**Sodium Thiosulfate**
- Sodium Thiosulfate, 5-Hydrate, Na₂S₂O₃•5H₂O
  Reagent Grade, ACS Specifications

**Solution Strengths**

<table>
<thead>
<tr>
<th>Strength</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 M</td>
<td>ECN-0023-01</td>
</tr>
</tbody>
</table>

**Standardized**

- 0.1 N

<table>
<thead>
<tr>
<th>Strength</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 N</td>
<td>ECN-0023-01</td>
</tr>
</tbody>
</table>

**Preparations**

**1.0 M Sodium Thiosulfate**

1. Add 800 mL of distilled water to a 1-litre volumetric flask containing a Teflon stir bar.
2. Add and dissolve 248.0 ± 0.1 g of sodium thiosulfate 5-hydrate. Remove the Teflon stir bar.
3. Add 1 mg of mercuric iodide as a preservative and dissolve.
4. Dilute to volume with distilled water and mix.

**0.1 N Sodium Thiosulfate**

(standardized to 4 decimal places)

1. Add 800 mL of freshly boiled and cooled distilled water to a 1-litre volumetric flask containing a Teflon stir bar.
2. Add and dissolve 24.82 ± 0.001 g of sodium thiosulfate 5-hydrate. Remove the Teflon stir bar.
3. Add 1 mg of mercuric iodide as a preservative and dissolve.
4. Dilute to volume with freshly boiled and cooled distilled water and mix.
5. Standardize as described below.

**Standardization**

See Reagent Preparation for:

- Potassium Biiodate
  - GFS Certified No. 76, GFS Chemicals
- Potassium Iodide
- 7.0 N Sulfuric Acid
- Starch Indicator (for manual titration)
- Mercuric Iodide

**Warning**

POISONOUS. Avoid inhalation. Use with adequate ventilation. Avoid contact with eyes and skin. Wear protective gloves when using. Photographic contaminant.

**Note:** It is preferable to make three separate smaller weighings of dried potassium biiodate rather than making a 2.40 g/L solution and taking three subsequent aliquots. However, for labs that do not have the capability of weighing to ± 0.1 mg, using the 2.40 g/L solution is acceptable. See the potassium biiodate reagent preparation section if you need to make the solution.

1. Dry enough GFS Certified No. 76 potassium biiodate for the weighings, in a 105°C oven for two hours. Do not exceed 120°C or degradation of the material may occur.
2. Cool the material to room temperature in a desiccator.

**Potentiometric Titration**

**Equipment**

- Metrohm E-536 Potentiograph
- 50 or 20 mL buret for the Potentiograph (depending on size of the buret used for the sample)
- Reference Electrode, Double Junction, Orion No. 900200 or equivalent
- Indicator Electrode, Platinum Inlay/Disc, Beckman No. 39273 or equivalent

1. According to the buret size used, weigh the amount of potassium biiodate indicated in the table below (or pipet the volume of 2.40 g/L potassium biiodate solution) and quantitatively transfer into a 250 mL beaker containing a Teflon stirring bar and 100 mL of distilled water.

<table>
<thead>
<tr>
<th>Buret Size</th>
<th>g Biiodate</th>
<th>mL Biiodate</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mL</td>
<td>0.12*</td>
<td>50.0</td>
</tr>
<tr>
<td>20 mL</td>
<td>0.05*</td>
<td>20.0</td>
</tr>
</tbody>
</table>

* Weighed to the nearest 0.0001 g.

2. While stirring, add 10 mL of 7.0 N sulfuric acid and 2.00 ± 0.01 g of reagent-grade potassium iodide.
3. After the potassium iodide has dissolved, immediately titrate with the 0.1 N sodium thiosulfate to be standardized. If using a Metrohm E536 Potentiograph autotitrator, use the following settings:

