Phase 1 Sample Digestion - must be done in a fume hood! Toxic gases may be produced.

1. Transfer one liter of the sample to a 2000-mL erlenmeyer flask. Add a 50-mm magnetic stir bar to the sample. Place the flask on a magnetic stirring hot plate and begin stirring.

   Caution: This procedure must be done in a fume hood. Toxic chlorine or other gases may be produced!

   Note: Hach recommends using dedicated digestion glassware and sample cells for this procedure.

2. Add 50 mL concentrated sulfuric acid to the sample.

   Note: Determine a reagent blank for each new lot of reagent by running the entire procedure, including the digestion, using one liter of deionized water instead of sample. Add the same amount of potassium permanganate as required by the sample. Subtract the reagent blank from each test result.

3. Add 25 mL concentrated nitric acid to the sample.

4. Add 4.0 g of potassium persulfate to the sample. Stir until dissolved.

   Note: Alternatively, add one 5-gram measuring scoop of potassium persulfate to the sample.
5. Add 7.5 g of potassium permanganate to the sample. Stir until dissolved.

*Note:* Alternatively, add a 10-gram measuring scoop of potassium permanganate to the sample.

6. Cover the flask with a watch glass. Begin heating the sample to a temperature of 90 °C after the reagents have dissolved. **AVOID BOILING.**

*Note:* For a mercury standard or reagent blank in distilled water the heat step is not necessary.

7. Continue to stir and heat the sample at 90 °C for two hours.

*Note:* A dark purple color must persist throughout the two hour digestion. Some samples, such as sea waters, industrial effluents or other samples high in organic matter or chloride concentration, require additional permanganate. It may be difficult to see a dark purple color if the sample contains a black/brown manganese dioxide precipitate. You may add more potassium permanganate if the solution is not dark purple.

8. Cool the digested sample to room temperature. A brown/black precipitate of manganese dioxide may settle during cooling. If the digested sample does not have a purple color, the digestion may be incomplete. Add more potassium permanganate. Return the sample to the magnetic stirring hot plate and continue digestion until a purple color persists.

9. Return the cool, digested sample to the cool, magnetic stirring hot plate. Turn the stirrer on.

10. Using a 0.5-gram measuring spoon, add 0.5-g-additions of hydroxylamine-hydrochloride until the purple color disappears. Wait 30 seconds after each addition to see if the purple disappears. Add hydroxylamine-hydrochloride until all the manganese dioxide is dissolved.

11. Remove the stir bar.

12. The digested sample is now ready for processing by cold vapor separation and preconcentration. Proceed to Phase 2.

---

**Phase 2 Cold Vapor Separation and Preconcentration of Mercury**
1. Transfer the digested sample to the Cold Vapor Gas Washing Bottle.  
   Note: The volume of digested sample should contain 0.1 to 2.5 µg Hg.

2. Set the Gas Washing Bottle in the support ring. Place the top on the Gas Washing Bottle. Wait until Step 9 to connect the mercury absorber column to the Gas Washing Bottle.

3. Connect the 100-mL erlenmeyer flask to the mercury absorber column.

4. Pipet 8 mL of HgEX Reagent B into the Mercury Absorber column.

5. Connect the power to the vacuum pump and apply vacuum to the Mercury Absorber Column. Draw most of the HgEX Reagent B into the 100-mL erlenmeyer flask.

6. Disconnect the vacuum using the quick disconnect when HgEX Reagent B begins to drip from the inner delivery tube on the Mercury Absorber Column (about 10 seconds after starting the vacuum). Do not draw enough air through the column to begin drying the packing.

7. Remove the 100-mL erlenmeyer flask from the Mercury Absorber Column. Replace it with the 10-mL Distilling Receiver.

8. Pipet 2 mL of HgEX Reagent C into the Mercury Absorber Column.
9. Connect the Mercury Absorber Column to the Gas Washing Bottle using the glass elbow.

10. Shake an ampule of HgEX Reagent A to suspend the undissolved reagent. Open the ampule and gently shake the contents into the Gas Washing Bottle through the side neck.

*Note:* Shaking the ampule is not necessary if there is no undissolved reagent in the ampule.

