EXERCISE 1

Food dye analysis

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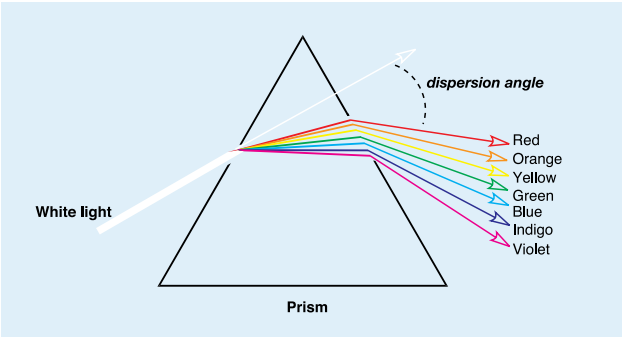
INTRODUCTION

The electromagnetic spectrum ranges from radio waves with wavelengths the size of buildings down to gamma rays, the size of atomic nuclei. White light forms a small part of this spectrum and is composed of a range of different wavelengths which can be dispersed using a prim into its component colours. The colour an object, or a solution, appears will depend on which light is transmitted or reflected in the visible spectrum and which light is absorbed. Using a UV-visible spectrometer and a range of food dyes you will test how the absorbance wavelength value relates to the colour of the solution.



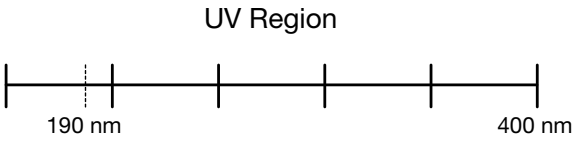
UV-Visible Spectrometer

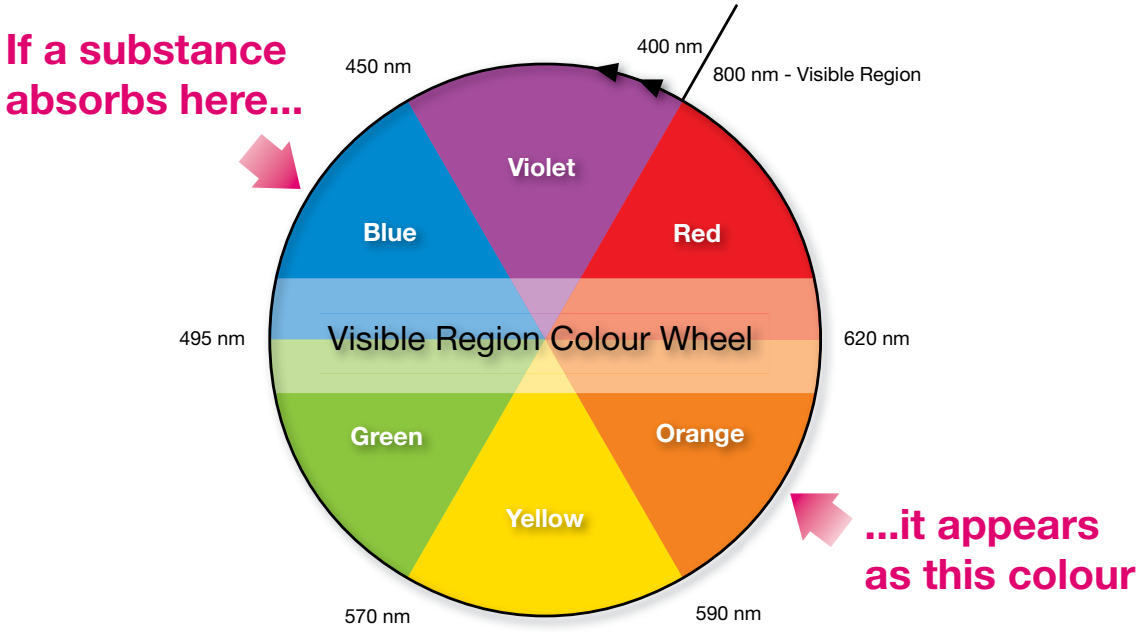
UV-visible spectrometers can be used to measure the absorbance of ultra violet or visible light by a sample. The spectrum produced is a plot of absorbance versus wavelength (nm) in the UV and visible section of the electromagnetic spectrum. Instruments can be used to measure at a single wavelength or perform a scan over a range in the spectrum. The UV region ranges from 190 to 400 nm and the visible region from 400 to 800 nm. The technique can be used both quantitatively and qualitatively.

