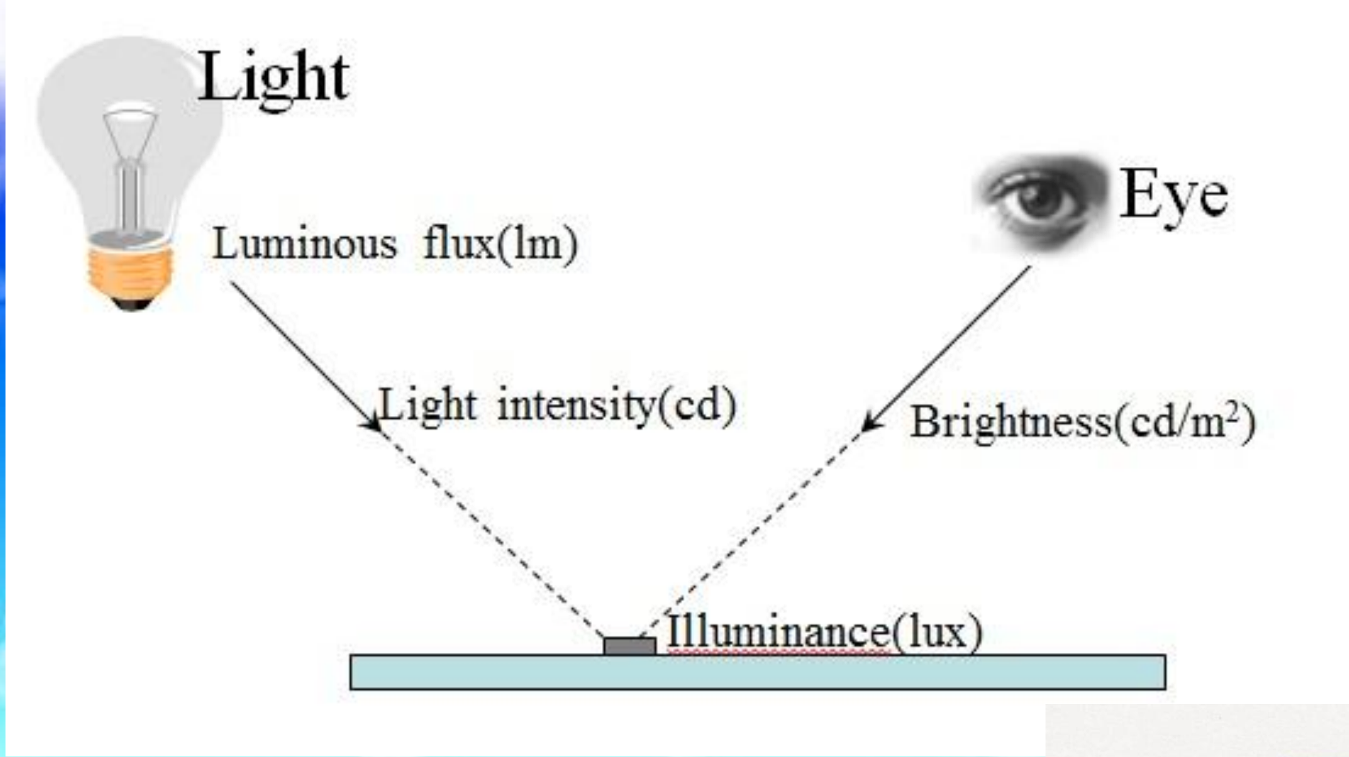
- **Iluminansi** (satuannya lux, lumen/m2, notasi E) Terkadang disebut tingkat penerangan merupakan banyaknya fluks luminous yang datang per satu unit bidang. 1 fc=footcandle = lumen/ft2

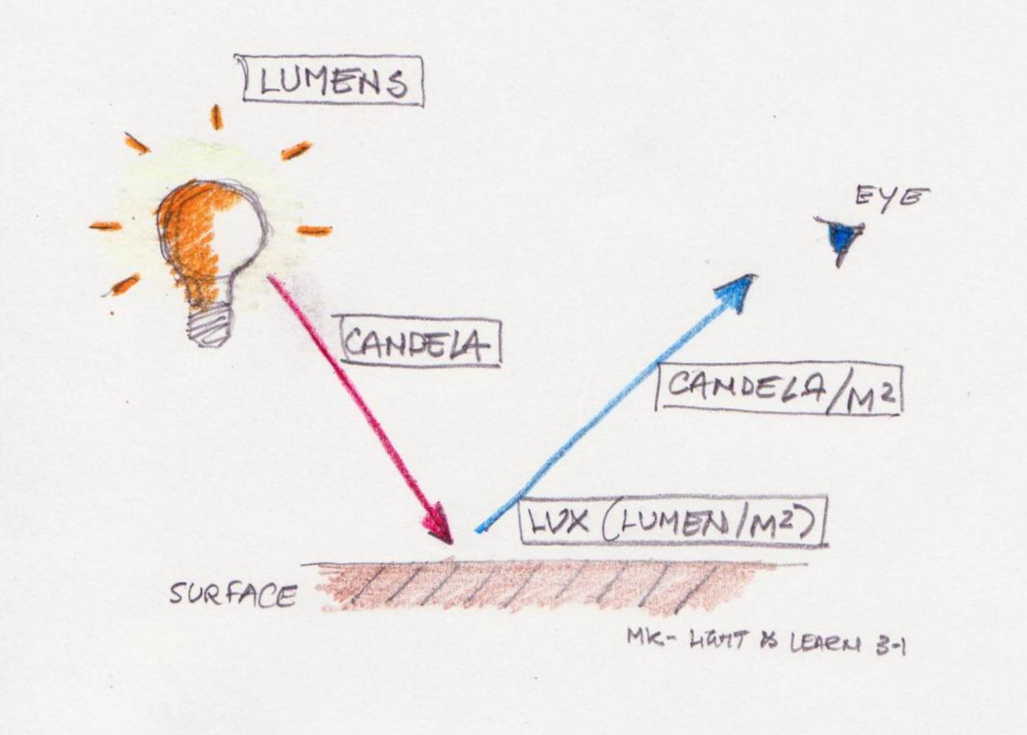
$$E = \frac{dF}{dA} = \frac{lumen}{m^2} = lux$$

