



# Laboratory Analyst Certification

2009

## Candidate

## Handbook



This booklet contains...

- Subject matter for the Laboratory Analyst tests
- Education and experience requirements
- Selected study references
- Certification policies
- Frequently Asked Questions

# Laboratory Analyst Certification

## 2009 Candidate Handbook



This handbook contains information about the Laboratory Analyst certification program. Please read this entire handbook to become familiar with certification procedures and policies. As a certificate applicant, you are responsible for knowing the contents of this handbook. If you have any questions please contact your Local Section Chair (listed in the TCP Application) or the CWEA office at 510-382-7800.

### Statement of Non-Discrimination Policy

CWEA does not discriminate among applicants on the basis of age, gender, race, religion, national origin, disability, sexual orientation or marital status.

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California Water Environment  
Association  
Technical Certification Program  
7677 Oakport Street, Suite 600  
Oakland, CA 94621

phone: 510-382-7800  
fax: 510-382-7810  
web: [www.cwea.org](http://www.cwea.org)

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# Introduction

## The California Water Environment Association

CWEA's mission is to enhance the education and effectiveness of California wastewater professionals through training, certification, dissemination of technical information, and promotion of sound policies to benefit society through protection and enhancement of the water environment.

CWEA is a California Nonprofit Corporation and is a Member Association of the Water Environment Federation and a member of the National Organization for Competency Assurance.

## The Technical Certification Program

The Technical Certification Program (TCP) was created to offer multilevel technical certification for individuals employed in the water quality field. Tests are written by vocational specialists and administered throughout the year in six different disciplines: Collection System Maintenance, Environmental Compliance Inspection, Laboratory Analyst, Plant Maintenance (Electrical/Instrumentation and Mechanical Technologist), and Industrial Waste Treatment Plant Operator.

CWEA first offered a certification program for operators of wastewater treatment plants in 1937. The program was administered by CWEA until 1973 when the State of California assumed responsibility for the program. During those 36 years, CWEA awarded 3,915 operator certificates.

In 1975 the first committees were formed to establish a new voluntary certification program for water quality professionals specializing in disciplines other than plant operation. Eventually, the Voluntary Certification Program (VCP) emerged with specialized certificate programs for Collection System Maintenance, Plant Maintenance, Environmental Compliance Inspection, and Laboratory Analyst. The first of the new certifications were given in April of 1976. In the 1980s two more disciplines were added: Electrical/Instrumentation, and Industrial Waste Treatment Plant Operator.

Today CWEA offers certification in six different vocational programs with a total of 23 different certifications. About 2,000 certification applications are processed every year and over 5,500 certificates are currently held by individuals in California, Michigan, Hawaii, and Missouri.

## The Certification Process

To become certified, **all applicants** must complete the Application For Technical Certification, pay the application fee, have appropriate experience and education, and pass the computer-based test. Application instructions and fee schedules are listed on the application.

# Important Information

After applications are received at the CWEA office applicant information is compiled in the certification database. Acceptance letters are then mailed to all applicants. The experience and education given on the application is then reviewed by CWEA staff. If the application is approved, then the applicant will receive an acceptance letter. If the application is rejected, the applicant will be notified and may be asked to supply more information if warranted. After completing the test, applicants are sent official test results. Those who pass the exam will then be mailed certificates and blue wallet cards.

## Code of Ethics

The Code of Ethics is intended to reflect the standards and behavior that California Water Environment Association certificate holders and applicants expect of each other as they perform their work protecting public health and the environment and that reaffirms the value of holding a CWEA certificate. The purpose of the Code of Ethics is to ensure public confidence in the integrity and service of professional water quality workers while performing their duties.

All California Water Environment Association certificate holders and applicants are expected to meet the following standards of professional conduct and ethics:

1. To protect public health, themselves, their co-workers, property, and the environment by performing the Essential Duties of the CWEA certified vocation safely and effectively, and complying with all applicable federal, state and local regulations.
2. To represent themselves truthfully and honestly throughout the entire certification process.
3. To adhere to all test site rules and make no attempt to complete the test dishonestly or to assist any other person in doing so.
4. To refrain from activities that may jeopardize the integrity of the Technical Certification Program.

## Test Administration And Admission

**Testing Dates and Sites:** Tests are given throughout the year. Applicants eligible for the test will receive an acceptance letter and instructions on how to schedule their exam.

Testing Window	Test Dates	Application Deadline
Spring	April 1 - June 30	February 28
Summer	July 1 - September 30	May 31
Fall	October 1 - December 31	August 31
Winter	January 1 - March 31	November 30

CWEA also provides reasonable accommodations for those with physical or learning disabilities (See following page: "Accommodations For Those With Physical or Learning Disabilities").



**Test Site Admission:** Certificate candidates are required to show at least one valid government issued photo identification (State driver's license or ID, or passport). Only after positive identification has been made by the testing proctor may a candidate begin the exam. Candidates do not require to show their acceptance letters to enter the test site.

**Test Security:** Beginning January 2009, all exams will be computer-based. No reference material, laptop computers, or cameras are allowed in the test site. Candidates will have access to an on-screen calculator, however, examinees are welcome to bring pre-approved calculator (visit [www.cwea.org/cbt](http://www.cwea.org/cbt)) Candidates are not allowed to take any notes from the test site. Candidates who violate test site rules may be asked to leave the site and may be disqualified from that test. All violations of test security will be investigated by CWEA and appropriate action will be taken.

### **Test Design And Format**

**Test Design:** All certification tests are designed to test knowledge and abilities required to perform *Essential Duties* with minimal acceptable competence.

The *Essential Duties* and *Test Content Areas* for each certification were determined by a job analysis and *meta-analysis* of job specifications by two independent psychometric consulting firms. The studies gathered data from onsite visits of over 31 water and wastewater agencies, interviews with 110 water and wastewater professionals, and analysis of more than 300 job specifications. All research was conducted under the guidance of the Technical Certification Program Committee, vocational sub-committees, and CWEA staff. All test questions are designed to measure at least one area of knowledge or ability that is required to perform an essential duty.

**Test Delivery Mechanism:** All tests are computer-based format and are written in the English language only.

**Test Format:** All Laboratory Analyst tests are given completely in the multiple choice format (see *Sample Test Questions* in this booklet for an example). The multiple choice format is considered the most effective for use in standardized tests. This objective format allows a greater coverage in content for a given amount of testing time and improves competency measurement reliability. Multiple choice questions range in complexity from simple recall of knowledge to the synthesis and evaluation of the subject matter.