11. Stopper the side neck on the Gas Washing Bottle.

12. Reconnect the vacuum to the Mercury Absorber Column using the quick disconnect. The vacuum will pull HgEX Reagent C through the Mercury Absorber Column packing into the 10-mL receiver. Air bubbles should be produced at the gas dispersion tube in the Gas Washing Bottle.

13. Press: **SHIFT TIMER**

A 5-minute reaction period will begin. Let the solution bubble for this period.

*Note:* Air flow rate through the Gas Washing Bottle should be between 1-5 liters/minute. Allow more bubbling time for lower air flow rates. For example, if the air flow rate is 1 liter/minute, let the solution bubble for 10 minutes.

*Note:* For DR/3000s, press **5 TIMER**

14. After the timer beeps, remove the glass elbow from the top of the Mercury Absorber Column. Keep the vacuum pump on.

15. Pipet 8 mL of HgEX Reagent B into the Mercury Absorber Column to elute the captured mercury. Continue to apply vacuum to pull the HgEX Reagent B into the Distilling Receiver.

16. Turn off or disconnect power to the vacuum pump when the volume in the Distilling Receiver reaches the 10 mL mark.

*Note:* If necessary, the volume in the Distilling Receiver may be brought up to 10 mL with HgEX Reagent B. To avoid low volumes in the future, disconnect the vacuum a little sooner in Step 6. This leaves more HgEX Reagent B in the packing of the Mercury Absorber Column.
17. Remove the Distilling Receiver from the Mercury Absorber Column. Reconnect the 100-mL erlenmeyer flask to the column.

18. Pipet 3 mL of HgEX Reagent B into the Mercury Absorber Column without applying vacuum. This keeps the absorber packing wet between tests.


Phase 3 Colorimetric Analysis

1. Enter the stored program number for the Cold Vapor Mercury method.
   
   Press: 312 READ/ENTER
   
   The display will read:
   
   Dial nm to 412

   Note: DR/2000s with software version 3.0 and greater will not display “Dial nm to” message if the wavelength is already set correctly. The display will show the message in Step 3. Proceed with Step 4.

   Note: For DR/3000s, insert the 10-mL Cell Riser into the sample cell compartment.

2. Rotate the wavelength dial until the small display reads:
   
   412 nm

3. Press: READ/ENTER
   
   The display will read:
   
   µg/L CV Hg

   Note: For DR/3000s, rotate the wavelength selector dial to a setting of 412 nm. Enter the calibration data in the Instrument Setup section following these steps.

4. Insert the 10-mL Cell Riser into the sample cell compartment.

   Note: For DR/3000s, insert the 10-mL Cell Riser into the sample cell compartment.
5. Using the funnel provided, add the contents of one HgEX Reagent 3 foil pillow to the eluate in the Distilling Receiver. Stopper the receiver. Invert to dissolve the reagent.

6. Add the contents of one HgEX Reagent 4 foil pillow to the Distilling Receiver using the funnel provided. Stopper the receiver. Invert to dissolve the reagent.

7. Add 8 drops of HgEX Reagent 5 to the Distilling Receiver. Stopper the Receiver. Invert to mix.

8. Press: **SHIFT TIMER**
   
   A two-minute reaction period will start.

   *Note: For DR/3000s, press 2 **TIMER.***

9. During the reaction period, transfer the solution to a 10-mL sample cell. Wipe the sample cell sides with a clean tissue.

   *Note: The Pour-Thru Cell cannot be used with this procedure.*

10. After the timer beeps, place the prepared sample into the cell holder and close the light shield.

11. Press: **ZERO**
    
    The display will show:
    
    WAIT
    
    then:
    
    0.0 µg/L CV Hg

   *Note: For DR/3000s, press ZERO. The display will show 0.1. This program uses a non-zero intercept.*

12. Remove the cell from the cell holder. Add the contents of one HgEX Reagent 6 foil pillow to the solution. Swirl the cell until the reagent is completely dissolved. Immediately go to Step 13.

   *Note: Do not use the funnel to add HgEX Reagent 6 to the sample cell. Any HgEX Reagent 6 in the funnel will make mercury undetectable in subsequent tests.*
13. Return the sample cell to the cell holder. Close the light shield.