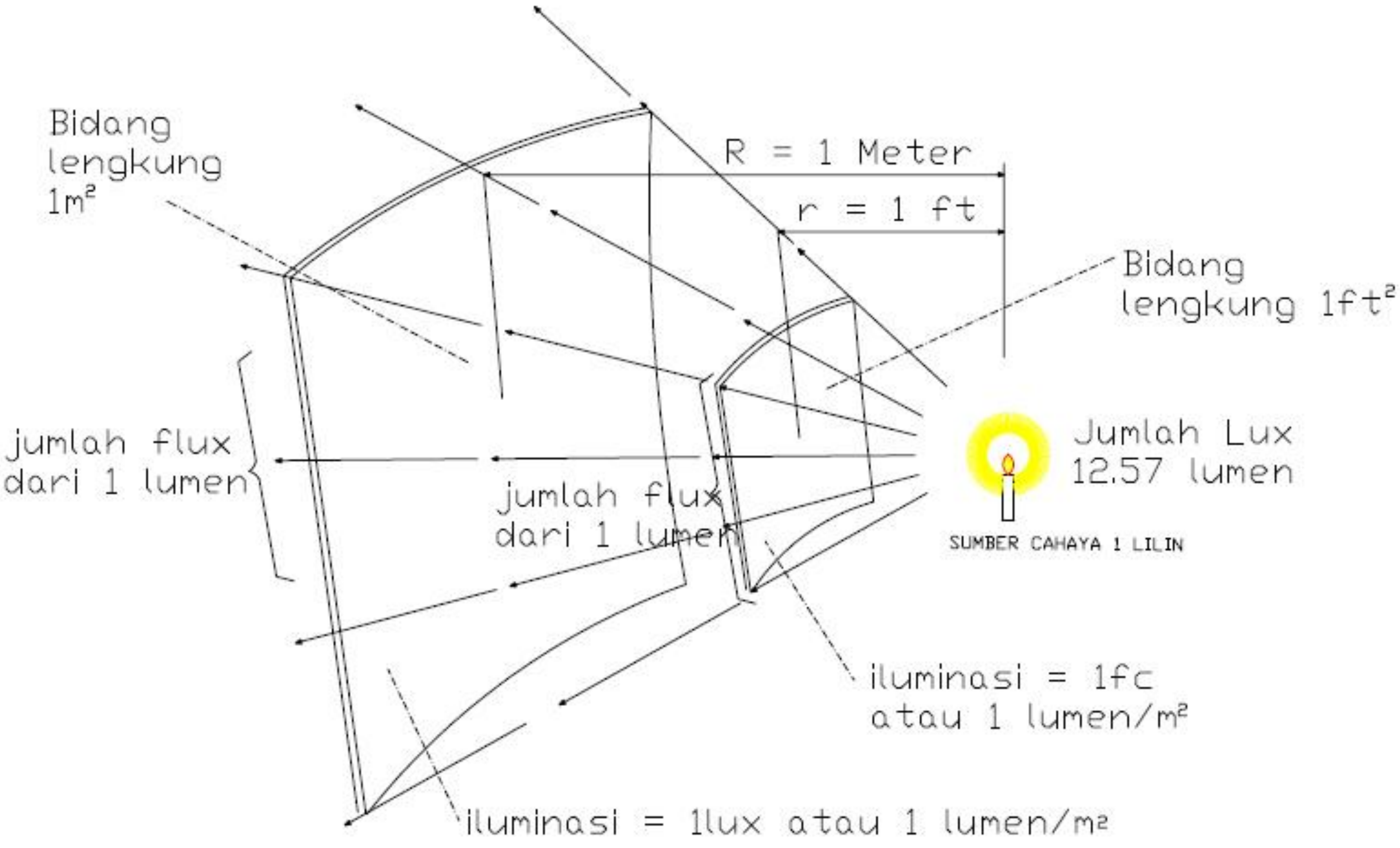
- Contoh tingkat penerangan :
  - Cahaya matahari dan cahaya langit 100.000 lux
  - Langit dengan bulan purnama : 92 lux

- Luminansi (Satuannya Candela/m2, notasi L) : Intensitas cahaya yang dipancarkan, dipantulkan kembali atau diteruskan dari suatu unit bidang yang diterangi. Pada buku acuan lama sering digunakan satuan footLambert (fL) untuk membedakan Luminansi dan Iluminansi. FootLambert=Footcandle x Faktor Refleksi
- Contoh Luminansi :
  - Bulan : 2900 cd/m2
  - Lampu TL : 6000 cd/m2

