INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY

COURSE	ROLL NO.	NAME	
CH-1172	23B0912	Aditya Sarvepalli	
ASSIGNMENT NO.		DUE DATE	SUB. DATE
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Experiment-3: Determination of Phosphoric acid in Soft Drinks.

Aim: To calculate the amount of phosphoric acid in a soft-drink (Thumbs up) using molybdenum blue.

Theory:

$$\rightarrow 7H_3PO_4 + 12(NH_4)_6Mo_7O_{24}\cdot 4H_2O \rightarrow 7(NH_4)_3[PO_4(MoO_3)_{12}] + 51NH_4^+ + 51OH^- + 33H_2O$$

→ In this experiment, ammonium molybdate $[(NH_4)_6Mo_7O_{24}\cdot 4H_2O]$ forms a colorless hexavalent phosphomolybdate with the phosphate $[PO_4^{3-}]$ ion.

→ In acidic conditions, the colorless complex is reduced to a blue pentavalent form by ascorbic acid.

→ The concentration of the pentavalent form can be determined spectrophotometrically by measuring its absorption at 830 nm.

Procedure:

1. Preparation of standard stock solution: 1.9412 g of KH_2PO_4 is dissolved in de-ionized water in a 1L volumetric flask and is topped off to 1L. (Standard A)
2. Preparation of working standard solution: Dilute the standard A 20 times by adding 2.5 mL A to 50 mL volumetric flask and top it to 50 mL (Standard B)

   Dilute standard B 12.5 times by adding 4mL of standard B to

50mL volumetric flask and top it to 50mL (Standard C)
The concentration of standard C is 4ppm P_2O_5.

3. Preparation of reducing solution R:
→ Dissolve 1.00g of ammonium molybdate in 50mL de-ionized water (solution M)
→ Dissolve 1.76g of ascorbic acid in 100mL deionized water (solution A)
→ Dilute 17mL of CC. H_2SO_4 in 200mL de-ionized water (solution S)
→ Mix 39mL of solution M, 60mL of solution A, 125mL of solution S and top it upto 250mL in a volumetric flask.

4. Sample preparation (Solution X):
→ Transfer 2.5mL of decarbonated drink to a 50mL volumetric flask and top it up to 50mL.
→ Prepare the sample test tubes as follows:

Vols (in mL)	Tube1	Tube2	Tube3	Tube4	Tube5	Tube6	Sample
Vol of Standard C	0	0.5	1	1.5	2	2.5	
Vol of Soln X							0.25
Vol of Soln R	2	2	2	2	2	2	2
Vol of water	3	2.5	2	1.5	1	0.5	2.75
Final Volume	5	5	5	5	5	5	5
Final CC of P_2O_5 (in ppm)	0	0.4	0.8	1.2	1.6	2	

→ Heat these test tubes in a water bath for 10 mins.

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→ Read the absorbance against a blank at 830nm.

Observations:

→ When N, A & S were added in order, there was a color change from colorless to yellow to pale green.

→ After the test tubes were removed from the water bath, some of them had turned blue.

→ Absorbance values for sample and standard tubes 1–6:

Solution	Concentration (ppm)	A_{830}
Tube 1	0	0.0149
Tube 2	0.4	0.1148
Tube 3	0.8	0.1417
Tube 4	1.2	0.2065
Tube 5	1.6	0.2714
Tube 6	2	0.3838
Sample		0.2495

Calculations

→ From the graph, equation of line is $y = 7.162x + 0.0149$

→ But, by Simple linear regression, line is $\boxed{y = (0.1434)x + 0.0693}$

∴ Concentration of sample is

$$0.2495 = (0.1434)x + 0.0693$$

$$\Rightarrow x = \frac{0.2495 - 0.0693}{0.1434}$$

$$\text{Cc. of } P_2O_5 = \boxed{x = 1.256 \text{ ppm}}$$

→ Calculation of phosphorus content in sample:

Considering the dilutions made to the original sample and the transformation from P_2O_5 to P, the amount of P in the sample (in ppm) $= x \times 20 \times 20 \times \frac{62}{142}$

$$= 1.256 \times 20 \times 20 \times \frac{62}{142}$$

$$\boxed{C = 219.357 \text{ ppm}}$$

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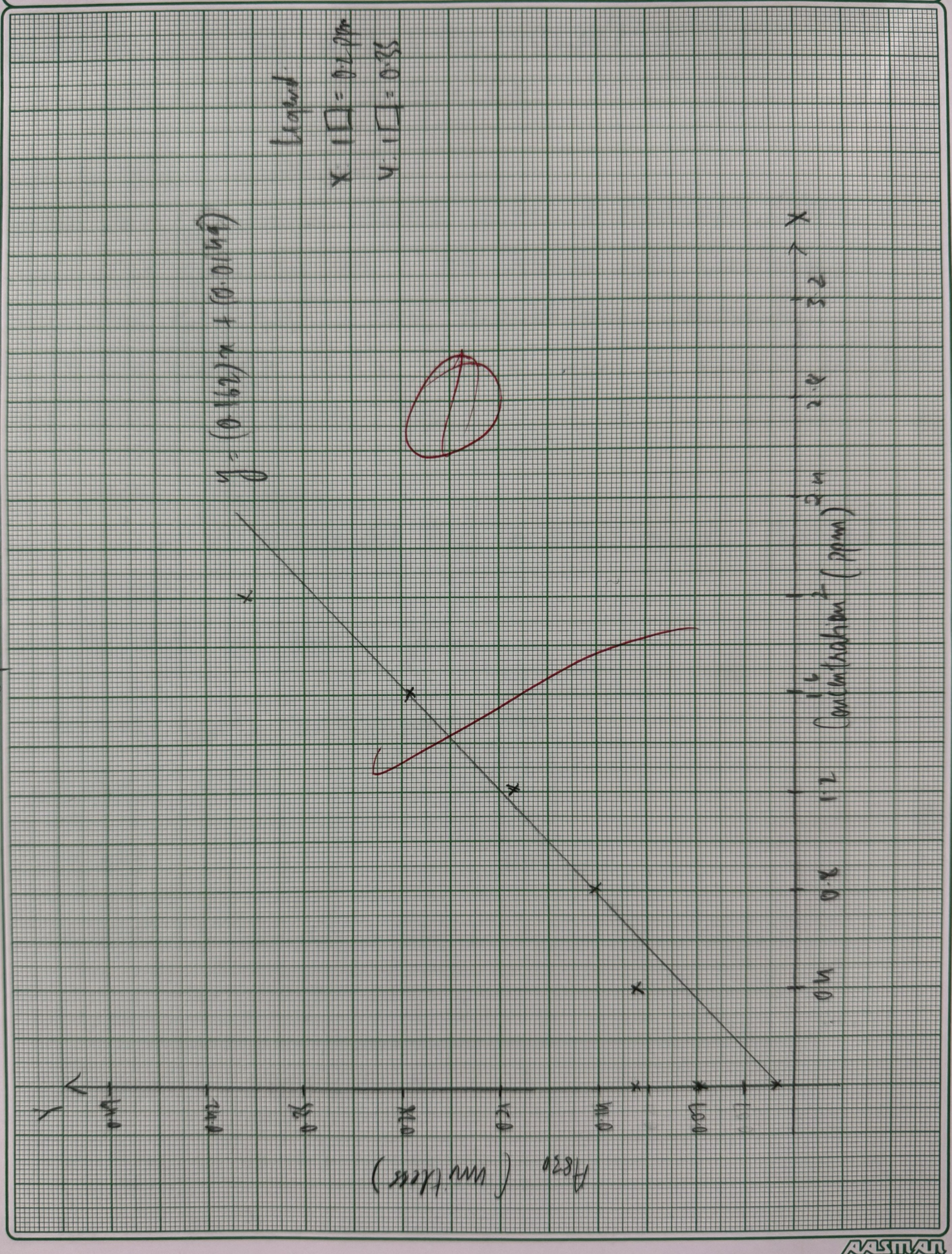
Graph: Concentration vs Area



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