METHOD

1. Prepare a dilute sample for each colour to be tested using a cuvette and distilled water (approximately 1 drop food colouring to 100 ml distilled water).
2. For each colour sample fill a plastic cuvette and stopper with a lid.
3. Prepare a blank sample cuvette containing distilled water only and stopper with a lid.
4. Use the colour wheel to predict absorbance values for each solution and record your predictions in the table provided.
5. Set up the spectrometer to scan the visible region from 350-800 nm and run each sample. Print out the spectrum and note the wavelength for each of the absorbance peaks. Compare these with your predictions.

Red	620-750 nm
Orange	590-620 nm
Yellow	570-590 nm
Green	496-570 nm
Blue	450-495 nm
Violet	380-450 nm





MATERIALS

Chemicals

- Food colouring samples - Red, yellow, green, blue, pink, black
- De-ionised/distilled water

Apparatus

- Disposable plastic cuvettes and stoppers
- Wash bottles x 4
- 100 ml beakers x 10
- 1 box pasteur pipettes and teats (*Plastic for younger children*)
- Tissues

Instrument

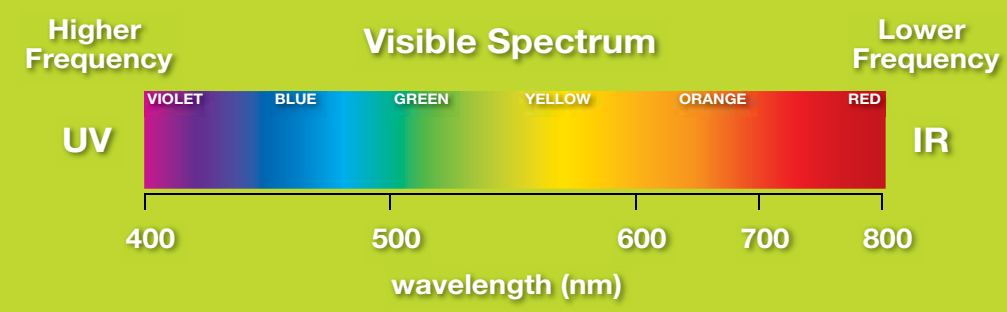
- UV-visible Spectrometer (integral printer and paper)
- Laptop (*optional*)
- Printer (*optional*)
- Connection cables x 2 (*optional*)

Set up for laptop and printer use:

- Connect UV-vis to laptop via left hand front USB port (Com 5)
- Connect printer to any USB port
- From spectrometer menu Select printer / auto print on / Computer USB / OK
- Open PVC program, set auto print to on or off depending on requirements.

