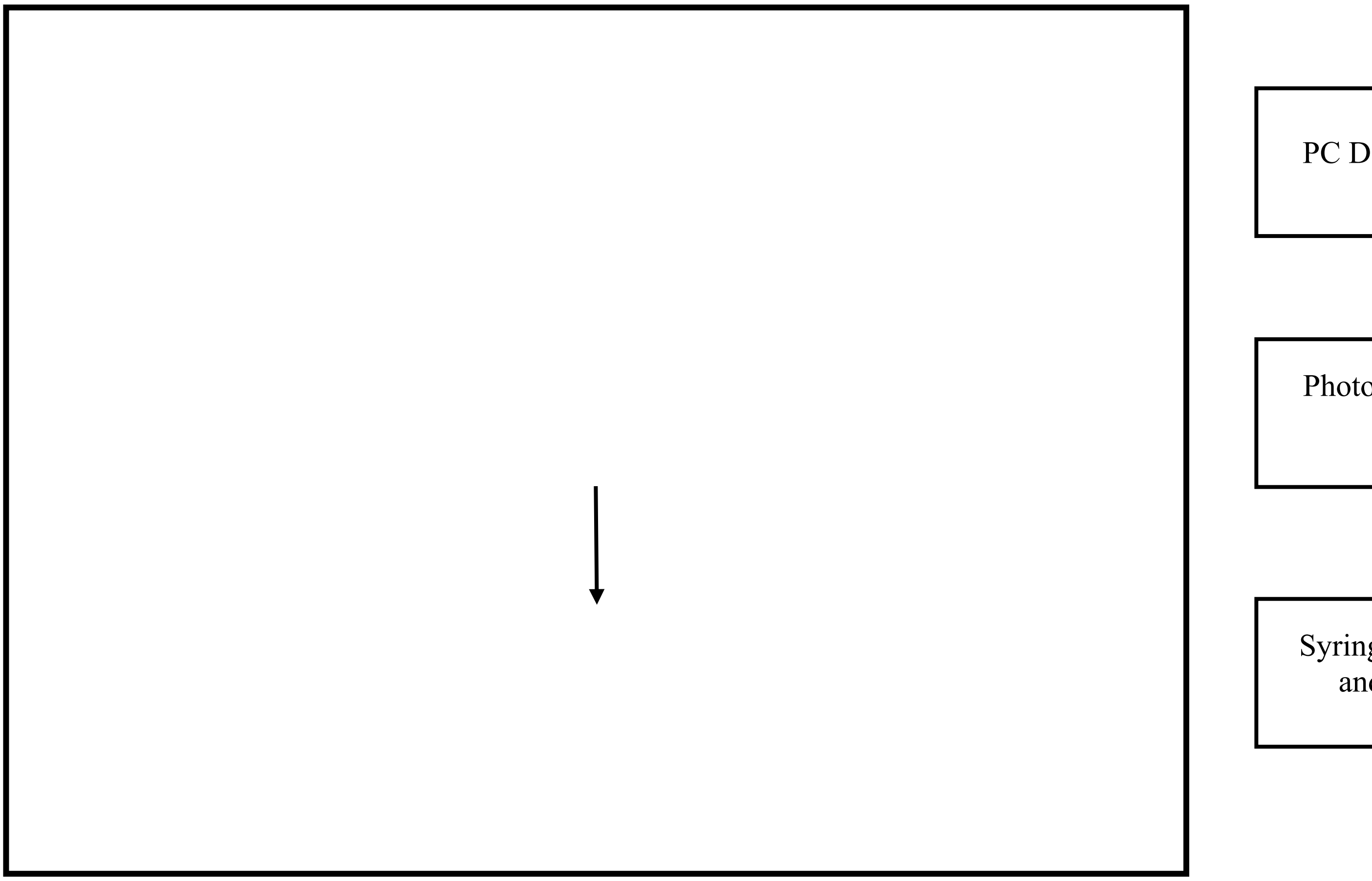
Electronic Supplementary Material (ESI) for Analytical Methods.

S1: The five stepper motors: three for the x, y and z axes, and one for each syringe pump were controlled using a PSoC4 microcontroller which also performed all the data logging as shown in the block diagram below.



S2: The Beer-Lambert linear relationship.

