UV-VISIBLE SPECTROSCOPY – THE DOUBLE BEAM ABSORPTION SPECTROMETER

1. a) Many substances absorb radiation in the UV and visible parts of the spectrum. This device passes light of varying wavelengths through a sample of a substance and compares the light absorbed at each wavelength against a reference sample. It then plots the results as a graph.

   b) The two lamps produce light in different parts of the spectrum. The deuterium lamp covers the UV part of the spectrum and the tungsten/halogen lamp covers the visible part.

   c) The diffraction grating is rotated so that each part of the spectrum passes through the slit in turn.

   d) The sample cell contains a solution of the substance you are investigating in a solvent which doesn't absorb significantly in the wavelength range you are interested in (200 – 800 nm). The reference cell contains the pure solvent.

   e) The rotating discs have three segments – one transparent, one mirrored and one opaque.

   If light from the source hits the first disc on the transparent section it passes through it, and then through the sample cell. It is then reflected by a mirror onto a second disc whose rotation is synchronised so that the light will hit the mirrored section and be reflected into the detector. (The red route on the diagram.)

   If light from the source hits the mirrored section on the first disc, it is reflected along the green route on the diagram through the reference cell. The spinning of the second disc is synchronised so that light taking this route will pass straight through it into the detector.

   If light from the source hits the opaque section of the first disc, no light passes through the device. This allows the computer to make an allowance for any current generated in the device in the absence of light.

   f) I_o is the intensity of light of each wavelength passing through the reference cell. I is the intensity of the same light passing through the sample cell. When the light falls on the detector it is converted into a current which the computer measures. The current is proportional to the intensity of the light.