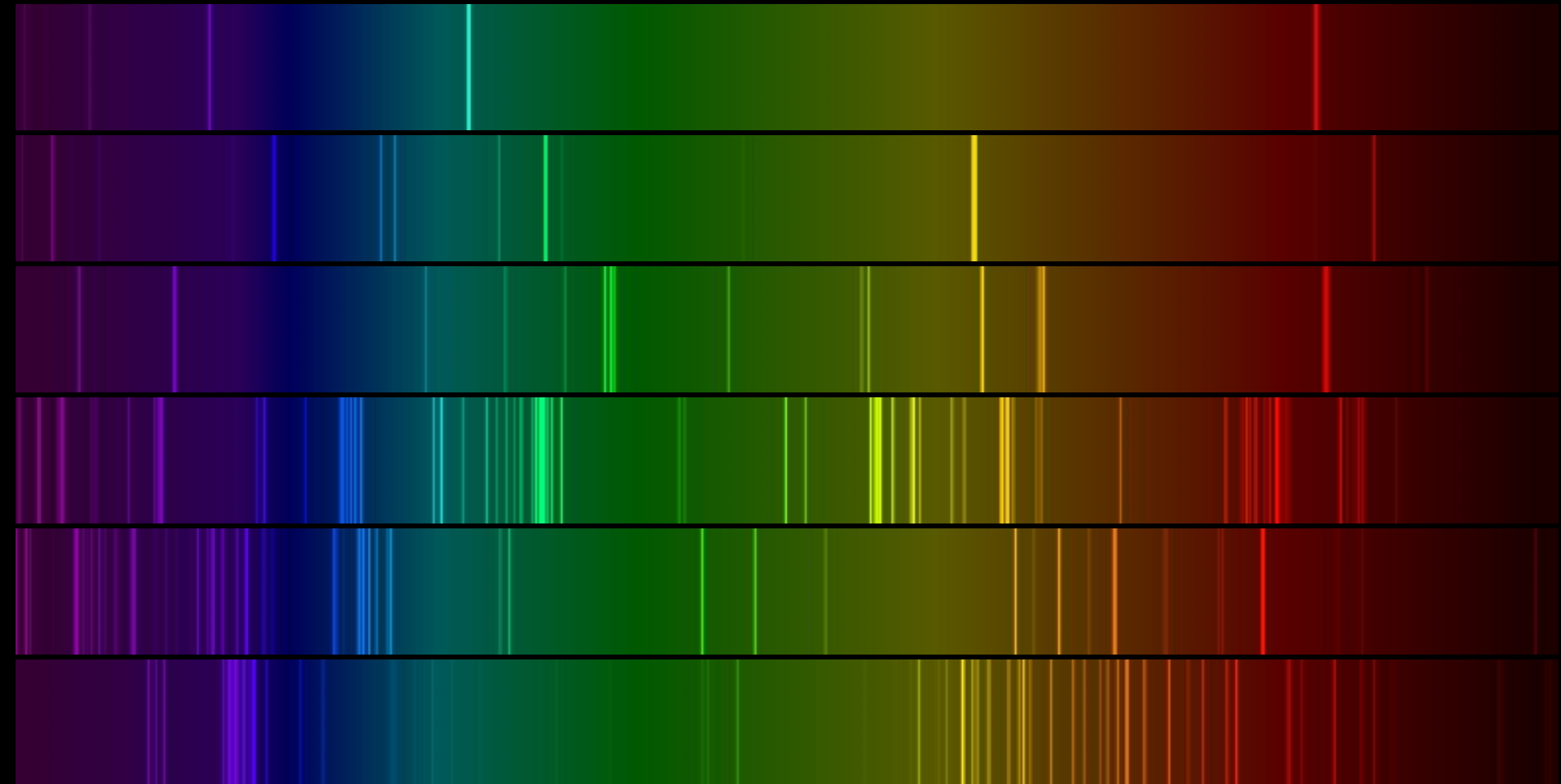


# ELECTRONS & LIGHT

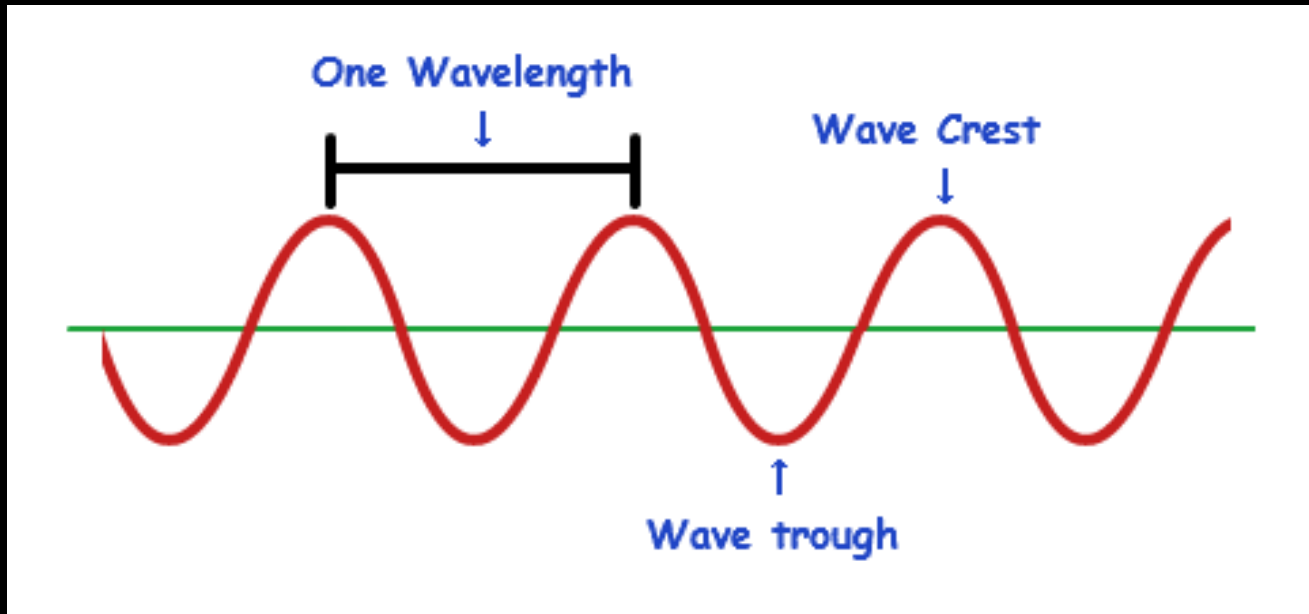


# THE BIG QUESTIONS

- What is light?
- How is light emitted?
- What do electrons have to do with light?
- How do flame tests help identify metals?
- What are emission spectra?

