ROQED PHYSICS LAB

Determination of the wavelength of light using a diffraction grating.

Purpose of work: how to
Learn measure the length of a light wave using a diffraction grating.

Equipment:
1) optical bench;
2) a diffraction grating;
3) a screen with a vertical slit.

On the board: The

diffraction grating is a set of parallel, equally spaced equal slots, separated by opaque intervals of equal width.

Theoretical part:

In this work, used to determine the light wavelength *diffraction grating* with a period **d is**. **The diffraction grating** is a set of parallel, equally spaced equal slots, separated by equal opaque gaps in width. If you look through the grating and the slit at the light source, then on the black background of the screen one can observe the diffraction spectra of the 1st, 2nd, etc. orders on both sides of the slit.

The wavelength is determined by the formula: $\boldsymbol{\lambda} = \frac{d\,Sin\,\varphi}{k}$

Where:
d is the grating period;
k is the order of the spectrum;
φ is the angle at which the maximum of light of the corresponding color is observed;
Since the angles at which the maxima of the 1st and 2nd orders are observed do not exceed 5 ^{0}, you can use their tangents instead of the sines of the angles, that is, the final formula for determining the wavelength will look like: $\boldsymbol{\lambda} = \frac{db}{ka}$.

Distance **a is** measured on the bench scale from the grating to the screen, distance **b** - on the screen scale from the slit to the selected line of the spectrum.

Workflow

1. Assemble the objects on the optical bench in the following order: screen, diffraction grating, screen with vertical slit, light source.

2. Start the simulation. The color source turns on and color bars appear on the screen.

3. Determine the position of the midpoints of the color bands in the spectra of the 1st or 2nd orders.

4. Measure the distance from the diffraction grating to the screen (a) and on the screen scale - the distance from the center to the selected line of the spectrum (b). Enter the data into the table.

5. Write a formula to calculate the wavelength. Diffraction grating period (d) 2.5 * 10^{-6}.
$\lambda = \frac{db}{ka}$

6. Table

	Color of stripes	to	a (m)	b (m)	**λ** (m)
	Violet				
	Blue				
	Cyan				
	Green				
	Yellow				
	Orange				

	Red				

6. Compare the results obtained with the table value for the wavelength of the visible part of the spectrum.

Purple - 380-430 nm
Blue 430-470 nm
Blue 470-500 nm
Green 500-560 nm
Yellow 560-590 nm
Orange 590-620 nm
Red 620-760 nm

Conclusion:

A. Measured the wavelengths of light. When using white light, all maxima (except for the central one) have a rainbow color, since different wavelengths correspond to different angles at which the interference maximum is observed.

B. Measured the wavelengths of light. When using white light, all the maxima are rainbow colored, since different wavelengths correspond to different angles at which the interference maximum is observed.

C. Measured the wavelengths of light. When using white light, all maxima (except for the central one) have a rainbow color, since different wavelengths correspond to different angles at which the interference minimum is observed.