EISCO PH0100QA Premium Quantitative Spectroscope User Guide

Contents

EISCO PH0100QA Premium Quantitative Spectroscope

Product Information

Specifications

- **Product:** Spectroscope
- **Catalog Number:** PH 0100QA
- **Diffraction Grating:** 500 lines/mm
- **Distance from Slit to Grating:** 19cm (0.19m)

FAQ

- **Q:** What should I do if I observe sodium lines in the spectrum unexpectedly?
  - **A:** Sodium contamination is common in spectrum tubes. If sodium lines appear where they shouldn’t, it may affect your observations. Clean or replace the spectrum tubes to avoid this issue.

Product Usage Instructions

Experiment Guide – General Background

When white light passes through a prism or a diffraction grating, it separates into its spectrum based on frequency. The spectroscope uses a diffraction grating with parallel slits to reveal the spectrum. The distance from the slit to the diffraction grating is crucial for calculations.

Required Components (Not Included)

- **Light Source:** Fluorescent light bulb
- **Quantity:** 1

Recommended Components (Not Included)

- **Spectrum Tube Power Supply:** PH 1199B (110V)

- **Spectrum Tubes Assorted:** PH 1196B 1-111
- **Spectrum Chart:** 1

Observing the Scale

- Ensure the bright purple line aligns with 436nm and the green line aligns with 546nm.
- Adjust readings if the scale is shifted by around 10 nanometers.

Experiment: Observing Bright Line Spectrum

Note to Teachers

- Spectrum tubes of various elements can be used for observations. In their absence, aqueous solutions can be used.

Make Your Own Spectrum Chart

1. Calibrate your spectroscope by aligning bright green and violet lines under the scale.

GENERAL BACKGROUND

A spectroscope helps scientist (and you) to study and observe a spectrum of light. In this case it helps you to observe visible light.

Visible light is just part of the electromagnetic spectrum. What makes this band of light unique is that humans can detect these frequencies with their eyes. There are other animals like bees for example that are able to see different frequencies of light. Scientists also use spectroscopes to study ultraviolet and infrared spectrums of faraway stars and galaxies. They can use these spectrums to determine the elements burning in distant stars.

When white light travels from one medium to another such as from air to glass, the light slows down and bends. The frequency of the light determines how much the light bends. Therefore shining white light through a prism will sort the light by its frequency. The higher the frequency of light the more it bends. This is called dispersion of light. Many spectroscopes use a prism to separate white light into its spectrum. However this spectroscope uses a diffraction grating.

Similarly, when white light travels through a double slit, an interference pattern immerges that is dependent on the wavelength of light. A diffraction grating will also reveal a spectrum. In this case the diffraction grating has a series of parallel slits 500 lines/mm. The distance from the slit to the diffraction grating is approximately 19cm or 0.19m.

Using the formula $y = \frac{m\lambda L}{d}$,

where y is the distance between the center bright fringe and the fringe you are looking at and m is an integer ordering each maximum bright point, and λ is the wavelength of light, we can calculate where a red line and violet line would be positioned on the end of the spectroscope.

A line with 400nm would be:

$$y = \frac{(1)(400 \times 10^{-9} m)(0.19m)}{2.0 \times 10^{-6} m} = 0.038m \text{ or } 3.8\,cm$$

A line with 700nm would be:

$$y = \frac{(1)(700 \times 10^{-9} m)(0.19m)}{2.0 \times 10^{-6} m} = 0.067m \text{ or } 6.7\,cm$$

The value for d is determined by the diffraction grating. If there are 500 lines/mm, then there are 2.0 x 10-6 m between the slits.

COMPONENTS

REQUIRED COMPONENTS (NOT INCLUDED)

Name of Part	Quantity
Light Source from a fluorescent light bulb	1

RECOMMENDED COMPONENTS (NOT INCLUDED)

Name of Part	Quantity
Spectrum Tube Power Supply (with safety door) PH 1199B (110V)	1
Spectrum Tubes Assorted (O, Ne, He, N, Ar, CO2, H, I, S, Xe, Kr) PH 1196B 1-111	
Spectrum Chart	1

DIAGRAM

DIAGRAM LABELING ALL PARTS

HOW TO USE THIS SPECTROSCOPE

Find a florescent light source and block all other light coming into the room by pulling curtains or shades down. Point the slit end of the spectroscope at the light source and observe this through the view finder. You should see what looks like a rainbow inside the spectroscope. There may be two or three different rainbows. Look to the right hand side inside the spectroscope and notice the scale. While looking at the scale, tilt the slit end of the spectroscope slowly upwards and downwards until a bright green and violet line appear just underneath the scale. This is the appropriate view position for this spectroscope. The scale is marked 4-7 to denote the visible spectrum. The measure is in 100 nanometers (nm). Therefore a bright line appearing at 4 would correspond to a wavelength of 400 nanometers.

When observing the scale, the bright purple line should coincide with 436 nm and the green line should coincide with 546 nm. If your scale is shifted to the right or left by 10 nanometers or so, you must adjust all your readings accordingly while using this spectroscope.

EXPERIMENT: OBSERVING BRIGHT LINE SPECTRUM

Note to Teachers: There are several different spectrum tubes available such as oxygen, neon, helium, nitrogen, argon, carbon dioxide, hydrogen, iodine vapor, sulphur, xenon and krypton. If you do not have spectrum tubes and a power source available students can observe spectrum by lighting aqueous solutions of copper sulfate or potassium permanganate.

SUPPLIES NEEDED:

- A spectroscope per student/group
- A spectrum tube holder
- A darkened classroom
- Several Spectrum Tubes of different elements/compounds
- Colored pencils or markers
- A chart showing the accepted spectrum for each of the elements/compounds used

Sodium is a common contaminant in spectrum tubes. Students may observe the sodium lines when they should not be there in the spectrum for a given element.