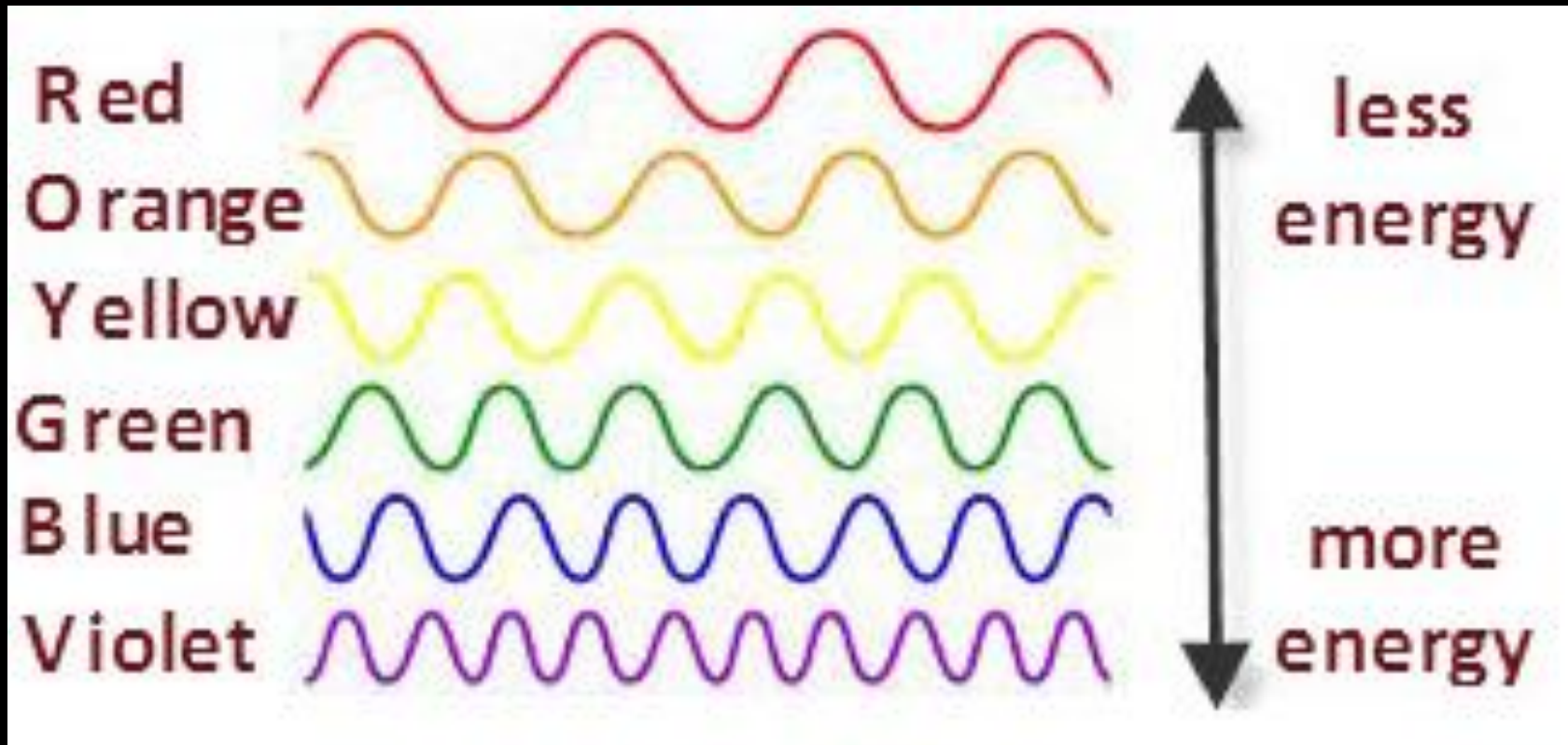
# THE ELECTROMAGNETIC SPECTRUM

- All light is part of the EM spectrum.
  - Most is **invisible**:
    - radio waves, microwaves, **IR**, **UV**, X-rays, gamma,
  - **Visible** light: **wavelength** from 400 to 700 nm.

