2. Volumetric Solutions

0.1 mol/l Ammonium Thiocyanate

One liter of this solution contains 7.612 g of ammonium thiocyanate (NH_4SCN, molecular weight: 76.12).

Weigh about 8 g of ammonium thiocyanate, and dissolve in 1,000 ml of water. This solution may be replaced by 0.1 mol/l potassium thiocyanate.

Standardization: Measure exactly 30 ml of 0.1 mol/l silver nitrate, and transfer into a flask with a ground-glass stopper. Add 50 ml of water, 2 ml of nitric acid, and 2 ml of ferric ammonium sulfate TS, and titrate with 0.1 mol/l ammonium thiocyanate while shaking until a red-brown color persists.

0.01 mol/l Bismuth Nitrate

One liter of this solution contains 4.851 g of bismuth nitrate ($Bi(NO_3)_3 \cdot 5H_2O$, molecular weight: 485.07).

Weigh 4.86 g of bismuth nitrate, dissolve in 60 ml of diluted nitric acid (1 → 10), and add water to make 1,000 ml.

Standardization: Measure exactly 25 ml of 0.01 mol/l bismuth nitrate, add 50 ml of water, and titrate with 0.01 mol/l EDTA (indicator: 1 drop of xylenol orange TS) until the color of the solution changes from red to yellow.

0.1 mol/l Ceric Ammonium Sulfate

One liter of this solution contains 66.858 g of ceric ammonium sulfate ($Ce(SO_4)_2 \cdot 2(NH_4)_2SO_4 \cdot 4H_2O$, molecular weight: 668.58).

Weigh 67 g of ceric ammonium sulfate, and dissolve in 0.5 mol/l sulfuric acid to make 1,000 ml. Standardize before use.

Standardization: Measure exactly 25 ml of 0.1 mol/l ceric ammonium sulfate, add 20 ml of water and 20 ml of diluted sulfuric acid (1 → 20), dissolve 1 g of potassium iodide, and titrate immediately with 0.1 mol/l sodium thiosulfate. When the color of the solution changes to light yellow near the end point, add 3 ml of starch TS as the indicator, and continue the titration until the blue color of the solution disappears. Perform the blank test, and make any necessary correction.

0.01 mol/l Ceric Ammonium Sulfate

Dilute 0.1 mol/l ceric ammonium sulfate with 0.5 mol/l sulfuric acid to 10 times its original volume.

0.1 mol/l Ceric Sulfate

One liter of this solution contains 33.224 g of ceric sulfate ($Ce(SO_4)_2$, molecular weight: 332.24).

Weigh 55 g of ceric ammonium sulfate, transfer into a beaker, mix with 31 ml of sulfuric acid, and add carefully a few 20-ml portions of water to dissolve the mixture. Cover the beaker, allow to stand overnight, filter through a glass filter, and add water to make 1,000 ml.

Standardization: Weigh accurately about 0.2 g of arsenic trioxide (standard reagent), previously dried at 100℃ for 1 hour, add 25 ml of sodium hydroxide solution (2 → 25), and dissolve while shaking. Add 100 ml of water, 10 ml of diluted sulfuric acid (1 → 3), 2 drops of *o*-phenanthroline TS, and 2 drops of a solution of osmic acid in 0.05 mol/l sulfuric acid (1 → 400), and titrate with 0.1 mol/l ceric sulfate until the red color of the solution changes to light blue.

$$\text{Normality factor} = \frac{\text{Weight (g) of arsenic trioxide} \times 1{,}000}{\text{Volume (ml) of 0.1 mol/l ceric sulfate consumed} \times 4.946}$$

2. Volumetric Solutions

0.05 mol/l EDTA

One liter of this solution contains 18.612 g of disodium ethylenediaminetetraacetate ($C_{10}H_{14}N_2Na_2O_8 \cdot 2H_2O$, molecular weight: 372.24).

Weigh 18.7 g of disodium ethylenediaminetetraacetate, and dissolve in freshly boiled and cooled water to make 1,000 ml.