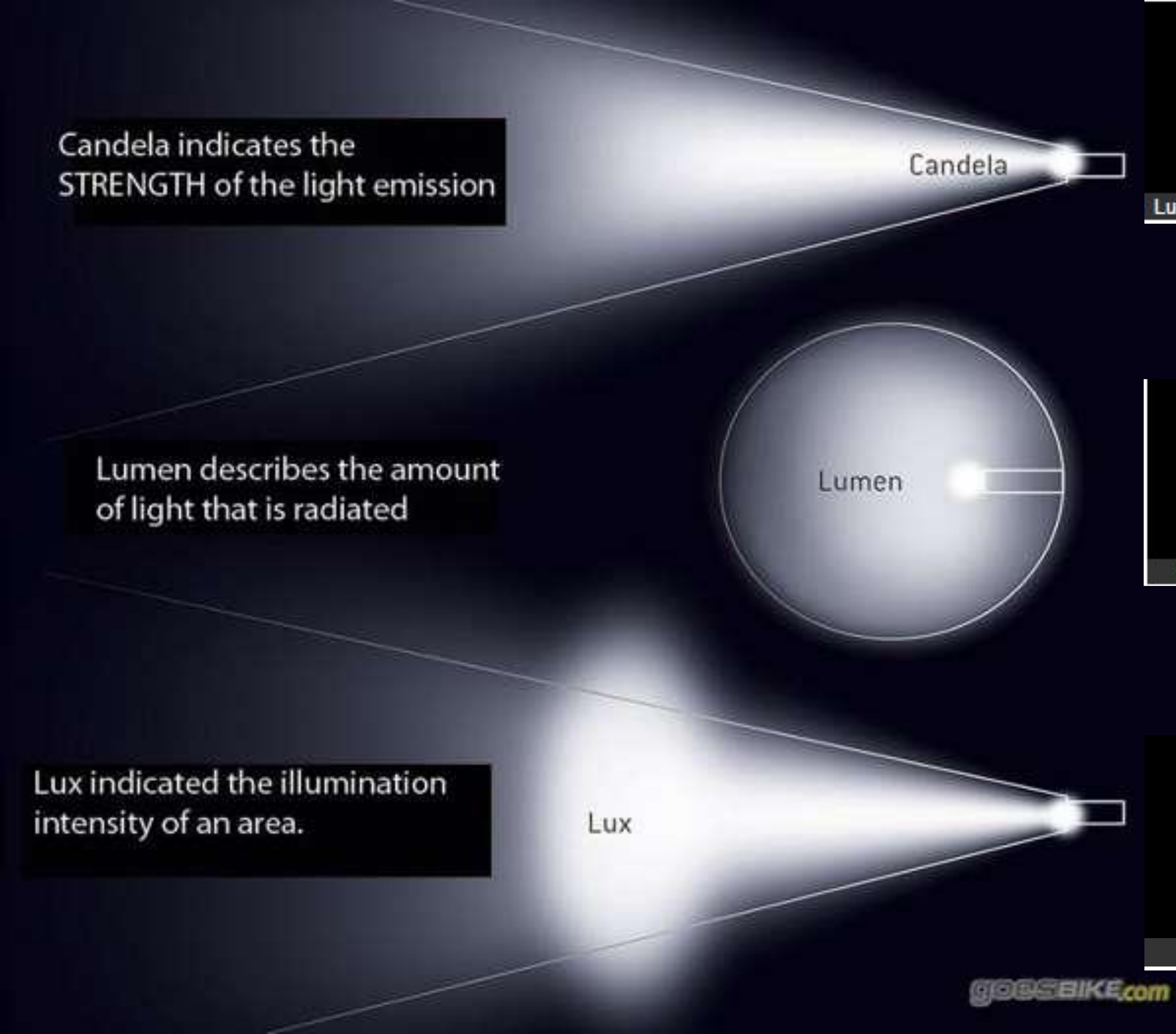

MATA
Sumber
Cahaya(S)
Luminasi(L)
ω
Intensitas
Cahaya(I)
R
Kuat Cahaya(E)
Luas
Permukaan(A)


Light
Eye
Luminous flux(lm)
Light intensity(cd)
Brightness(cd/m²)
Illuminance(lux)


LUMENS
EYE
CANDELA
CANDELA/M²
LUX (LUMEN/M²)
SURFACE
MK- LIGHT & LEARN 3-1


Bidang
lengkung
1m²
R = 1 Meter
r = 1 ft
Bidang
lengkung 1ft²
jumlah flux
dari 1 lumen
jumlah flux
dari 1 lumen
Jumlah Lux
12.57 lumen
SUMBER CAHAYA 1 LILIN
iluminasi = 1fc
atau 1 lumen/m²
iluminasi = 1lux atau 1 lumen/m²

ket : 1lux = 0.0929 fc, 1fc = 10.76 lux



Candela indicates the STRENGTH of the light emission

Lumen describes the amount of light that is radiated

Lux indicated the illumination intensity of an area.

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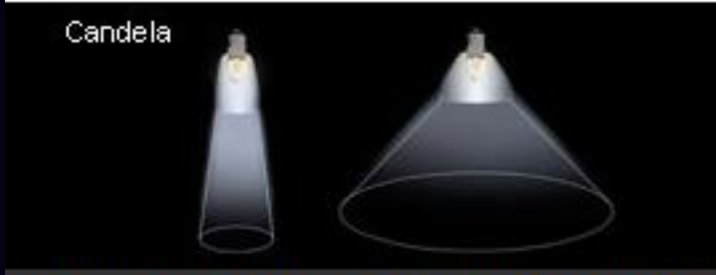
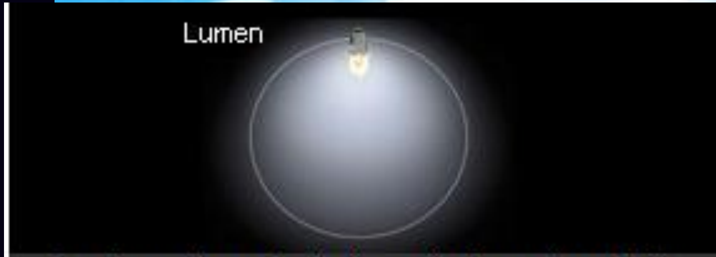
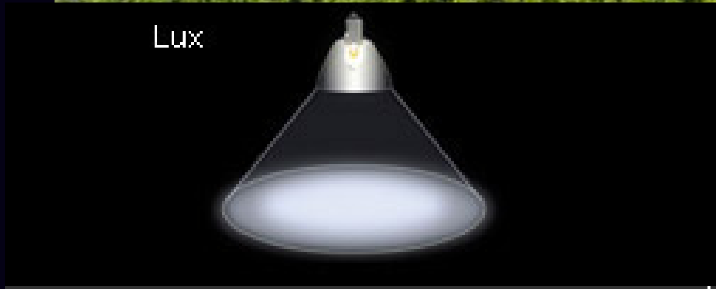


