

# Atomic Spectra

## Light, Energy, and Electron Structure



### Introduction

When a pure atomic gas such as hydrogen or helium is subjected to a high-voltage electrical discharge, light is produced and the gas glows. When this light is observed through a diffraction grating, a series of bright colored lines is observed. The series of bright lines is called an atomic emission spectrum and is unique to each element. In this activity, a spectroscopic will be used to view the "bright line" emission spectra of different elements and determine their wavelengths. A spectroscopic contains a diffraction grating that separates light into its component wavelengths.

### Concepts

- Atomic emission spectrum
- Quantization of energy
- Electron energy levels
- Electron transitions

### Materials

Colored pencils or crayons

Gas discharge (spectrum) tubes, such as hydrogen, helium, mercury, and neon

Light sources, such as incandescent and fluorescent lightbulbs, street lamps, neon signs, and novelty "neon" lamps

Power supply

Ring clamps, 2 (optional)

Ring stand (optional)

Spectroscope

### Safety Precautions

*Spectrum tubes operate at very high voltages and can produce a large electric shock. Do not touch the ends of the tube when the power supply is on. Do not touch the contacts on the transformer when the power is on. Make sure the power supply is turned off before inserting or removing the spectrum tube. To extend the life of the tubes, do not leave the tubes on for more than 30–45 sec at a time—cycle the power on and off as needed to complete the observations. Spectrum tubes may get very hot. Never touch a spectrum tube when the power is on. After turning off the power, allow the tube to cool before removing it from the power supply.*

### Procedure

1. Using a spectroscopic, observe the continuous "rainbow" spectrum from an incandescent lightbulb.
2. Observe the colors of light in the visible spectrum and the wavelength range for each band. Sketch the spectrum of white light using colored pencils in appropriate wavelength boxes. Note that the units of wavelength on the spectroscopic are nanometers ( $1 \text{ nm} = 10^{-9} \text{ m}$ ).
3. *Optional:* For optimum viewing of the emission spectra of gas discharge tubes, stabilize the spectroscopic on a ring stand. Set up a ring stand in front of the power supply and attach one ring clamp. Place the spectroscopic on the ring clamp and adjust the height of the ring clamps so that the eyepiece on the spectroscopic is approximately level with the middle of the gas discharge tube. Attach a second ring clamp on top of the spectroscopic so that it will be held firmly in position without moving.
4. With the power OFF, ask the instructor to insert the hydrogen spectrum tube between the contacts on the power supply.
5. Move the power supply so that the spectrum tube is about 3–5 cm away from the spectroscopic.
6. Turn on the power on the power supply and observe the atomic emission spectrum of hydrogen.

# Atomic Spectra Flinn Chem Topic Lab Answers

**AW Chickering**



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**Proceedings** American Society for Engineering Education. Conference, 1989      Science Citation Index , 1993 Vols for 1964 have guides and journal lists      *Atomic Spectra* R. C. Johnson, 1957      **Atomic Spectra and Atomic Structure** Gerhard Herzberg, 1957      **Atomic Spectra and Atomic Structure** Gerhard Herzberg, J. W. T. Spinks, 1965      *The Theory of Atomic Spectra* Edward Uhler Condon, George Shortley, 1951      *Introduction to Atomic Spectra* Harvey Elliott, 1985

**Analytical Atomic Spectroscopy** William Schrenk, 2012-12-06 This textbook is an outgrowth of the author's experience in teaching a course primarily to graduate students in chemistry that included the subject matter presented in this book. The increasing use and importance of atomic spectroscopy as an analytical tool are quite evident to anyone involved in elemental analysis. A number of books are available that may be considered treatises in the various fields that use atomic spectra for analytical purposes. These include areas such as arc spark emission spectroscopy, flame emission spectroscopy, and atomic absorption spectroscopy. Other books are available that can be catalogued as methods books. Most of these books serve well the purpose for which they were written but are not well adapted to serve as basic textbooks in their fields. This book is intended to fill the aforementioned gap and to present the basic principles and instrumentation involved in analytical atomic spectroscopy. To meet this objective, the book includes an elementary treatment of the origin of atomic spectra, the instrumentation and accessory equipment used in atomic spectroscopy, and the principles involved in arc spark emission, flame emission, atomic absorption, and atomic fluorescence. The chapters in the book that deal with the methods of atomic spectroscopy discuss such things as the basic principles involved in the method, the instrumentation requirements, variations of instrumentation, advantages and disadvantages of the method, problems of interferences, detection limits, the collection and processing of the data, and possible applications.      **Introduction to Atomic Spectra** Harvey Elliott White, 1934

Principles of Atomic Spectra Bruce W. Shore, Donald Howard Menzel, 1968      **Introduction to Atomic Spectra** Harvey Elliott White, 1989      *Introduction to Atomic Spectra* Harvey Elliott White, 1999      Atomic Spectra , 2020      *Guide-Lines to Planning Atomic Spectrometric Analysis* B. Magyar, 2012-12-02 *Studies in Analytical Chemistry* Volume 4 *Guide Lines to Planning Atomic Spectrometric Analysis* covers the physico-chemical background of atomic absorption spectrometry (AAS) and atomic emission spectrometry (AES). This book is composed of six chapters and begins with an introduction to the criteria on choosing the best and most suitable method for solving a given analytical problem. The next chapters deal with the properties, generation, and absorption of electromagnetic radiation as well as the theory of atomic spectra that require knowledge of X-ray. Other chapters discuss the broadening of atomic lines, which is important for understanding that calibration curves in AAS are always bent. A chapter examines the sensitivity of determination by AAS and AES. The last chapter describes the spectrometric measurement of atomic absorption and emission. This chapter also looks into the influence of the design of the monochromator upon the measured emission intensity and calibration curve by AAS. This book will prove useful to analytical

chemists and researchers     **Atomic Spectra** H. G. Kuhn,1971     **Introduction to the Theory of Atomic Spectra** Igor' Il'ich Sobel'man,1972     Atomic Spectra and the Vector Model Chris Candler,1937     **Theory of Atomic Spectra** Edward Uhler Condon,1987     *The Theory of Atomic Spectra* E. U. Condon,G. H. Shortley,1985     Spectrochemical Analysis by Atomic Absorption and Emission L H J Lajunen,Paavo Peramaki,2007-10-31 Atomic spectrometric techniques and ICP MS are frequently used in trace element analysis in many laboratories For those using them or utilizing the analysis results obtained it is essential to understand about the instrumental methods involved Spectrochemical Analysis by Atomic Absorption and Emission provides this knowledge by describing both the theory of atomic spectroscopy and all the major atomic spectrometric techniques AAS Flame AES Plasma AES AFS and ICP MS including basic concepts instrumentation and applications Chapters also cover Sample preparation methods Instrument components Hyphenated analysis techniques Revised and fully updated the book continues to be highly practical and wide in scope and contains illustrations which aid understanding Spectrochemical Analysis by Atomic Absorption and Emission is ideal for students and their lecturers but will also be useful for practitioners who already use the techniques but would like to know more about the insides of the black box

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