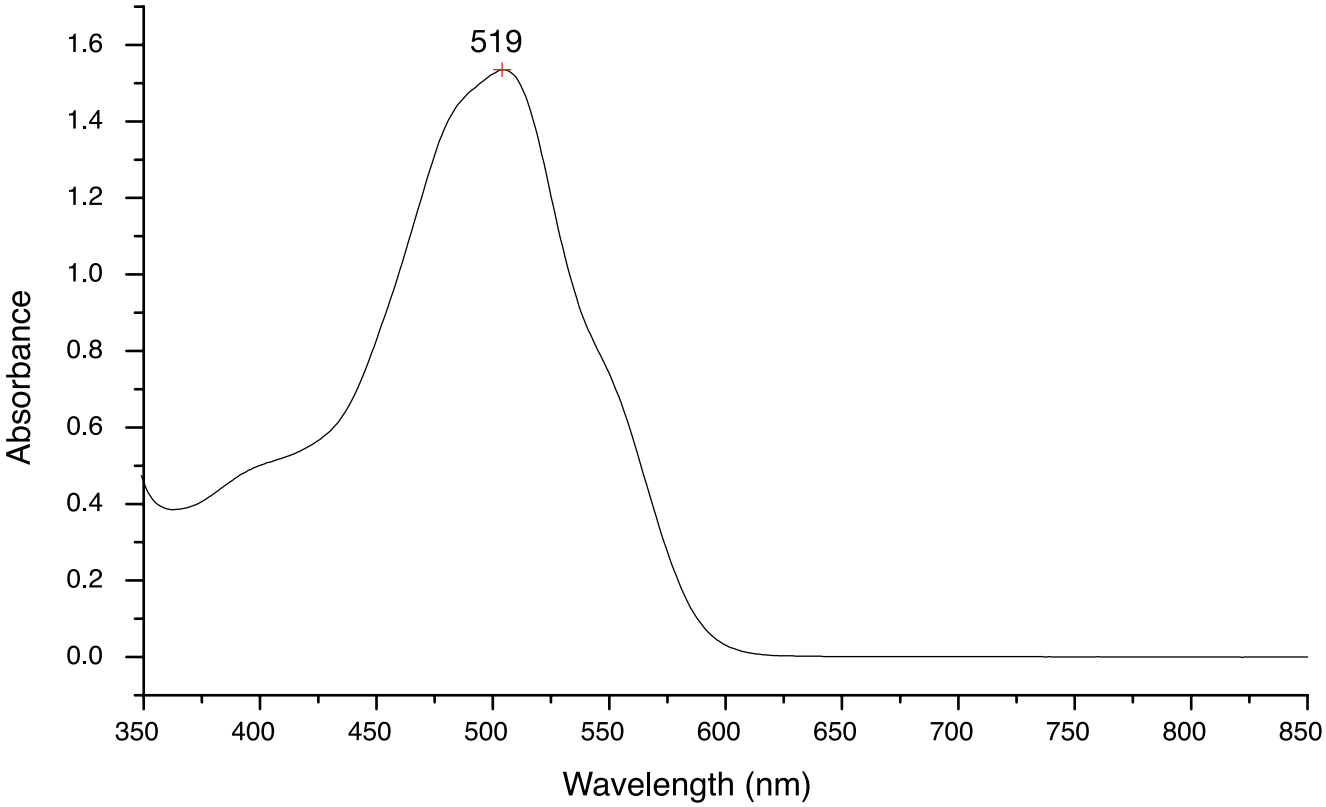
RESULTS

COLOUR	PREDICTED ABSORBANCE VALUE (nm)	ACTUAL ABSORBANCE VALUE (nm)	NOTES
Red	496 - 570	519 & 528	Absorbs Green
Yellow	380 - 450	428	Absorbs Violet
Green	620 - 750	427 & 635	Absorbs Red
Blue	590 - 620	409 & 628	Absorbs Orange
Pink	496 - 470 570 - 590	510	Absorbs possibly Green/Yellow
Black	?	519 & 635	**Note:** This absorbs both in the Red and Green which are directly opposite, solution appears black