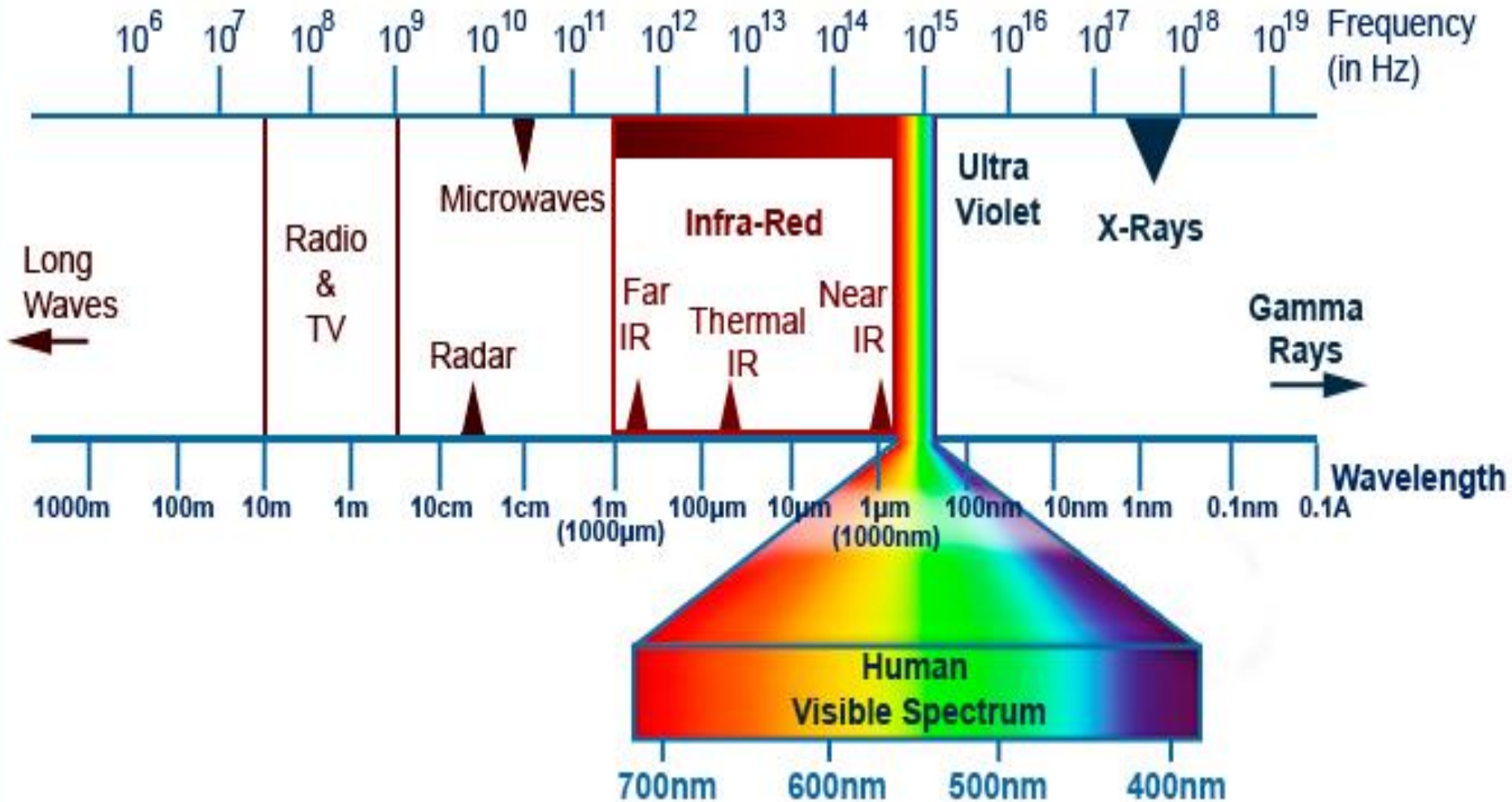


# LIGHT

- **Light** is a carrier of **energy**.
  - **Energy** is proportional to **frequency**.
  - **Frequency** is inversely proportional to **wavelength**.

