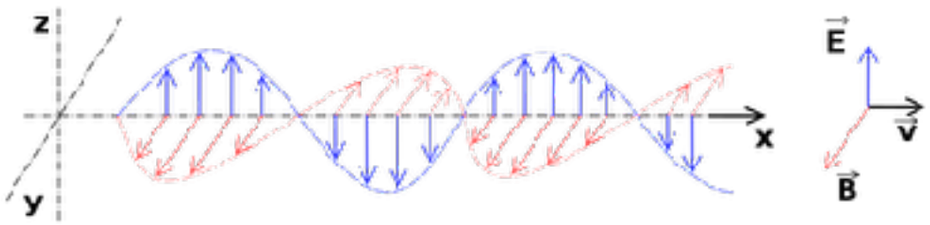
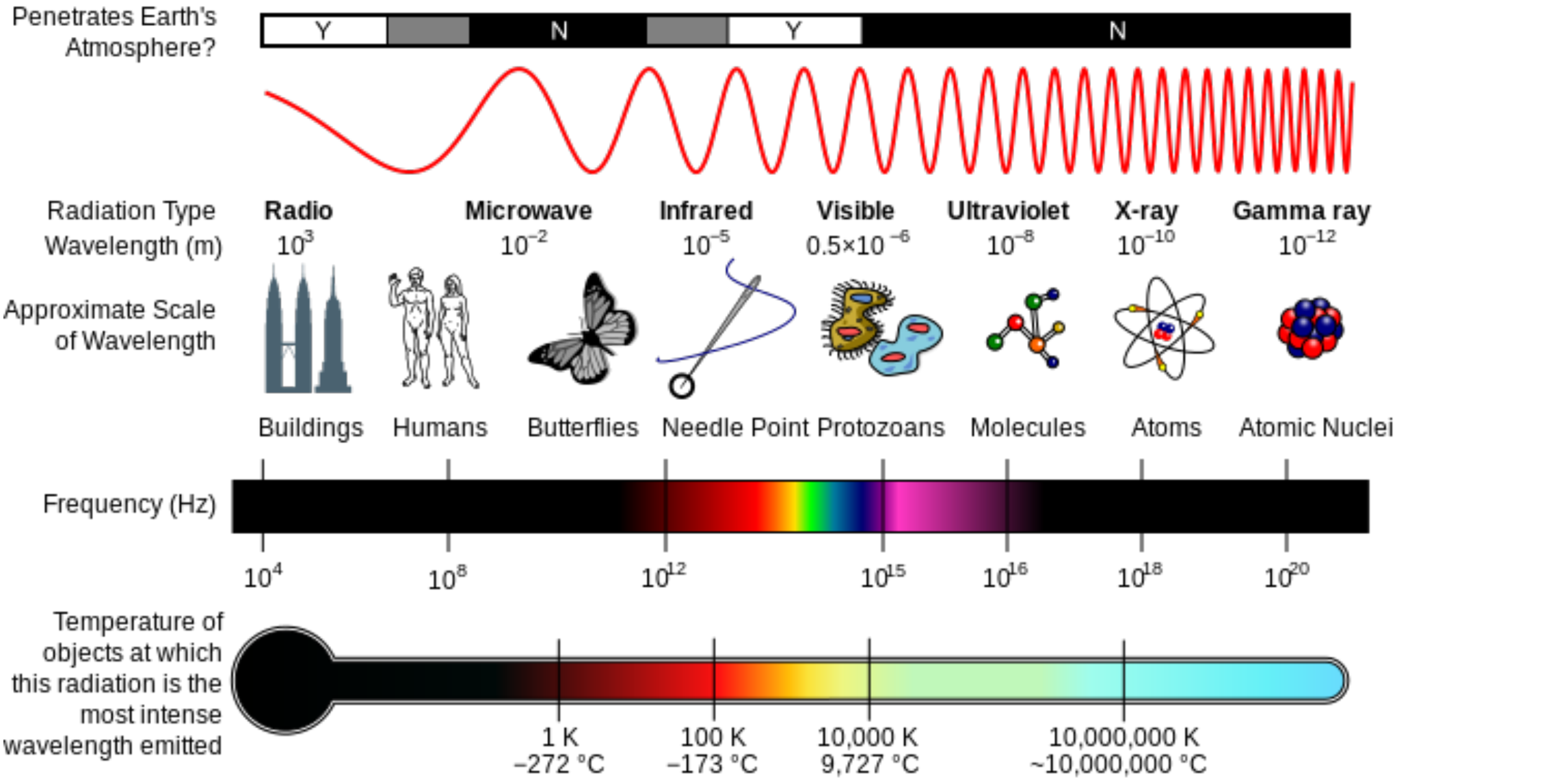
Electromagnetic spectrum