Absorbance and concentration were determined by measuring the transmittance (T):

$$T = \frac{P}{P_0}$$

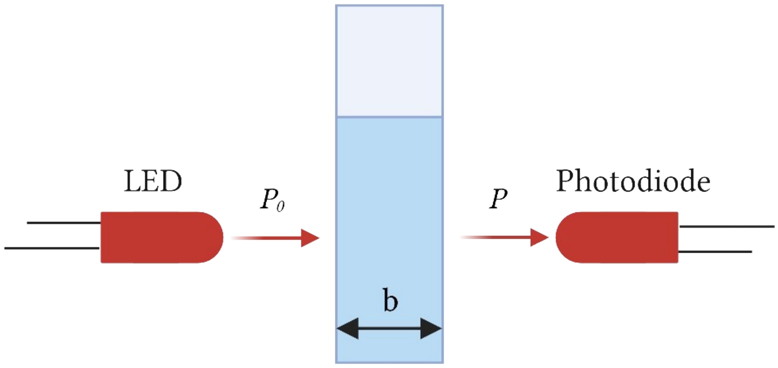


Figure SA. Illustration of transmittance measurement using an LED and photodiode. In this example, P_0 represents the light intensity that would reach the photodiode with a solution referred to as the blank in the cuvette. Moreover, P is the light intensity that would reach the photodiode with a sample or standard, which absorbs some electromagnetic radiation, in the cuvette. Finally, b is the path length of the cuvette.

When using photodiodes in photocurrent mode, the current is converted to a voltage using a current-to-voltage converter. For this particular set-up, 0% transmittance was the dark voltage, V_d, which was 3.3 V. 100% transmittance, which corresponds to P_0 when a blank was in the cuvette, was calculated by subtracting the blank voltage, V_0, from the dark voltage, V_d, of 3.3 V, therefore:

$$P_0 \propto V_d - V_0$$

Similarly (to calculate P), the voltage, V, when a sample was in the cuvette was also subtracted from the dark voltage (V_d) of 3.3 V to determine the value which corresponds to P at the photodiode:

$$P \propto V_d - V$$

The transmittance was calculated as:

$$T = \frac{P}{P_0} = \frac{V_d - V}{V_d - V_0}$$

Absorbance was determined from transmittance as:

$$A = log_{10}\frac{1}{T}$$

$$A = log_{10}\frac{1}{\left(\frac{V_d - V}{V_d - V_0}\right)}$$

$$A = log_{10}\left(\frac{V_d - V}{V_d - V_0}\right)^{-1}$$

$$A = log_{10}\frac{V_d - V_0}{V_d - V}$$

S3. Detailed drawings of the 3D printed rack, baseplate in figure SB, lid in figure SC, and novel 3D colourimetric cell in figure SD.