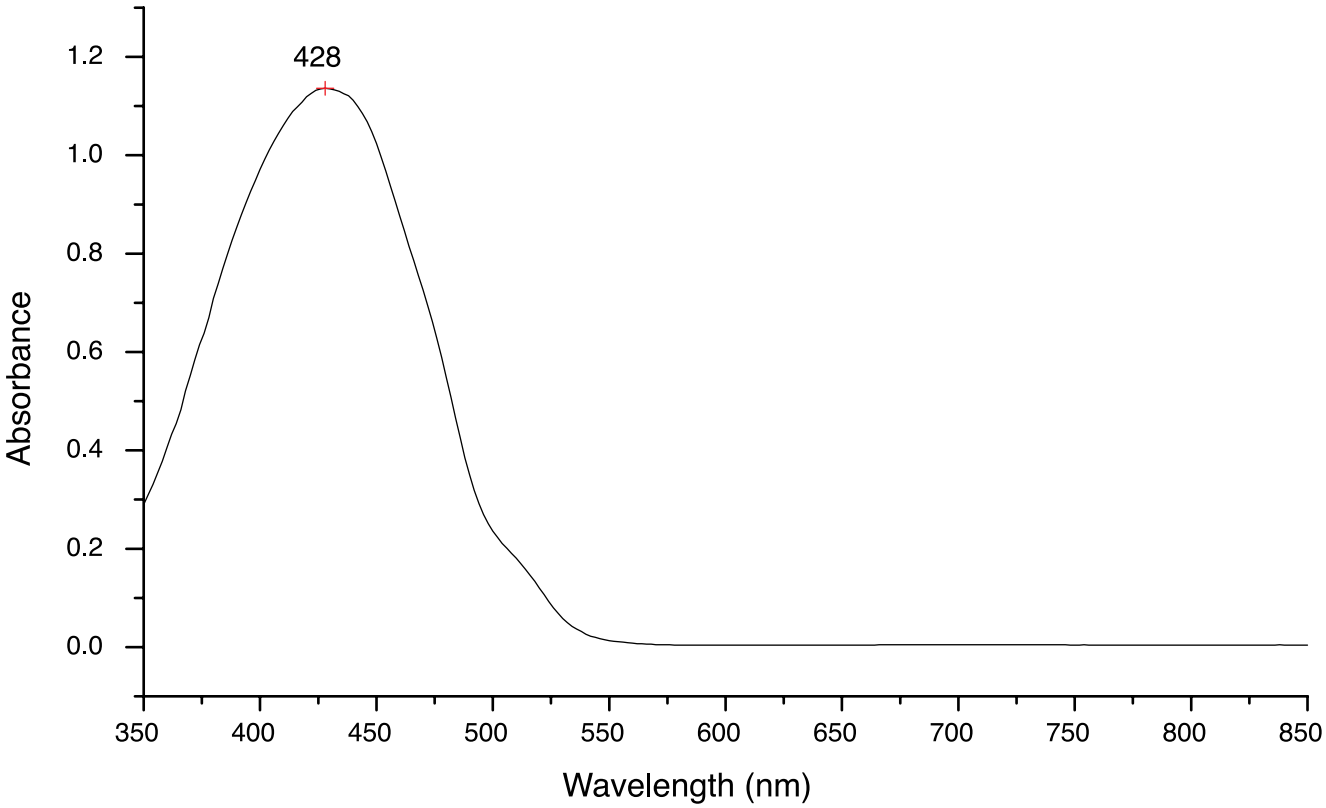


MODEL SPECTRA

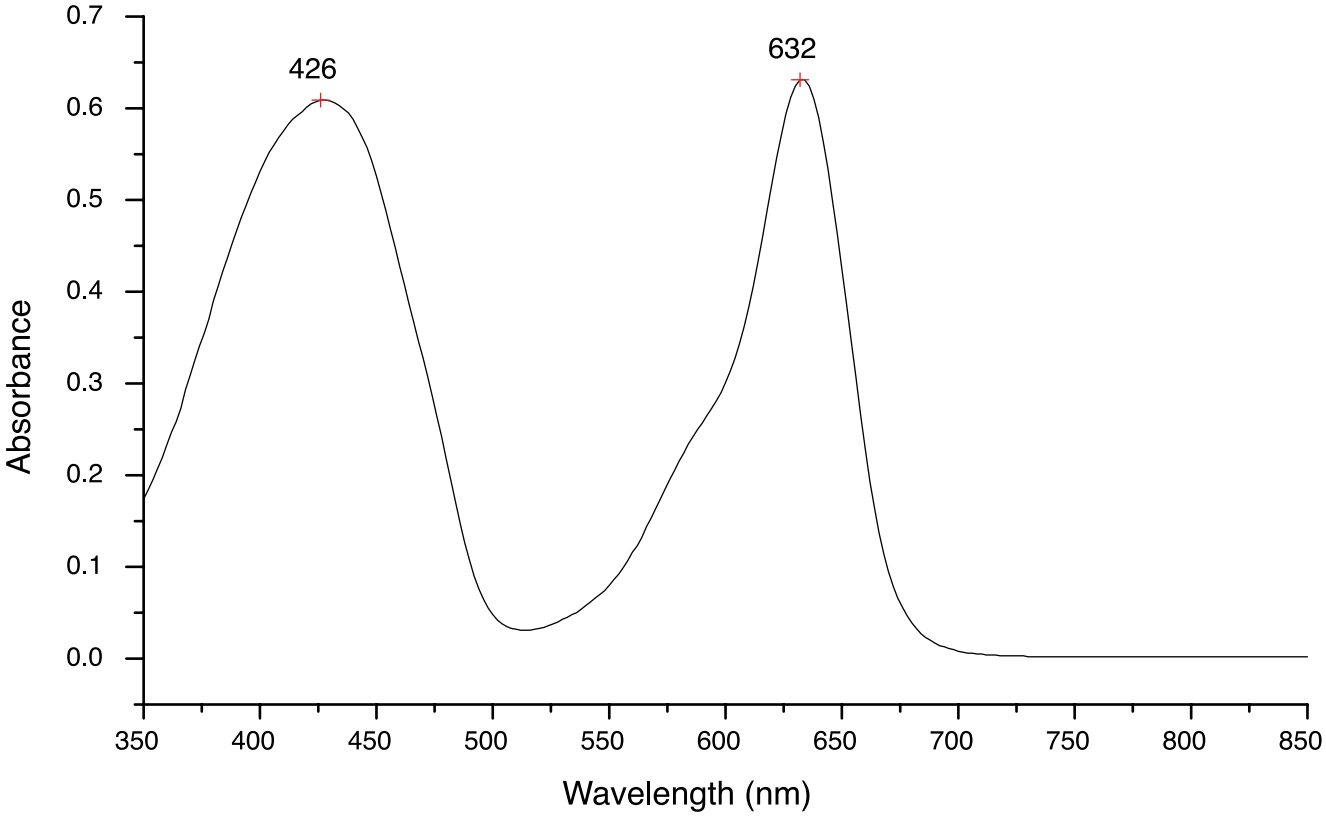
Red: 519 and 528 nm