### **Test Scoring**

**Scoring Method:** All tests are mechanically scored by CWEA. The overall test score will determine if you pass or fail the test. Generally, the minimum score

required to pass the test is 75% (this passing score may be adjusted downward depending on the difficulty level of each particular test). When taking your test it is recommended that you try your best to score as high as possible. Do not try to target the minimum passing score.

**How Passing Scores Are Set:** Each time a certification test is given, the questions are changed resulting in a different test form. Since each form has different questions, the difficulty level of the test may not be the same from form to form. The passing score is developed as an overall estimate of minimal acceptable competence in the Test Content Areas by subject matter and testing experts. Passing scores are determined by an overall passing score, not by performance on individual Test Subject Areas, and are independent of other candidates' scores. Partial credit will not be awarded for any test item answered incorrectly.

### **Test Rescheduling and Cancellation Instructions**

#### **Reschedule your Testing Window**

To reschedule your application you must submit a written request (a letter stating that you wish to reschedule) to the adjacent (next) window once without a fee. A \$40 administrative fee is required to reschedule your application again to the third window. There are no exceptions to this policy.

#### **Reschedule your Test Appointment**

If you already have a scheduled exam with our testing administrator, Pearson VUE (PV), and wish to reschedule your appointment, you must contact (PV) one (1) business day in advance to avoid losing your exam fee.

#### **Cancel your Application**

To cancel your application you must submit a written request ( a letter stating you wish to cancel your application) to CWEA. The written request must be received at the CWEA office before the testing window begins. Full refunds, less a \$40 administrative fee, will be made within 4 weeks after the scheduled date.

#### **Item Appeals**

Candidates who wish to appeal a specific test item must do so during the test by completing the *Candidate Comment Review Screen* during the exam. Candidate comments will be evaluated and appropriate adjustments will be made to the test content. Candidates submitting comments will not be contacted in regards to the appeal.

#### **Test Result Notification**

Exam results are routinely mailed to certificate candidates approximately 4 weeks after the examination date. No results are given by phone, fax or email. All results are confidential and are only released to the certificate candidate. There are no exceptions to this policy.



**Issue of Certificate/ Blue Wallet Card**

Certificates and blue wallet cards will be issued to all candidates who pass the examination. Certificates and blue wallet cards are mailed about two to three weeks after result notifications have been mailed.

**Renewal of Certification**

All certificates must be renewed annually. The first renewal is due one year from the last day of the month in which the certification exam was held. Certificate renewals less than one year past due are subject to the renewal fee plus a penalty of 100 percent of the renewal fee. Certificates more than one year past due will need to retest to regain certification. Renewal notices are mailed to certificate holders two months before the due date. It is the responsibility of the certificate holder to ensure that his or her certificate(s) remains valid.

**Re-Certification**

CWEA Certificate holders shall be required to renew certificates annually, and shall be required to provide evidence of completion of 12 contact hours of continuing education requirements every two years. For more information, visit CWEA's website: [www.cwea.org](http://www.cwea.org).

**Accommodations For Those With Physical or Learning Disabilities**

In compliance with the Americans with Disabilities Act, reasonable accommodations will be provided for those individuals who provide CWEA with a physician's certificate, or its equivalent, documenting a physical or psychological disability that may affect the individual's ability to successfully complete the certification examination. Written requests for reasonable accommodations must be made no later than three weeks before the examination date.



# Grade I Laboratory Analyst

Laboratory Analyst Grade I Certification is designed to demonstrate competency at the entry and basic working level. More specifically, Grade I certification implies competence in the knowledge, skills and abilities required to perform the *Essential Duties* of an entry level water quality laboratory analyst.

## Eligibility Criteria For Taking The Test

There are no experience or education requirements for Grade I certification. Completing the Application for Technical Certification, paying the appropriate application fee, and passing the examination are the only requirements. It is, however, *recommended* that Grade I candidates have at least one year of experience working as a laboratory analyst performing the *Essential Duties* listed below. Many candidates without the recommended experience have difficulty successfully completing the computer-based test.

## Essential Duties Of The Grade I

### Laboratory Analyst

Individuals certified as Grade I Laboratory Analyst are expected to possess acceptable competency when performing the tasks that are necessary for entry level water quality laboratory analyst. These necessary tasks are known as the *Essential Duties*. The certification test measures knowledge, skills and abilities required to perform the *Essential Duties*.

#### Essential Duties for Grade I

101. Assists the laboratory supervisor in coordinating the activities and operations of the laboratory and overseeing lower level staff. (As required, assists in training or other laboratory and pretreatment staff).
102. Designs and performs laboratory analyses and develops new methods and techniques of analysis
103. Performs chemical and physical analysis of water, wastewater, stormwater and industrial water to ensure compliance with federal environmental compliance regulations
104. Monitors and reviews the result of the quality assurance/control program and analyzes laboratory data and recommends treatment modifications
105. Calibrates, operates and maintains wastewater laboratory equipment including, but not limited to analytical balance, dissolved oxygen meter, pH meter, specific ion electrodes, specific conductance meter, heating apparatus, stirring apparatus, incubator, autoclave, sterilizer, water bath, oven muffle

furnace dessicator, spectrophotometer, atomic absorption spectrophotometer, phase contract microscope, vacuum pumps, programmable calculator, distillation apparatus, and bunsen burner

106. Operates and maintains field wastewater monitoring equipment including, but not limited to, automatic composite sampler, flumes, weirs, pressure transducer/interrogator level monitor, dipper flow meter, portable pH meter, portable specific conductance meter and field dissolved oxygen meter
107. Conducts physical, chemical and biological analyses of water, wastewater, sludge, settleable constituents, floatable constituents and soils including, but not limited to, acidity, alkalinity, biochemical oxygen demand, boron, calcium, chemical oxygen demand, chloride, chlorine residual, coliform MPN, fecal coliform, grease, hardness, magnesium, nitrogen (ammonia, kjeldahl, nitrate, nitrite, organic) pH, phosphate, potassium, solids (settleable, suspended, total volatile), specific conductance, sulfate, surfactant volatile acids, heavy metals, water suitability and inhibitory residue
108. Writes and evaluates reports regarding industrial, commercial and institutional discharge site visits

## Complexity Of Test Questions

At the Grade I level, certificate candidates are expected to have basic knowledge of the job and the ability to safely perform the *Essential Duties* listed above. Examinees will have to answer multiple-choice questions that test knowledge, comprehension, and application of the subject matter. The complexity of the questions will range from basic recall of previously learned material and the ability to understand the meaning of the subject matter, to being able to apply knowledge to new situations.