14. Press: READ/ENTER

The display will show:

WAIT

then the results for the mercury concentration of the original sample will be displayed in µg/L mercury.

Note: For DR/3000s, pressing READ is not necessary. The instrument will automatically display the result.

Instrument Setup
DR/3000 Instruments

1. Enter the following data according to the procedure using Stored Program 1 (see paragraph 3.3.4.2 in the DR/3000 Instrument Manual).

2. After entering 1 STORED PROGRAM, zero the instrument without placing a sample cell into the cell compartment. The prompting light on the STANDARD 1 key will flash. Use this key to enter the absorbance data for each standard. The STANDARD 2 key is used to enter the concentration values.

3. Press: -0.03 STANDARD 1. This enters the absorbance value for the blank.

4. Press: 0 STANDARD 2. This enters the blank concentration value and completes the first calibration data point.

5. Continue entering the absorbance and concentration values for each data point from the table below, using Step 3 and 4 as examples.

6. After the last calibration point is entered, press BEST FIT CALCULATE to terminate entry and store the calibration.

7. Press: 1 CONC. The instrument will enter readout mode and display the correct decimal placement.

<table>
<thead>
<tr>
<th>Calibration data point</th>
<th>Absorbance</th>
<th>Concentration (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.03</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0.094</td>
<td>0.5</td>
</tr>
<tr>
<td>3</td>
<td>0.227</td>
<td>1.0</td>
</tr>
<tr>
<td>4</td>
<td>0.355</td>
<td>1.5</td>
</tr>
<tr>
<td>5</td>
<td>0.465</td>
<td>2.0</td>
</tr>
<tr>
<td>6</td>
<td>0.558</td>
<td>2.5</td>
</tr>
<tr>
<td>7</td>
<td>0.637</td>
<td>3.0</td>
</tr>
</tbody>
</table>
1. Turn the instrument on. Press **SHIFT METHOD** to enter the configuration mode. The display will show: **MOMENTARY** or **CONSTANT ON**

2. Press the up arrow key twice to select HACH UPDATE. Press **READ/ENTER**. The display will show: **ENTER #:**

3. Press: 

```
PROG 3 BATT 1 EDIT 2 READ ENTER
```

The display will show: 
**P 312 ENTER nm**

4. Press: 

```
%7 4 BATT 1 EDIT 2 READ ENTER
```

The display will show: 
**P 312 Decimal? 00.00**

5. Use the arrow keys to correctly position the decimal point. Press the down arrow key once. The display will show: 
**DECIMAL? 000.0**

6. Press **READ ENTER**. The display will show: 
**P 312 UNITS?**

7. Use the arrow keys to select the appropriate unit of measure. Press the down arrow key three times. The display will show: 
**P 312 µg/l**

8. Press **READ/ENTER** when the correct unit of measure is displayed. This display will show: 
**P 312 µg/l _**

9. Construct the display to read the correct symbol. The symbol must be entered exactly as shown including spaces between characters: 
**CV Hg**

   a) Select letters and numbers by scrolling to the correct character with the arrow keys.
   
   b) To make a letter or number uppercase, press the **SHIFT** key.
   
   c) The space is the character displayed after one press of the down arrow key.
   
   d) Make sure to enter the display line *EXACTLY* as shown, including the spaces. Do not enter trailing spaces.
   
   e) Accept each symbol by pressing **READ/ENTER**.
   
   f) To end symbol entry, press **READ/ENTER** a second time after accepting the last character.

10. When the instrument is out of symbol entry mode, the display will read: 
**P 312 TIMER**

11. This method has 2 timed steps, so press **SHIFT TIMER**. The display will show: 
**MM:SS TIME 1?**
12. Enter a timer value of 5 minutes. Press: 0 5 0 0