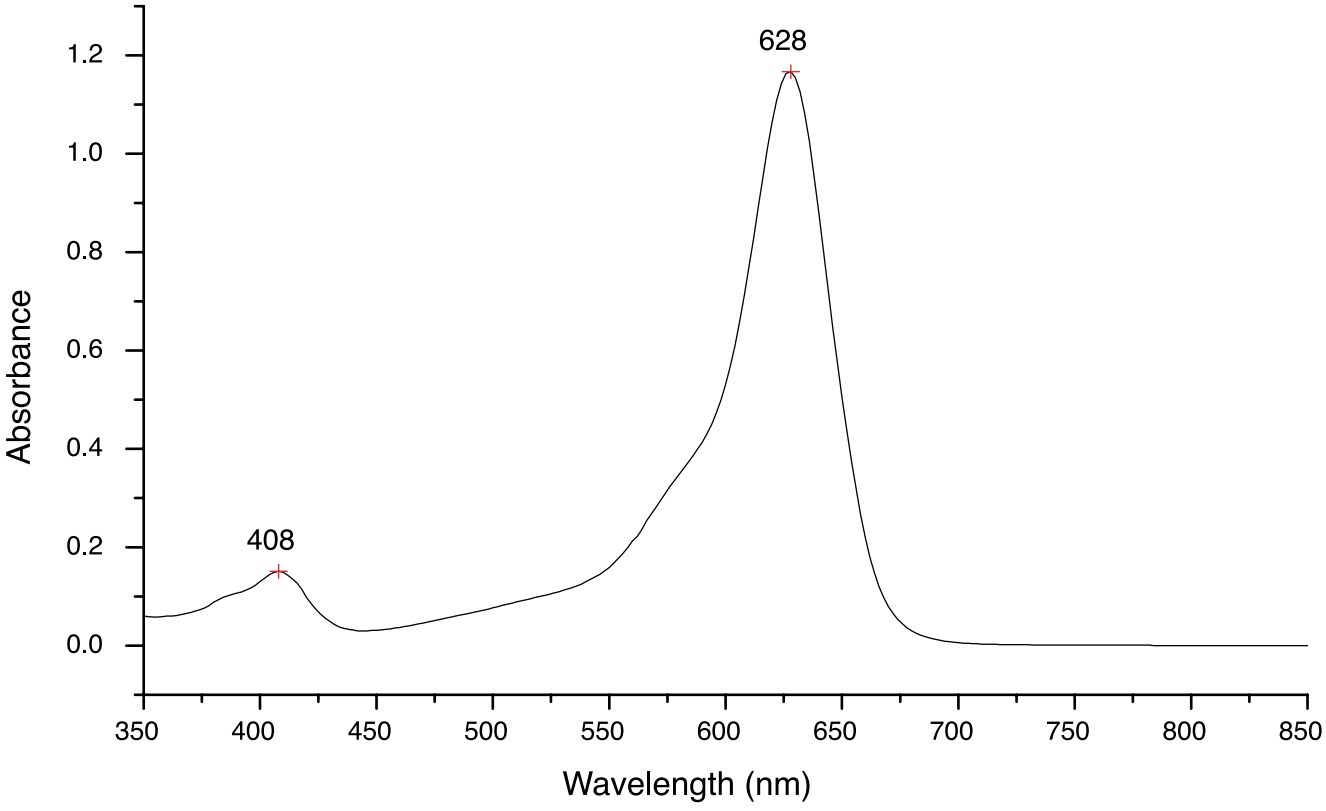
Yellow: 428 nm



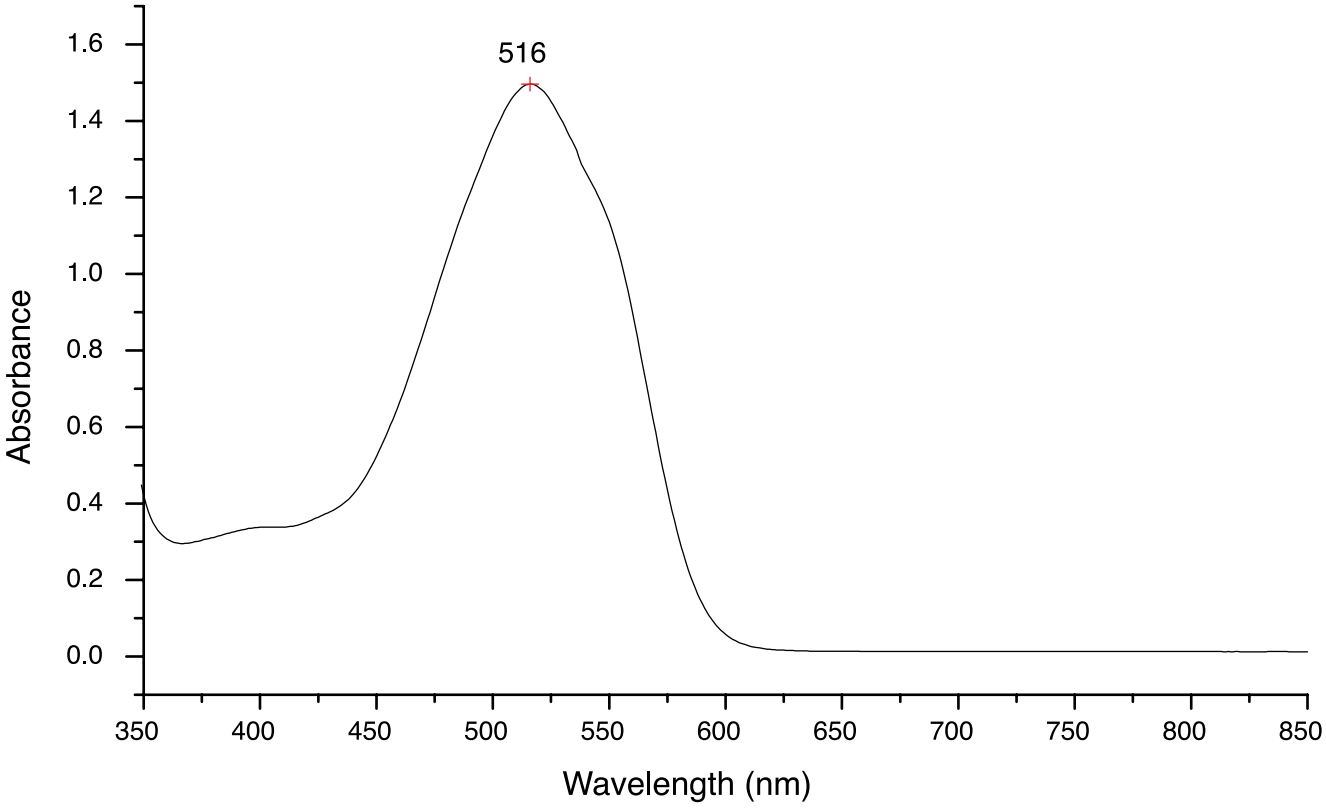
Green: 635 nm