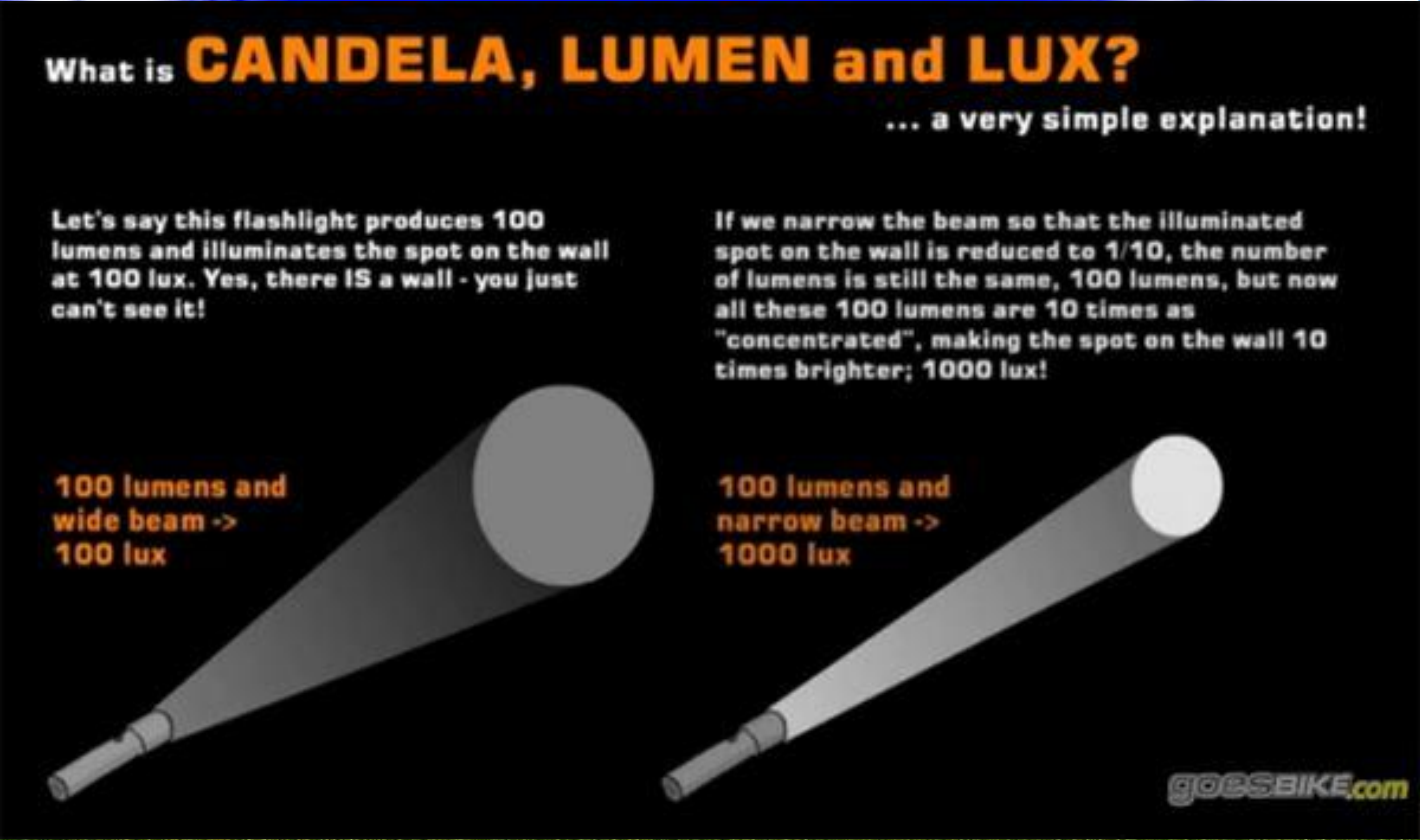
Luminous intensity refers to the strength of the beam



Luminous flux refers to the emitted quantity of light



Illuminance refers to the illuminated area.



What is CANDELA, LUMEN and LUX?

... a very simple explanation!

Let's say this flashlight produces 100 lumens and illuminates the spot on the wall at 100 lux. Yes, there IS a wall - you just can't see it!

If we narrow the beam so that the illuminated spot on the wall is reduced to 1/10, the number of lumens is still the same, 100 lumens, but now all these 100 lumens are 10 times as "concentrated", making the spot on the wall 10 times brighter; 1000 lux!

100 lumens and wide beam -> 100 lux

100 lumens and narrow beam -> 1000 lux

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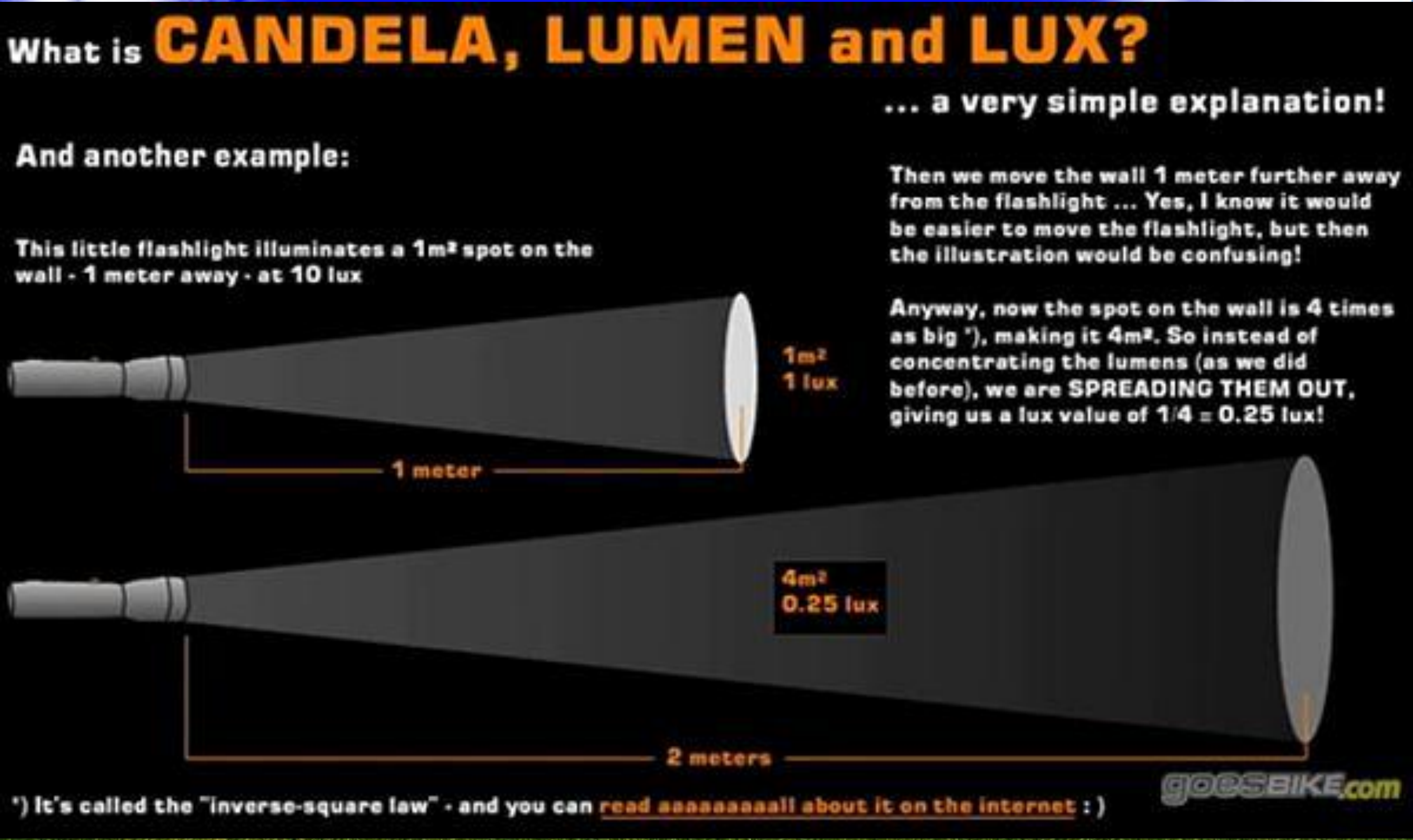


What is CANDELA, LUMEN and LUX?