13. Press READ/ENTER to accept the timer value. The display will show: MM:SS TIME 2?

14. Enter a timer value of 2 minutes. Press: 0 2 0 0

15. Press READ/ENTER to accept the timer value. The display will show: MM:SS TIME 3?

16. Press READ/ENTER to complete the timer entry. The display will show: #0 STANDARD

17. Press READ/ENTER to display the zero data pair. The display will show: 0.000 Abs 000.0 µg/l

18. Press READ/ENTER. The display will show: #1 STANDARD

19. Press READ/ENTER. The display will prompt for entry of the first concentration point: #1 000.0 µg/l

20. Enter concentration point #1 from the table below by pressing 0002 so that the display shows: # 1 000.2 µg/l

21. Press READ/ENTER. The display will prompt for entry of the first absorbance point: # 1 0.000 Abs

22. Enter absorbance point #1 from the table below by pressing 0021. The display will show: # 1 0.021 Abs

23. Press READ/ENTER. The display will show the first data pair: 0.021 Abs 000.2 µg/l

24. Press READ/ENTER to accept the first data pair. The display will show: #2 STANDARD

25. Following steps 19-24 above, enter the remaining data pair values from this table.

<table>
<thead>
<tr>
<th>Standard</th>
<th>Concentration (µg/L)</th>
<th>Absorbance (Abs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#0</td>
<td>0.0</td>
<td>0.000</td>
</tr>
<tr>
<td>#1</td>
<td>0.2</td>
<td>0.021</td>
</tr>
<tr>
<td>#2</td>
<td>1.0</td>
<td>0.224</td>
</tr>
<tr>
<td>#3</td>
<td>1.5</td>
<td>0.345</td>
</tr>
<tr>
<td>#4</td>
<td>2.0</td>
<td>0.454</td>
</tr>
<tr>
<td>#5</td>
<td>2.5</td>
<td>0.553</td>
</tr>
<tr>
<td>#6</td>
<td>3.0</td>
<td>0.640</td>
</tr>
</tbody>
</table>

26. When the last point pair is entered, the display will show: #7 STANDARD

27. Press SHIFT READ/ENTER to complete data point entry. The display will show: 

28. Enter the validation number 3974. The display will show: 

# 3974
29. Press **READ/ENTER**. The display will show: **COMPLETED**

then:

**P 312 µg/l CV Hg**

If the display shows **INCORRECT #**, then prompts for the validation number, a mistake may have been made during data entry. Make sure the validation number is correct. If so, the error occurred during some other portion of the method entry. Press **METH** and respond to the **ABORT?** message by pressing **READ/ENTER**, then re-enter the method.

The instrument is now ready for use with method 312.

**Sample Collection And Preservation**

Collect 1000 mL of sample in an analytically clean, glass or polyethylene terephthalate (PET) container. Add 10 mL of concentrated hydrochloric acid to preserve the sample before sample collection. Fill the container completely full to minimize air space when closed. Close a glass container with a ground glass stopper. Close a PET container with a PET cap or a polypropylene cap (no liner).

Store aqueous samples at 2-6 °C. Acid-preserved samples are stable for at least 6 months.

**Accuracy Check**

**Standard Additions Method**

a) Use a TenSette® pipet to add 0.10 mL of a 12.5 mg/L Mercury Standard Solution to the purged solution in the Gas Washing Bottle after an analysis has been performed. Immediately stopper the Gas Washing Bottle.

b) Begin at Step 3 of Phase 2. Follow the procedure steps.

c) Test the eluate as described in Phase 3. The displayed concentration should be between 1.1-1.4 µg/L Hg.

**Standard Solution Method**

a) Transfer 800 mL of mercury-free water into the Gas Washing Bottle.

b) Add 50 mL of concentrated sulfuric acid and 25 mL of concentrated nitric acid to the water. Swirl to mix.

c) Prepare a 0.1-mg/L mercury standard solution by serially diluting a 1000-mg/L Mercury Standard Solution:

- To make a 10.0-mg/L standard, add 1.0 mL of concentrated nitric acid to a 500-mL volumetric flask. Dilute 5.00 mL of a 1000 mg/L standard to 500 mL with deionized water. Mix well.

- To make a 1.0-mg/L standard solution, add 0.2 mL of concentrated nitric acid to a 100-mL volumetric flask. Dilute 10.0 mL of the 10.0-mg/L standard to 100 mL with deionized water. Mix well.