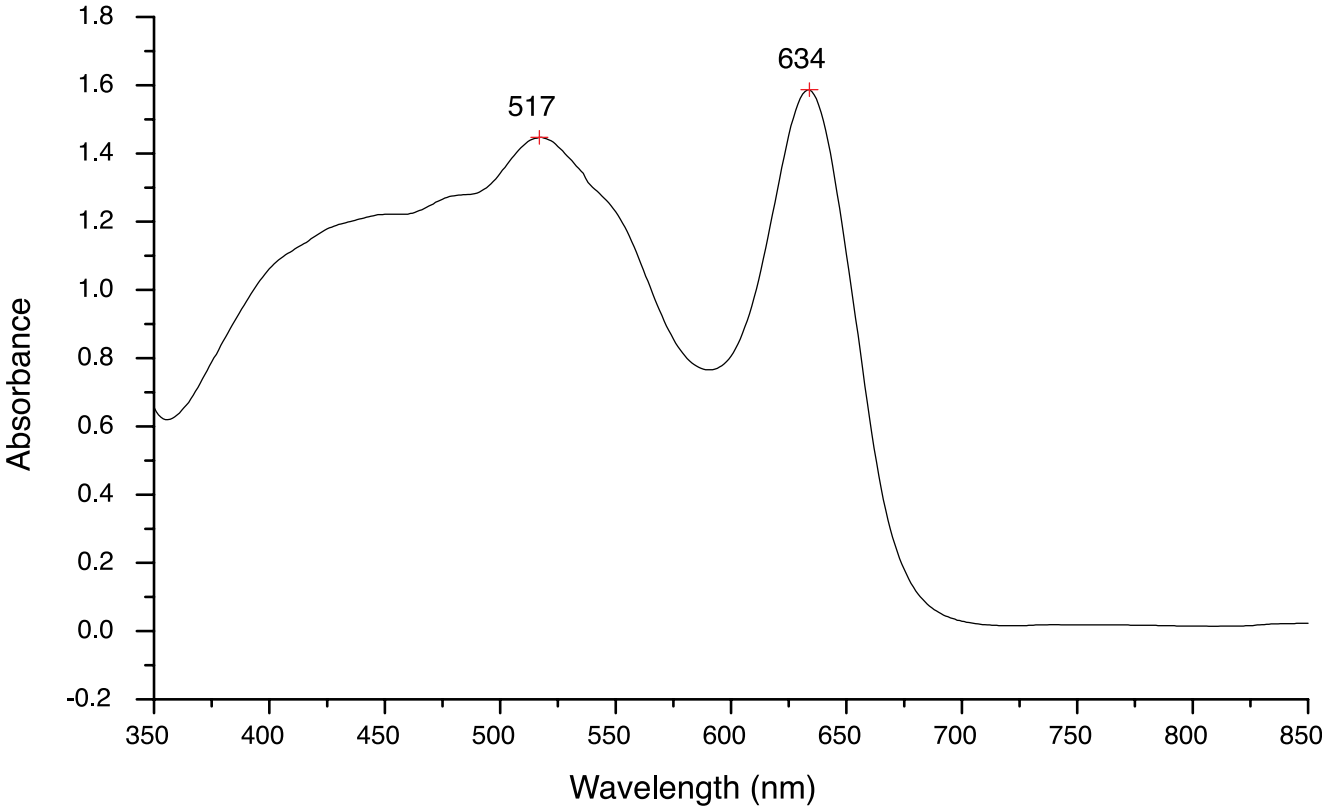
Blue: 628 nm



Pink: 510 nm



Black: 519 and 635 nm



STUDENT WORK SHEET

COLOUR	PREDICTED ABSORBANCE VALUE (nm)	ACTUAL ABSORBANCE VALUE (nm)	NOTES
Red			
Yellow			
Green			
Blue			
Pink			
Black