

# PHYS 3650L - Modern Physics Laboratory

## Laboratory Advanced Sheet

### The Absorption Spectra

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1. Objectives. The objective of this laboratory is to measure the wavelengths of light absorbed by a liquid sample.

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2. Theory.

An incandescent source such as a hot solid metal filament produces a continuous spectrum of wavelengths. A substance placed in the path of light from a continuous spectrum source will absorb certain colors from the continuous spectrum. The resulting absorption spectrum consists of a collection of well-defined dark lines or gaps in the otherwise continuous spectrum. By studying the absorption spectrum of an unknown substance it is possible to reliably identify it.

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3. Apparatus and experimental procedures.

a. Equipment.

- 1) Spectrophotometer system.
- 2) Diffraction grating.
- 3) Incandescent light source.
- 4) Optics bench.
- 5) High sensitivity light sensor.
- 6) Colored liquid sample.

- 7) Computer with computer interface.
  - 8) Rotary motion sensor.
  - 9) Colored liquid samples.
  - b. Experimental setup. To be provided by the student.
  - c. Capabilities. To be provided by the student.
  - d. Procedures. Detailed instructions are provided in paragraph 4 below.
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#### 4. Requirements.

- a. In the laboratory.
  - 1) Your instructor will introduce you to the equipment to be used in the experiment.
  - 2) Measurements to determine the angles of diffraction will be made for all lines observed in the absorption spectrum of a sample.
  - 3) Your instructor will discuss methods to be used to process your data using the Microsoft Excel™ spreadsheet program.
- b. After the laboratory. The items listed below will be turned in at the beginning of the next laboratory period. A complete laboratory report is **not** required for this experiment.

#### **Para 3. Apparatus and experimental procedures.**

- 1) Provide a figure of the experimental apparatus (para 3b).
- 2) Provide descriptions of the capabilities of equipment used in the experiment (para 3c).

**Para 4. Data.** Data tables are included at Annex A for recording measurements taken in the laboratory. A copy of these tables must be included with the lab report. Provide the items listed below in your report in the form a Microsoft Excel™ spreadsheet showing data, calculations and graphs. The spreadsheet will include:

1) For each sample: a table with columns for dark line, measured angle of diffraction to the right, angle of diffraction to the left, mean angle of diffraction, and calculated wavelength.

## Para 5. Results and Conclusions.

### a. Results.

1) A statement identifying the absorbed wavelengths for each liquid sample.

### b. Conclusions.

1) Make a conclusion about the ability of the technique to observe the absorption spectra.

2) Describe the sources of error in the experiment.

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## Annex A Data

1. Diffraction grating constant.

$a =$  \_\_\_\_\_m

2. Angle of diffraction, 1<sup>st</sup> order.

a. Sample 1

Dark Line	Diffraction Angle (degrees)	
	Right	Left


b. Sample 2.

Dark Line	Diffraction Angle (degrees)	
	Right	Left


c. Sample 3.

Dark Line	Diffraction Angle (degrees)	
	Right	Left


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