EXPERIMENT 2

QUANTITATIVE DETERMINATION OF VITAMIN C IN COMMERCIAL TABLETS

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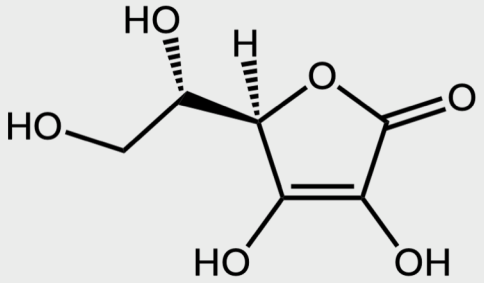
Purpose

To determine the mass of vitamin C (ascorbic acid) in a commercial tablet.

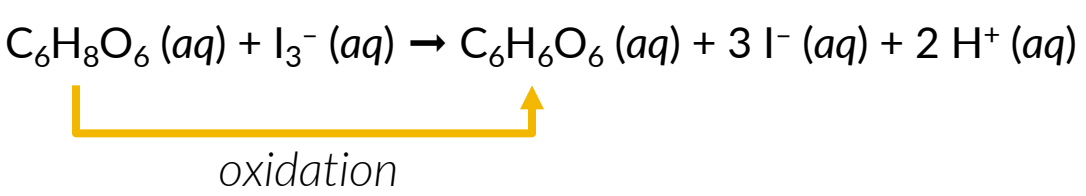


$C_6H_8O_6$

Method

Titrimetry (volumetric analysis), which requires a 'clean' chemical reaction that involves the analyte as one of the reactants and has a well-defined stoichiometry. We also need a good titrant and indicator.

Ascorbic acid is a reductant. As such, it undergoes oxidation in the presence of triiodide (I_3^-) via:



Problem → No triiodide salts are commercially available.

Solution → We can make I_3^- readily in the lab.

$$IO_3^- (aq) + 8\ I^- (aq) + 6\ H^+ (aq) \rightarrow 3\ I_3^- (aq) + 3\ H_2O (l)$$

Procedural Outline

The main idea in the titrimetric determination of ascorbic acid is to:

Make an excess of I_3^- using IO_3^- *in the presence of ascorbic acid*.

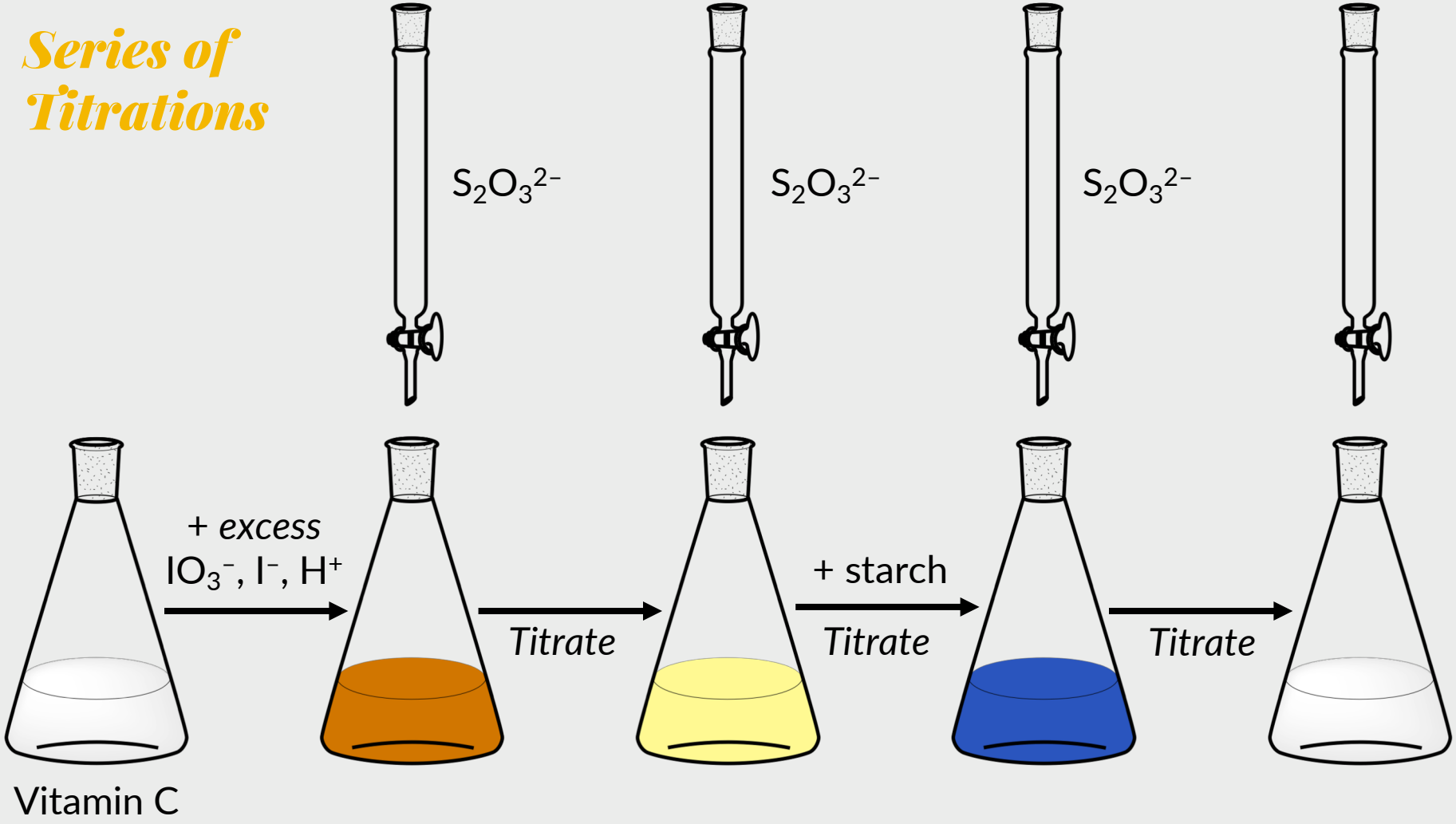
$$IO_3^- (aq) + 8\ I^- (aq) + 6\ H^+ (aq) \rightarrow 3\ I_3^- (aq) + 3\ H_2O\ (l)$$

↓

Titrate the *remaining* I_3^- with thiosulfate ($S_2O_3^{2-}$) using starch indicator.

$$I_3^- (aq) + 2\ S_2O_3^{2-} (aq) \rightarrow 3\ I^- (aq) + S_4O_6^{2-} (aq)$$

Series of Titrations



Standardize the thiosulfate solution

Primary standards: very stable, high purity, and have known molar mass

Commercially available hydrates of $Na_2S_2O_3$ are not primary standards because may have different hydrates ($Na_2S_2O_3 \cdot xH_2O$).

↓

KIO_3 is a primary standard. It can be used to standardize thiosulfate solutions.

$$IO_3^- (aq) + 8\ I^- (aq) + 6\ H^+ (aq) \rightarrow 3\ I_3^- (aq) + 3\ H_2O\ (l)$$

Titrate the I_3^- with the *same* thiosulfate ($S_2O_3^{2-}$) solution.

$$I_3^- (aq) + 2\ S_2O_3^{2-} (aq) \rightarrow 3\ I^- (aq) + S_4O_6^{2-} (aq)$$

↓

Now we can determine the concentration of thiosulfate solution used.

Notes

1. Work independently today.
2. Try to finish standardization by 3:45pm today.
3. There are worked-out examples in the lab manual.
4. Lab report: Ex. 3 due next week Tuesday/Wednesday
5. Quizzes: use a pen + wait