<table>
<thead>
<tr>
<th>E536 Potentiograph:</th>
<th>Control Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut-Off:</td>
<td>OFF</td>
</tr>
<tr>
<td>Autocontrol:</td>
<td>OFF</td>
</tr>
<tr>
<td>Feeding Time:</td>
<td>15 min/100% volume</td>
</tr>
<tr>
<td>Selector Switch:</td>
<td>mV, pH</td>
</tr>
<tr>
<td>Measuring Span:</td>
<td>500 mV</td>
</tr>
<tr>
<td>Changeover Switch:</td>
<td>400 mm/100% volume</td>
</tr>
<tr>
<td>Buret Size:</td>
<td>50 or 20 mL as required</td>
</tr>
<tr>
<td>Reference Electrode:</td>
<td>Double Junction, Orion No. 900200</td>
</tr>
<tr>
<td>Indicator Electrode:</td>
<td>Platinum Inlay/Disc. Beckman No. 39261</td>
</tr>
</tbody>
</table>

4. Determine the volume (mL) of 0.1 N sodium thiosulfate at the end point using concentric arcs.

5. Run the standardization in triplicate.

6. Calculations:
   a. For direct weighing of Potassium Biiodate
   
   \[
   N_{Na_2S_2O_3} = \frac{[g \text{ KH(IO}_3\text{)}_2]}{[\text{mL titrated}][0.03250]} = \frac{30.769[g \text{ KH(IO}_3\text{)}_2]}{[\text{mL titrated}]}
   \]
   
   b. For 2.4 g/L solution used:
      - For 50 mL Buret
   
   \[
   N_{Na_2S_2O_3} = \frac{[g \text{ KH(IO}_3\text{)}_2 \text{ weighed}][50.0 \text{ mL}]}{[\text{mL titrated}][0.03250][1000]} = \frac{1.538[g \text{ KH(IO}_3\text{)}_2 \text{ weighed}]}{[\text{mL titrated}]}
   \]
      - For 20 mL Buret
   
   \[
   N_{Na_2S_2O_3} = \frac{[g \text{ KH(IO}_3\text{)}_2 \text{ weighed}][20.0 \text{ mL}]}{[\text{mL titrated}][0.03250][1000]} = \frac{0.615[g \text{ KH(IO}_3\text{)}_2 \text{ weighed}]}{[\text{mL titrated}]}
   \]

   \[
   0.03250 = \text{ milliequivalent wt. of KH(IO}_3\text{)}_2
   \]

   \[
   1000 = \text{ factor for converting mL to L}
   \]

   c. Calculate the mean normality (\(\bar{N}\)) and standard deviation (s):

   \[
   \bar{N} = \frac{\sum N}{n}
   \]

   Where:
   - \(N\) = the individual normality results
   - \(\sum N\) = the sum of the \(n\) normality results
   - \(n\) = the number of replicate results

   \[
   s = \sqrt{\frac{\sum (N - \bar{N})^2}{n-1}}
   \]

   d. Laboratory experience at Kodak shows the standard deviation (s) should be \(\leq 0.0003\). Determine the standard deviation (s) for your laboratory.
Manual Titration

1. Weigh 0.12 ± 0.0001 g of potassium biiodate and quantitatively transfer (or pipet 50.0 mL of 2.40 g/L potassium biiodate solution) into a 250 mL Erlenmeyer flask containing a Teflon stirring bar and 100 mL of distilled water.

2. While stirring, add 10 mL of 7.0 N sulfuric acid and 2.00 ± 0.01 g of reagent-grade potassium iodide.

3. After the potassium iodide has dissolved, immediately titrate (while stirring) with the 0.1 N sodium thiosulfate to be standardized from a 50 mL buret to a light yellow color. Add 5 mL of starch indicator and titrate drop by drop until the disappearance of the blue color.

4. Calculations:
   a. For direct weighing of Potassium Biiodate

   \[
   N \text{Na}_2\text{S}_2\text{O}_3 = \frac{[g \text{ KH(IO}_3)_2]}{[\text{mL titrated}][0.03250]} = \frac{30.769[g \text{ KH(IO}_3)_2]}{[\text{mL titrated}]}
   \]

   b. For 2.4 g/L solution used:

   For 50 mL Buret

   \[
   N \text{Na}_2\text{S}_2\text{O}_3 = \frac{[g \text{ KH(IO}_3)_2 \text{ weighed}][50.0 \text{ mL}]}{[\text{mL titrated}][0.03250][1000]} = \frac{1.538[g \text{ KH(IO}_3)_2 \text{ weighed}]}{[\text{mL titrated}]}
   \]

   \[
   0.03250 = \text{milliequivalent wt. of KH(IO}_3)_2
   \]

   \[
   1000 = \text{factor for converting mL to L}
   \]