Colorimetry with a Smartphone

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Emily Rochette

Jake Rowan

Mick Moylan

THE UNIVERSITY OF
MELBOURNE

How do you teach instrumental analysis?

Reflecting on teaching topics like colorimetry, UV-Vis, HPLC, NMR, mass and infrared spectroscopy, what are some challenges you face?

Today's Colorimetry Focus:
- Accessible for secondary school laboratory
- Models the work of chemists

# Links to the 2023 Study Design: Investigation Methodologies

Controlled experiment: An experimental investigation of the relationship between an independent variable and a dependent variable, controlling all other variables as is realistic. This may also include setting up a set of 'controls.' For example, to plot a standard curve in colorimetry experiments.
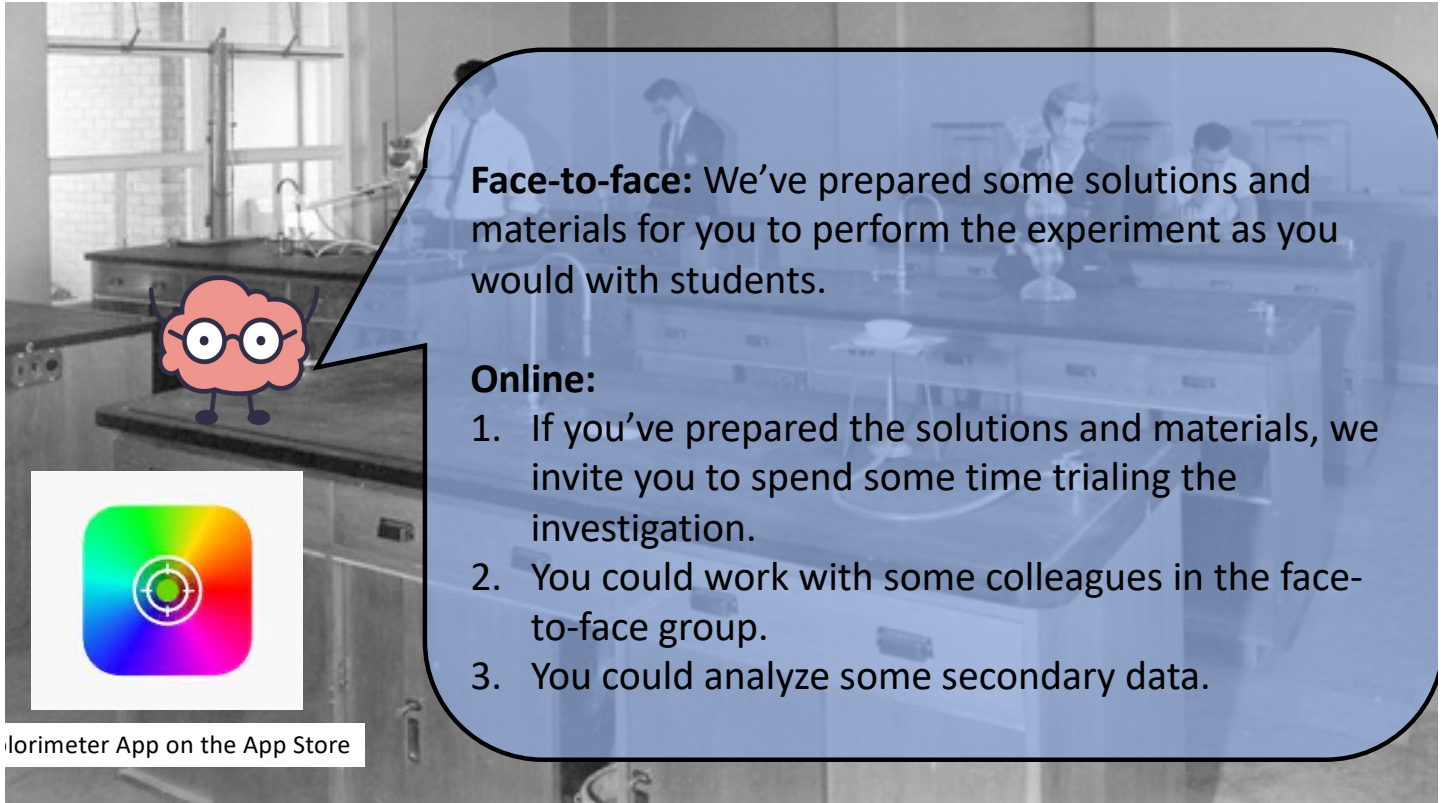

Unit 2, Area of Study 2

How do chemical reactions shape the natural world?
    How are chemicals measured and analyzed?

