

Methods

Iron is present in nature in the form of its oxides, or in combination with silicon or sulfur. The soluble iron content of surface waters rarely exceeds 1 mg/L, while ground waters often contain higher concentrations. The National Secondary Drinking Water Standard for iron is 0.3 mg/L, as iron concentrations in excess of 0.3 mg/L impart a foul taste and cause staining. High concentrations in surface waters can indicate the presence of industrial effluents or runoff.

Iron contamination in oil field brines are typically a result of corrosion processes of iron-containing metallic components and equipment. Accumulation of insoluble iron salts in a brine completion fluid can result in substantial formation damage and can significantly affect the productivity of an oil well. Quantifying total iron in brine is critical.

The Phenanthroline Method (total & soluble; total & ferrous)

References: APHA Standard Methods, 23rd ed., Method 3500-Fe B - 1997. ASTM D 1068-77, Iron in Water, Test Method A. J.A. Tetlow and A.L. Wilson, “The Absorptiometric Determination of Iron in Boiler Feed-water”, *Analyst*. Vol. 89, p. 442 (1964).

With the Phenanthroline Method, ferrous iron reacts with 1,10-phenanthroline to form an orange-colored chelate. To determine total iron, thioglycolic acid solution is added to reduce ferric iron to the ferrous state. The reagent formulation minimizes interferences from various metals. Results are expressed as ppm (mg/L) Fe.

The PDTs Method (total)

References: G. Frederick Smith Chemical Co., The Iron Reagents, 3rd ed., p. 47 (1980). J.A. Tetlow and A.L. Wilson, “The Absorptiometric Determination of Iron in Boiler Feed-water”, *Analyst*. Vol. 89, p. 442 (1964).

CHEMetrics’ colorimetric method for determining total iron uses thioglycolic acid to dissolve particulate iron and to reduce iron from the ferric to the ferrous state. Ferrous iron then reacts with PDTs (3-(2-pyridyl)-5,6-bis(4-phenylsulfonic acid)-1,2,4-triazine disodium salt) in acid solution to form a purple-colored chelate. Results are expressed as ppm (mg/L) Fe.

The Ferric Thiocyanate Method (Iron in Brine)

References: D. F. Boltz and J. A. Howell, eds., *Colorimetric Determination of Nonmetals*, 2nd ed., Vol. 8, p. 304 (1978). Carpenter, J.F. “A New Field Method for Determining the Levels of Iron Contamination in Oilfield Completion Brine”, *SPE International Symposium* (2004).

The Iron in Brine test employs the ferric thiocyanate chemistry. In an acidic solution, hydrogen peroxide oxidizes ferrous iron. The resulting ferric iron reacts with ammonium thiocyanate forming a red-orange colored thiocyanate complex, in direct proportion to the iron concentration.

Results, expressed in mg/L, can be converted to mg/kg by dividing by the density of the brine.



Range: 0-1 & 1-10 ppm MDL: 0.05 ppm / Method: Phenanthroline	
Iron (total & ferrous) CHEMets Kit	Cat# K-6210
CHEMets Refill, 30 ampoules	R-6201
Activator Solution Pack, six 10 mL bottles	A-6000 ¹
Low Range Comparator 0, 0.1, 0.2, 0.3, 0.4, 0.6, 0.8, 1.0 ppm	C-6001
High Range Comparator 1, 2, 3, 4, 5, 6, 7, 8, 10 ppm	C-6010
Kit comes in a plastic case and contains everything needed to perform 30 tests: Refill, Low and High Range Comparators, Activator Solution, 25 mL sample cup and instructions.	

Range: 0-30 & 30-300 ppm MDL: 5 ppm / Method: Phenanthroline	
	Cat#
Iron (total & ferrous) VACUettes Kit	K-6210D
VACUettes Refill, 30 ampoules	R-6201D
Activator Solution Pack, six 10 mL bottles	A-6000
Low Range Comparator 0, 5, 7.5, 10, 15, 20, 25, 30 ppm	C-6001D
High Range Comparator 30, 60, 90, 120, 150, 175, 200, 250, 300 ppm	C-6010D
Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Activator Solution, dilutor snapper cup, micro test tubes, and instructions.	