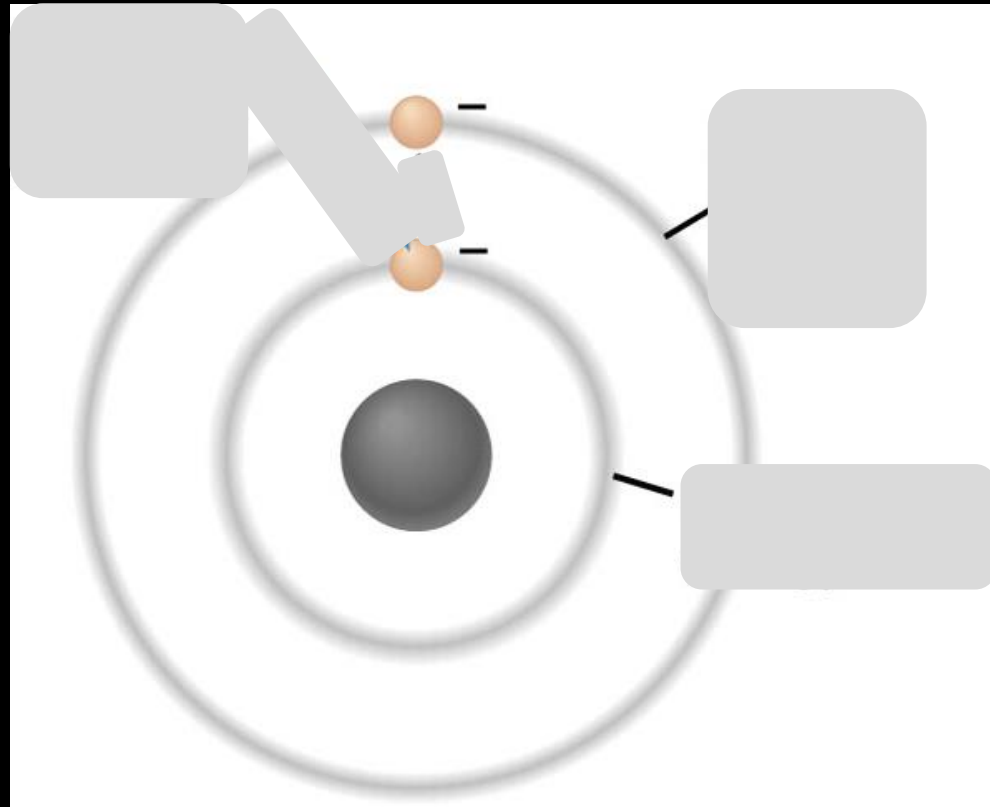


# The Electromagnetic Spectrum

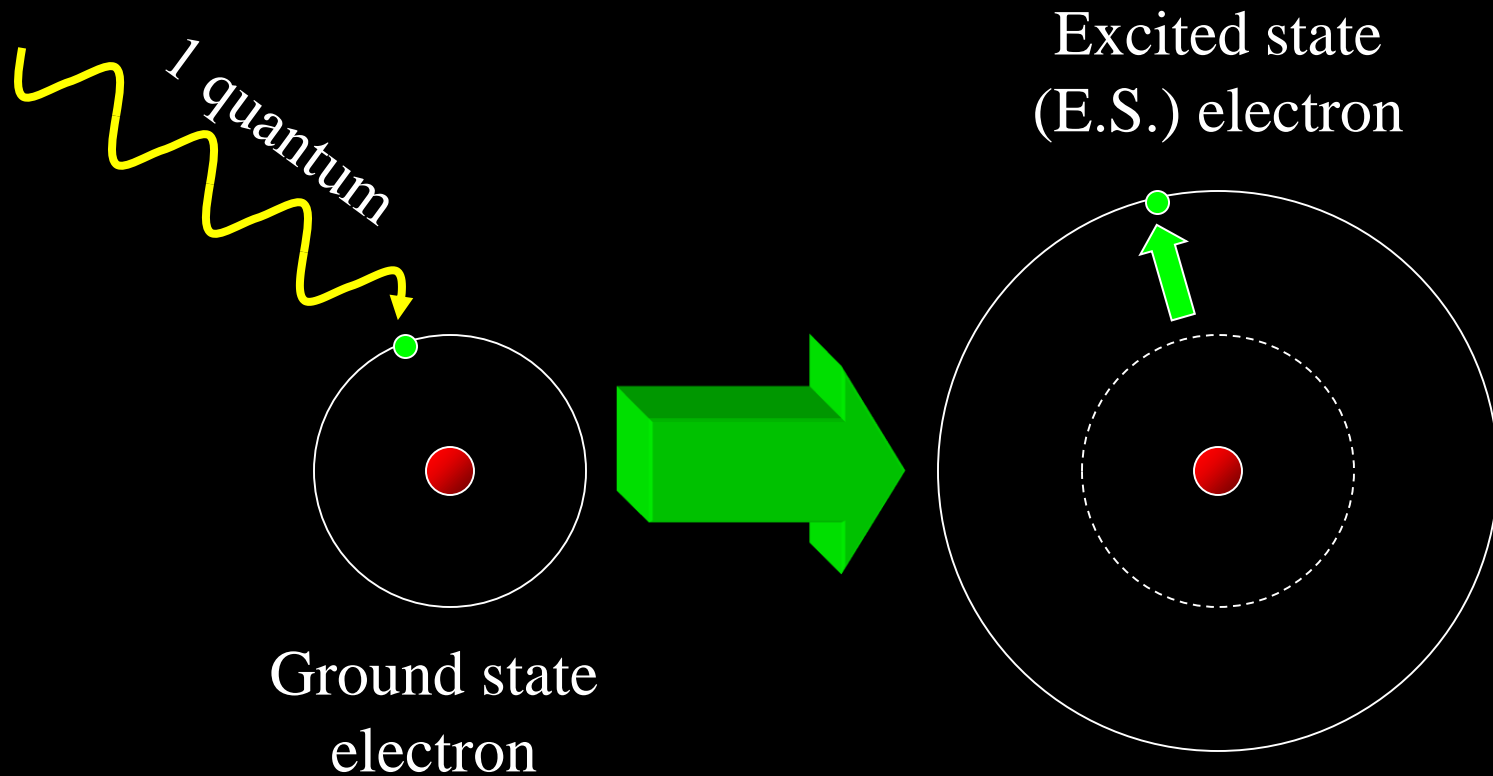


# ELECTRONS AND ENERGY

- **Ground state:**
  - lowest energy an  $e^-$  can occupy.
- **Excited state:**
  - high-energy position.
- **Quantum** (*pl. quanta*):
  - amount of energy needed to move an  $e^-$  to a higher energy level.

