

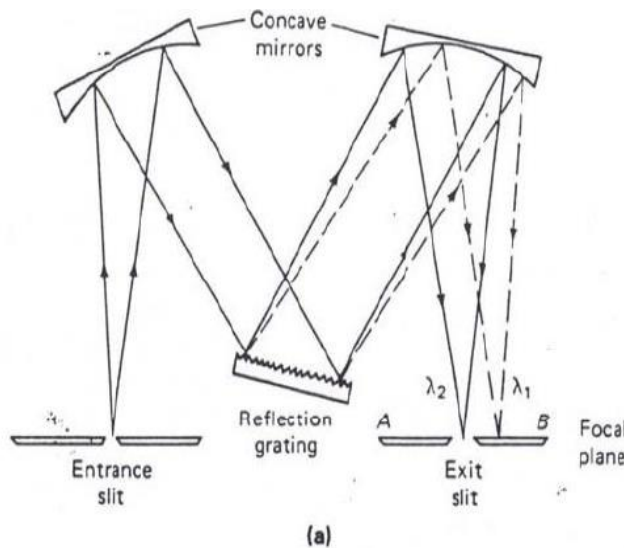


Section A: [Model Answer]

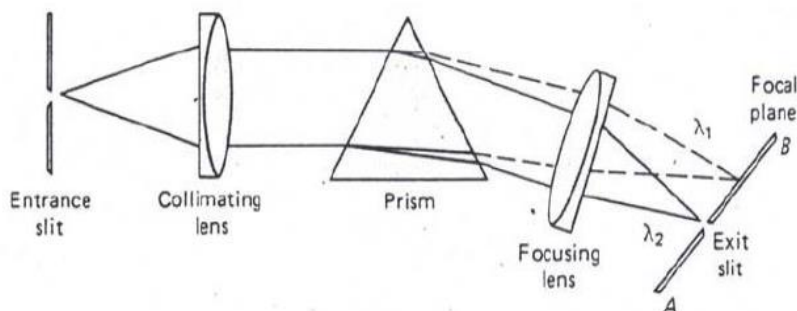
1:

A UV –Vis spectrophotometer is a device used to measure the transmittance or absorbance of a sample as a function of the wavelength of the electromagnetic spectrum. The key components of UV-visible spectrophotometers are:

- A light source which generates a broad band of electromagnetic radiation (UV (Deuterium lamp) and visible (Tungsten lamp))
- A dispersion device (monochromator) which selects a particular wavelength or wavelengths such as prism or diffraction gratings.



Changing the position of prism or diffraction gratings will change the λ that will pass through the exit slit



- A sample cell

For visible region (glass cell is used).

For UV region (quartz cell is used)

- One or more detectors to measure the intensity of radiation such as barrier layer cell, photo cell, and photo multiplier tube

2:

The linearity of the Beer-Lambert law is limited by chemical and instrumental factors. Causes of nonlinearity include:

- deviations in absorptivity coefficients at high concentrations ($>0.01M$) due to electrostatic interactions between molecules in close proximity
- scattering of light due to particulates in the sample
- fluorescence or phosphorescence of the sample
- changes in refractive index at high analyte concentration
- shifts in chemical equilibrium as a function of concentration
- non-monochromatic radiation, deviations can be minimized by using a relatively flat part of the absorption spectrum such as the maximum of an absorption band
- stray light

3:

Chromophore: A chromophore is the part of a molecule responsible for its color. The color that is seen by our eyes is the one not absorbed within a certain wavelength spectrum of visible light. The chromophore is a region in the molecule where the energy difference between two separate molecular orbitals falls within the

range of the visible spectrum. Visible light that hits the chromophore can thus be absorbed by exciting an electron from its ground state into an excited state.

Auxochrome: An auxochrome is a functional group of atoms attached to the chromophore which modifies the ability of the chromophore to absorb light, altering the wavelength or intensity of the absorption.

Red shift: The displacement of spectral lines towards longer wavelengths

Blue Shift: The displacement of the spectrum to shorter wavelengths

4:

A=abC. $0.338=b \times 0.0005$. So, $b= 676$.

With Best Wishes,
Dr. Ehab Abdelhamed Abdelrahman
Lecturer of Inorganic and Analytical chemistry