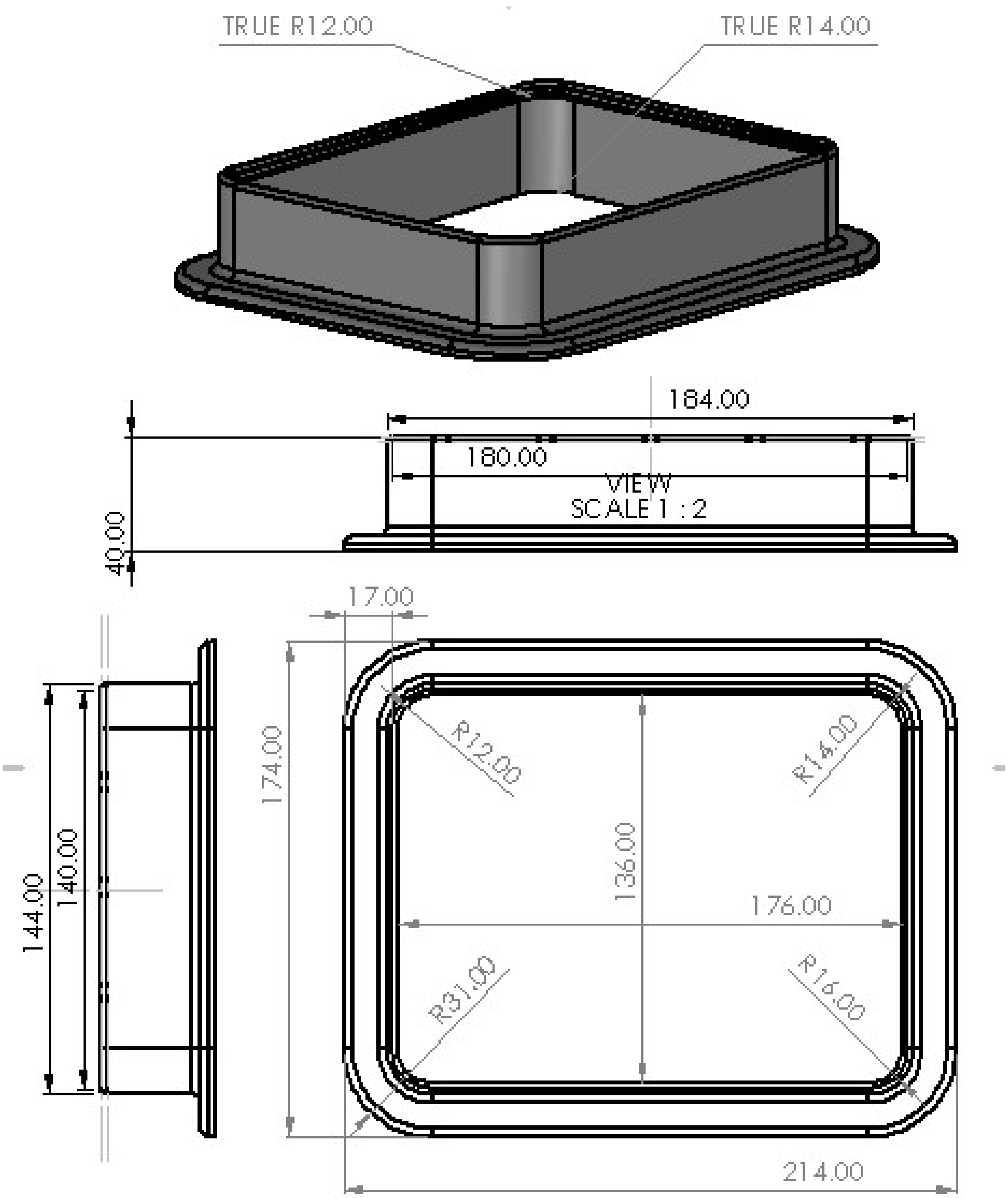


Figure SB. 3D printed base plate of rack with flange to facilitate fastening to the base platform.