Range: 0-1 & 1-10 ppm MDL: 0.05 ppm / Method: Phenanthroline	
Iron (total & soluble) CHEMets Kit	Cat# K-6010
CHEMets Refill, 30 ampoules	R-6001
Activator Solution Pack, six 10 mL bottles	A-6000 ¹
Low Range Comparator 0, 0.1, 0.2, 0.3, 0.4, 0.6, 0.8, 1.0 ppm	C-6001
High Range Comparator 1, 2, 3, 4, 5, 6, 7, 8, 10 ppm	C-6010
Kit comes in a plastic case and contains everything needed to perform 30 tests: Refill, Low and High Range Comparators, Activator Solution, 25 mL sample cup and instructions.	

Range: 0-30 & 30-300 ppm MDL: 5 ppm / Method: Phenanthroline	
	Cat# K-6010D
Iron (total & soluble) VACUettes Kit	
VACUettes Refill, 30 ampoules	R-6001D
Activator Solution Pack, six 10 mL bottles	A-6000 ¹
Low Range Comparator 0, 5, 7.5, 10, 15, 20, 25, 30 ppm	C-6001D
High Range Comparator 30, 60, 90, 120, 150, 175, 200, 250, 300 ppm	C-6010D
Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Activator Solution, dilutor snapper cup, micro test tubes and instructions.	

Range: 0-60 & 60-600 ppm MDL: 10 ppm / Method: Phenanthroline	
	Cat# K-6010A
Iron (total & soluble) VACUettes Kit	
VACUettes Refill, 30 ampoules	R-6001A
Activator Solution Pack, six 10 mL bottles	A-6000 ¹
Low Range Comparator 0, 10, 15, 20, 30, 40, 50, 60 ppm	C-6001A
High Range Comparator 60, 120, 180, 240, 300, 350, 400, 500, 600 ppm	C-6010A
Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Activator Solution, dilutor snapper cup, micro test tubes and instructions.	

Range: 0-120 & 120-1200 ppm MDL: 20 ppm / Method: Phenanthroline	
Iron (total & soluble) VACUettes Kit	Cat# K-6010B
VACUettes Refill, 30 ampoules	R-6001B
Activator Solution Pack, six 10 mL bottles	A-6000 ¹
Low Range Comparator 0, 20, 30, 40, 60, 80, 100, 120 ppm	C-6001B
High Range Comparator 120, 240, 360, 480, 600, 700, 800, 1000, 1200 ppm	C-6010B
Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Activator Solution, dilutor snapper cup, micro test tubes and instructions.	

Range: 0-1200 & 1200-12,000 ppm MDL: 200 ppm / Method: Phenanthroline	
	Cat#
Iron (total & soluble) VACUettes Kit	K-6010C
VACUettes Refill, 30 ampoules	R-6001C
Activator Solution Pack, six 10 mL bottles	A-6000 ¹
Low Range Comparator 0, 200, 300, 400, 600, 800, 1000, 1200 ppm	C-6001C
High Range Comparator 1200, 2400, 3600, 4800, 6000, 7000, 8000, 10,000, 12,000 ppm	C-6010C
Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Activator Solution, dilutor snapper cup, micro test tubes and instructions.	

Range: 0-100 & 100-1000 mg/L MDL: 5 mg/L / Method: Ferric Thiocyanate	
Iron in Brine CHEMets Kit	Cat# K-6002
CHEMets Refill, 30 ampoules	R-6002
Acidifier Solution Pack, six 20 mL bottles	A-6001 ²
Activator Solution Pack, six 20 mL bottles	A-6002 ¹
Low Range Comparator 0, 10, 20, 30, 40, 60, 80, 100 mg/L	C-6002
High Range Comparator 100, 200, 300, 400, 500, 600, 700, 800, 1000 mg/L	C-6012
Kit comes in a plastic case and contains everything needed to perform 30 tests (except distilled water): Refill, Low and High Range Comparators, Acidifier Solution, Activator Solution, 50 mL sample cup with cap, 1.0 mL syringe (2 ea) and instructions.	

Instructions and SDSs are posted on our website.
If no shelf life is listed for a product, then the shelf life is at least 1 year.

⚠ WARNING! The product employing the Ferric Thiocyanate method can expose you to chemicals including methanol, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.



Instrumental Kits

Multi-Analyte Photometers
V-2000 / V-3000
(See page 14 for instrumental features)

Range: 0-6.00 ppm
Method: Phenanthroline

Iron (total & ferrous) Vacu-vials Kit	Cat# K-6203
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Kit comes in a cardboard box and contains everything needed to perform 30 tests: thirty ampoules, Activator Solution, 25 mL sample cup, ampoule blank and instructions.