- To make a 0.1-mg/L standard solution, add 0.2 mL of concentrated nitric acid to a 100-mL volumetric flask. Dilute 10.00 mL of the 1.0-mg/L solution to 100 mL with deionized water. Mix well.

d) Pipet 10.0 mL of the 0.1-mg/L mercury standard solution into the Gas Washing Bottle. Swirl to mix.

e) Begin at Step 2 of Phase 2. Follow the procedure steps.
f) Test the eluate as described in Phase 3. The displayed concentration should be between 0.9-1.1 µg/L Hg.

System Start Up

Hach recommends that the analyst perform a few analyses on mercury standards and blanks for system equilibration before beginning sample testing. This allows the system to stabilize before processing samples.

Startup Standard

Test a mercury standard solution by following the procedure under Accuracy Check using the Standard Solution Method. Continue with step g (below) if the value is not within specified limits.

g) Pipet 10.0 mL of the 0.1-mg/L mercury standard solution into the purged solution in the Gas Washing Bottle. Immediately stopper the Gas Washing Bottle.

h) Begin at Step 3 of Phase 2. Follow the procedure steps.

i) Test the eluate as described in Phase 3. The displayed concentration should be between 0.9-1.1 µg/L Hg. Repeat steps g-i if the value is not within these limits.

Startup Blank

Run a system blank by using the purged solution in the Gas Washing Bottle after a satisfactory test of the Startup Standard has been completed.

a) Leave the purged solution in the Gas Washing Bottle. Do not add an aliquot of mercury standard.

b) Begin at Step 3 of Phase 2. Follow the procedure steps.

c) Test the eluate as described in Phase 3. The displayed concentration should be ≤ 0.2 µg/L Hg. Repeat the Startup Blank procedure until a reproducible value is obtained.

Method Performance

Precision

**DR/2000:** In a single laboratory using a standard solution of 1.00 µg/L Hg and two representative lots of reagent with a DR/2000, a single operator obtained a mean value of 0.95 µg/L Hg and a standard deviation of ±0.05 µg/L Hg for nine replicates.

**DR/3000:** In a single laboratory using a standard solution of 1.00 µg/L Hg and two representative lots of reagent with a DR/3000, a single operator obtained a mean value of 0.96 µg/L Hg and a standard deviation of ±0.04 µg/L Hg for nine replicates.

Estimated Detection Limit

The estimated detection limit for the Cold Vapor Mercury method is 0.1 µg/L Hg.
Standards were used to prepare a single test solution with the following matrix. A second test solution containing only mercury at the same concentration was prepared as the control. The two solutions were digested then analyzed concurrently. There was no interference from the matrix of the test solution at the concentrations listed:

<table>
<thead>
<tr>
<th>Ion or Substance</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag\textsuperscript{+2}</td>
<td>7 mg/L Ag\textsuperscript{+2}</td>
</tr>
<tr>
<td>Al\textsuperscript{+3}</td>
<td>10 mg/L Al\textsuperscript{+3}</td>
</tr>
<tr>
<td>Au\textsuperscript{+3}</td>
<td>500 µg/L Au\textsuperscript{+3}</td>
</tr>
<tr>
<td>Cd\textsuperscript{+2}</td>
<td>10 mg/L Cd\textsuperscript{+2}</td>
</tr>
<tr>
<td>Co\textsuperscript{+2}</td>
<td>10 mg/L Co\textsuperscript{+2}</td>
</tr>
<tr>
<td>Cr\textsuperscript{+6}</td>
<td>10 mg/L Cr\textsuperscript{+6}</td>
</tr>
<tr>
<td>Cu\textsuperscript{+2}</td>
<td>10 mg/L Cu\textsuperscript{+2}</td>
</tr>
<tr>
<td>F\textsuperscript{-}</td>
<td>1.0 mg/L F\textsuperscript{-}</td>
</tr>
<tr>
<td>Fe\textsuperscript{+2}</td>
<td>100 mg/L Fe\textsuperscript{+2}</td>
</tr>
<tr>
<td>Hg\textsuperscript{+2}</td>
<td>1 µg/L Hg\textsuperscript{+2}</td>
</tr>
<tr>
<td>Mo\textsuperscript{+6}</td>
<td>10 mg/L Mo\textsuperscript{+6}</td>
</tr>
<tr>
<td>Ni\textsuperscript{+2}</td>
<td>10 mg/L Ni\textsuperscript{+2}</td>
</tr>
<tr>
<td>NO\textsubscript{3}^{-}-N</td>
<td>50 mg/L NO\textsubscript{3}^{-}-N</td>
</tr>
<tr>
<td>Pb\textsuperscript{2+}</td>
<td>10 mg/L Pb\textsuperscript{2+}</td>
</tr>
<tr>
<td>SiO\textsubscript{2}</td>
<td>100 mg/L SiO\textsubscript{2}</td>
</tr>
<tr>
<td>Zn\textsuperscript{+2}</td>
<td>10 mg/L Zn\textsuperscript{+2}</td>
</tr>
</tbody>
</table>