... a very simple explanation!

And another example:

This little flashlight illuminates a 1m² spot on the wall - 1 meter away - at 10 lux

Then we move the wall 1 meter further away from the flashlight ... Yes, I know it would be easier to move the flashlight, but then the illustration would be confusing!

Anyway, now the spot on the wall is 4 times as big *), making it 4m². So instead of concentrating the lumens (as we did before), we are SPREADING THEM OUT, giving us a lux value of 1/4 = 0.25 lux!

*) It's called the "inverse-square law" - and you can read aaaaaaaaall about it on the internet :)

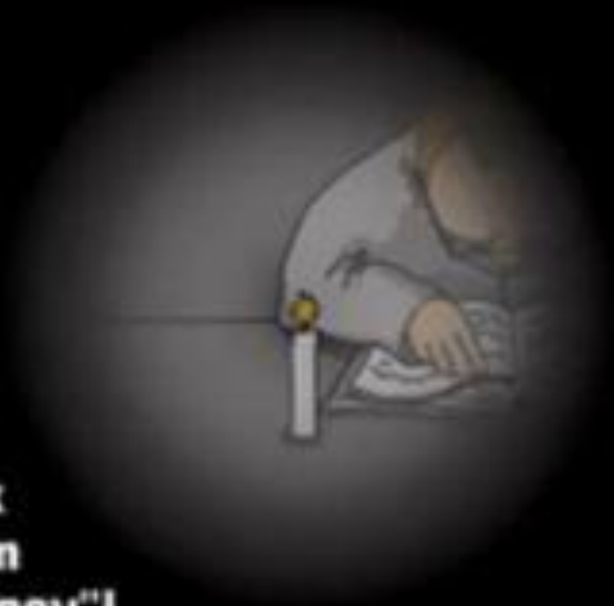
What is CANDELA, LUMEN and LUX?

... a very simple explanation!

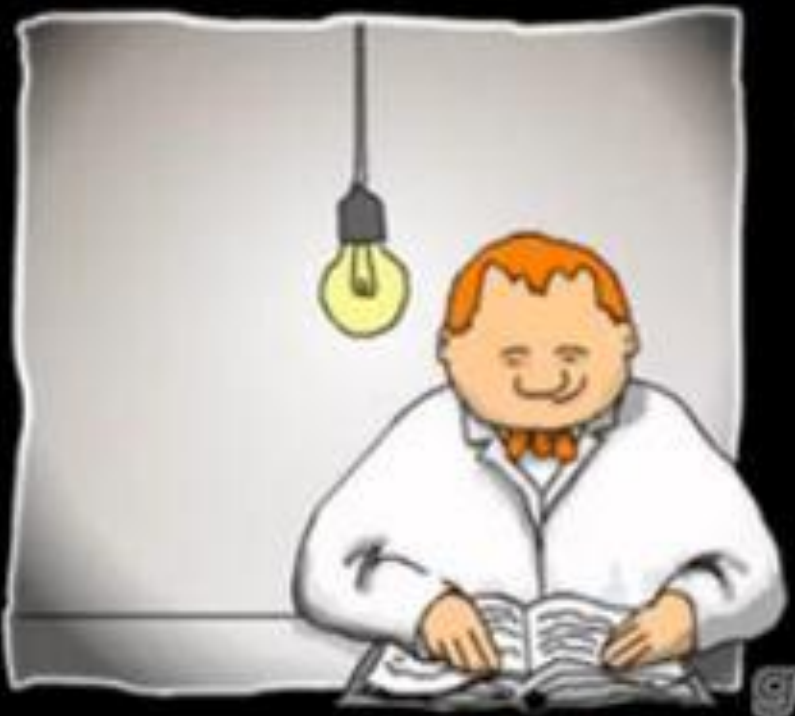
CANDELA is a measure of light intensity - measured at the light source. 1 candela is close to the light intensity of one ordinary candle! Like, "how BRIGHT is this light"!

LUMEN measures the total amount of light, independent of distribution, emitted from a light source, like for example a flashlight. Like, "how MUCH light is coming from this flashlight"!

LUX is a measure of illumination of a surface at distance. Like, "how well is this object ILLUMINATED at this distance from the light!"



Trouble reading? Professor Wise's book suffers from "lux-deficiency"!



Oh yeah, much better. 300-500 lux is fine for reading.