## Test Content Areas

The following list is an outline of *Test Content Areas*. Each content area is a Knowledge, Skill, or Ability that is required to perform the *Essential Duties* listed above. Most of the Knowledge, Skills, or Abilities are required to perform the *Essential Duties* are equally important in the demonstration of acceptable competency. Thus, most of the content areas listed below are equally weighted on the test. Those content areas not equally weighted are indicated with the approximate relative weighting in parenthesis. These are approximate relative weightings within



a given Knowledge, Skill, or Ability, not the entire set of test content areas.

**Test Content Areas for Grade I**

**Knowledge of:**

- 101. Basic understanding of standard physical, chemical and microbiological properties of wastewater
- 102. Methods and techniques used in quantitative laboratory analysis related to subject matter
- 103. Laboratory equipment related to subject matter and its use and care
- 104. Laboratory hazards and proper safety precautions and procedures, chemical hygiene, including personal protective equipment
- 105. Methods for preparation of standardized reagents and media
- 106. Methods of cleaning glassware used in laboratory analysis
- 107. Basic wastewater mathematical calculations related to subject matter, including significant figures

**Skill to:**

- 108. Perform standard quantitative laboratory analysis (60%)
- 109. Communicate clearly and concisely, both orally and in writing, in the English language (20%)
- 110. Establish and maintain effective working relationships with those contacted in the course of the work (20%)

**Ability to:**

- 111. Perform standard physical, chemical and biological tests on treated and polluted water, potable water, industrial and domestic wastewater and related materials, including proper sampling and preservation techniques
- 112. Analyze and interpret standard laboratory test results
- 113. Maintain accurate and complete laboratory records
- 114. Follow established safe working practices

- 115. Follow oral and written instructions
- 116. Clean and prepare laboratory equipment/ glassware and maintain laboratory in orderly fashion
- 117. Read, understand and follow proper procedures in preparing standardized reagents and media
- 118. Perform basic wastewater mathematical calculations



# Grade II Laboratory Analyst

Laboratory Analyst Grade II Certification is designed to demonstrate competency at the skilled or journey level. More specifically, Grade II certification implies competence in the knowledge, skills, and abilities required to perform the *Essential Duties* of a skilled water quality laboratory analyst.

## Eligibility Criteria For Taking The Test

The basic requirement is four years of full-time work in water/wastewater laboratory analysis. You may also qualify by having two years of experience and holding a Laboratory Analyst Grade I Certificate for one year, **OR** having two years of full-time experience and holding an Associate's degree in a related field, **OR** having one year of full-time experience and holding a Bachelor's, or higher, degree in a related field.

Eligibility criteria are summarized in the table below. You may qualify by meeting either Education/Experience Combination **A**, **B**, **C**, or **D**. If you do not meet any of the combinations of experience and education, then you do not qualify for Grade II:

Combination	EDUCATION & CERTIFICATIONS	+	EXPERIENCE
<b>A</b>	None		4 full-time years in laboratory analysis
<b>B</b>	Hold Grade 1 Lab Analyst for 1 year.		2 full-time years in laboratory analysis
<b>C</b>	AA/AS degree in a related field		2 full-time years in laboratory analysis
<b>D</b>	Hold a BA/BS, or higher, degree in a related field		1 full-time year in laboratory analysis

## Qualifying With Your Education

Holding a college degree, or its equivalent, in a field related to your vocation will reduce the number of years required for your test (see the table above). Your degree must be in a field that is related to the certificate for which you are applying. If you are uncertain if your degree is related to your vocation you should still include your degree information in your application. The Technical Certification Program Committee will determine if your degree qualifies. If it does not, you will be accepted for the next highest grade level for which you qualify. Associate's and Bachelor's degrees in technical fields are usually accepted. Degrees are evaluated on a case-by-case basis upon receipt of the application. College credit without a degree is not accepted unless it can be demonstrated that the credit is equivalent to a degree.

## Essential Duties Of The Grade II Laboratory Analyst

Individuals certified as Grade II Laboratory Analysts are expected to possess acceptable competency when performing the tasks that are necessary for skilled or journey level water quality laboratory analyst. These necessary tasks are known as the *Essential Duties*. The certification test measures knowledge, skills and abilities required to perform the *Essential Duties*.

- Essential Duties for Grade II**
200. Assists the laboratory supervisor in coordinating the activities and operations of the laboratory and overseeing lower level staff. (As required, assists in training or other laboratory and pretreatment staff).
  201. Designs and performs laboratory analyses and develops new methods and techniques of analysis
  202. Performs chemical and physical analysis of water, wastewater, stormwater and industrial water to ensure compliance with federal environmental compliance regulations
  203. Monitors and reviews the result of the quality assurance/control program and analyzes laboratory data and recommends treatment modifications
  204. Calibrates, operates and maintains waste water laboratory equipment including, but not limited to, analytical balance, dissolved oxygen meter, pH meter, specific ion electrodes, specific conductance meter, heating apparatus, stirring apparatus, incubator, autoclave, sterilizer, water bath, oven muffle furnace, dessicator, spectrophotometer, atomic absorption spectrophotometer, phase contract microscope, vacuum pumps, programmable calculator, distillation apparatus, and bunsen burner
  205. Operates and maintains field wastewater monitoring equipment including, but not limited to, automatic composite sampler, flumes, weirs, pressure transducer/interrogator level monitor, dipper flow meter, portable pH meter, portable specific conductance meter and field dissolved oxygen meter



206. Conducts physical, chemical and biological analyses of water, wastewater, sludge, settleable constituents, floatable constituents and soils including, but not limited to, acidity, alkalinity, biochemical oxygen demand, boron, calcium, chemical oxygen demand, chloride, chlorine residual, coliform MPN, fecal coliform, grease, hardness, magnesium, nitrogen (ammonia, kjeldahl, nitrate, nitrite, organic) pH, phosphate, potassium, solids (settleable, suspended, total volatile), specific conductance, sulfate, surfactant volatile acids, heavy metals, water suitability and inhibitory residue
207. Writes and evaluates reports regarding industrial, commercial and institutional discharge site visits

microbiological properties of wastewater

202. General understanding of basic wastewater processes
203. Principles and practices of qualitative and quantitative chemistry, biology and bacteriology
204. Basic knowledge of pertinent federal and state codes and regulations involved in discharge permit, ELAP certification
205. Methods of handling, storing and disposal of hazardous chemicals and wastes

**Skill to:**

206. Perform standard quantitative laboratory analysis (50%)
207. Communicate clearly and concisely, both orally and in writing, in the English language (30%)
208. Establish and maintain effective working relationships with those contacted in the course of work (20%)

**Complexity Of Test Questions**

At the Grade II level, certificate candidates are expected to have the knowledge, skill and ability to safely and effectively accomplish most of the *Essential Duties* listed above. Grade II candidates are also expected to be able to be familiar with the Grade I Test Content Areas. Examinees will have to answer multiple choice questions that test comprehension, application and analysis of the subject matter. The complexity of the questions will cover the ability to basically understand the subject matter; to recall and apply principles, ideas, and theories; and to break down ideas and theories into their constituent parts.

