Radiation

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Directions: In groups of 2 or 3, research your topic using any IB Physics resource guide, write up a 2-3 slide presentation of the concepts and write up two practice problems (with HIDDEN or SEPARATE solutions) on a shared Googledoc for the class to use as practice. Make reference to the data booklet wherever possible. Please make sure any practice problems you "take" from a resource are at the SL level.

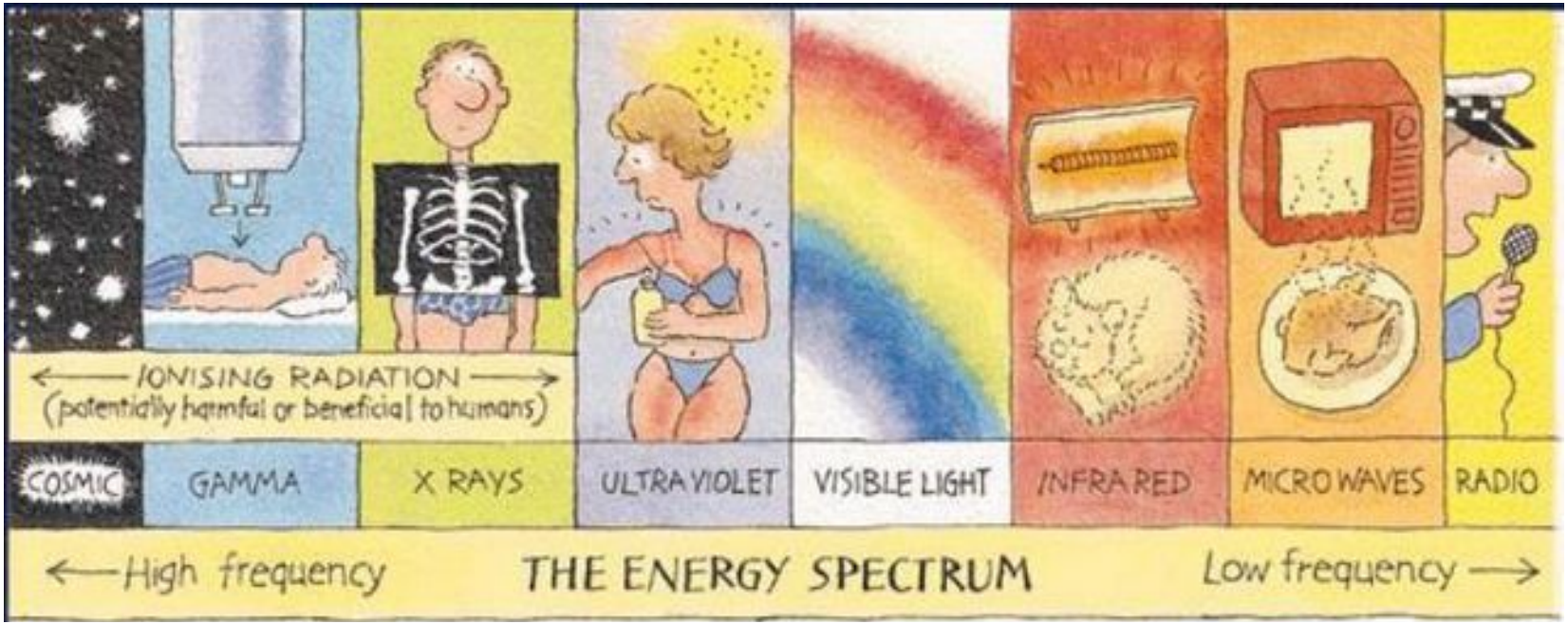
DUE DATE: Tuesday, November 24, 2020 End of Period

CONDUCTION	Josefina and Efren
CONVECTION	Haier
RADIATION	Alister and Alex
CLIMATE BALANCE	Javier and Manuel
GLOBAL WARMING	Nathan and Eric

Radiation can be divided up into 3 categories:

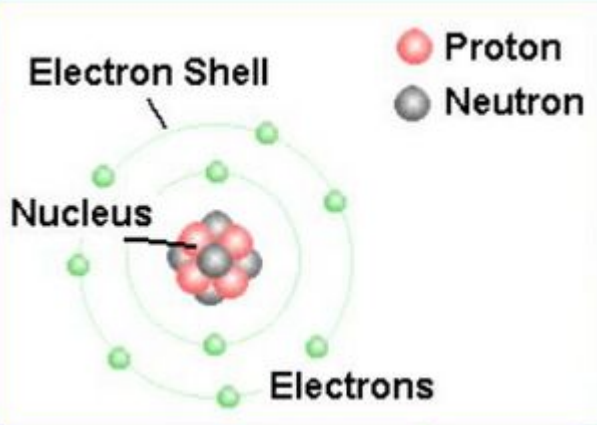
1) Non-Ionizing:
    a) Microwaves, UV, Laser, etc
2) Ionizing:
    a) X-rays, Alpha, Beta, and Gamma radiation
3) Energetic Particles:
    a) Charged particles and neutrons

