Practical No 1

EMISSION SPECTRA OF ELEMENTS

Part A. ANALYSIS OF EMISSION SPECTRA OF DIFFERENT ELEMENTS USING SPECTROSCOPE

Equipment:

1. Prism spectroscope.
2. Box with gaseous (helium, mercury) discharge lamp connected to supply system.
3. Monochromator with photocell.

Course of measurements:

1. Switch on the light source for illuminating the spectroscope scale. Next, point the end of the scale tube towards this source of light.
2. Put the discharge tube with helium in front of the collimator and look in the ocular. You can see the emission spectral lines of helium against the background of spectroscope scale.
3. The position of each line of helium emission spectrum should be read off the spectroscope scale. Put the results into the table in the report's sheet.
4. Using Table 1 identify the spectral lines of helium and match their position on the scale with wavelength.

Table. 1. *The wavelengths and intensities of main emission spectral lines of helium.*

Element	Colour of line	Wavelength [nm]	Intensity
Helium	I red	830	weak
	II red	740	intense
	yellow	583	intense
	I green	476	weak
	II green	470	intense
	blue	460	intense
	I violet	450	weak
	II violet	445	intense

5. Plot the dependence of the wavelength on the scale interval on the plotting paper. The obtained plot is a dispersion curve of the used prism.
6. Remove the discharge tube with helium. Put the discharge tube with mercury in front of the collimator. Observe the emission spectral lines of mercury.
7. Read off the position of each line of mercury emission spectrum and put it into the table in the report's sheet.

8. Using the prism dispersion curve plotted earlier fing the wavelengths of mercury spectral lines.

Part B. SPECTRAL CHARACTERISTICS OF WHITE LIGHT SOURCE (GLOW LAMP)

White light from the glow lamp passes though the slit (s_1) and falls on a prism which causes light dispersion. Next the dispersed light passes though the slit (s_2) and falls on a diffraction grating which allows for the selection of a given wavelength of dispersed light. Using the knob to set the monochromator scale to the appropriate position of a diffraction grating can be obtained. The light of selected wavelength falls on a photocell and causes a flow of photocurrent which can be measured by a very sensitive galvanometer. A calibration curve allows for allocation of monochromator scale positions to the appropriate wavelengths of dispersed light. The intensity of photocurrent is proportional to the intensity of dispersed light.

Course of measurements:

1. Turn the digital multimeter on. Choose the option μA on the scale.
2. Set the value of 12.00 on a monochromator scale and read off the photocurrent intensity. Put this value into the table in the report's sheet.
3. Turn the knob with 0.2 step on the monochromator scale until you reach the value of 16.00. For each knob position read off the photocurrent intensity and write it down in the table.
4. Using the attached monochromator calibration curve plot the dependence of the photocurrent intensity on wavelength of light (nm).

Required theoretical knowledge:

1. Nature of light and quantum concept.
2. Types of spectra and the mechanism of their formation. Atomic and molecular (oscillation, vibration) spectra.
3. The behaviour of light while passing through a prism and diffraction grating.
4. Prism spectroscope, monochromator – principle of operation.
5. Analysis of a spectrum applying the spectroscope.
6. Application of spectral analysis in medical science.

Recommended literature:

1. R. K. Hobbie, "Intermediate Physics for Medicine and Biology", Springer, 1997.
2. P. Davidovits, "Physics in Biology and Medicine", Elsevier, 2001.

Wrocław Medical University Department of Biophysics and Neuroscience	**Practical No 1** **Emission spectra of elements**
…… ……..……..…….. ……..…… Student names	Faculty: …….. Group number: …… Date: ……..……
Grade:	Tutor's signature:

1. Examine the emission spectrum of known element (helium).

Element	Position of line on the scale	Colour of line	λ [nm]	Line intensity
Helium				

2. Prepare a dispersion curve of a prism – plot the dependence of the wavelength on the scale interval on the plotting paper.