In addition, no interference occurred with a test solution containing 1000 mg/L Na\textsuperscript{+}, 1000 mg/L K\textsuperscript{+}, 1000 mg/L Mg\textsuperscript{2+}, and 400 mg/L Ca\textsuperscript{2+}.

**Storage and Maintenance of the Cold Vapor Mercury Apparatus**

**Storage**

Store the apparatus as follows for fastest system stabilization and greatest sensitivity:

- Store the Gas Washing Bottle filled with deionized water containing 15 mL of concentrated sulfuric acid. Seal the bottle with the Gas Washing Bottle stopper and top.

- Store the Mercury Absorber Column with the packing wetted with HgEX Reagent B. The erlenmeyer flask should be kept attached underneath the column. The top of the Mercury Absorber column should be attached to the Gas Washing Bottled with the glass elbow as in the procedure.

**Glassware Care**

Hach recommends using dedicated glassware and sample cells because of the sensitivity of this procedure. Thoroughly clean the glassware and sample cells between tests. After washing, rinse with 1:1 hydrochloric acid solution, then rinse several times with deionized water.
Maintaining the System

- With proper care and storage, the Mercury Absorber Column may be used an unlimited number of times.
- Replace the Mercury Scrubber in the air trap housing at least once for every reagent set used.
- Moisture build up on the Gas Washing Bottle side of the Acro® 50 Vent Filter will reduce the purging air flow rate. If this occurs replace the filter or dry it in an oven at 110 °C.

Summary of Method

The sample is digested to convert all forms of mercury in the sample to mercuric (Hg²⁺) ions. The mercuric ions in the digested sample are converted to mercury vapor in a semi-closed system. The vapor is carried into a chemically activated absorber column by ambient air where the mercury vapor is converted to mercuric chloride.

The mercuric chloride is eluted off the column and a sensitive indicator is added. The instrument is zeroed using the absorbance peak of the unreacted indicator. A complexing agent is added to break the mercury:indicator complex. The increase in unreacted indicator causes an increase in absorbance which is proportional to the amount of mercury in the original sample.

Safety

Wear personal protective equipment such as safety glasses with side shields, or a face shield to protect your eyes. Use other protective equipment as necessary (such as a fume hood) to avoid chemical exposure. Perform all steps exactly as prescribed in the procedure.

Waste Disposal

Proper management and disposal of waste is the responsibility of the waste generator. Hach Company provides waste disposal information as a guideline only. It is up to the generator to arrange for proper disposal and comply with applicable local, state, and federal regulations governing waste disposal. Hach Company makes no guarantees or warranties, express or implied, for the waste disposal information represented in this procedure.

1. Dispose of the solution in the Gas Washing Bottle by neutralizing the solution to a pH of 6-9 and flushing to the sanitary sewer with water for several minutes.

2. The mercury contained in one liter of sample is concentrated by a factor of 100 by the Mercury Absorber Column. Mercury analysis within the range of the test may produce a solution in the sample cell that is above the RCRA Toxicity Characteristic limit of 0.20 mg/L Hg. The sample cell will contain 0.25 mg/L mercury if the original sample was at 2.5 µg/L mercury (the upper limit of the test range). Dispose of the solution in the sample cell as a hazardous waste if the test result was over 2 µg/L mercury in the original sample. Otherwise, pour the solution into the sanitary sewer and flush with water for several minutes.