The Energy Spectrum



Radiation in Space

Radiation in space is composed of energetic charged particles (atoms with their electrons mostly or completely stripped)



Radiation in Earth

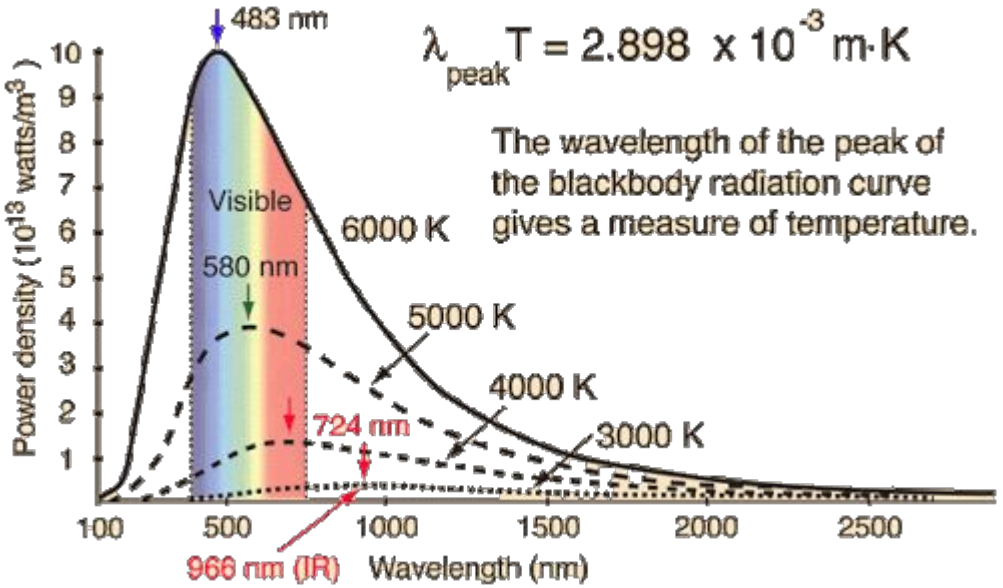
1370 W/m^2 = Solar Constant (No atmosphere)

1000 W/m^2 = I (Add atmosphere)

2 W/m^2 = I (Very Cloudy day)

170 W/m^2 = I (Average weather)

Wein Displacement Law



The more temperature the more overall intensity

Peak is at a shorter wavelength for higher temperature objects.

Emissivity

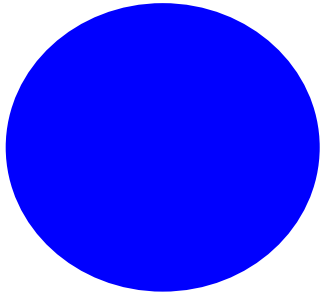
0<= e <=1

0: Perfect reflector (Like a mirror)

1: Perfect absorber. (Completely black objects,

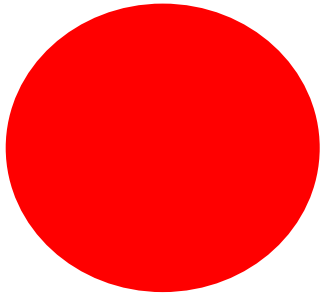
also known as Black Bodies)

Emissivity is a fraction



Emitted Power = 3

e = ⅗ = 0.6



Emitted Power = 5

The Stefan Boltzman Law

Power emitted by BB is proportional with Temp^4

P = sigma*A*T^4 where A = surface area

A = 4pi*r^2

I = P/A = sigma*T^4

Applying emissivity to Stefan’s law

P = e*sigma*A*T^4

Albedo = 1 - e (If all that is absorbed is emitted)

Clouds and Snow are very good reflectors.

Water is very bad reflector but good emissor

Practice Problem 1:

X and Y are spherical black bodies that radiate the same power. The temperature of X is 350 K and the temperature of Y is 700 K.

What is the ratio $\frac{\text{radius of X}}{\text{radius of Y}}$?

A. 16

B. 4

C. $\frac{1}{4}$

D. $\frac{1}{16}$

Answer 1:

Px = Py

4*pi*rx^2*Tx^4*sigma = 4*pi*ry^2*(2Tx)^4*sigma

(rx/ry)^2 =16

rx/ry = 4

Practice Problem 2:

Global warming reduces the ice and snow cover on Earth. Which of the following correctly describes the changes in albedo and rate of energy absorption by Earth?

	Albedo	Rate of energy absorption
A.	increase	increase
B.	decrease	increase
C.	increase	decrease
D.	decrease	decrease