

ATOMIC EMISSION SPECTROSCOPY

INTRODUCTION

Identification of the composition of materials by spectroscopy is a technique that has been used extensively in astronomy and chemistry. Light from the material observed, whether it is from a distant star or a chemical in a laboratory is passed through a prism or a diffraction grating. The prism or grating separates the electromagnetic spectrum into its component wavelengths that can then be measured. The visible part of the spectrum is the portion of the electromagnetic spectrum observable by the human eye and provides enough data to be used as an identification technique for some elements.

The spectrum is a manifestation of the difference in electronic energy levels in the particular substance being studied. The human eye is able to see the wavelengths of light given off by an excited hydrogen electron making a transition from an outer n level to $n = 2$. There are many other transitions (including transitions to the hydrogen electron ground state at $n = 1$) that the human eye is unable to detect. The difference in energy levels for the visible spectrum of a hydrogen atom can be represented as:

$$\Delta E = R_H \left[\frac{1}{2^2} - \frac{1}{n^2} \right] \quad (1)$$

where R_H is the Rydberg constant which, in energy units, has the value of $2.180 \times 10^{-18} \text{ J}$. Because we measure the wavelengths of the transitions in the spectrum instead of the energy, and because

$$\Delta E = \frac{hc}{\lambda} \quad (2)$$

equation (1) becomes:

$$\frac{1}{\lambda} = \frac{R_H}{hc} \left[\frac{1}{2^2} - \frac{1}{n^2} \right] \quad (3)$$

where h is Planck's constant and c is the speed of light. Because R_H , h , and c are all constants we can combine them into one constant, R_{∞} . We can now write Equation (3) as

$$\frac{1}{\lambda} = R_{\infty} \left[\frac{1}{2^2} - \frac{1}{n^2} \right] \quad (4)$$

In this form, the accepted value of the modified Rydberg constant, R_{∞} , is $1.097 \times 10^7 \text{ m}^{-1}$.

In this experiment a hand-held spectroscope, which utilizes a simple diffraction grating, will be used to separate the visible light into its components. The atomic spectral data from hydrogen will be used to determine the value of the Rydberg constant in units of m^{-1} .

Atomic Emission Spectroscopy Lab Answers

M Mosston



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Food Analysis Laboratory Manual S. Suzanne Nielsen, 2017-06-07 This third edition laboratory manual was written to accompany Food Analysis Fifth Edition by the same author New to this third edition of the laboratory manual are four introductory chapters that complement both the textbook chapters and the laboratory exercises The 24 laboratory exercises in the manual cover 21 of the 35 chapters in the textbook Many of the laboratory exercises have multiple sections to cover several methods of analysis for a particular food component or characteristic Most of the laboratory exercises include the following background reading assignment objective principle of method chemicals reagents precautions and waste disposal supplies equipment procedure data and calculations questions and references This laboratory manual is ideal for the laboratory portion of undergraduate courses in food analysis

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