Standardization: Measure exactly 20 ml of 0.05 mol/l EDTA, add 2 ml of ammonia－ammonium chloride buffer (pH 10.7) and water to make about 100 ml, and titrate with 0.025 mol/l zinc chloride (indicator: 5 drops of eriochrome black T TS).

$$\text{Normality factor} = \frac{\text{Volume (ml) of 0.025 mol/l zinc chloride consumed}}{\text{Volume (ml) of 0.05 mol/l EDTA} \times 2}$$

0.02 mol/l EDTA

Prepare as directed under 0.05 mol/l EDTA, using 7.5 g of disodium ethylenediaminetetraacetate.

Standardization: Measure exactly 25 ml of 0.02 mol/l EDTA, add 2 ml of ammonia－ammonium chloride buffer (pH 10.7) and water to make about 100 ml, and titrate with 0.025 mol/l zinc chloride (indicator: 3 drops of eriochrome black T TS).

0.01 mol/l EDTA

Prepare as directed under 0.05 mol/l EDTA, using 3.8 g of disodium ethylenediaminetetraacetate.

Standardization: Measure exactly 50 ml of 0.01 mol/l EDTA, add 2 ml of ammonia－ammonium chloride buffer (pH 10.7) and water to make about 100 ml, and titrate with 0.025 mol/l zinc chloride (indicator: 3 drops of eriochrome black T TS).

0.5 mol/l Ethanolic Potassium Hydroxide

See 0.5 mol/l Potassium Hydroxide, Ethanolic.

0.1 mol/l Ethanolic Potassium Hydroxide

See 0.1 mol/l Potassium Hydroxide, Ethanolic.

0.1 mol/l Ferric Ammonium Sulfate

One liter of this solution contains 48.22 g of ferric ammonium sulfate ($Fe(NH_4)(SO_4) \cdot 12H_2O$, molecular weight: 482.19).

Weigh 49 g of ferric ammonium sulfate, dissolve in cooled mixture of 6 ml of sulfuric acid and 300 ml of water, and add water to make 1,000 ml.

Standardization: Measure exactly 25 ml of 0.1 mol/l ferric ammonium sulfate into an iodine-flask, add 5 ml of hydrochloric acid and shake. Add and dissolve 2 g of potassium iodide, stopper tightly, and allow to stand for 10 minutes. Add 50 ml of water, titrate liberated iodine with 0.1 mol/l sodium thiosulfate. When the color of the solution changes to light yellow near the end point, add 3 ml of starch TS as the indicator, and continue the titration until the blue color of the solution disappears. Perform a blank test in the same manner, and make any necessary correction.

Store, protecting from light, and restandardize frequently.

0.1 mol/l Ferrous Ammonium Sulfate

One liter of this solution contains 39.214 g of ferrous ammonium sulfate ($Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$, molecular weight: 392.14).

Weigh 40 g of ferrous ammonium sulfate, dissolve in 100 ml of cooled, diluted sulfuric acid (1 → 2), and add water to make 1,000 ml.

Standardization: Measure exactly 25 ml of 0.1 mol/l ferrous ammonium

sulfate, and titrate with 0.1 mol/l ceric sulfate (indicator: 2 drops of *o*-phenanthroline TS) until the red color of the solution changes to light blue.

15 mol/l Formic Acid

One liter of this solution contains 690.4 g of formic acid (HCOOH, molecular weight: 46.03).

Weigh 705 g of formic acid, and add water to make 1,000 ml.

Standardization: Measure exactly 1 ml of 15 mol/l formic acid, add water to make 50 ml, and titrate with 0.5 mol/l sodium hydroxide (indicator: 3 drops of phenolphthalein TS).

6 mol/l Hydrochloric Acid

Prepare and standardize as directed under 1 mol/l Hydrochloric Acid, using 570 ml of hydrochloric acid.

1 mol/l Hydrochloric Acid

One liter of this solution contains 36.461 g of hydrochloric acid (HCl).

Measure 95 ml of hydrochloric acid, and add water to make 1,000 ml.

Standardization: Weigh accurately about 1.5 g of sodium carbonate (standard reagent), previously dried at about 270℃ for 1 hour, dissolve it in 100 ml of water, and titrate with 1 mol/l hydrochloric acid (indicator: 2 drops of bromophenol blue TS). Near the end point, boil to expel carbon dioxide, and immediately continue the titration.