**Test Content Areas**

The following list is an outline of Test Content Areas. Each content area is a knowledge, skill, or ability that is required to perform the *Essential Duties* listed above. Most of the Knowledge, Skills, or Abilities are required to perform the *Essential Duties* are equally important in the demonstration of acceptable competency. Thus, most of the content areas listed below are equally weighted on the test. Those content areas not equally weighted are indicated with the approximate relative weighting in parenthesis. These are approximate relative weightings within a given Knowledge, Skill, or Ability, not the entire set of test content areas. Candidates should also be thoroughly familiar with the Grade I Laboratory Analyst *Test Content Areas*.

**Test Content Areas for Grade II**

200. Test Content Areas identified on the Test Content Specifications for Laboratory Analysis Grade I

**Knowledge of:**

201. Understanding of physical, chemical and



# Grade III Laboratory Analyst

Laboratory Analyst Grade III Certification is designed to demonstrate competency at the lead or advanced technical level. More specifically, Grade III certification implies competence in the knowledge, skills and abilities required to perform the *Essential Duties* of a lead or advanced water quality laboratory analyst.

## Eligibility Criteria For Taking The Test

The basic requirement is six years of full-time work in laboratory analysis. You may also qualify by having four years of experience and holding a Laboratory Analyst Grade II Certificate for two years, **OR** having four years of full-time experience and holding an Associate's degree in a related field, **OR** having three years of full-time experience and holding a Bachelor's, or higher, degree in a related field.

Eligibility criteria are summarized in the table below. You may qualify by meeting either Education/ Experience Combination **A**, **B**, **C**, or **D**. If you do not meet any of the combinations of experience and education, then you do not qualify for Grade III:

Combination	EDUCATION & CERTIFICATIONS	+	EXPERIENCE
<b>A</b>	None		6 full-time years in laboratory analysis
<b>B</b>	Hold Grade II Lab Analyst Certificate for 2 years		4 full-time years in laboratory analysis
<b>C</b>	Hold an Associate's degree in a related field		4 full-time years in laboratory analysis
<b>D</b>	Hold a BA/BS, or higher, degree in a related field		3 full-time years in laboratory analysis

## Using Your Education To Help Qualify For The Test

Holding a college degree, or its equivalent, in a field related to your vocation will reduce the number of years required for your test (see the table above). Your degree must be in a field that is related to the certificate for which you are applying. If you are uncertain if your degree is related to your vocation you should still include your degree information in your application. The Technical Certification Program Committee will determine if your degree qualifies. If it does not, you will be accepted for the next highest grade level for which you qualify. Associate's and Bachelor's degrees in technical fields are usually accepted. Degrees are evaluated on a case-by-case basis upon receipt of the application. College credit without a degree is not accepted unless it can be demonstrated that the credit is equivalent to a degree.

## Essential Duties Of The Grade III

### Laboratory Analyst

Individuals certified as Grade III Laboratory Analysts are expected to possess acceptable competency when performing the tasks that are necessary for lead or advanced level water quality laboratory analysts. These necessary tasks are known as the *Essential Duties*. The certification test measures knowledge, skills and abilities required to perform the *Essential Duties*.

### Essential Duties for Grade III

300. Plans, prioritizes, assigns, supervises and reviews work performed on the chemical, biological, and bacteriological analysis of wastewater, biosolids, soils, and industrial pre-treatment waste samples
301. Performs specialized tests and analyses on raw and digested sludges and water, including tests for volatile and suspended solids, volatile acids, alkalinity, chlorides, biochemical oxygen demand, coliform MPN, and standard plate counts
302. Evaluates the work of laboratory personnel engaged in chemical, physical, biological, biochemical and instrumental analysis to insure laboratory quality standards are maintained and work is completed according to schedule
303. Provides technical information, recommends and assists in the implementation of goals an objectives, and interprets and implements policies and procedures
304. Provides preliminary written reports on results, reviews data prepared by lower level staff, reviews literature on technical issues and prepare reports on special projects
305. Maintains the quality assurance program as specified by the Environmental Protection Agency and other regulatory agencies
306. Participates in the selection, training, motivation and evaluation of staff; participates in the monitoring of employee performance objectives; prepares employee performance reviews; provides or coordinates staff training; and implements disciplinary procedures
307. Analyzes and interprets laboratory data and recommends process changes to water and wastewater treatment plants to insure quality standards



- 308. Establishes schedules and methods for collecting samples
- 309. Directs special investigations in wastewater, soils, biosolids waste, industrial pretreatment, process controls and recommends changes as appropriate
- 310. Prepares, organizes, and completes monthly quarterly, and annual wastewater discharge and biosolids reports, and ensures compliance with established permits and regulations
- 311. Provides or coordinates staff training and works with employees to correct deficiencies
- 312. Participates in the preparation and administration of the laboratory budget, submits budget recommendations and monitors expenditures
- 313. Estimates time, materials and equipment required for job assignments and orders materials as required

**Complexity Of Test Questions**

At the Grade III level, certificate candidates are expected to have the knowledge, skill and ability to safely and effectively accomplish and coordinate complex tasks as listed in the *Essential Duties* above. Grade III candidates are also expected to be familiar with the Grade I and II Laboratory Analyst knowledge, skills and abilities. Examinees will have to answer multiple choice questions that test application, analysis, and synthesis of the subject matter. The complexity of the questions will cover the ability to abstract in particular and concrete situations, to clarify and organize theories and ideas, and to put facts together to form new solutions.

**Test Content Areas**

The following list is an outline of Test Content Areas. Each content area is a Knowledge, Skill, or Ability that is required to perform the *Essential Duties* listed above. Most of the Knowledge, Skills, or Abilities are required to perform the *Essential Duties* are equally important in the demonstration of acceptable competency. Thus, most of the content areas listed below are equally weighted on the test. Those content areas not equally weighted are indicated with the approximate relative weighting in parenthesis. These are approximate relative weightings within a given Knowledge, Skill, or Ability, not the entire set of test content areas. Candidates should also be thoroughly familiar with the Grade I and II Collection System Maintenance *Test Content Areas*.