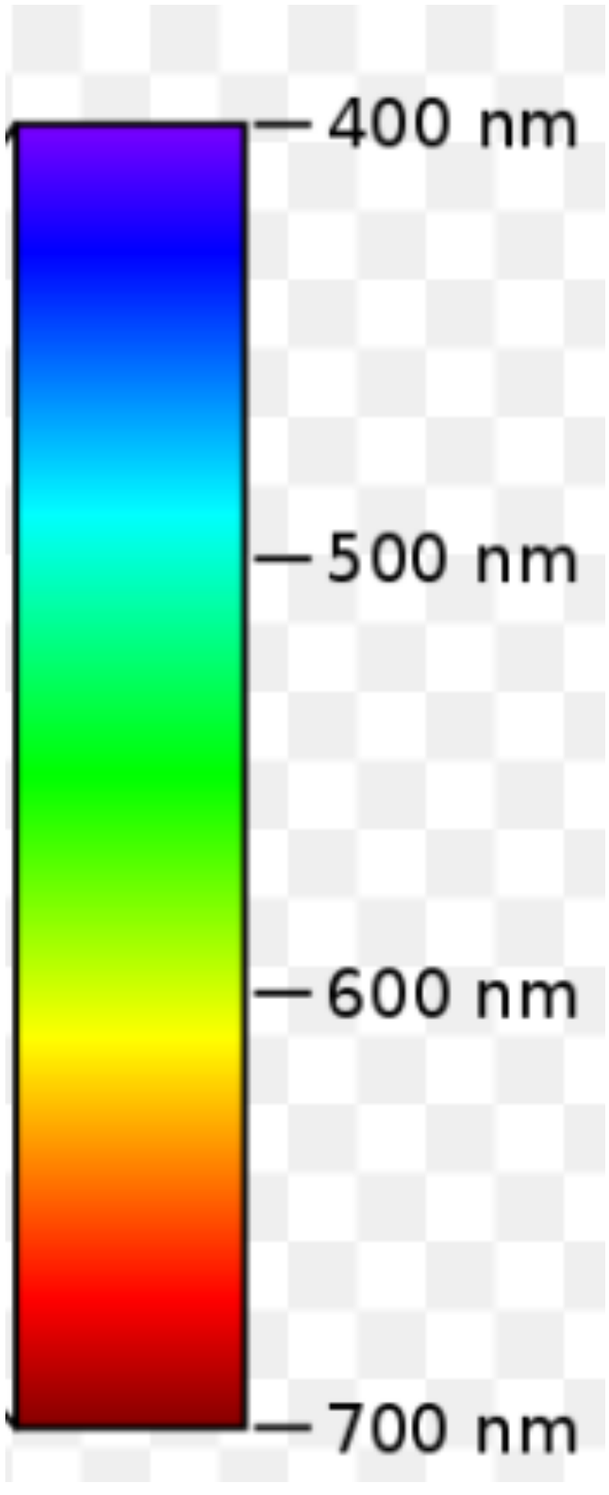


- **Light** is an electromagnetic **wave** having **wavelength** and **frequency** in a certain range



A diagram of the electromagnetic spectrum (from Wikipedia)