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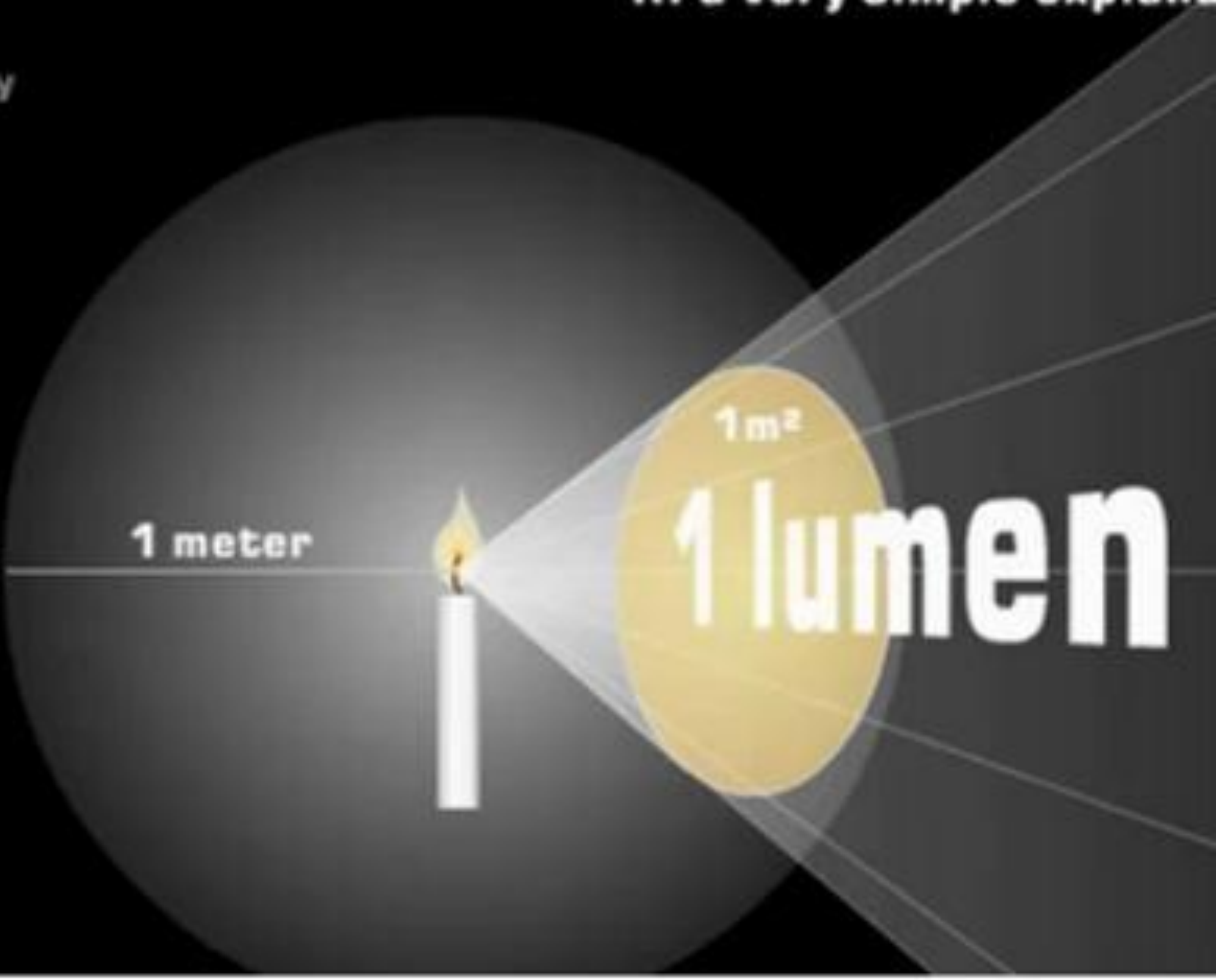
One candela = the light intensity from a candle (more or less)

... a very simple explana

... a very simple explana

One candela = the light intensity from a candle (more or less)

One lumen = the amount of light produced by a 1 candela source radiating out through 1 steradian (one steradian is about 1/12.57 of a sphere) - in this case 1m² of this sphere



One candela = the light intensity from a candle (more or less)

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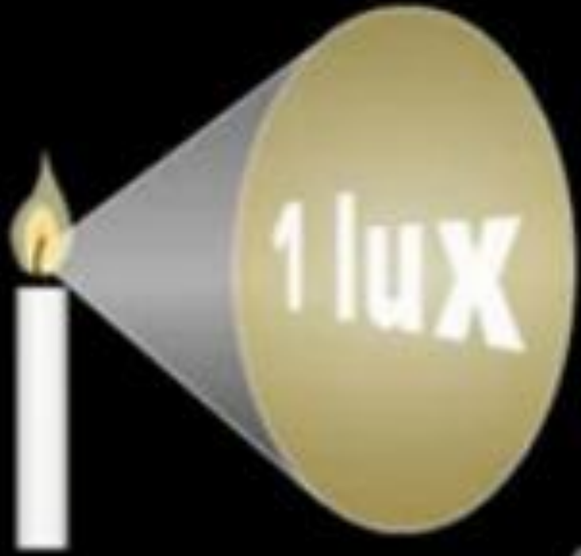
One lumen = the amount of light produced by a 1 candela source radiating out through 1 steradian (one steradian is about 1/12.57 of a sphere) - in this case 1m² of this sphere

One lux = the illumination produced when there is one lumen falling on one square meter



