

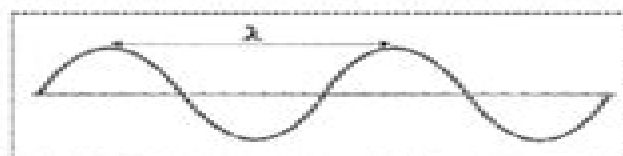


## 5: Flame Tests and Atomic Spectra (Experiment)

### Objectives

- To perform flame tests of metal cations in order to observe their characteristic colors.
- To perform calculations to determine the frequency and energy of the emitted photons.
- To relate these results to the types of electronic transitions occurring in these elements.
- To observe and understand line emission spectra of atoms using gas-discharge tubes.
- To practice writing electron configurations for these (and other) elements.

Electromagnetic radiation is energy in the form of waves. Waves are characterized by their wavelength ( $\lambda$ ) and frequency ( $\nu$ ). Wavelength is defined as the distance between successive crests (or troughs) on a wave, and is measured in meters. Frequency is defined as the number of waves that pass a given point every second, and is measured in 1/seconds ( $1/s$  or  $s^{-1}$ ), or Hertz (Hz).



All electromagnetic waves travel at the speed of light ( $c$ ), or  $3.0 \times 10^8 \text{ m/s}$ . The relationship between the wavelength, frequency and speed of a wave is given by the equation:

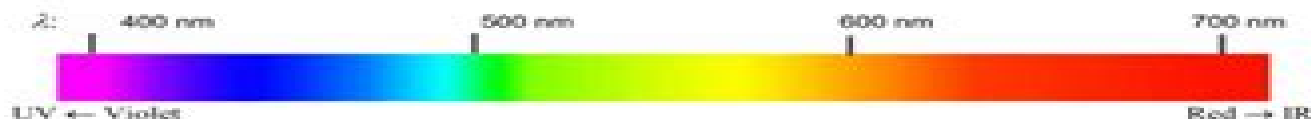
$$c = \lambda \times \nu \quad (5.1)$$

Electromagnetic radiation also occurs as discrete "packets" called *photons*. The energy ( $E$ ) of a photon (in Joules,  $J$ ) is given by the equation:

$$E_{\text{photon}} = h \times \nu \quad (5.2)$$

Here,  $h$  is Planck's constant, which has a value of  $6.63 \times 10^{-34} \text{ J} \cdot \text{s}$ .

Visible light is the most familiar example of electromagnetic radiation. Differences in the wavelengths of visible light are manifested as different colors, shown in the color spectrum below (colors can be seen in the PDF document on-line). Other examples of electromagnetic radiation include X-rays, ultraviolet light, infrared light, microwaves and radio waves.



So, how does electromagnetic radiation relate to flame tests? Well, when an atom or ion absorbs energy, its electrons can make transitions from lower energy levels to higher energy levels. The energy absorbed could be in the form of heat (as in flame tests), or electrical energy, or electromagnetic radiation. However, when electrons subsequently return from higher energy levels to lower energy levels, energy is released predominantly in the form of *electromagnetic radiation*.

The spacing between energy levels in an atom determines the sizes of the transitions that occur, and thus the energy and wavelengths of the collection of photons emitted.

# Lab Manual Pavia Spectra

**J Dewey**



## Lab Manual Pavia Spectra:

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**Handbook of Vibrational Spectroscopy** John M. Chalmers,Peter R. Griffiths,2002      Scientific and Technical Books and Serials in Print ,1989      *Student Guide and Solutions Manual to Accompany Ternay's Contemporary Organic Chemistry* Robert F. Francis,1979      **CHEM 130, Theory and Practice of Identification, CHEM 132, Qualitative Organic**

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## Reviewing **Lab Manual Pavia Spectra**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Lab Manual Pavia Spectra**," an enthralling opus penned by a highly acclaimed wordsmith, readers embark on an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve in to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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