Range: 0-6.00 ppm
Method: Phenanthroline

Iron (total & soluble) Vacu-vials Kit	Cat# K-6003
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Kit comes in a cardboard box and contains everything needed to perform 30 tests: thirty ampoules, Activator Solution, 25 mL sample cup, ampoule blank and instructions.

Vacu-vials Kits require the use of a CHEMetrics Direct-Readout Photometer (photometers sold separately) or a spectrophotometer capable of accepting a 13 mm diameter round cell. See page 14 for details.

Components and Accessories	
Description	Cat#
Sample Cup Pack, 25 mL (6 ea)	A-0013
Micro Test Tube Pack, small (10 ea)	A-0015
Dilutor Snapper Cup Pack (6 ea)	A-0018
Ampoule Blank Pack (5 ea)	A-0023
Syringe Pack, 1.0 mL (6 ea)	A-0027
Sample Cup & Cap Pack, 50 mL (6 ea)	A-0058
Micro Test Tube Pack, 5 mL (5 ea)	A-0199
* Sample Zeroing Accessory Pack	A-0503

¹ The accessory pack supplies enough solution to perform at least 200 CHEMets tests, at least 200 Vacu-vial tests, or 42 VACUette tests. A-6000 Activator Solution is required for total iron analysis only.

² The accessory pack supplies enough solution for approximately 100 tests.

* For use when testing colored or turbid samples. See page 13 for details.

Instructions and SDSs are posted on our website.
If no shelf life is listed for a product, then the shelf life is at least 1 year.



Manganese

Method

Surface and ground waters rarely contain more than 1 mg/L of soluble or suspended manganese. Manganese can act as an oxidizing or a reducing agent depending on its valence state. Manganese is also used in the manufacture of batteries and as an alloying metal in the manufacture of steel and aluminum. The National Secondary Drinking Water Standard for manganese is 0.05 mg/L, as higher concentrations will impart a foul taste to water and discolor laundry and porcelain surfaces.

The Periodate Method

Reference: APHA Standard Methods, 14th ed. Method 314 C (1975).

CHEMetrics' tests employ the periodate chemistry that measures soluble manganese compounds but does not differentiate the various valence states. Results are expressed as ppm (mg/L) Mn.

Permanganate (MnO₄⁻) develops approximately 25% more color with this reagent than other forms of manganese, causing a high bias. If the sample is known to contain manganese in the form of permanganate only, multiplying test results by 0.8 will improve the accuracy of the results.

Visual Kits

Range: 0-2 ppm
MDL: 0.15 ppm / Method: Periodate

CHEMets Kit	Cat# K-6502
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CHEMets Refill, 30 ampoules	R-6502
Activator Solution Pack, six 10 mL bottles	A-6502 ¹
Comparator, Shelf life 1 year: 0, 0.3, 0.6, 0.8, 1.0, 1.5, 1.8, 2.0 ppm	C-6502

Kit comes in a plastic case and contains everything needed to perform 30 tests: Refill, Comparator, Activator Solution, 25 mL sample cup and instructions.

Instrumental Kit

Multi-Analyte Photometers
V-2000 / V-3000
(See page 14 for instrumental features)

Range: 0-30.0 ppm
Method: Periodate

Vacu-vials Kit	Cat# K-6503
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Kit comes in a cardboard box and contains everything needed to perform 30 tests: thirty ampoules, Activator Solution, 25 mL sample cup, 1.0 mL syringe, ampoule blank and instructions.

Vacu-vials Kits require the use of a CHEMetrics Direct-Readout Photometer (photometers sold separately) or a spectrophotometer capable of accepting a 13 mm diameter round cell. See page 14 for details.

Components and Accessories	
Description	Cat#
Sample Cup Pack, 25 mL (6 ea)	A-0013
Ampoule Blank Pack (5 ea)	A-0023
Syringe Pack, 1.0 mL (6 ea)	A-0027
* Sample Zeroing Accessory Pack	A-0503

¹ The accessory pack supplies enough solution to perform at least 200 tests.

* For use when testing colored or turbid samples. See page 13 for details.

Instructions and SDSs are posted on our website.
If no shelf life is listed for a product, then the shelf life is at least 1 year.