1 ml of 1 mol/l hydrochloric acid = 52.99 mg of Na_2CO_3

0.5 mol/l Hydrochloric Acid

Prepare and standardize as directed under 1 mol/l Hydrochloric Acid, using 47.5 ml of Hydrochloric Acid.

0.2 mol/l Hydrochloric Acid

Dilute 1 mol/l hydrochloric acid with water to 5 times its original volume, or prepare as directed under 1 mol/l Hydrochloric Acid, using 19 ml of hydrochloric acid. Standardize as directed under 1 mol/l Hydrochloric Acid.

0.1 mol/l Hydrochloric Acid

Dilute 1 mol/l hydrochloric acid with water to 10 times its original volume, or prepare as directed under 1 mol/l Hydrochloric Acid, using 9.5 ml of hydrochloric acid. Standardize as directed under 1 mol/l Hydrochloric Acid.

0.02 mol/l Hydrochloric Acid

Dilute 0.1 mol/l hydrochloric acid with water to 5 times its original volume, and standardize as directed under 1 mol/l Hydrochloric Acid.

0.01 mol/l Hydrochloric Acid

Dilute 0.1 mol/l hydrochloric acid with water to 10 times its original volume, and standardize as directed under 1 mol/l Hydrochloric Acid.

0.5 mol/l Hydroxylamine Hydrochloride

One liter of this solution contains 34.745 g of hydroxylamine hydrochloride ($NH_2OH \cdot HCl$, molecular weight: 69.49).

Weigh exactly 35 g of hydroxylamine hydrochloride, add 40 ml of water, and dissolve by heating to about 65℃. Cool, add 15 ml of bromophenol blue—sodium hydroxide TS, and add ethanol to make exactly 1,000 ml. Prepare freshly before use.

0.05 mol/l Iodine

One liter of this solution contains 12.690 g of iodine (I, atomic weight: 126.90).

Weigh about 14 g iodine, dissolve in 100 ml of potassium iodide solution (9 → 25), and add 3 drops of hydrochloric acid and water to make 1,000 ml. Store in a bottle with a ground-glass stopper, and restandardize frequently.

Standardization: Weigh accurately about 0.15 g of arsenic trioxide (standard reagent), previously powdered and dried at 100℃ to constant weight, and

dissolve it in 20 ml of 1 mol/l sodium hydroxide by heating if necessary. Add about 40 ml of water and 2 drops of methyl orange TS, and add diluted hydrochloric acid (1 → 4) until the yellow color of the solution changes to light pink. Add 2 g of sodium hydrogen carbonate, about 50 ml of water, and 3 ml of starch TS, and titrate with 0.05 mol/l iodine until a blue color persists.

1 ml of 0.05 mol/l Iodine = 4.946 mg As_2O_3

0.05 mol/l Iodine for Sodium Hydrosulfite

One liter of this solution contains 12.690 g of iodine (I, atomic weight: 126.90).

Weigh about 13 g of iodine, dissolve in the solution, previously prepared by dissolving 40 g of potassium iodide in 25 ml of water, and add 0.5 ml of hydrochloric acid and water to make 1,000 ml. Store in a brown bottle in a dark place.

Standardization: Measure exactly 25 ml of 0.05 mol/l iodine for sodium hydrosulfite, and titrate with 0.1 mol/l sodium thiosulfate (indicator: starch TS). Add the indicator after the color of the solution changes to pale yellow.

0.1 mol/l Magnesium Acetate

One liter of this solution contains 21.446 g of magnesium acetate ($Mg(CH_3COO)_2 \cdot 4H_2O$, molecular weight: 214.46).

Weigh 2.15 g of magnesium acetate, and dissolve in water to make 1,000 ml.

Standardization: Measure exactly 10 ml of 0.1 mol/l magnesium acetate, add 50 ml of water and 3 ml of ammonia－ammonium chloride buffer (pH 10.7), and titrate with 0.05 mol/l EDTA (indicator: 3 drops of eriochrome black T TS).

0.05 mol/l Oxalic Acid

One liter of this solution contains 6.303 g of oxalic acid ($C_2H_2O_4 \cdot 2H_2O$, molecular weight: 126.07).

Weigh 6.45 g of oxalic acid, and dissolve in water to make 1,000 ml. Store in a light-resistant bottle with a ground-glass stopper.