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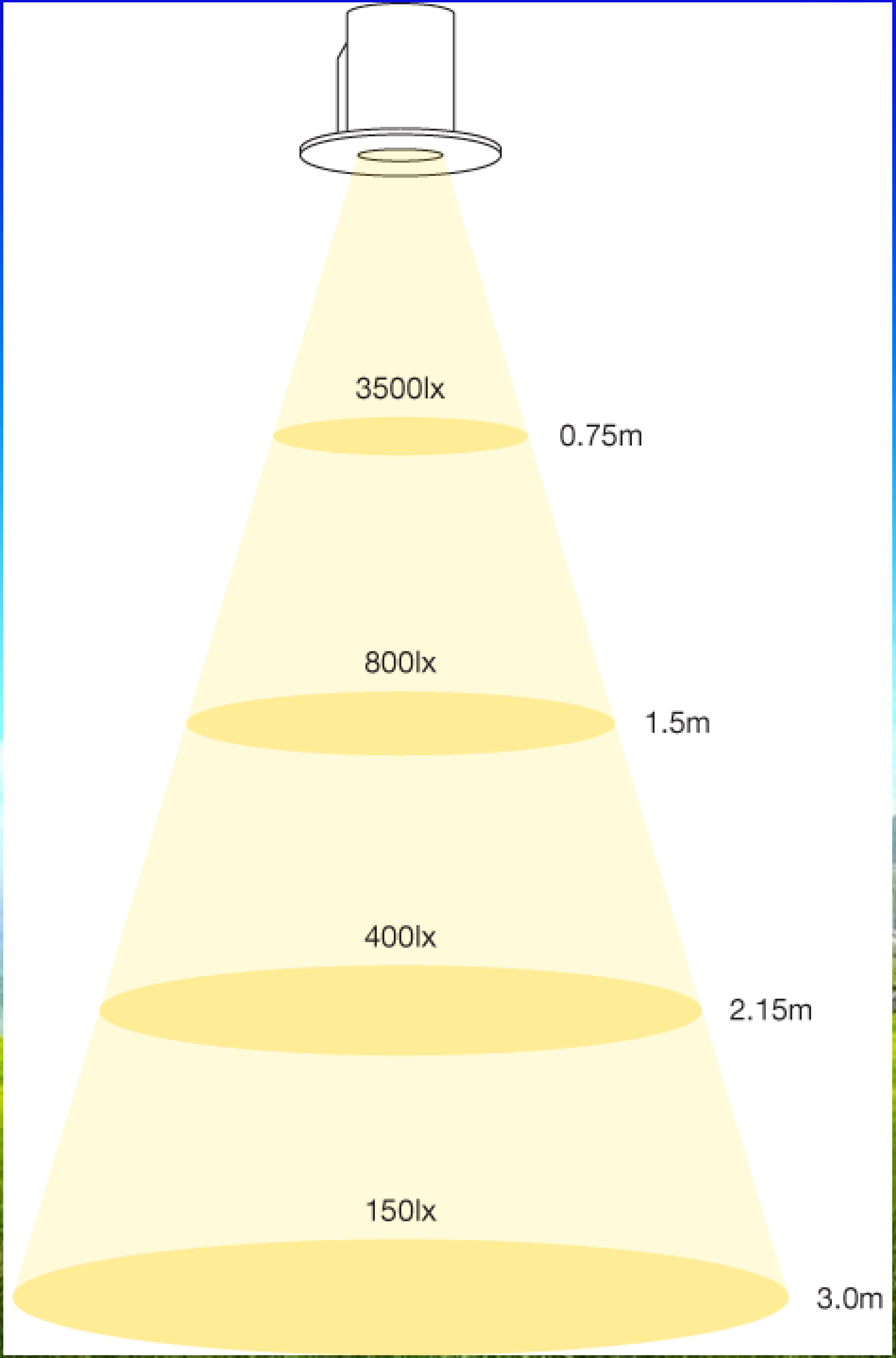
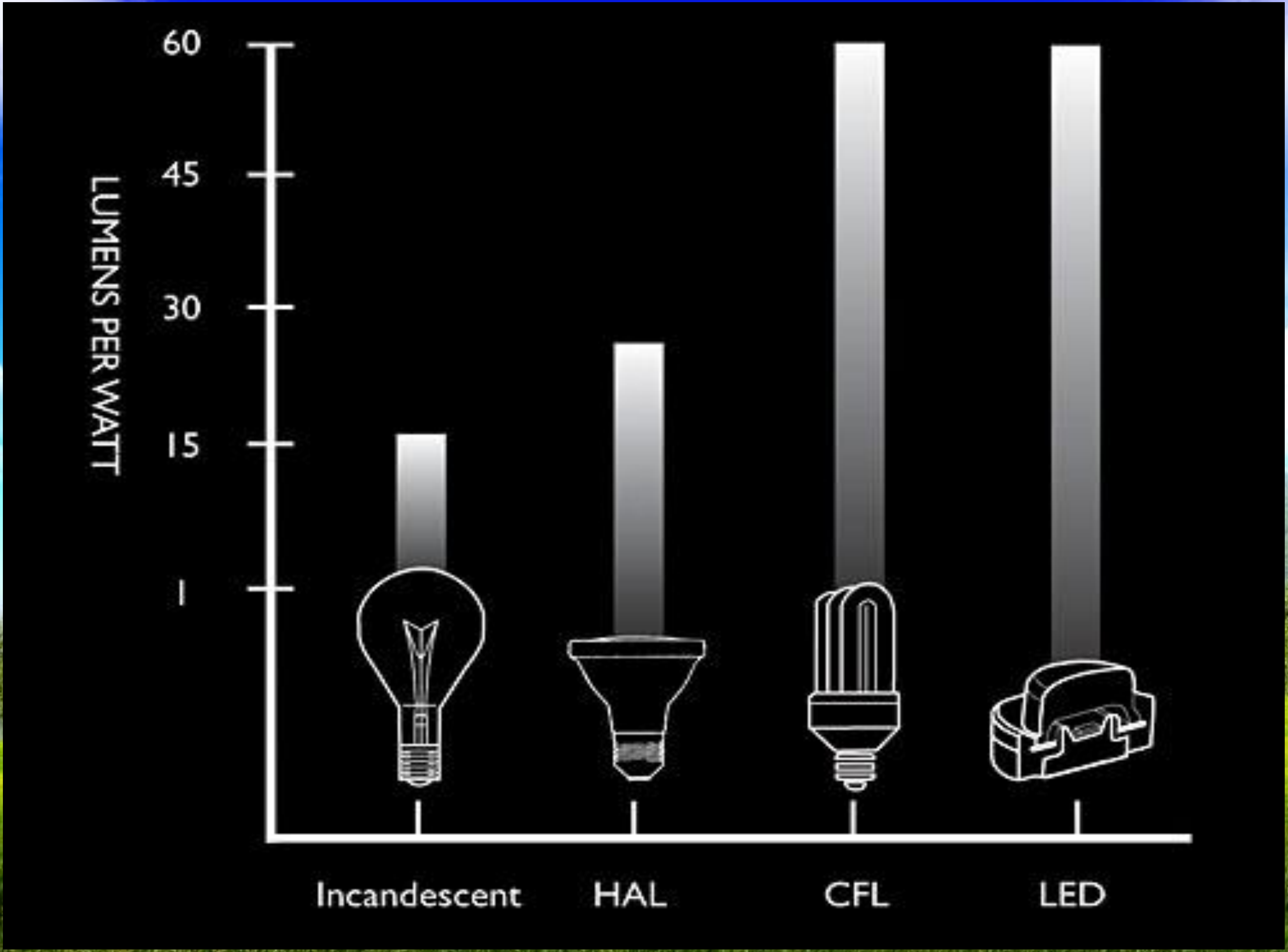
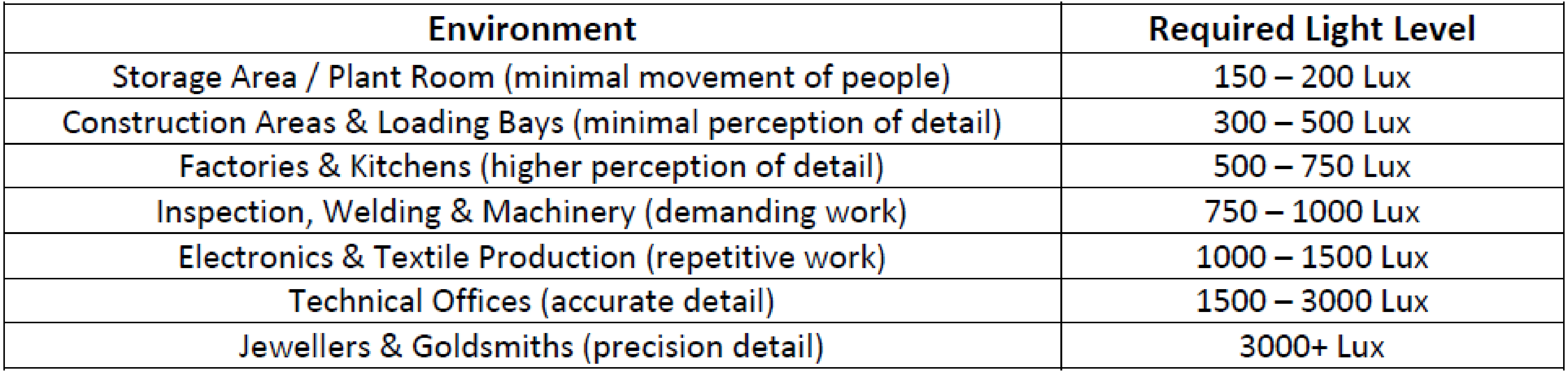