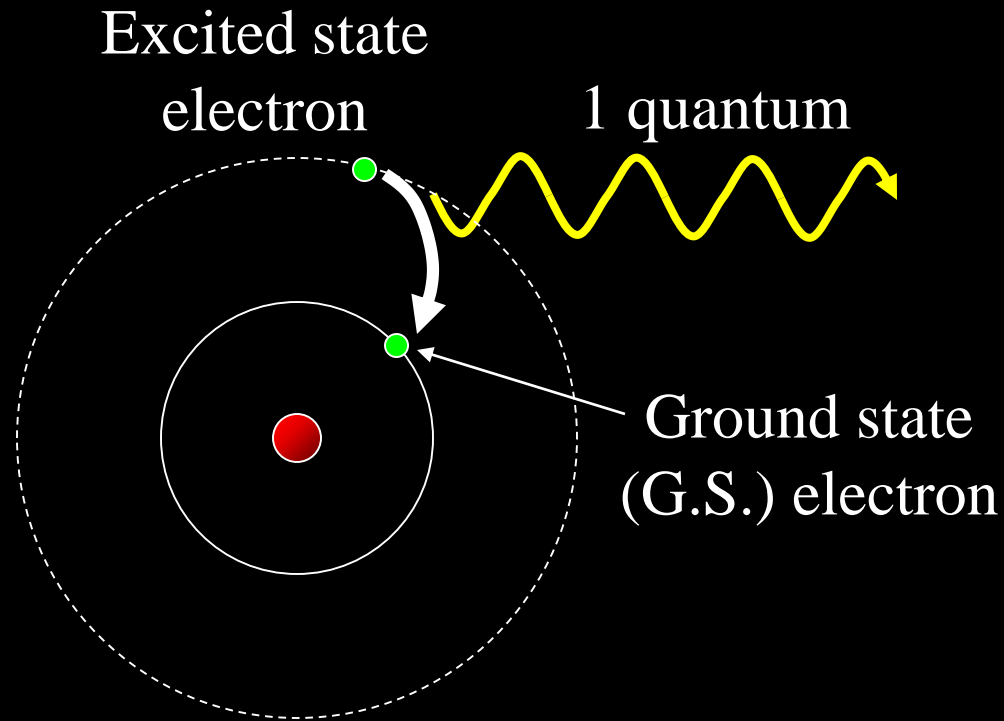


# LIGHT AND ELECTRONS



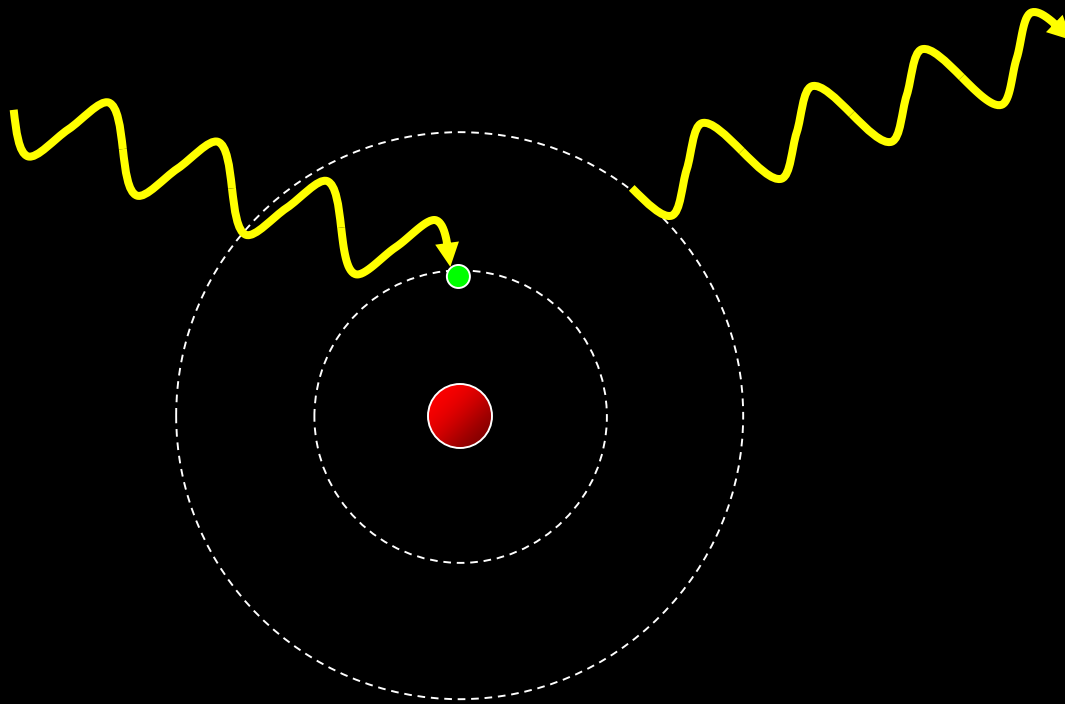


# LIGHT AND ELECTRONS





# LIGHT AND ELECTRONS



# EMISSION SPECTRUM

- **Emission spectrum** – wavelengths of light given off by an element when it is excited (usu. by heat).
  - Every element has unique emission spectrum.

# EMISSION SPECTRA



Hydrogen

The image shows the emission spectrum of hydrogen, which consists of a continuous background of colors (violet, blue, cyan, green, yellow, orange, red) with several distinct, bright vertical lines. The most prominent lines are in the visible range: a violet line at approximately 410 nm, a blue-violet line at 434 nm, a cyan line at 486 nm, a bright green line at 656 nm, and a red line at 658 nm. There are also fainter lines in the ultraviolet and infrared regions.



Helium

The image shows the emission spectrum of helium, which consists of a continuous background of colors with several distinct, bright vertical lines. The most prominent lines are in the visible range: a violet line at approximately 668 nm, a blue-violet line at 669 nm, a blue line at 687 nm, a cyan line at 706 nm, a green line at 722 nm, a yellow-green line at 792 nm, a yellow line at 801 nm, an orange line at 845 nm, and a red line at 866 nm. There are also fainter lines in the ultraviolet and infrared regions.



Carbon

The image shows the emission spectrum of carbon, which consists of a continuous background of colors with several distinct, bright vertical lines. The most prominent lines are in the visible range: a violet line at approximately 844 nm, a blue-violet line at 845 nm, a blue line at 865 nm, a cyan line at 883 nm, a green line at 900 nm, a yellow-green line at 923 nm, a yellow line at 944 nm, an orange line at 975 nm, a red line at 993 nm, and a red line at 1013 nm. There are also fainter lines in the ultraviolet and infrared regions.

# FLAME TESTS

- **Flame test** – used to ID some metals in compounds.
  - Each metal gives a flame a characteristic color.
  - Can identify metals based on flame colors.