Standardization: Measure exactly 25 ml of 0.05 mol/l oxalic acid, add 200 ml of diluted sulfuric acid (1 → 20), and heat to about 70℃. Titrate with freshly standardized 0.02 mol/l potassium permanganate while hot.

0.1 mol/l Perchloric Acid

One liter of this solution contains 10.046 g of perchloric acid ($HClO_4$, molecular weight: 100.46).

Measure about 8.5 ml of perchloric acid, transfer into a 1,000-ml volumetric flask, add 950 ml of acetic acid, and shake well. Add 15 ml of acetic anhydride by 1 ml each time, while shaking well, and add acetic acid to make 1,000 ml. Allow to stand overnight.

Standardization: Weigh accurately about 0.4 g of potassium hydrogen phthalate, previously dried at 120℃ for 1 hour, and dissolve it in 50 ml of acetic acid while heating on a water bath. Titrate with 0.1 mol/l perchloric acid (indicator: 1 ml of crystal violet－acetic acid TS) until the purple color of the solution changes to blue.

$$\text{Normality factor} = \frac{\text{Weight (g) of potassium hydrogen phthalate} \times 1{,}000 \times 10}{\text{Volume (ml) of 0.1 mol/l perchloric consumed} \times 204.22}$$

1/60 mol/l Potassium Dichromate

One liter of this solution contains 4.903 g of potassium dichromate ($K_2Cr_2O_7$, molecular weight: 294.18).

Weigh exactly 4.903 g of potassium dichromate (standard reagent), previously powdered and dried at 120℃ to constant weight, and dissolve it in water to make exactly 1,000 ml.

2. Volumetric Solutions

1 mol/l Potassium Hydroxide

One liter of this solution contains 56.106 g of potassium hydroxide (KOH, molecular weight: 56.11).

Prepare and standardize as directed under 1 mol/l Sodium Hydroxide, using about 70 g of potassium hydroxide.

0.5 mol/l Potassium Hydroxide

Dilute 1 mol/l potassium hydroxide with freshly boiled and cooled water to 2 times its original volume, or prepare as directed under 1 mol/l Potassium Hydroxide, using about 35 g of potassium hydroxide. Standardize as directed under 1 mol/l Potassium Hydroxide.

0.1 mol/l Potassium Hydroxide

Dilute 1 mol/l potassium hydroxide with freshly boiled and cooled water to 10 times its original volume, or prepare as directed under 1 mol/l Potassium Hydroxide, using about 7 g of potassium hydroxide. Standardize as directed under 1 mol/l Potassium Hydroxide.

0.5 mol/l Potassium Hydroxide, Ethanolic

One liter of this solution contains 28.053 g of potassium hydroxide (KOH, molecular weight: 56.11).

Weigh about 35 g of potassium hydroxide, dissolve in 20 ml of water, and add aldehyde-free ethanol to make 1,000 ml. Transfer the solution into a bottle tightly stoppered with a ground or rubber stopper, allow to stand for 24 hours, and decant quickly the supernatant into another bottle. Stopper tightly with a rubber stopper, and store, protecting from light.

Standardization: Measure exactly 25 ml of 0.5 mol/l hydrochloric acid, add 50 ml of water, and titrate with 0.5 mol/l ethanolic potassium hydroxide (indicator: 2 drops of phenolphthalein TS).

0.1 mol/l Potassium Hydroxide, Ethanolic

Prepare and standardize as directed under 0.5 mol/l Ethanolic Potassium Hydroxide, using about 7 g of potassium hydroxide.

0.02 mol/l Potassium Permanganate

One liter of this solution contains 3.1607 g of potassium permanganate ($KMnO_4$, molecular weight: 158.03).

Weigh about 3.3 g of potassium permanganate, dissolve in 1,000 ml of water, and boil for about 15 minutes. Allow to stand in a tightly stoppered flask for at least 2 days, and filter through asbestos. Store in a light-resistant, glass-stoppered bottle, and restandardize frequently.

Standardization: Weigh accurately about 0.2 g of sodium oxalate (standard reagent), previously dried at 110℃ to constant weight, and dissolve it in about 250 ml of water. Add 7 ml of sulfuric acid, heat to about 70℃, and titrate with 0.02 mol/l potassium permanganate while hot.

