Laboratory Analyst Certification

2006-2007

Candidate Handbook

This booklet contains...

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

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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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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 twice yearly in five different disciplines: Collection System Maintenance, Environmental Compliance Inspection, Laboratory Analysis, Plant Maintenance (Electrical/Instrumentation and Mechanical Technologist), and Industrial Waste Treatment Plant Operation.
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 3915 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 Analysis. 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 1200 certification applications are processed every year and over 4000 certificates are currently held by individuals in California and other parts of the United States.

Important Information

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 written test. Application instructions and fee schedules are listed on the application. After applications are received at the CWEA office applicant information is compiled in the certification database. Application receipts are then mailed to all applicants. The experience and education given on the application is then reviewed by CWEA staff. Next, the applications are reviewed by TCP Local Section Chairs. If the application is approved, then the applicant will receive an confirmation letter giving test site information. If the application is rejected, the applicant will be notified and may be asked to supply more information if warranted. After completing the written test applicants are sent results. Those who pass will then be mailed certificates and 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 reaffirm 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 coworkers, 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.

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 twice each year on the fourth Saturday of January and July (see Application for Technical Certification for test schedule and test site map).

Applicants who are eligible for the test will be mailed a confirmation letter and map to their test site. Reasonable accommodations can be made for those who cannot take the test on Saturdays because of religious reasons by contacting the CWEA office at 510-382-7800. 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 proctor may a candidate's test booklet be distributed. Candidates are not required to show their eligibility letters to enter the test site.

Test Security: All tests are closed-book. No reference material, programmable calculators, cell phones, palm pilots, PDAs, computers, or cameras are allowed in the test site. Candidates should only bring a scientific calculator and a few #2, or softer, pencils. All writing and notes must be in the test booklet. 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 subcommittees, 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 given in a test booklet with a separate form for marking answers. Tests 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.

Exam Postponement and Cancellation Instructions

To postpone your application you must submit a signed written request (a letter stating that you wish to postpone), with a $35 administrative fee. The written request **and** payment must be received at the CWEA office no later than six (6) days after the scheduled test date. You may only postpone your application twice. There are no exceptions to this policy.

To cancel your application you must submit a signed written request (a letter stating you wish to cancel your application) to CWEA. The written request must be received at the CWEA office no later than six (6) days after the scheduled test date. Full refunds, less a $35 administrative fee, will be made within 4 weeks after the scheduled date. There are no exceptions to this policy.

Item Appeals

Candidates who wish to appeal a specific test item must do so during the test by completing an Item Appeal form available from the test proctor. Item appeals will be evaluated and appropriate adjustments made during the scoring process.

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.

Issue of Certificate

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

Grade I Laboratory Analyst

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 late fee. Certificates more than one year past due are not renewable. Re-testing is required to
reinstate certificates more than one year past due. 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. Continuing education will be required for renewal after July 2002.

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.

Accommodations For Those With Physical or Learning Disabilities
In compliance with the Americans with Disabilities Act, special 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 special accommodations must be made no later than 3 weeks before the examination date.

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 written 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 written 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. Performs routine laboratory analysis; including chloride, conductivity, alkalinity, pH, temperature, total hardness, turbidity, chlorine residual (free and combined), dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, solids (total, dissolved, suspended, volatile, non-volatile), settleable solids; and microbiological analyses, including sterile techniques, total and fecal coliform (MPN), confirmed test, media preparation, and total plate count

102. Maintains routine documentation, including worksheet/log sheet entries, sample documentation, and chain-of-custody forms. Record data precisely and accurately

103. Operates and maintains test equipment such as UV/visible spectrophotometer, dissolved oxygen meters, pH meters and turbidimeter. Performs routine calibration

104. Collects samples of wastewater, sludge, receiving water and industrial waste in accordance with established lab procedures

105. Prepares, sorts, washes, decontaminates, sterilizes and stores lab glassware

106. Prepares chemical reagents and bacteriological culture media

107. Performs routine quality control checks for all reagents, media and data generated specific to subject matter

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
A	None	4 full-time years in laboratory analysis
B	Grade I Laboratory Analyst Certificate for 1 year	2 full-time years in laboratory analysis
C	AA/AS degree in a related field	2 full-time years in laboratory analysis
D	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. Essential duties identified on the Test Content Specifications for Laboratory Analysis Grade I

