Electron Energy Transitions

Unit: Electronic Structure

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

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

- Explain the meaning of the lines in emission spectra.

Success Criteria:

- Descriptions include colors, approximate wavelengths, and relationship between number of lines and number of electrons.

Tier 2 Vocabulary: emission, spectrum, ground, excited

Language Objectives:

- Explain scientific information about energy transmissions and line spectra.

Notes:

quantum: a discrete quantity of energy that cannot be divided.

ground state: the lowest available energy level for an electron.

excited state: a higher energy level than the ground state.

emission spectrum: the wavelengths (colors) of light emitted by an element when its electrons are "excited" (raised to a higher energy state) and then allowed to return to the ground state.

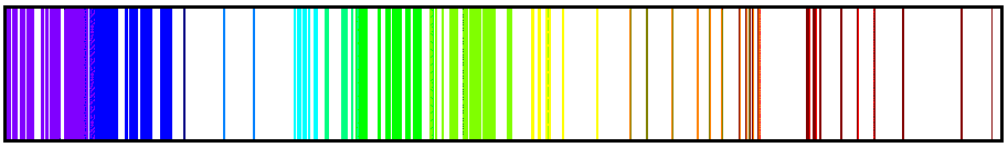
spectroscope: a device that separates colors of light based on their wavelengths.

Use this space for summary and/or additional notes:

If you were to look at a glass tube filled with hydrogen gas that was energized with electricity, the gas in the tube would appear to be blue, because the electrons are energized, and the energy of the light they emit as they return to the $n = 2$ quantum energy level corresponds with a blue color.

If you were to split the light emitted by hydrogen into its component colors using a spectroscope, you would see the following:

Atoms with more electrons have a larger number of possible transitions, each with different energies. This results in more lines in their emission spectrum, as with iron:



photon: a single "piece" (particle/wave) of light.

luminescence: light that is not generated by high temperatures alone. (In fact, it usually occurs at low temperatures. Causes include electrical energy and chemical reactions.)

fluorescence: a type of luminescence that occurs when electrons of an element are excited and return immediately to the ground state, giving off a photon. The wavelength of the photon given off is usually different from the wavelength of the photon used to raise the electrons to the excited state.

phosphorescence: "glow-in-the-dark" luminescence—a type of luminescence that occurs when electrons are excited, but cannot return directly to the ground state. The indirect path is slower, which cause the material to "glow" for a longer period of time (in some cases, hours).

triboluminescence: a form of luminescence in which light is generated by breaking asymmetrical bonds in a crystal. In the case of wintergreen Life Savers, when the sugar crystals are crushed, the positive and negative charges get separated. The voltage between them causes a spark. Normally, these sparks are in the ultraviolet part of the spectrum and cannot be seen; however, wintergreen oil (methyl salicylate) is fluorescent. It absorbs the photons of ultraviolet light and emits photons of blue light, which we can see.

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