1 ml of 0.02 mol/l $KMnO_4$ = 6.700 mg $Na_2C_2O_4$

0.1 mol/l Silver Nitrate

One liter of this solution contains 16.987 g of silver nitrate ($AgNO_3$, molecular weight: 169.87).

Weigh about 17.5 g of silver nitrate, and dissolve in 1,000 ml of water. Store protecting from light.

Standardization: Measure exactly 25 ml of 0.1 mol/l sodium chloride, and add 50 ml of water and 1 ml of potassium chromate solution (1 → 20). While shaking, titrate with 0.1 mol/l silver nitrate until a light red-brown color persists.

0.1 mol/l Sodium Acetate

One liter of this solution contains 13.608 g of sodium acetate (CH_3COONa·

$3H_2O$, molecular weight: 136.08).

Weigh 8.2 g of anhydrous sodium acetate, and dissolve in acetic acid to make 1,000 ml.

Standardization: Measure exactly 25 ml of 0.1 mol/l sodium acetate, add 50 ml of acetic acid, and titrate with 0.1 mol/l perchloric acid (indicator: 1 ml of α-naphtholbenzein) until the color of the solution changes from yellow-brown through yellow to green. Perform the blank test, and make any necessary correction.

0.1 mol/l Sodium Chloride

One liter of this solution contains 5.844 g of sodium chloride (NaCl, molecular weight: 58.44).

Weigh exactly 5.844 g of sodium chloride (standard reagent), previously dried at 110℃ for 2 hours, and dissolve it in water to make exactly 1,000 ml.

1 mol/l Sodium Hydroxide

One liter of this solution contains 39.997 g of sodium hydroxide (NaOH, molecular weight: 40.00).

Weigh 45 g of sodium hydroxide, dissolve in about 950 ml of water, and add barium hydroxide saturated solution, freshly prepared, until no more precipitate is formed. Shake well the mixture, stopper tightly, and allow to stand overnight. Collect the supernatant by decantation or filtration. Store in a bottle tightly stoppered with a rubber stopper, or in a bottle equipped with an absorption tube of carbon dioxide (soda lime), and restandardize frequently.

Standardization: Weigh accurately about 5 g of potassium hydrogen phthalate, previously powdered and dried at 100℃ for 3 hours, dissolve it in 75 ml of freshly boiled and cooled water, and titrate with 1 mol/l sodium hydroxide (indicator: 2 drops of phenolphthalein TS).

0.5 mol/l Sodium Hydroxide

Using about 22 g of sodium hydroxide, prepare, standardize, and store as directed under 1 mol/l Sodium Hydroxide. Restandardize frequently.

0.25 mol/l Sodium Hydroxide

Dilute 1 mol/l sodium hydroxide with freshly boiled and cooled water to 4 times its original volume, or prepare as directed under 1 mol/l Sodium Hydroxide, using about 11 g of sodium hydroxide. Standardize and store as directed under 1 mol/l Sodium Hydroxide. Restandardize frequently.

0.2 mol/l Sodium Hydroxide

Dilute 1 mol/l sodium hydroxide with freshly boiled and cooled water to 5 times its original volume, or prepare as directed under 1 mol/l Sodium Hydroxide, using about 9 g of sodium hydroxide. Standardize and store as directed under 1 mol/l Sodium Hydroxide. Restandardize frequently.

0.1 mol/l Sodium Hydroxide

Dilute 1 mol/l sodium hydroxide with freshly boiled and cooled water to 10 times its original volume, or prepare as directed under 1 mol/l Sodium Hydroxide, using about 4.5 g of sodium hydroxide. Standardize and store as directed under 1 mol/l Sodium Hydroxide. Restandardize frequently.

0.05 mol/l Sodium Hydroxide

Dilute 1 mol/l sodium hydroxide with freshly boiled and cooled water to 20 times its original volume. Standardize and store as directed under 1 mol/l Sodium Hydroxide. Restandardize frequently.

0.02 mol/l Sodium Hydroxide

Dilute 0.1 mol/l sodium hydroxide with freshly boiled and cooled water to 5 times its original volume. Standardize and store as directed under 1 mol/l Sodium Hydroxide. Restandardize frequently.