Quantitative analysis of salts: The application of colorimetry and/or UV-visible spectroscopy, including the use of a calibration curve to determine the concentration of ions or complexes in a water or soil sample

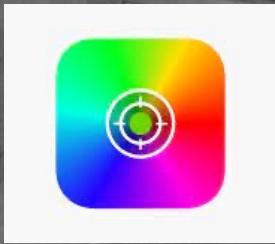Perhaps these aren't the only links to curriculum documents…
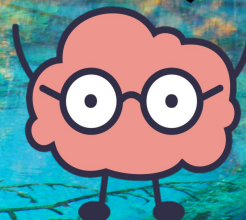
Face-to-face: We've prepared some solutions and materials for you to perform the experiment as you would with students.
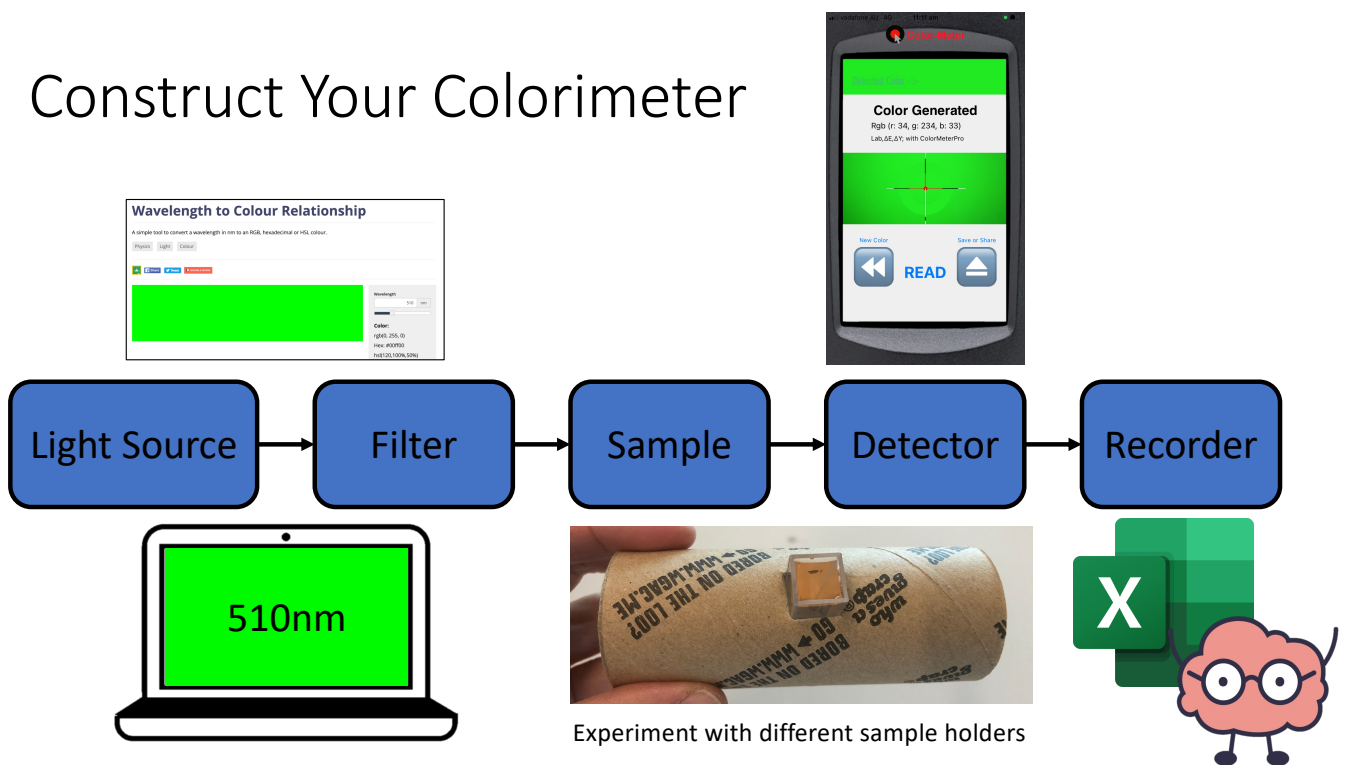
Online:
1. If you've prepared the solutions and materials, we invite you to spend some time trialing the investigation.
2. You could work with some colleagues in the face-to-face group.
3. You could analyze some secondary data.