3. The mercury scrubber will capture mercury vapor if the Mercury Absorber Column is not properly activated using HgEX Reagent B and HgEx Reagent C. In addition, mercury is also captured if the capacity of the Absorber Column is exceeded. If the Mercury Scrubber has captured mercury vapor, it must be disposed of according to applicable regulations.
# REQUIRED REAGENTS

**Cold Vapor Mercury Reagent Set (25 tests)** ......................................................... 26583-00

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity Required</th>
<th>Unit</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HgEX Reagent A, Stannous Sulfate Solution Ampules</td>
<td>1</td>
<td>25/pkg</td>
<td>26588-25</td>
</tr>
<tr>
<td>HgEX Reagent B, Sulfuric Acid Solution</td>
<td>19 mL</td>
<td>500 mL</td>
<td>26589-49</td>
</tr>
<tr>
<td>HgEX Reagent C, Sodium Hypochlorite Solution</td>
<td>2 mL</td>
<td>55 mL</td>
<td>26590-59</td>
</tr>
<tr>
<td>HgEX Reagent 3, Alkaline Reagent Powder Pills</td>
<td>1 pillow</td>
<td>25/pkg</td>
<td>26584-48</td>
</tr>
<tr>
<td>HgEx Reagent 4, Indicator Powder Pills</td>
<td>1 pillow</td>
<td>25/pkg</td>
<td>26585-48</td>
</tr>
<tr>
<td>HgEx Reagent 5, Hydroxide Solution</td>
<td>8 drops</td>
<td>10 mL SCDB</td>
<td>26586-36</td>
</tr>
<tr>
<td>HgEx Reagent 6, Complexing Reagent Powder Pills</td>
<td>1 pillow</td>
<td>25/pkg</td>
<td>26587-48</td>
</tr>
<tr>
<td>Mercury Scrubber</td>
<td>2/reagent set</td>
<td>2/pkg</td>
<td>26558-00</td>
</tr>
</tbody>
</table>

**Digestion Reagents**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity Required</th>
<th>Unit</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydroxylamine Hydrochloride, ACS</td>
<td>varies</td>
<td>113 g</td>
<td>246-14</td>
</tr>
<tr>
<td>Nitric Acid, ACS</td>
<td>25 mL</td>
<td>500 mL</td>
<td>152-49</td>
</tr>
<tr>
<td>Potassium Permanganate, ACS</td>
<td>varies</td>
<td>454 g</td>
<td>168-01</td>
</tr>
<tr>
<td>Potassium Persulfate, ACS</td>
<td>4.0 g</td>
<td>454 g</td>
<td>26175-01</td>
</tr>
<tr>
<td>Sulfuric Acid, ACS</td>
<td>50 mL</td>
<td>4 kg</td>
<td>979-09</td>
</tr>
</tbody>
</table>