2. Volumetric Solutions

0.01 mol/l Sodium Hydroxide

Dilute 0.1 mol/l sodium hydroxide with freshly boiled and cooled water to 10 times its original volume. Standardize and store as directed under 1 mol/l Sodium Hydroxide. Restandardize frequently.

0.1 mol/l Sodium Thiosulfate

One liter of this solution contains 24.819 g of sodium thiosulfate ($Na_2S_2O_3 \cdot 5H_2O$, molecular weight: 248.19).

Weigh about 26 g of sodium thiosulfate and 0.2 g of anhydrous sodium carbonate, and dissolve in freshly boiled and cooled water to make 1,000 ml. Restandardize frequently.

Standardization: Titrate 0.05 mol/l iodine with 0.1 mol/l sodium thiosulfate, or titrate 1/60 mol/l potassium dichromate as follows:

Measure exactly 30 ml of 1/60 mol/l potassium dichromate, transfer into a flask with a ground-glass stopper, and add 50 ml of water, 2 g of potassium iodide, and 5 ml of hydrochloric acid. Stopper tightly, and allow to stand for 10 minutes. Add 100 ml of water, and titrate with 0.1 mol/l sodium thiosulfate (indicator: 4 ml of starch TS).

0.005 mol/l Sodium Thiosulfate

0.1 mol/l Sodium Thiosulfate , add water, fresh boiled and cooled, to dilute to 20 times its original volume. Standardize as directed for 0.1 mol/l Sodium Thiosulfate.

0.01 mol/l Sodium Thiosulfate

Dilute 0.1 mol/l sodium thiosulfate with freshly boiled and cooled water to 10 times its original volume. Standardize as directed under 0.1 mol/l Sodium Thiosulfate before use.

0.5 mol/l Sulfuric Acid

One liter of this solution contains 49.04 g of sulfuric acid (H_2SO_4, molecular weight: 98.08).

Measure about 1,000 ml of water, add slowly 30 ml of sulfuric acid to the water while stirring, and allow to cool to 20℃.

Standardization: Standardize as directed under 1 mol/l Hydrochloric Acid, or as follows:

Measure exactly 20 ml of 0.5 mol/l sulfuric acid, and transfer into a 500-ml beaker. Add 250 ml of water and 1 ml of hydrochloric acid, and heat to boil. Add slowly warm barium chloride solution (3 → 25), while stirring continuously, until no more precipitate is formed. Heat the mixture on a water bath for 1 hour, collect the precipitate by filtering through a filter paper for quantitative analysis, wash with hot water until the washings do not respond to the test for Chloride, and dry together with the filter paper. Then, ignite to constant weight, and weigh accurately as $BaSO_4$.

0.25 mol/l Sulfuric Acid

Prepare and standardize as directed under 0.5 mol/l Sulfuric Acid, using 15 ml of sulfuric acid.

0.1 mol/l Sulfuric Acid

Prepare and standardize as directed under 0.5 mol/l Sulfuric Acid, using 6 ml of sulfuric acid.

0.05 mol/l Sulfuric Acid

Dilute 0.5 mol/l sulfuric acid with water to 10 times its original volume, or prepare as directed under 0.5 mol/l Sulfuric Acid, using 3 ml of sulfuric acid. Standardize as directed under 0.5 mol/l Sulfuric Acid.

0.005 mol/l Sulfuric Acid

Dilute 0.05 mol/l sulfuric acid with water to 10 times its original volume, and standardize as directed under 0.5 mol/l Sulfuric Acid.

2. Volumetric Solutions

0.1 mol/l Titanium Trichloride

One liter of this solution contains 15.424 g of titanium trichloride ($TiCl_3$, molecular weight: 154.24).

Measure 75 ml of titanium trichloride solution, and add 75 ml of hydrochloric acid and freshly boiled and cooled water to make 1,000 ml. Transfer into a light-resistant bottle equipped with a buret, replace the air in the bottle with hydrogen, allow to stand for 2 days, and use. Standardize before use.