Colorimeter App on the App Store

Construct Your Colorimeter

Light Source	→	Filter	→	Sample	→	Detector	→	Recorder

510nm

Experiment with different sample holders
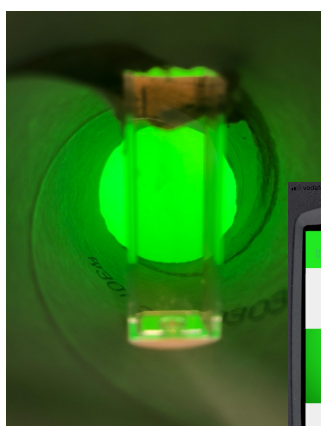
The Step-by-step Guide: Standard Solutions

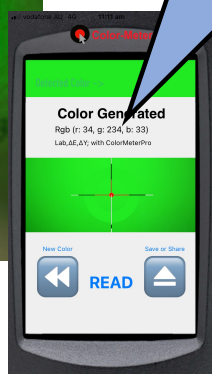- Food dye*: 0%, 20%, 40%, 60%, 80%, 100%

- Copper sulfate: 0.0M, 0.1M, 0.2M, 0.3M, 0.4M, 0.5M

* We'll continue with this example! But you could use $CuSO_4$ solutions!


Collecting and Recording Data

r: 34, g: 234, b:33

Concentration (%)	Intensity of Green Light Transmitted	Absorbance
0	242	
20	240	
40	236	
60	233	
80	232	
Unknown	238	

Analyzing the Data

Concentration (%)	Intensity of Green Light Transmitted	Absorbance
0	242	0.000
20	240	0.004
40	236	0.011
60	233	0.016
80	232	0.018
Unknown	238	0.013

Calibration Curve for the Percentage Concentration per Absorbance of Red Food Dye at 510nm
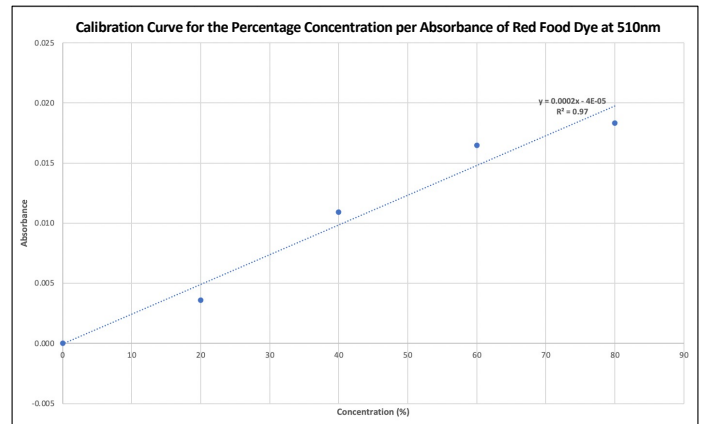
$$A = -\log\frac{I}{I_0}$$

$I \longrightarrow$ Intensity of the sample

$I_0 \longrightarrow$ Intensity of the blank (0%)

Secondary Data

Concentration (%)	Intensity of Green Light Transmitted	Absorbance
0	192	
20	186	
40	180	
60	175	
80	166	
Unknown	177	

$$A = -\log\frac{I}{I_0}$$

$I \longrightarrow$ Intensity of the sample

$I_0 \longrightarrow$ Intensity of the blank (0%)