Waves

Unit: Electronic Structure

MA Curriculum Frameworks (2016): HS-PS1-1

Mastery Objective(s): (Students will be able to…)

- Explain what waves are and how they propagate.
- Describe the relative energies of different waves based on their frequencies and positions within the electromagnetic spectrum.
- Calculate the frequency and wavelength of electromagnetic waves.

Success Criteria:

- Descriptions are accurate and backed up by evidence.
- Calculations are correct.
- Algebra and rounding to appropriate number of significant figures is correct.

Tier 2 Vocabulary: wave, spectrum

Language Objectives:

- Explain scientific information about waves and the electromagnetic spectrum.

Notes:

wave: an energy disturbance that travels from one place to another.

medium: the substance that a wave travels through. Electromagnetic waves (including light) can travel without a medium.

- The wave travels through the medium.
- All (or nearly all) of the energy passes through the medium—the medium doesn't absorb it.

Some examples of waves:

Type of Wave	Medium
sound	air (or water, solids)
ocean	water
electromagnetic (*e.g.,* light, radio)	none

Use this space for summary and/or additional notes:

wavelength (λ): the length of the wave, measured from a specific point in the wave to the same point in the next wave. unit = distance (m, cm, nm, *etc.*)

frequency: (f or ν) the number of waves that travel past a point in a given time.
Symbol = f; unit = $^{1}/_{\text{time}}$ = Hz

$$\text{speed} = \lambda f$$

Electromagnetic waves (such as light, radio waves, etc.) travel at a constant speed—the speed of light. The speed of light is a constant, and is denoted by the letter "*c*" in equations.

$$c = 3.00 \times 10^{8}\ {}^{\text{m}}/_{\text{s}} = 186{,}000 \text{ miles per second}$$

The energy (*E*) that a wave carries equals a constant times the frequency. (Think of it as the number of bursts of energy that travel through the wave every second.) For electromagnetic waves (including light), the constant is Planck's constant (named after the physicist Max Planck), which is denoted by a script h in equations. So the equation is:

$$E = hf$$

where $h = 6.63 \times 10^{-34}$ J·s = Planck's constant

Louis de Broglie: French physicist. Showed that any object with momentum (*i.e.,* has mass and is moving) creates a wave as it moves.

Large objects with a lot of momentum (such as people) create waves with wavelengths that are far too small to detect.

Small objects (such as electrons) create waves with wavelengths in the visible part of the spectrum. This is why we can see the light produced by electrons as they move.

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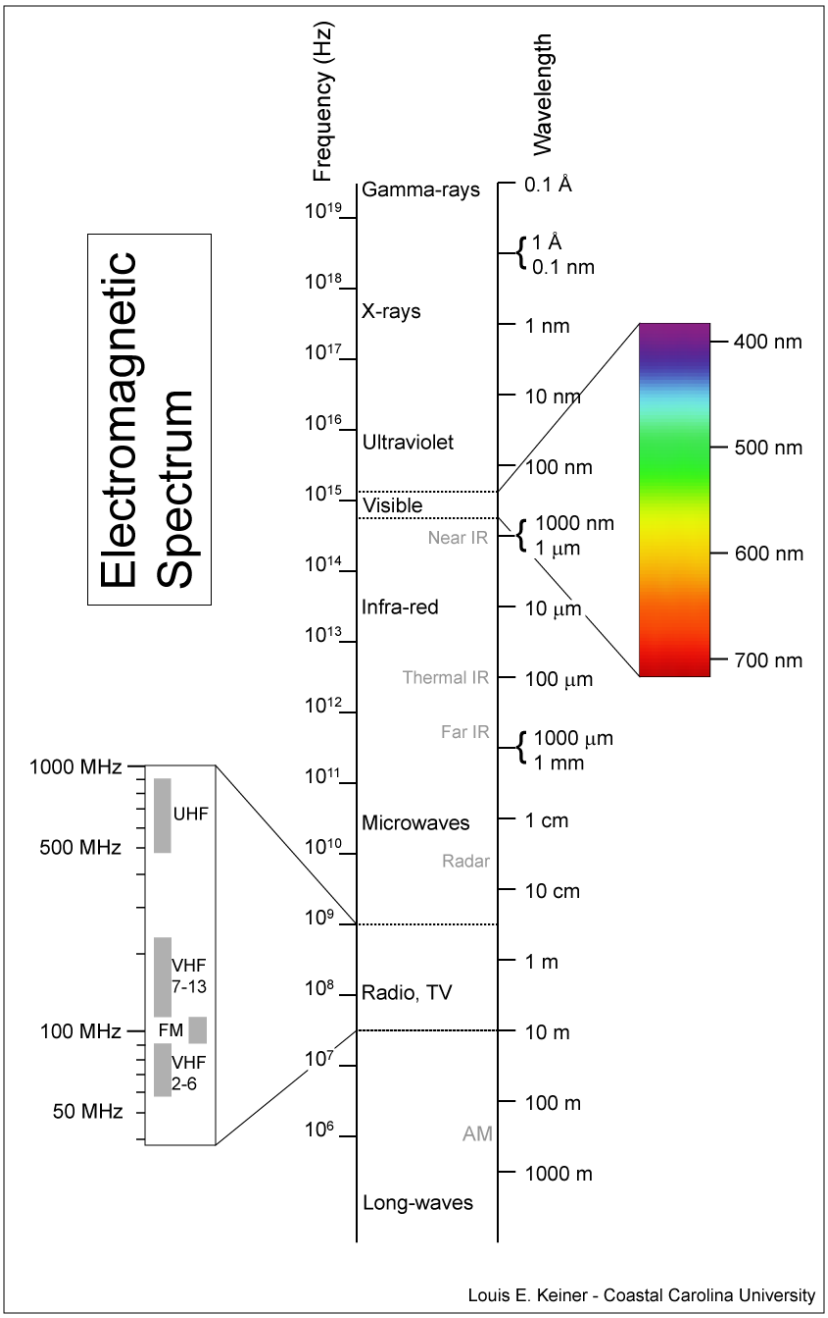
spectrum: the set of all possible wavelengths. Visible light is one set of wavelengths that are part of the full electromagnetic spectrum.



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