**Test Content Areas Grade III**

- 300. Knowledge, skill and ability identified on the Test Content Specifications for Laboratory Analysis Grades I and II

**Knowledge of:**

- 301. The services, operations and activities of a wastewater treatment laboratory testing program
- 302. The modern and complex principles and practices of chemistry, bacteriology and biology
- 303. Chemical, biological, bacteriological and physical characteristics of wastewater, biosolids, soils, and industrial pretreatment samples
- 304. Principles and practices of supervision, training and personnel management
- 305. Pertinent federal and state codes and regulations. (Federal Environmental Protection Agency, State Department of Health, and State Water Resources Quality Control Standards regarding water and wastewater)
- 306. Occupational hazards and standard safety practices, including chemical hygiene plan

**Skill to:**

- 307. Perform analyses in Essential Duty 301
- 308. Establish and maintain effective working relationships with those contacted in the course of work (i.e., employees, governmental agencies and the public)
- 309. Communicate clearly and concisely, both orally and in writing, in the English language

**Ability to:**

- 310. Supervise, train and evaluate the activities of a staff
- 311. Evaluate, interpret, and apply the results of laboratory testing, including advanced mathematical calculations, such as statistics
- 312. Conduct chemical, biological, and physical analyses of environmental samples



# Grade IV Laboratory Analyst

Laboratory Analyst Grade IV Certification is designed to demonstrate competency at the program manager level. More specifically, Grade IV certification implies competence in the knowledge, skills and abilities required to perform the *Essential Duties* of a water quality laboratory manager or supervisor.

## Eligibility Criteria For Taking The Test

The basic requirement is eight years of full-time work in laboratory analysis. You may also qualify by having six years of experience and holding a Laboratory Analyst Grade III Certificate for two years, **OR** having six years of full-time experience and holding an Associate's degree in a related field, **OR** having five years of full-time experience and holding a Bachelor's, or higher, degree in a related field. All Grade IV candidates must also demonstrate at least one year of experience supervising the work of others.

Requirements or qualification are summarized in the table below. You may qualify by meeting either Education/Experience Combination **A**, **B**, **C**, or **D**. If you do not meet any of the combinations of experience and education, then you do not qualify for Grade IV:

Combination	EDUCATION & CERTIFICATIONS	EXPERIENCE
<b>A</b>	None	8 years in laboratory analysis with one of those years supervising others
<b>B</b>	Hold Grade III Lab Analyst certificate for 2 years.	6 years in laboratory analysis with one of those years supervising others
<b>C</b>	Hold an AA/AS, or higher, degree in a related field	6 years in laboratory analysis with one of those years supervising others
<b>D</b>	Hold a Bachelor's, or higher, degree in a related field	5 years in laboratory analysis with one of those years supervising others

## Qualifying With Your Education

Holding a college degree, or its equivalent, in a field related to your vocation will reduce the number of years required for your test (see the table above). Your degree must be in a field that is related to the certificate for which you are applying. If you are uncertain if your degree is related to your vocation, you should still include your degree information in your application. The Technical Certification Program Committee will determine if your degree qualifies. If it does not, you will be accepted for the next highest grade level for which you qualify. Associate's and Bachelor's degrees in technical fields are usually accepted. Degrees are evaluated on a case-by-case

basis upon receipt of the application. College credit without a degree is not accepted unless it can be demonstrated that the credit is equivalent to a degree.

## Essential Duties Of The Grade IV Laboratory Analyst

Individuals certified as Grade IV Laboratory Analysts are expected to possess acceptable competency when performing the tasks that are necessary for management level laboratory analysts. These necessary tasks are known as the *Essential Duties*. The certification test measures knowledge, skills and abilities required to perform the *Essential Duties*.

### Essential Duties for Grade IV

401. Manages laboratory division staff, including developing and implementing laboratory division plans, goals and objectives consistent with authority goals and objectives
402. Directs, controls and implements laboratory services for the analysis of wastewater, potable water and industrial wastewater
403. Manages laboratory division budget, including: (a) preparation of budget and staffing recommendations; (b) initiating and/or approving purchase requests; (c) adhering to purchasing policies and procedures; and (d) monitoring expenditures to ensure that division's expenses remain within budget
404. Manages monitoring programs and ensures that all monitoring program reporting requirements are met. Monitoring programs include: (a) discharge monitoring, (b) ocean water monitoring, (c) in-house biosolids and residuals monitoring, and (d) storm water permit monitoring
405. In support of monitoring programs perform analyses on samples of wastewater, wastewater solids and industrial wastewater using standard physical, chemical and bacteriological instrumental methods
406. Ensures laboratory maintains current and appropriate certifications with State Department and Health Services
407. Develops and implements plant and field sampling and testing programs
408. Manages authority revenue sampling programs, including collection systems



- program and analysis; data collection, compilation, and review; and quarterly and annual report preparation
409. Keeps current on new federal, state, and local wastewater related regulations and their impact on monitoring and other related programs
  410. Reviews and prepares written comments and recommendations on proposed federal, state and local wastewater regulations
  411. Reviews and approves staff recommendations on division work organization, assignments, work schedules and training needs
  412. Identifies and addressing division training needs
  413. Reviews and disciplinary actions
  414. Prepares and approves technical reports and correspondence on various matters as required and approves sections of National Pollution Discharge Elimination System (NPDES) reports pertaining to analytical data
  415. Coordinates laboratory services with operations and pretreatment programs and municipal supplies
  416. Establishes staffing supply, and equipment budget needs for the laboratory, prepares justification and support documentation, and compiles annual budget requests
  417. Oversees and ensures the laboratory accreditation and quality assurance programs to meet EPA and other regulatory requirements
  418. Assists in the establishment of discharges and in the review of applications for discharge of industrial wastewater and contaminated groundwater to sewer system
  419. Represent City and Treatment Plant in public and private meetings on matters relating to analytical procedures

### Complexity Of Test Questions

At the Grade IV level, certificate candidates are expected to have the knowledge, skill and ability to administer, coordinate and manage complex programs described in the *Essential Duties* above. Grade IV candidates are also expected to be familiar

with the Grade I, II, and III Laboratory Analyst knowledge, skills and abilities. Examinees will have to answer multiple choice questions that test analysis, synthesis and evaluation of the subject matter. The complexity of the questions will cover the ability to clarify and organize theories and ideas, to put together facts to form new solutions, and to make managerial level judgements.