Name:_____
Date:_____

Make Your Own Spectrum Chart

1. Calibrate your spectroscope by looking up at the fluorescent lights in the classroom. Move your spectroscope slowly up and down until a bright green and a bright violet line appear just under the scale inside your spectroscope.
2. The bright green line should appear at around 550 nm and the bright violet line should appear around 440nm. If the lines appear around 460nm and 570nm for example, then all your observations need to be adjusted by subtracting 20nm for each reading.

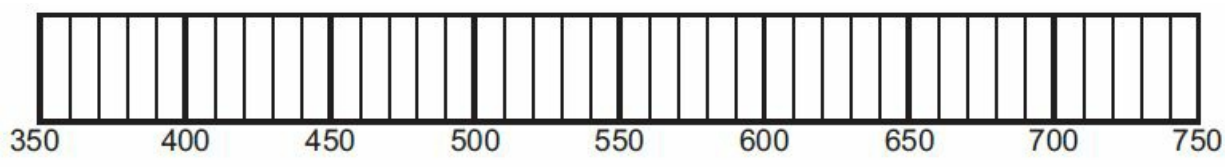
The bright green line occurs at _____ the bright violet line occurs at _____, therefore I must add or subtract _____ from each measurement.

On the chart below, record your element or compound and then using your colored pencils, draw a line where each one of your spectrum lines appears. When you are finished compare your data to a spectrum chart.

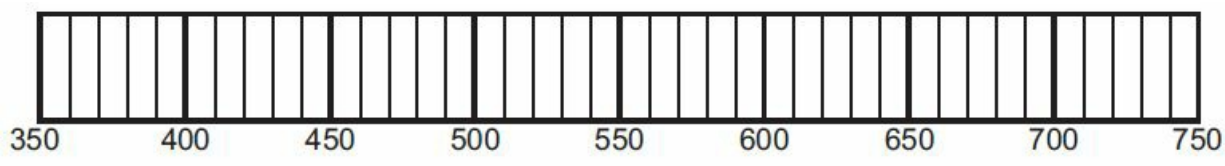
QUESTIONS

1. How did your spectrum lines compare with the spectrum lines on the “official” chart? Did you fail to see any lines?
2. Sodium is a common containment in many spectrum tubes. Was there evidence that any of the tubes you viewed contained sodium?
3. Use your spectrum chart to identify some given elements. Your teacher will place three different tubes into the holder and you need to identify them using your chart.
    - **a.** _____
    - **b.** _____
    - **c.** _____

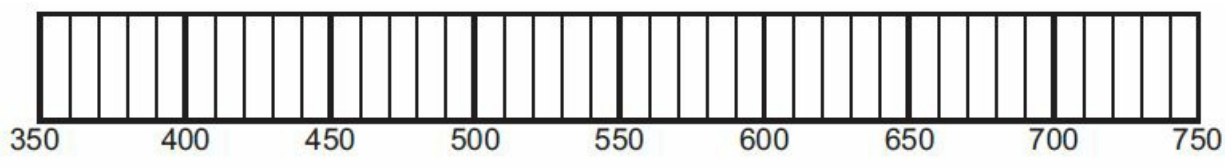
Element/Compound: _____



Element/Compound: _____



Element/Compound: _____



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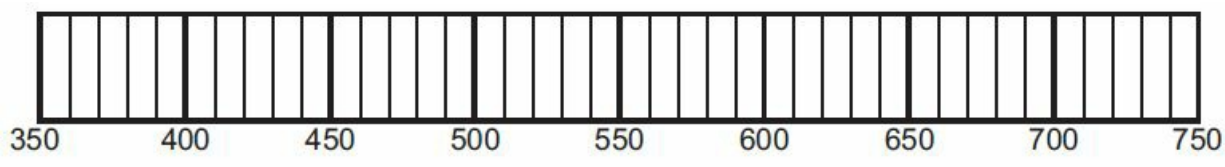

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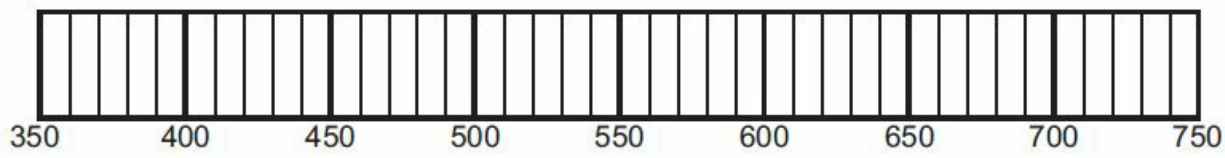
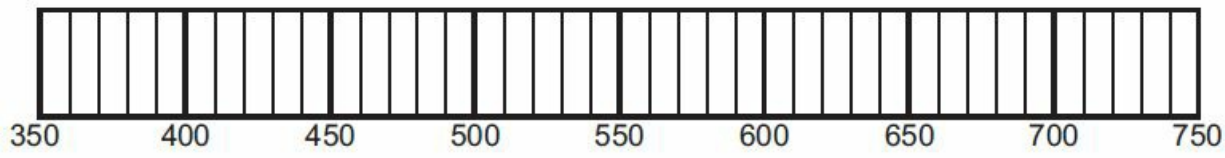


Element/Compound: _____



Contact

- **Manufactured by:** EISCO

U.S. Distributor

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Documents / Resources

	EISCO PH0100QA Premium Quantitative Spectroscope [pdf] User Guide PH0100QA Premium Quantitative Spectroscope, PH0100QA, Premium Quantitative Spectroscope, Quantitative Spectroscope, Spectroscope

References

- eiscosci.com
- User Manual