Optics



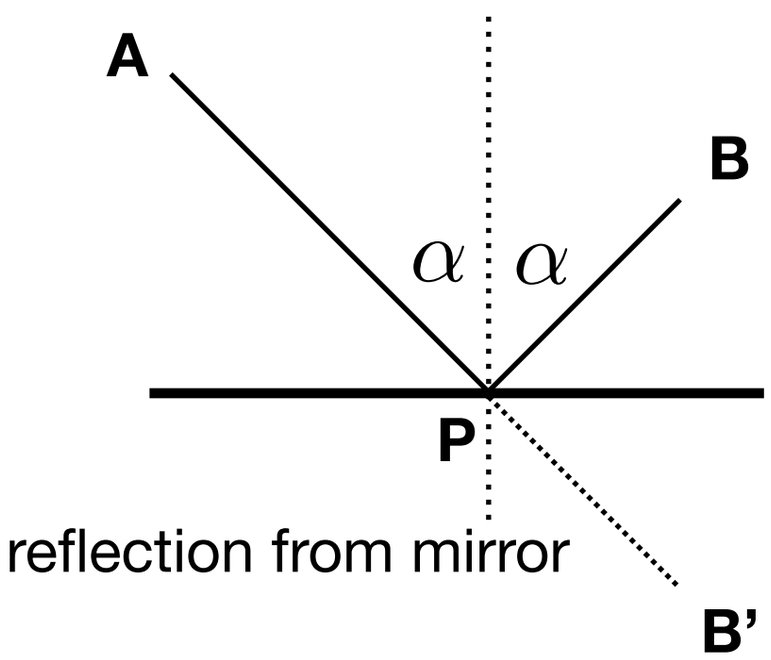
- **Optics** studies behavior, properties and propagation of **light**
- **Light** has a **wave nature** but in many cases behaves as **ray of particles**
- This happens when the **wavelength of light is much smaller than distances** of interest
- **Visible light** has a **wavelength between 400 and 700 nm** (thickness of a sheet of paper and of a human hair is approximately 100,000 nm)

- **Geometrical optics:** light - collection of rays traveling in straight lines
- **Physical optics:** includes wave effects such as diffraction and interference
- **Quantum optics:** light behaves both as particle and as wave

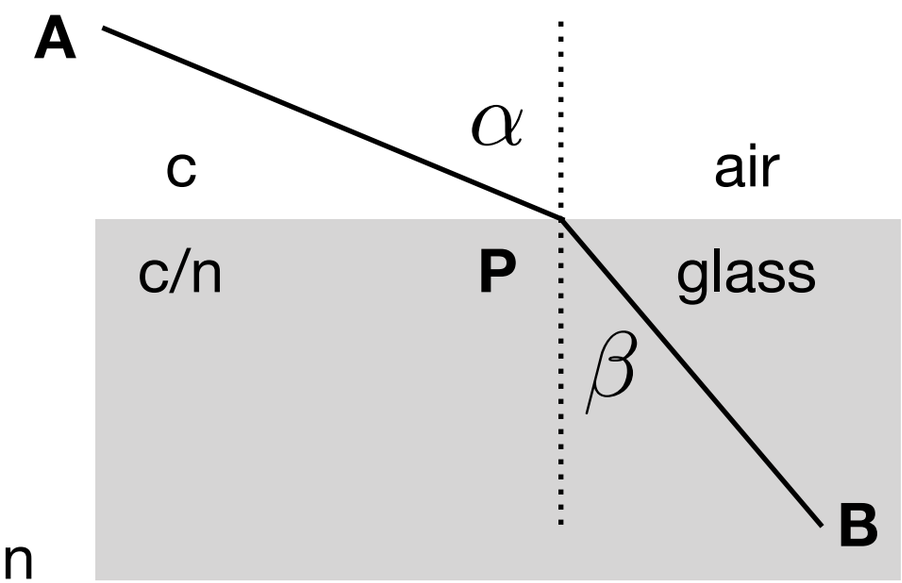
Geometrical Optics

- **Light rays** propagate in **straight lines**
- **Light rays** can **bend**, get **reflected** and get **absorbed** at various **interfaces**
- **Speed of light** changes in **different media** and is usually smaller than the speed in vacuum
- Many properties can be understood from **Fermat's principl**e

Fermat's principle (the principle of least time) is the principle that the path taken between two points by a ray of light is the **path that can be traversed in the least time**



reflection from mirror



refraction

Homework

Problem 1

Try to find two parallel mirrors and stand between them. What do you see? What is the distance between images?

Problem 2

Sketch the path of the ray entering the set of two mirrors forming a right angle. The same question for an angle of 30 degrees. See the Figure.