### Test Content Areas

The following list is an outline of *Test Content Areas*. Each content area is a Knowledge, Skill, or Ability that is required to perform the *Essential Duties* listed above. Most of the Knowledge, Skills, or Abilities are required to perform the *Essential Duties* are equally important in the demonstration of acceptable competency. Thus, most of the content areas listed below are equally weighted on the test. Those content areas not equally weighted are indicated with the approximate relative weighting in parenthesis. These are approximate relative weightings within a given Knowledge, Skill, or Ability, not the entire set of test content areas. Candidates should also be thoroughly familiar with the Grade I, II, and III Laboratory Analyst *Test Content Areas*.

#### Test Content Areas for Grade IV

400. Knowledge, skill and ability identified on the Test Content Specifications for Laboratory Analysis Grades I, II, and III

#### Knowledge of:

401. Current technological developments in wastewater treatment/control and principles and practices as applied to the treatment and disposal of treated wastewater and biosolids
402. Federal, state and local laws and regulations applicable to analytical procedures
403. Analytical techniques (such as GC/MS, ICP/MS), equipment, procedures, sampling techniques, methods of statistical analysis and data processing as applied to laboratory data management
404. Management principles including planning, organizing, staffing, directing, controlling and budgeting
405. Conventional quality assurance/quality control (QA/QC) practices for the wastewater laboratory, including the preparation of QA/QC charts
406. Wastewater treatment processes and expected operating parameters to recognize and pursue atypical test results and treatment process performance



# Sample Test Questions

## Sample Test Questions

The following sample test questions are provided to help you become familiar with the multiple choice format. The following test questions reflect only a sample of the subject matter covered on the test. For each question, choose the single most correct answer. An answer key is given at the end of this section.

### Grade I Laboratory Analyst

1. The phenolphthalein alkalinity of a water sample is zero if:

- the pH is greater than 8.3 .
- the pH is less than 8.3 .
- the sample hardness is less than 20 mg/L.
- the sample is anaerobic.

2. Turbidity is measured using:

- a spectrophotometer.
- matched nessler tubes.
- a nephelometer.
- a DO meter.

3. Given the following data, calculate the COD for the sample:

mL of FAS to titrate 10 mL of 0.25N dichromate=10.7 mL  
of FAS to titrate reagent blank=10.6  
mL of FAS to titrate sample =7.5  
sample size mL=20

- 290 mg/L
- 1240 mg/L
- 975 mg/L
- 413 mg/L

4. An example of a base is:

- ammonium hydroxide.
- ammonium chloride.
- sodium sulfate
- sodium hypochlorite

### Grade II Laboratory Analyst

1. When analyzing sulfate by the turbidimetric method, samples yielding results over 40 mg/L should be:

- read as they are.
- thrown out, as they are obviously contaminated.
- diluted to less than 5 mg/L.
- diluted to less than 40 mg/L.

2. Residual chlorine samples to be analyzed using the amperometric titration method should be titrated:

- at pH 3.5 to 4.5 for free chlorine.
- at pH 6.5 to 7.5 for combined chlorine.
- using 0.01 N or 0.025 N sodium thiosulfate.
- using 0.00564 phenylarsine oxide.

3. If the anticipated BOD (unseeded) of a wastewater sample is 120 mg/L, the sample volume giving nearest to 50% oxygen depletion in a 300 mL BOD bottle is (initial DO=8mg/L):

- 1 mL
- 3 mL
- 5 mL
- 10 mL

4. In the dissolved oxygen determinations using the iodometric method, azide modification effectively removes interferences caused by:

- nitrite.
- activated sludge which has a high oxygen utilization rate.
- ferrous iron.
- all of the above.

### Grade III Laboratory Analyst

1. A wastewater plant is discharging a partially nitrified effluent. How might this impact the BOD test on the effluent?

- There is no impact as BOD measures only carbonaceous demand.
- The BOD will be lower because the nitrate in the sample will inhibit bacteria.
- The BOD will be higher due to the initial presence of ammonia and nitrifying bacteria.
- Erroneous results will be obtained because nitrite will interfere with the DO determinations.



2. A solution of EDTA requires 18.50 mL to titrate 20.00 mL of a Ca standard. The standard was prepared by dissolving 1.000g CaCO<sub>3</sub> in dilute HCl and diluting to 1000 mL. A 100.0 mL water sample is titrated with 10.80 mL EDTA solution. Ca=40.8, C=12.01, O=16.00  
The water sample contains:
  - a. 46.7 mg/L Ca
  - b. 4.3 mg/L Ca
  - c. 96.5 mg/L Ca
  - d. 43.2 mg/L Ca
3. The correct media for the confirmed multiple tube fermentation test is:
  - a. brilliant green lactose bile broth.
  - b. lauryl tylose broth.
  - c. EMB broth
  - d. nutrient broth.
4. The component peaks of a gas chromatogram are quantitatively analyzed on the basis of:
  - a. the solvent used for extraction.
  - b. peak area.
  - c. ratio of peak height to peak area.
  - d. ratio of retention time to peak area.

**Grade IV Laboratory Analyst**

1. For a comprehensive quality assurance program, the EPA states that one of the following may not be necessary:
  - a. Two replicates of sample A
  - b. Laboratory spike into sample B
  - c. Sample B taken at the same time as Sample A
  - d. Field spike into sample B
2. You must select one of two approved methods for performing a test. Method A requires 15 minutes of analyst time per test, and uses no special instruments. Method B requires 7 minutes of analyst time per test and uses an instrument costing \$13,000. Base salary for the analyst is \$2,200 per month and employer paid benefits add 40% to the base salary and overhead adds another 60%. Assume there are 2,080 working hours per year. The instrument has a one year full warranty and maintenance and repair costs for the subsequent years are estimated at \$1,000 per year. The instrument has an 8 year service life. The test is now run on one sample at each of three locations, five days a week. The RWQCB may add one or two more sampling locations to the present requirements.

The justification for expenditure for an instrument must show at least a 20% cost savings. Assume there is no inflation in salary.

The recommendation you make is to:

- a. remain with method A.
  - b. purchase the equipment with the present requirements.
  - c. purchase the equipment if one more sample location is added.
  - d. purchase the equipment if two more sample locations are added.
3. An organism associated with activated sludge treatment problems is the:
    - a. sphaerotilus.
    - b. streptococcus.
    - c. salmonella.
    - d. rotifer.
  4. A toxicant concentration producing death of test organisms, usually defined as a median value of 50%, is known as:
    - a. an acute toxicity concentration.
    - b. a chronic toxicity concentration.
    - c. an LC<sub>50</sub> value.
    - d. an EC<sub>50</sub> value.