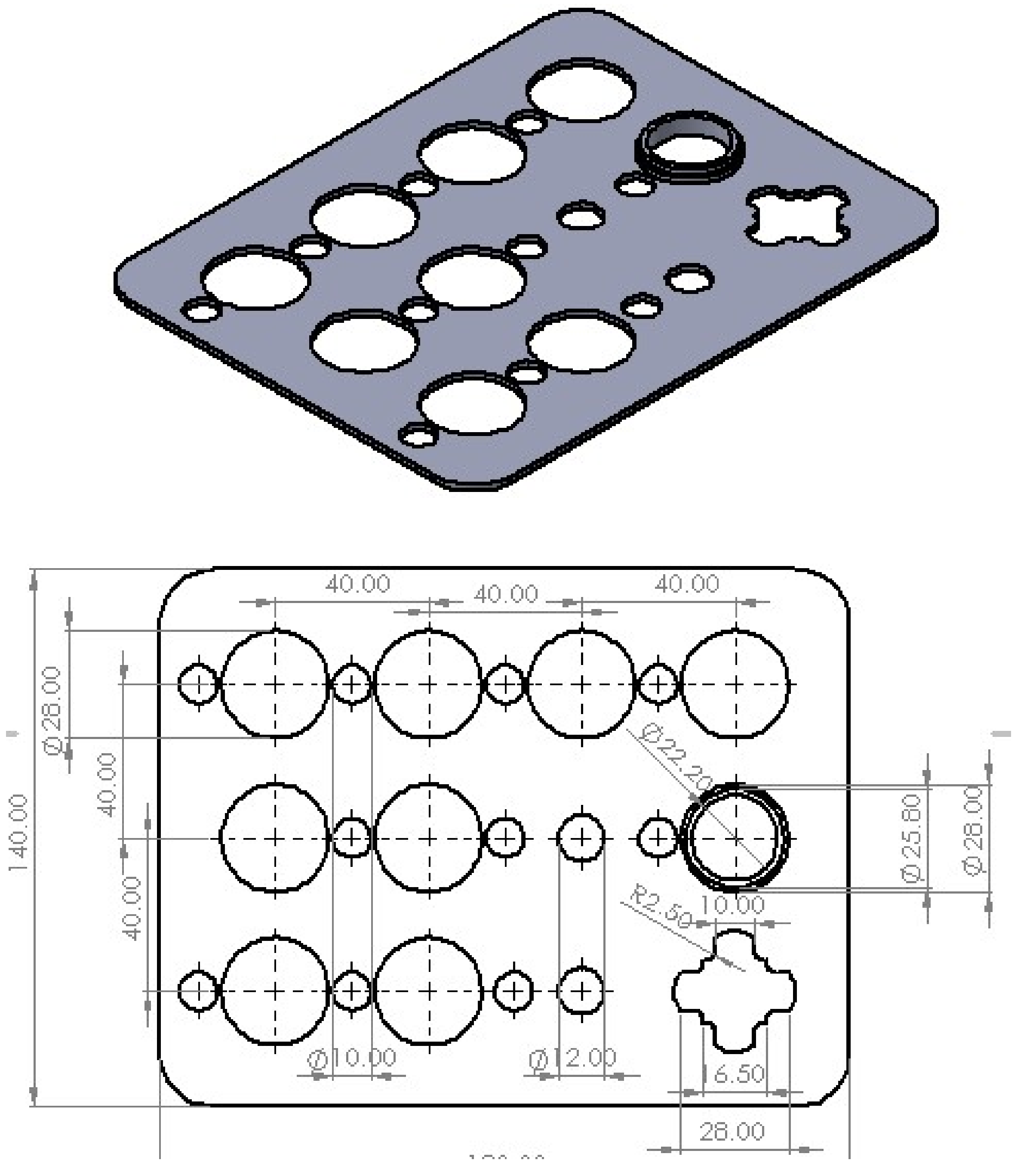


Figure SC. 3D printed lid of the rack, designed to accommodate eight 25 ml flat bottom Sarstedt containers (diameter 40 mm) and two 1.5 ml Eppendorfs (diameter 12 mm) and the colourimetric cell (the irregular shape on bottom right).

