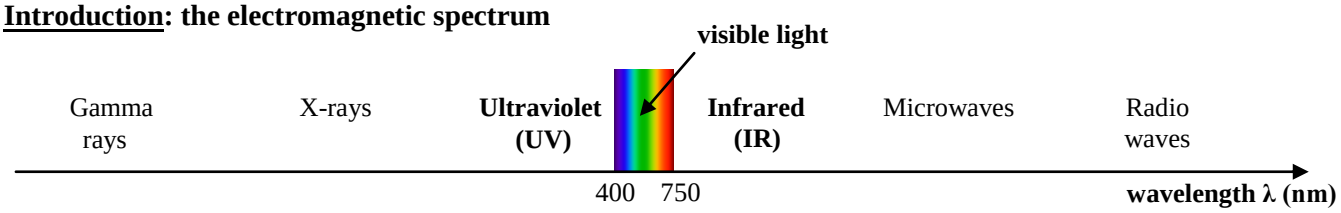
LAB WORK 1 SPECTROSCOPY

Introduction: the electromagnetic spectrum



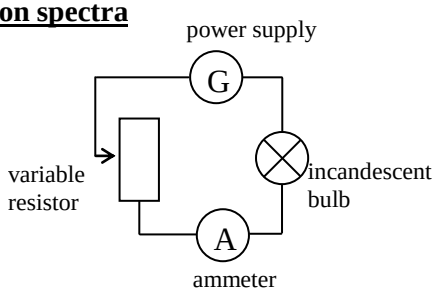
The **visible light spectrum** is the small portion of the electromagnetic spectrum that is visible to the human eye. Each electromagnetic radiation is characterized by its **wavelength λ in nanometers (nm)**.
The wavelengths of the visible electromagnetic radiations range from approximately 400 nm (violet) to approximately 800 nm (red).

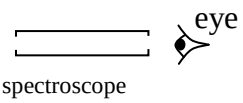
A **spectroscope** is an instrument used to generate a **spectrum**, that is a dispersion of light into its constituent colours.

1. Emission spectra

1.1. Continuous emission spectra

Experiment:





a. What is the variable resistor used for?.....
b. What happens when current flows through a conductor? .....
c. When the current increases, how does the temperature of the light bulb filament vary? .....
How does the intensity of the emitted light vary? .....
How does the colour of the emitted light vary?.....
d. Observe the spectrum through the spectroscope. Which colour of the spectrum becomes visible last as the temperature of the light bulb filament is increased?..... . Draw the spectra observed at the:

↳ **lowest** temperature

(colour of light :……. ……..……...)

↳ **highest** temperature

(colour of light :……. ……..……...)

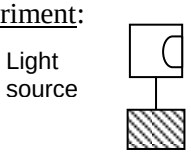
Conclusion: **A hot body** (here the filament of the bulb) **emits light whose spectrum is called** ……
……
The more the temperature increases, the more the spectrum ……
……
As the temperature of a body increases, it appears first …… then ……..

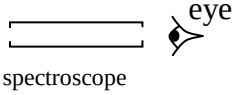
Application to astronomy:

↳ astronomers can measure the temperature of a distant star by studying the star's spectrum of thermal radiation. Some stars look rather reddish, other rather bluish. Which are those whose surface temperature is the highest?..... the lowest?.....

1.2. Line emission spectra

Experiment:





Observe different light sources through the spectroscope

a. Draw the spectra of the light emitted by different gas discharge lamps:
(A *gas discharge lamp* contains gas under low pressure. The electric discharges cause the gas atoms to emit light.)

↳ Cadmium vapour lamp

(colour of light :……..……....)

↳ Sodium vapour lamp

(colour of light :……..……....)

↳ Neon vapour lamp

(colour of light :……..……....)

Conclusion: in a gas discharge lamp, hot gas under low pressure **emits light whose spectrum is called** …..

……

(consisting of a series of …… on a …… background).

This spectrum is characteristic of the chemical element present in the lamp (Cd, Na, Ne…).

b. Draw the spectra of the light emitted by a:

↳ Low energy light bulb

(colour of light :……..……....)

↳ "Neon" tube (= fluorescent tube) on the ceiling

(colour of light :……..……....)

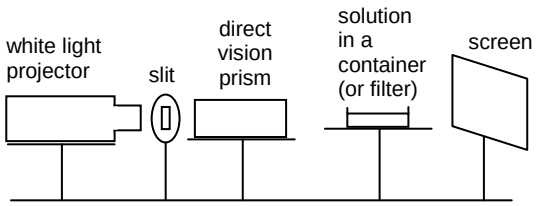
(A *fluorescent tube* is a type of gas discharge lamp which contains a mixture of mercury vapour and noble gas such as argon or xenon but in fact rarely neon. The electric discharges cause the atoms to emit UV light. This UV light then excites the fluorescent coating inside the tube, which produces visible light.)

Compare the two spectra.

Conclusion: a low energy light bulb is ……..

2. Absorption spectra

2.1. Absorption spectrum of a solution



White light passes through a solution (or a filter):

Observe the different spectra obtained on the screen and draw:

↳ the spectrum of white light that hasn't passed through a solution (or a filter)

↳ the spectrum of white light having passed through

♣ a potassium permanganate solution

♣ a copper sulphate solution

♣ a red filter

a. Is the light absorbed or emitted by the medium it passes through?.....

b. Complete the table :

Solution (or filter)	Colour of the solution (or filter)	Colours of the **transmitted radiations**	Colours of the **absorbed radiations**
Potassium permanganate			
Copper sulphate			
Red filter			

Why does the red filter appear red?.....

2.2. Absorption spectrum of a gas (with the simulation software *Spectres*)

Observe the absorption spectra of some chemical elements (setup at the bottom).

Compare the emission spectrum (setup at the top) and the absorption spectrum of a given chemical element.

2.3. Conclusion:

a. The spectrum of white light having passed through a substance is called ……

(consisting of …… on a …… background).

This spectrum is characteristic of the substance.

b. The emission lines and the absorption lines of a chemical element ……..