**Sample Test Question Answer Key**

**Grade I**

1. a
2. c
3. a
4. a

**Grade III**

1. c
2. a
3. a
4. b

**Grade II**

1. d
2. d
3. d
4. a

**Grade IV**

1. b
2. d
3. a
4. c



# Selected References

The following table lists references that may be useful when studying for the certification test. The latest edition of *Standard Methods* is the single most important study reference. If your knowledge of basic math and chemistry is adequate, *Standard Methods* is the only reference you are likely to need. Although test questions can be referenced in the publications listed below, they are not necessarily derived directly from them. Instead the subject matter for test questions is determined by the *Test Content Areas* listed in this handbook.

Reference
<b>General Reference</b>
CWEA , (2001), <i>Laboratory Analyst Study Guides</i> , Grades 1-4 Oakland, CA. 510-382-7800. <a href="http://www.cwea.org">www.cwea.org</a>
Hach Company, (1989), <i>Hach Water Analysis Book</i> <a href="http://www.hach.com">www.hach.com</a>
Water Environment Federation, (1985), <i>Simplified Laboratory Procedures For Wastewater Examination</i> , Alexandria, VA 1-800-666-0206. <a href="http://www.wef.org">www.wef.org</a>
Eaton, Andrew, <i>et al.</i> (Eds.), (1995) <i>Standard Methods for the Examination of Water and Wastewater</i> , 19 <sup>th</sup> ed., Water Environment Federation. Alexandria, VA. 1-800-666-0206 <a href="http://www.wef.org">www.wef.org</a>
<b>Aquatic Toxicology</b>
Rand and Petrocelli, (1985), <i>Fundamentals Of Aquatic Toxicology: Methods and Applications</i> , Hemisphere Publishing. <a href="http://www.amazon.com">www.amazon.com</a> or other online booksellers
U.S. Environmental Protection Agency, (1991), <i>Methods For Measuring The Acute Toxicity Of Effluents And Receiving Waters To Freshwater And Marine Organisms</i> , EPA/600/4-90/027. <a href="http://www.epa.gov">www.epa.gov</a>
<b>General Chemistry</b>
Skoog & West, (1980) <i>Fundamentals of Analytical Chemistry</i> , Saunders College Publishing. <a href="http://www.directtextbook.com">www.directtextbook.com</a> and other online booksellers
Shugar and Ballinger, (1990), <i>Chemical Technicians Ready Handbook</i> , McGraw-Hill. <a href="http://www.amazon.com">www.amazon.com</a>
U.S. Environmental Protection Agency, (YEAR), <i>Identification Of Organic Compounds in Industrial Effluents</i> , EPA-600/4-79-016. Cincinnati. <a href="http://www.epa.gov">www.epa.gov</a>
U.S. Environmental Protection Agency, (YEAR), <i>Methods For Chemical Analysis of Water and Wastes</i> , EPA-600/4-79-016. Cincinnati.
Skoog, (1985), <i>Principles of Instrumentation Analysis</i> , 3 <sup>rd</sup> ed., Saunders College Publishing. <a href="http://www.amazon.com">www.amazon.com</a> and other online booksellers
Snoeyink and Jenkins, (1980), <i>Water Chemistry</i> , Wiley. ISBN: 0471051969 <a href="http://www.amazon.com">www.amazon.com</a> and other online booksellers
<b>Laboratory Safety</b>
Furr, (1989), <i>CRC Handbook of Laboratory Safety</i> , <a href="http://www.crcpress.com">www.crcpress.com</a>
<i>Prudent Practices for Handling Hazardous Chemical in Laboratories</i> , (1995) National Academy Press. <a href="http://www.nap.edu">www.nap.edu</a>
<i>Supervisor's Guide to Safety and Health Programs</i> , (1992) Water Environment Federation. Alexandria, VA. 800-666-0206. <a href="http://www.wef.org">www.wef.org</a>
<b>Management</b>
<i>Manage for Success: Effective Utility Leadership Practices</i> , Office of Water Programs, California State University Sacramento, 6000 J Street, Sacramento, CA. 95819-6025, (916) 278-6142. <a href="http://www.owp.csus.edu">www.owp.csus.edu</a>
Michigan State University, (YEAR), <i>Supervisory Management in the Wastewater Field</i> , Self-study course, 1-800-356-5705. <a href="http://www.vu.msu.edu">www.vu.msu.edu</a>
<b>Mathematics</b>
Price, Joanne Kirkpatrick (1991), <i>Applied Mathematics for Wastewater Plant Operators</i> , CRC Press <a href="http://www.crcpress.com">www.crcpress.com</a> 1-800-272-7737 ISBN: 0877628092
Sokal and Rohf, (1973), <i>Introduction to Biostatistics</i> , W.H. Freeman and Company.
<b>Microbiology/Bacteriology</b>
U.S. Environmental Protection Agency, <i>Microbiological Methods for Monitoring the Environment</i> , EPA/600/4-90/027. Cincinnati. <a href="http://www.epa.gov">www.epa.gov</a>
<i>Wastewater Biology: The Microlife</i> , (1990) Water Environment Federation. Alexandria, VA. 800-666-0206. <a href="http://www.wef.org">www.wef.org</a>



<b>Reference</b>
<b>Quality Assurance/Quality Control</b>
U.S. Code of Federal Regulations, 40 CFR Parts 160 and 795, Good Laboratory Practice.
U.S. Environmental Protection Agency, (1979) Handbook for Analytical Quality Control in Water and Wastewater Laboratories, EPA-600/4-79/019. Cincinnati. <a href="http://www.epa.gov">www.epa.gov</a>
Eaton, Andrew, <i>et al.</i> (Eds.), (1995) <i>Standard Methods for the Examination of Water and Wastewater</i> , 19 <sup>th</sup> ed., Water Environment Federation. Alexandria, VA. 1-800-666-0206. General discussions are found in Part 1. QA/QC procedures specific to each determination can be found in the introductory material before each analysis.
<b>Regulations</b>
California Health and Safety Code and California Administrative Code, Title 8 and 22, California Domestic Water Quality and Monitoring Regulations. Use the most updated versions.
Clean Water Act of 1987, <i>Water Environment Federation</i> . Alexandria, VA. 800-666-0206. <a href="http://www.wef.org">www.wef.org</a>
Environmental Laboratory Accreditation Program (ELAP) Legislation Documents, AB3739, AB2160, AB 45.
DOHS/ELAP, (1993), <i>ELAP Quick Reference Guide</i> , Los Angeles. 213-620-3564.
<b>Sample Collection and Preparation</b>
Keith, (1988), <i>Principles of Environmental Sampling</i> , ACS. <a href="http://www.amazon.com">www.amazon.com</a> and other booksellers
<i>Wastewater Sampling for Process and Quality Control</i> (MOP OM-1), (1980) Water Environment Federation. Alexandria, VA. 800-666-0206.
<b>Water and Wastewater Operations</b>
White, Van Nostrand, Reinhold, (1992), <i>Handbook of Chlorination and Alternative Disinfectants</i> , Water Environment Federation. Alexandria, VA. 800-666-0206.
<i>Operation of Municipal Wastewater Treatment Plants</i> (MOP 11), (1991) Water Environment Federation. Alexandria, VA. 800-666-0206.