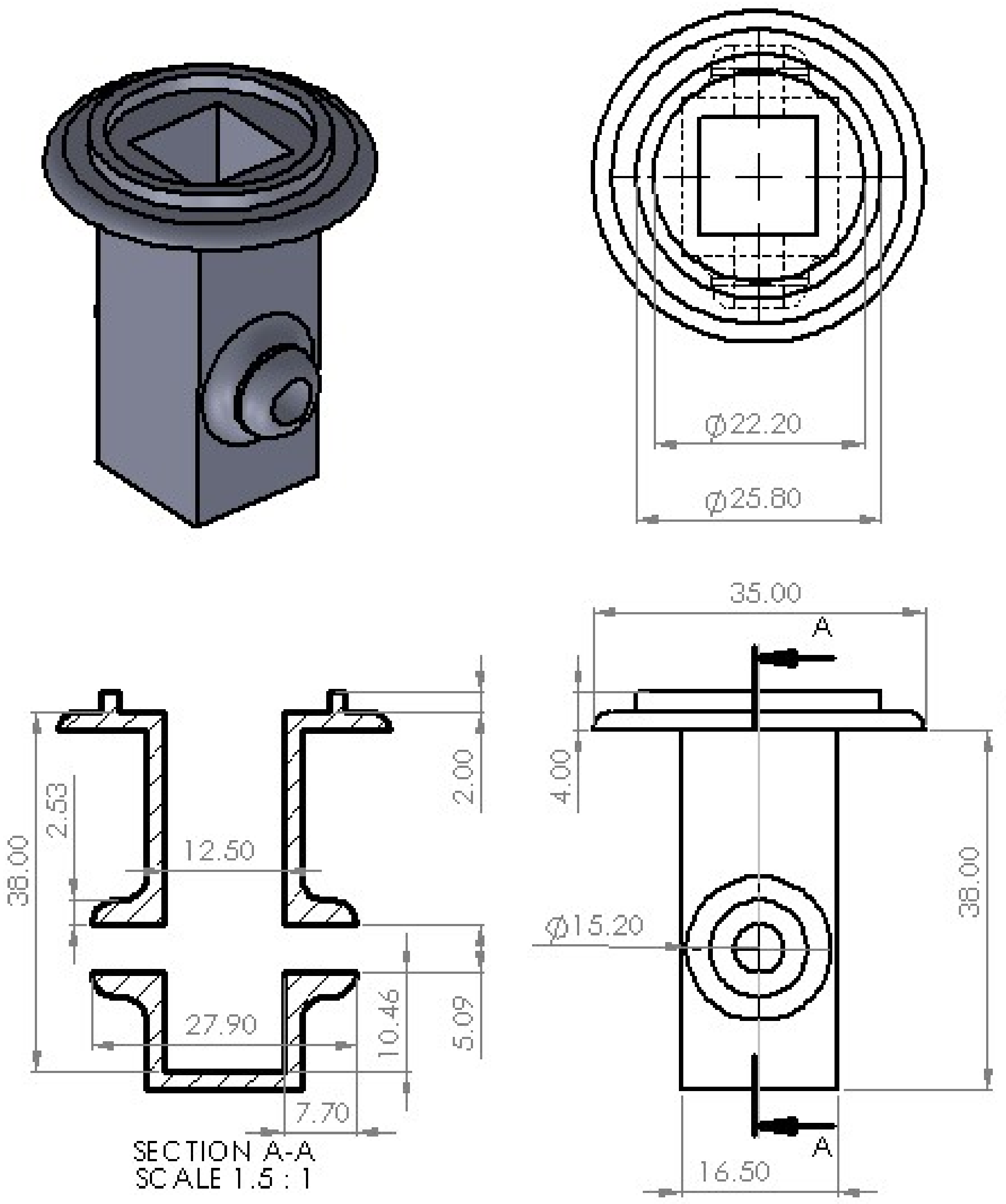


Figure SD. A 3D printed colourimetric cell to facilitate an LED and photodiode and a polystyrene cuvette (10 x 10 x 45 mm).

S4. A simple magnetic stirrer was constructed from a 3.3 V DC motor, a bottle cap and two 10 x 6 mm neodymium magnets to fit under the moving platform holding the 3.5 ml cuvette.

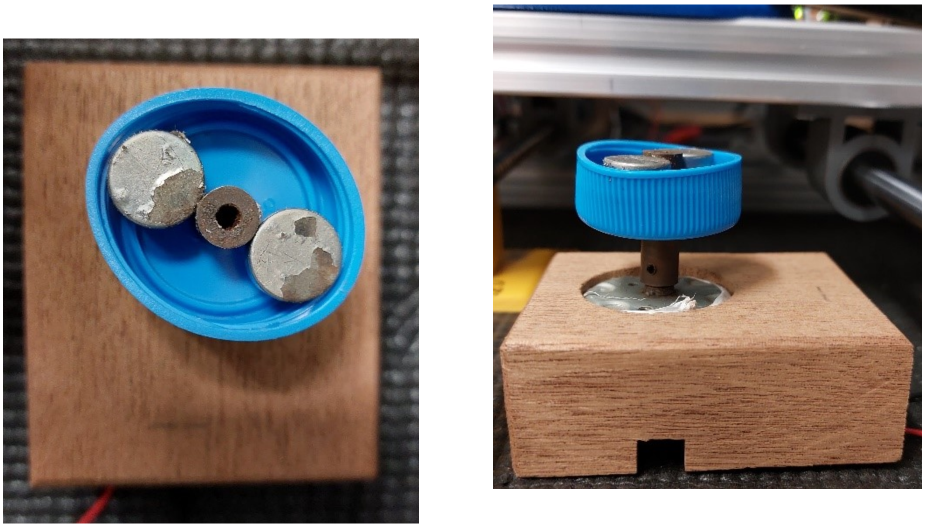


Figure SE. Plan and side view of the simple magnetic stirrer.

S5. An Infrared LED and matching photodiode controlled using a PSoC4 microcontroller.

A simple cell was constructed as seen in SF.