3500lx
0.75m
800lx
1.5m
400lx
2.15m
150lx
3.0m

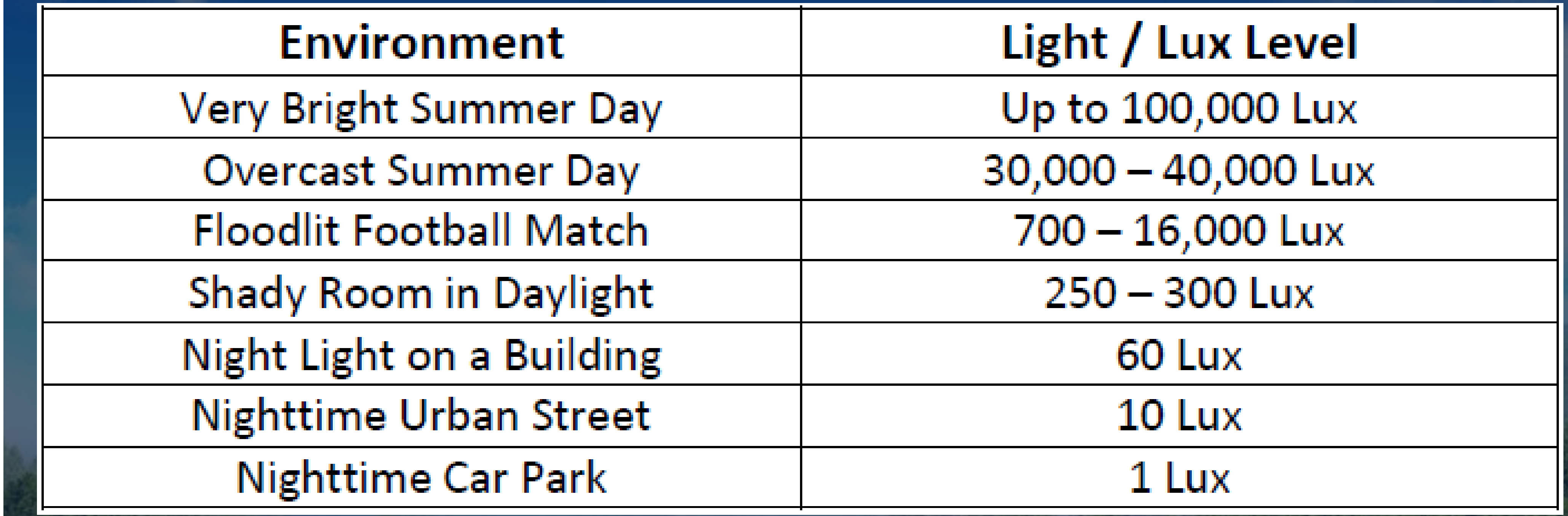

LUMENS PER WATT
60
45
30
15
1
Incandescent
HAL
CFL
LED

No	Aktifitas atau Area	Lux (Rata -rata)
1	Penerangan Umum	100
2	**Ruang Operasi**	
	Penerangan Umum	500
	Kantor Dokter	300
	Meja Operasi	20000
3	**Kamar Perawatan**	
	Penerangan Umum	100
	Baca	300
	Kamar Mandi/WC	200
4	**Perpustakaan/ Ruang Tunggu**	
	Penerangan Umum	200
	Baca	300
	Pemantauan	700
5	Kantor Pengawas	200
6	Daerah komersil	200
7	Ruang merokok	150
8	Tangga dan selasar	200

Standar kebutuhan pencahayaan



Environment	Required Light Level
Storage Area / Plant Room (minimal movement of people)	150 – 200 Lux
Construction Areas & Loading Bays (minimal perception of detail)	300 – 500 Lux
Factories & Kitchens (higher perception of detail)	500 – 750 Lux
Inspection, Welding & Machinery (demanding work)	750 – 1000 Lux
Electronics & Textile Production (repetitive work)	1000 – 1500 Lux
Technical Offices (accurate detail)	1500 – 3000 Lux
Jewellers & Goldsmiths (precision detail)	3000+ Lux



Environment	Light / Lux Level
Very Bright Summer Day	Up to 100,000 Lux
Overcast Summer Day	30,000 – 40,000 Lux
Floodlit Football Match	700 – 16,000 Lux
Shady Room in Daylight	250 – 300 Lux
Night Light on a Building	60 Lux
Nighttime Urban Street	10 Lux
Nighttime Car Park	1 Lux

TUGAS I

- Carilah gambar yang menunjukkan 3 peran cahaya yang berbeda selain sebagai penerangan. Berilah penjelasan menggunakan kata-kata sendiri untuk setiap gambarnya
- Carilah alat lain yang digunakan dalam bangunan/rumah dimana prinsip kerjanya memanfaatkan penggunaan inframerah dan ultraviolet (1 alat berbasis inframerah dan 1 alat berbasis ultraviolet). Berilah penjelasan menggunakan kata-kata sendiri untuk setiap alatnya

- Carilah ilustrasi yang menjelaskan perbedaan antara fluks luminous, intensitas cahaya, iluminansi dan luminansi. Jelaskan menggunakan kata-kata sendiri perbedaan dari keempat besaran cahaya tersebut.

KETENTUAN PEMBUATAN TUGAS :

- Tugas dibuat di microsoft word

INGAT : Penjelasan diminta menggunakan **kata-kata sendiri**

- Dikumpulkan dalam bentuk file di situs kuliah online paling lambat hari Senin, tanggal 24 Maret 2014