13E - 2ND CLASS

RADIATION

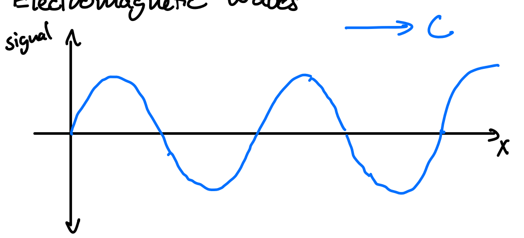
$q = \varepsilon \sigma A (T^4 - T_{sur}^4)$

ε = emissivity
σ = Stefan-Boltzmann Constant
T_{sur} = Temp. of the surroundings $\neq T_\infty$

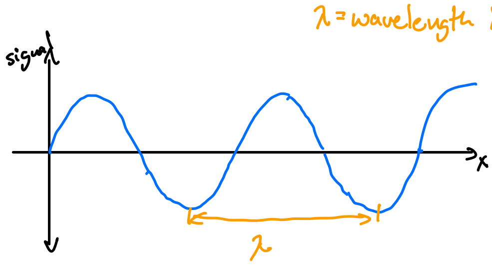
Black body: $\varepsilon = 1$
Grey body: $\varepsilon = \alpha$

- All matter emits radiation
- thermal radiation
  - in a material the temperature can effect the energy levels of electrons to yield thermal radiation.
  - thermal radiation is an electromagnetic wave
    - it travels at the speed of light
      $C = 300 \times 10^6$ m/s
      $= 186{,}000$ mi/s
  - it does NOT require a medium

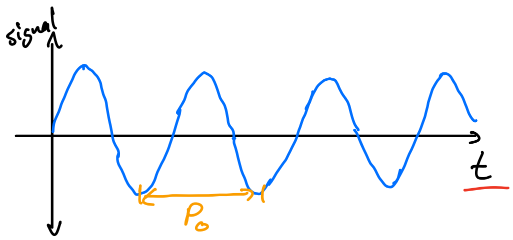
Electromagnetic Waves



λ = wavelength [μm]



$1 \mu m = 1 \times 10^{-6}$ m
1 nm $= 1 \times 10^{-9}$ m



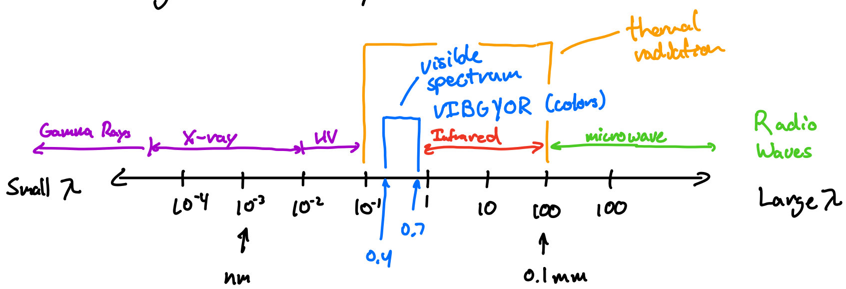
P_o = period

$\nu = \frac{1}{P_o}$ = frequency = $\frac{1 \text{ cycle}}{\text{second}}$ = Hz

$C = \nu \lambda$ ← the speed of the wave is equal to the frequency times wavelength

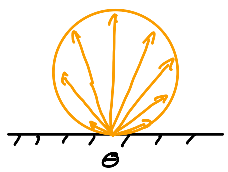
$\lambda = \frac{C}{\nu}$

Electromagnetic [Em] Spectrum



1. λ "spectral"
2. θ "angular, directional"

We will treat radiation as a surface phenomenon



Radiation Fluxes [W/m²]

E = emissive power $= \varepsilon\sigma T_s^4$ - emitted by a surface
G = irradiation - incident on a surface
J = radiosity - radiation leaving a surface
q''_{rad} = net radiative flux - net radiation leaving the surface
$= J - G$

* E, G, J, q''_{rad} are over all directions and all the wavelengths