Standardization: Weigh 3 g of ferrous ammonium sulfate, transfer into a wide-mouthed 500-ml flask, and, while passing carbon dioxide, add 50 ml of freshly boiled and cooled water to dissolve it. Add 25 ml of diluted sulfuric acid (27 → 100), and add quickly 40 ml of 0.02 mol/l potassium permanganate, exactly measured, while passing carbon dioxide. Titrate with 0.1 mol/l titanium trichloride to almost the end point, add immediately 5 g of ammonium thiocyanate, and continue the titration with 0.1 mol/l titanium trichloride until the color of the solution disappears. Perform a blank test, and make any necessary correction.

$$\text{Normality factor} = \frac{\text{Volume (ml) of 0.02 mol/l potassium permanganate added}}{\text{Volume (ml) of 0.1 mol/l titanium trichloride consumed}}$$

0.02 mol/l Zinc Acetate

One liter of this solution contains 4.390 g of zinc acetate ($Zn(CH_3COO)_2 \cdot 2H_2O$, molecular weight: 219.51).

Weigh 4.43 g of zinc acetate, dissolve in 20 ml of water and 2 ml of diluted acetic acid (1 → 20), and add water to make 1,000 ml.

Standardization: Measure exactly 25 ml of 0.02 mol/l zinc acetate, add 2 ml of ammonia-ammonium chloride buffer (pH 10.7) and water to make about 100 ml, and titrate with 0.02 mol/l EDTA (indicator: 3 drops of eriochrome black T TS).

0.01 mol/l Zinc Acetate

One liter of this solution contains 2.1951 g of zinc acetate ($Zn(CH_3COO)_2 \cdot 2H_2O$, molecular weight: 219.51).

Weigh about 2 g of zinc acetate, and dissolve in water to make 1,000 ml.

Standardization: Measure exactly 25 ml of 0.01 mol/l zinc acetate, add 2 ml of ammonia-ammonium chloride buffer (pH 10.7) and water to make about 100 ml, and titrate with 0.01 mol/l EDTA (indicator: 3 drops of eriochrome black T TS).

0.05 mol/l Zinc Chloride

One liter of this solution contains 6.815 g of zinc chloride ($ZnCl_2$, molecular weight: 136.30).

Weigh accurately about 1.6 g of zinc (standard reagent), transfer into a beaker, and add 30 ml of diluted hydrochloric acid (1 → 4). Cover the beaker with a watch glass, and allow to stand. After the generation of the hydrogen gas becomes slow, dissolve the contents of the beaker while heating gently on a water bath. Wash the watch glass and the inside of the beaker, condense to almost dryness on a water bath, cool, and add water to make exactly 500 ml.

0.025 mol/l Zinc Chloride

Weigh accurately about 1.6 g of zinc (standard reagent), proceed in the same manner as directed under 0.05 mol/l Zinc Chloride, cool, and add water to make exactly 1,000 ml.

2. Volumetric Solutions

0.01 mol/l Zinc Sulfate

One liter of this solution contains 2.8756 g of zinc sulfate ($ZnSO_4 \cdot 7H_2O$, molecular weight: 287.56).

Weigh 2.9 g of zinc sulfate, and dissolve in water to make 1,000 ml.

Standardization: Weigh accurately about 0.5 g of aluminum, add 20 ml of hydrochloric acid, dissolve while heating gently, and add water to make exactly 1,000 ml. Measure exactly 10 ml of the solution, transfer into a beaker containing 90 ml of water and 3 ml of hydrochloric acid, and add 1 drop of methyl orange TS and 25 ml of 0.02 mol/l EDTA. Add dropwise ammonia TS until the red color of the solution changes to orange-yellow, add 10 ml of ammonium acetate buffer and 10 ml of diammonium phosphate buffer, boil for 5 minutes, and cool quickly. Mix 3 drops of xylenol orange TS, and add dropwise 0.01 mol/l zinc sulfate until the yellow color of the solution changes to reddish yellow. Add 2 g of sodium fluoride, boil for 2 to 5 minutes, cool quickly, and titrate the liberated EDTA with 0.01 mol/l zinc sulfate until the yellow color of the solution changes to reddish yellow. Calculate the weight (mg) T of aluminum oxide (Al_2O_3) equivalent to 1 ml of 0.01 mol/l zinc sulfate by the following formula:

$$T = \frac{18.895 \times \text{Weight (g) of aluminum}}{\text{Volume (ml) of 0.01 mol/l zinc sulfate titrated}} \quad \text{(mg/ml).}$$