**REQUIRED APPARATUS**

**Cold Vapor Mercury Apparatus Set** ........................................................................ 26744-00

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity Required</th>
<th>Unit</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acro® 50 Vent Filter</td>
<td>1</td>
<td>18/pkg</td>
<td>26833-18</td>
</tr>
<tr>
<td>Air Trap Housing</td>
<td>1</td>
<td>each</td>
<td>26639-00</td>
</tr>
<tr>
<td>Ampule Breaker</td>
<td>1</td>
<td>each</td>
<td>25640-00</td>
</tr>
<tr>
<td>Breaker/Capper Tool for Mercury Scrubber</td>
<td>1</td>
<td>each</td>
<td>26640-00</td>
</tr>
<tr>
<td>C-flex Tubing, 0.25” ID, white</td>
<td>4 ft</td>
<td>25 ft</td>
<td>23273-67</td>
</tr>
<tr>
<td>Cell Riser, DR/2000</td>
<td>1</td>
<td>each</td>
<td>45282-00</td>
</tr>
<tr>
<td>Cell Riser, DR/3000</td>
<td>1</td>
<td>each</td>
<td>48403-00</td>
</tr>
<tr>
<td>Clamp for Mercury Absorber Column</td>
<td>1</td>
<td>each</td>
<td>26562-00</td>
</tr>
<tr>
<td>Distilling Receiver, 10 mL</td>
<td>1</td>
<td>each</td>
<td>26554-38</td>
</tr>
<tr>
<td>Erlenmeyer Flask, 100 mL</td>
<td>1</td>
<td>each</td>
<td>26553-42</td>
</tr>
<tr>
<td>Funnel</td>
<td>1</td>
<td>each</td>
<td>25843-35</td>
</tr>
<tr>
<td>Gas Washing Bottle, 1200 mL</td>
<td>1</td>
<td>each</td>
<td>26622-00</td>
</tr>
<tr>
<td>Glass Elbow, with hose adapter</td>
<td>1</td>
<td>each</td>
<td>26552-00</td>
</tr>
<tr>
<td>Mercury Absorber Column</td>
<td>1</td>
<td>each</td>
<td>26555-10</td>
</tr>
<tr>
<td>Rod Clamp</td>
<td>2</td>
<td>each</td>
<td>326-00</td>
</tr>
<tr>
<td>Support Ring for Gas Washing Bottle</td>
<td>1</td>
<td>each</td>
<td>26563-00</td>
</tr>
<tr>
<td>Stopper, for Distilling Receiver</td>
<td>1</td>
<td>each</td>
<td>26559-00</td>
</tr>
<tr>
<td>Stopper, for Gas Washing Bottle</td>
<td>1</td>
<td>each</td>
<td>26623-00</td>
</tr>
<tr>
<td>Support Base and Rod</td>
<td>1</td>
<td>each</td>
<td>329-00</td>
</tr>
<tr>
<td>Tubing Quick Disconnect, HDPE</td>
<td>1</td>
<td>12/pkg</td>
<td>14810-00</td>
</tr>
</tbody>
</table>

**Digestion Apparatus**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity Required</th>
<th>Unit</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erlenmeyer Flask, 2000 mL</td>
<td>1</td>
<td>each</td>
<td>24894-54</td>
</tr>
<tr>
<td>Hot Plate/Stirrer, 120 V</td>
<td>1</td>
<td>each</td>
<td>23442-00</td>
</tr>
<tr>
<td>Hot Plate/Stirrer, 240 V</td>
<td>1</td>
<td>each</td>
<td>23442-02</td>
</tr>
<tr>
<td>Spoon, measuring, 0.5 g</td>
<td>1</td>
<td>each</td>
<td>907-00</td>
</tr>
<tr>
<td>Stir Bar</td>
<td>1</td>
<td>each</td>
<td>20953-55</td>
</tr>
<tr>
<td>Thermometer, -20 to 110 °C</td>
<td>1</td>
<td>each</td>
<td>566-01</td>
</tr>
<tr>
<td>Watch Glass</td>
<td>1</td>
<td>each</td>
<td>578-67</td>
</tr>
</tbody>
</table>
OPTIONAL REAGENTS

Hydrochloric Acid, ACS ................................................................. 500mL .................... 134-49
Mercury Standard Solution, 12.5 mg/L Hg (NIST) ........................................... 100 mL .................. 2389-42
Mercury Standard Solution, 1000 mg/L Hg (NIST) ........................................... 100 mL ........... 14195-42
Water, deionized .................................................................................. 4 L .................... 272-56

OPTIONAL APPARATUS

Analytical Balance .................................................................................. each ........... 25568-00
Cylinder, graduated, 1000 mL, with handle ................................................ each .............. 26129-53
Incoming Air Filtration Apparatus ................................................................. each .......... 26846-00
Spoon, measuring, 5 g ........................................................................... each ............. 26572-05
Spoon, measuring, 10 g ......................................................................... each ............. 26572-10
Stir Bar Retriever .................................................................................... each ............. 15232-00
TenSette Pipet, 0.1-1.0 mL .................................................................. each ........... 19700-01
TenSette Pipet, 1.0-10.0 mL ................................................................. each ........... 19700-10
TenSette Pipet tips, for 19700-01 ........................................................ 50/pkg ........... 21856-96
TenSette Pipet tips, for 19700-10 ........................................................ 50/pkg ........... 21997-96
Vacuum Pump, with fittings, 115 V ......................................................... each ............. 26557-00
Vacuum Pump, with fittings, 230 V ......................................................... each ............. 26557-02