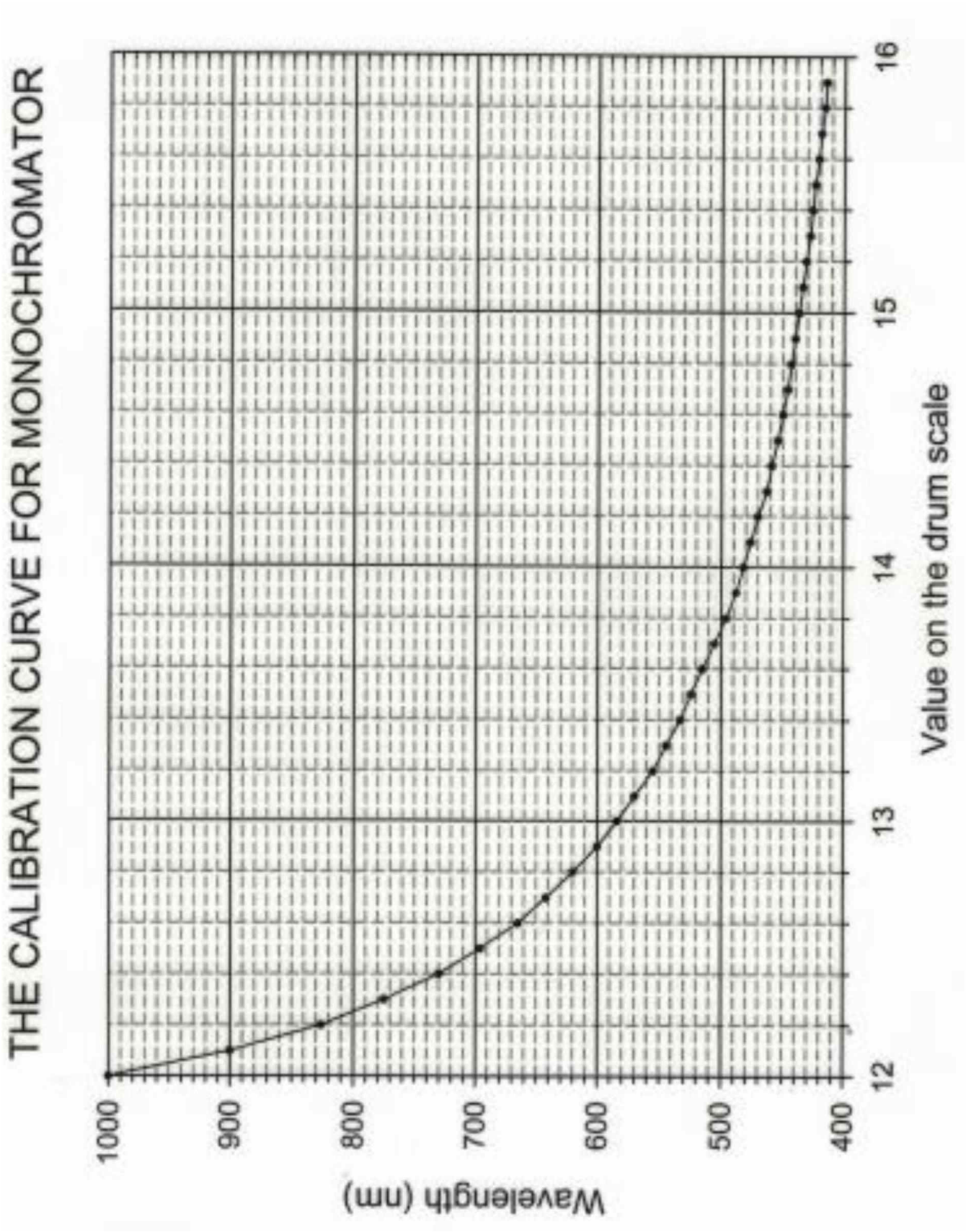
3. Examine the emission spectrum of another element. Read the emission wavelengths off the dispersion curve.

Element	Position of line on the scale	Colour of line	λ [nm]	Line intensity

4. Using monochromator determine the dependence of the photoelectric current intensity on wavelength.

Position of mono-chromator	Wavelength λ [nm]	Current intensity [μA]	Position of mono-chromator	Wavelength λ [nm]	Current intensity [μA]
12.0			14.2		
12.2			14.4		
12.4			14.6		
12.6			14.8		
12.8			15.0		
13.0			15.2		
13.2			15.4		
13.4			15.6		
13.6			15.8		
13.8			16.0		
14.0					

5. Plot the dependence of the photoelectric current intensity on wavelength on the plotting paper.


THE CALIBRATION CURVE FOR MONOCHROMATOR
Wavelength (nm)
1000
900
800
700
600
500
400
12
13
14
15
16
Value on the drum scale