For information about obtaining these publications visit the website or call the phone number listed in the reference. If no web address or phone number is listed, contact the publishing agency directly or contact your local library or bookstore.

This reference list is intended to assist certificate candidates in preparation for the Laboratory Analyst certification test. Use of these references does not guarantee successful completion of the test. There may be other publications that may be helpful to candidates preparing for the test. CWEA encourages candidates to identify and utilize other resources in preparing for the test.



## Preparing For Your Test

This section addresses a few possible methods for preparing for the certification test. Since you are most familiar with your own abilities you are responsible for determining the best method for preparing for your certification test. Following the suggestions in this section does not guarantee you will pass the certification test.

**Determining Your Preparedness:** An individual's preparedness for the certification test depends on a number of things including amount of practical experience in the vocation and years of education. If you are unsure how prepared you are for the test review the *Essential Duties* and *Test Content Areas* for the test that you are considering. If you are not familiar with most of the *Essential Duties* and *Test Content Areas* you should consider reviewing some of the material in the references listed for that grade level. You may also want to consider applying for a lower grade level if appropriate.

**Using The Selected References:** After evaluating how well prepared you are for the test, you may want to review some of the Selected References. The references in this list may be used to review those Test Content Areas that you are not familiar with or those for which you have little background. Well prepared candidates may only have to brush up on a few topics while those less prepared may have to study extensively.

**Study Sessions:** CWEA Local Section host at least two study sessions in various parts of California. All applicants will be mailed the date and location of the nearest preparation classes if provided by Local Section to CWEA staff. Usually these classes are given about two months before the test date and last a full day with Grades I and II material covered in the morning and Grades III and IV covered in the afternoon.

**Using the Essential Duties and Test Content Areas as a Guide to Your Study:** The Essential Duties (EDs) are a basic outline of the test subject matter. You can use the EDs as your study guide by referring to the EDs in the primary Selected References. As you study, you will find that the TCAs are related to the EDs. Each test question is written to address at least one TCA and its related ED.



## FAQs Frequently Asked Questions

**Question:** Is it required that I begin at the Grade I level then work my way up from there to higher levels?

**Answer:** No. You may take any test that you qualify for with your education and experience. However, if you are just starting out, you can see by the education and experience requirements that you can work your way up the grade levels faster if you become certified at Grade I, then achieve each successive certification as soon as you get the required education and experience.

**Question:** If I take a Grade II, III, or IV test will I have to know the Test Content Areas for the lower level tests?

**Answer:** Yes, the subject matter for each test builds on the subject matter for those tests below its grade level. A thorough knowledge of the Test Content Areas for the grade level that you are taking is most important to your preparation, but you should expect questions from any of the lower grade levels.

**Question:** If I am re-taking a test that I had previously failed do I need to re-submit a full application and the entire application fee.

**Answer:** No, you must complete the re-test application with appropriate fees.

**Question:** Is continuing education required to renew my certification?

**Answer:** Yes. For any certificate earned on or after July 2002, you need to obtain 12 hours of continuing education every two years. For more information, visit [www.cwea.org](http://www.cwea.org), or feel free to call the CWEA office.

**Question:** How long is the test?

**Answer:** All tests have about 75-100 questions and 3 hours are given for completion.

**Question:** Can I take more than one certification test at a same time?

**Answer:** Yes, but you can only take up to two at a same time (under a different vocation). You will be given a total of three hours to complete both tests.

**Question:** How do I get a receipt showing I paid for the test?

**Answer:** A receipt is sent to all applicants upon request. Hold on to this receipt until the certification process is over in case you have to submit it to your employer for reimbursement.

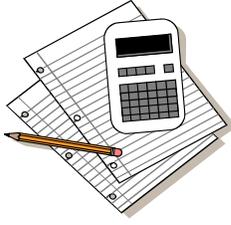
**Question:** If I am applying for the Grade IV test do I need to be a supervisor?

**Answer:** No, you just need to have about one year of supervision experience, verified by your manager. You do not have to hold the title of "Supervisor."

**Question:** Can I qualify for the test with water laboratory analyst or other experience similar to that in a wastewater laboratory?

**Answer:** Yes, if your experience is similar to the Essential Duties listed in this handbook.





LABORATORY ANALYST  
Formulae and General Information\*

Element Symbols and Atomic Weights:\*\*

Aluminum	Al	27
Arsenic	As	75
Calcium	Ca	40
Carbon	C	12
Chlorine	Cl	35.5
Chromium	Cr	52
Copper	Cu	63.5
Hydrogen	H	1
Iodine	I	126.9
Magnesium	Mg	24
Nickel	Ni	59
Nitrogen	N	14
Oxygen	O	16
Phosphorus	P	31
Potassium	K	39
Silver	Ag	108
Sodium	Na	23
Sulfur	S	32

Conversion Factors:

1 gal = 8.34 lbs  
1 cu ft = 7.48 gal  
1 lb = 454 grams

Abbreviations

AA = atomic absorption  
AE = atomic emission  
mL = milliliter  
mg = milligram  
L = liter  
g = gram  
GC = gas chromatography  
F = formal  
M = molar  
N = normal  
MGD = million gallons per day

MPN Index (10 mL, 1.0 mL, 0.1 mL)

5 - 3 - 0	80
5 - 5 - 3	900
5 - 5 - 5	> 1600

\*\*Source: *Standard Methods for the Examination of Water and Wastewater*, 18th Edition.

\*These formulae and general information are given on all Laboratory Analyst tests.

Testing Window	Test Dates	Application Deadline
Spring	April 1 - June 30	February 28
Summer	July 1 - September 30	May 31
Fall	October 1 - December 31	August 31
Winter	January 1 - March 31	November 30

### Other CWEA Certificate Programs

- ◆ Biosolids Land Application Management
- ◆ Environmental Compliance Inspector
- ◆ Laboratory Analyst
- ◆ Plant Maintenance
  - Electrical Instrumentation
  - Mechanical Technologist
- ◆ Industrial Waste Treatment Plant Operator



**California Water Environment Association**  
 7677 Oakport Street, Suite 600  
 Oakland, CA 94621



**Have a question?**  
**Give us a call at (510) 382-7800.**