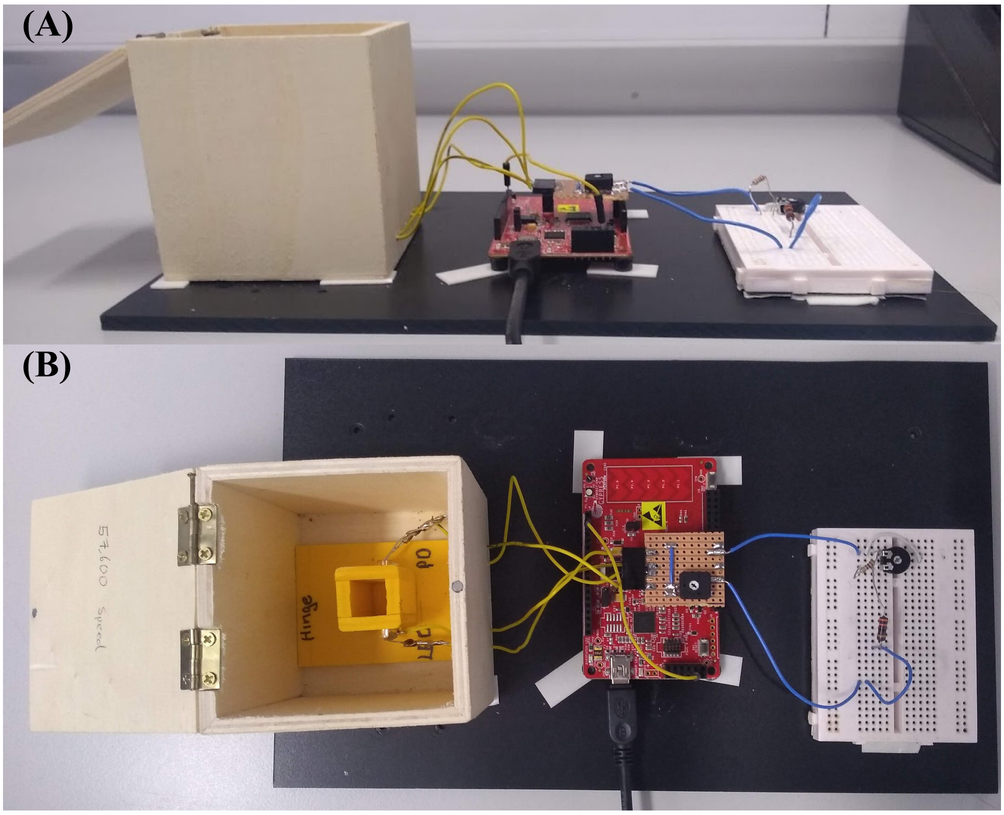


Figure SF. Side view (A) and plan view (B) of the simple cell constructed to hold a cuvette with a path length of 1 cm.

The cell in figure **SF** was used to assess the sensitivity of a variety of LED and photodiodes. The LED (850 nm) and matching photodiodes were located directly opposite, as seen in figure SF (B), at a distance of 15 mm from the base of the cuvette to the centre of the matching pair.

The mV value of the blank was subtracted from the voltage obtained for each concentration of $P\text{-}PO_4^{3-}$, from 10 – 200 µg P L^{-1} (prepared according to EPA Method 365.3).

S6. Table SA. The concentration of P (mg L^{-1} P-PO_4^{3-}) of triplicate measurements in each sample using the saROS determined in each sample prepared according to section 2.3 compared to the EPA Method 365.3 and the Hach PhosVer 3® Method according to sections: 2.5.2; 2.5.1; 2.5.3, respectively. The t_{exp} for replicates is much less than the t_{table} value of 2.776 for 4 degrees of freedom and 95% confidence interval, indicating no real difference in values obtained between the saROS and Standard Method 365.3 methodologies.

Sample	saROS P±SP (mg/L)	Standard Method 365.3 P (mg/L)	Hach P (mg/L)	t_{exp}
A	3.361 ± 0.014	3.384 ± 0.105	3.125	0.093
B	3.803 ± 0.015	3.851 ± 0.058	3.325	0.253
C	0.971 ± 0.045	0.958 ± 0.096	1.423	0.051
D	1.125 ± 0.049	0.987 ± 0.160	1.350	0.431
E	1.230 ± 0.020	1.119 ± 0.154	1.050	0.367
F	1.904 ± 0.041	1.912 ± 0.088	2.050	0.031
G	2.837 ± 0.100	2.872 ± 0.017	2.750	0.169
H	3.065 ± 0.008	3.127 ± 0.208	3.375	0.182
I	6.862 ± 0.001	6.826 ± 0.119	7.125	0.139
J	2.385 ± 0.016	2.513 ± 0.273	2.045	0.323
K	0.895 ± 0.100	0.861 ± 0.069	1.120	0.123
L	2.253 ± 0.014	2.310 ± 0.127	2.043	0.209
M	3.912 ± 0.041	3.760 ± 0.410	3.640	0.311
N	2.421 ± 0.043	2.310 ± 0.297	2.205	0.263
O	3.708 ± 0.036	3.819 ± 0.437	3.487	0.221
P	1.620 ± 0.001	1.573 ± 0.208	1.824	0.138