201. Performs routine laboratory analyses, including atomic absorption (FAA, GFAA, cold vapor, gaseous hydride generation), sulfate, chlorine demand, oil and grease, nitrate, nitrite, ammonia, phosphate, fluoride, TKN, total phosphorus, process control topics (MLSS/SVI, MCRT, F/M, chlorination/dechlorination, volatile acids/ alkalinity ratio); microbiological testing (completed test, membrane filter technique), acute bioassay, total organic carbon

202. Assists in design/development of new methods and techniques of analysis

203. Calibrates, operates and maintains wastewater laboratory equipment related to subject matter including field wastewater monitoring equipment

204. Complete basic lab reports

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 breakdown 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 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%)

Ability to:

209. Perform analyses for subject matter in Essential Duty 201 (50%)

210. Recommend or devise corrective action for analytical or instrumentation procedures (i. e., troubleshoot) (15%)

211. Conduct more advanced wastewater mathematics (15%)

212. Prepare clear, concise and technical reports (15%)

213. Train and supervise the work of others (5%)

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
A	None	6 full-time years in laboratory analysis
B	Hold Grade II Laboratory Analyst Certificate for 2 years	4 full-time years in laboratory analysis
C	Hold an Associate's degree in a related field	4 full-time years in laboratory analysis
D	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 Written 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. Essential duties identified on the Test Content Specifications for Laboratory Analysis Grades I and II

301. Performs routine laboratory analysis, including ion chromatography, ICP/AES, Spectrophotometry (surfactants-MBAS, phenols, cyanide) gas-liquid chromatography; total organic carbon; chronic toxicity tests; Water suitability and inhibitory residue; microscopic examination of activated sludge

302. Plans, prioritizes, assigns, supervises and reviews work performed and data generated on the chemical, biological, and bacteriological analysis of wastewater, biosolids, soils, and industrial pretreatment waste samples

303. Provides preliminary written reports on results, reviews data prepared by lower level staff, reviews literature on technical issues and prepare reports on special projects

304. Maintains the quality assurance program as specified by the CDHS/ELAP and other regulatory agencies

305. Participates in the selection, training and evaluation of staff; participates in the monitoring of employee performance objectives; assists in the preparation of employee performance reviews. Interprets and implements agency policies and procedures

306. Analyzes and interprets laboratory data and recommends process changes to water and wastewater treatment plants to insure quality standards

307. Assists in special investigations in wastewater, soils, biosolids, industrial pretreatment, process controls and makes recommendations as appropriate

308. Provides or coordinates staff training and works with employees to correct deficiencies

309. Participates in the preparation and administration of the laboratory budget, submits budget recommendations and monitors expenditures

310. Assists in preparation, organization, and completion of monthly, quarterly, and annual wastewater discharge and biosolids reports

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 waste water)

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
A	None		8 years in laboratory analysis with one of those years supervising others
B	2 years holding Grade III Laboratory Analyst certificate		6 years in laboratory analysis with one of those years supervising others
C	Hold an AA/AS, or higher, degree in a related field		6 years in laboratory analysis with one of those years supervising others
D	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

400. Essential duties identified on the Test Content Specifications for Laboratory Analysis Grades I, II, and III

401. Manages laboratory division staff, including developing and implementing laboratory division plans, acting consistently with agency goals and objectives

402. Directs, controls and implements laboratory services for the analysis of wastewater 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) receiving water monitoring, (c) biosolids and residuals monitoring, and (d) storm water monitoring

405. Ensures laboratory maintains current and appropriate certifications with State Department of Health Services

406. Develops and implements plant and field sampling and testing programs, including QA/QC

407. Keeps current on pertinent federal, state, and local regulations. Prepares written comments and recommendations on

proposed regulations

408. Reviews and approves staff recommendations on division work organization, assignments, work schedules and training needs

409. Reviews and implements disciplinary actions

410. Prepares and approves technical reports and correspondence to regulatory agencies

411. Coordinates laboratory services with operations and pretreatment programs

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

Skill to:

407. Develop and maintain effective working relationships and understand and carry out verbal and written instructions (45%)

408. Communicate effectively with regulatory, plant, and member agency staffs and with the general public, in the English language (45%)

409. Perform analytical procedures as required (10%)

Ability to:

410. Plan, organize, direct, coordinate, and review the work of laboratory personnel

411. Analyze, interpret and effectively apply results of laboratory tests

412. Read, interpret and apply pertinent regulations

413. Prepare clear and concise technical reports

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:

   a. the pH is greater than 8.3 .
   b. the pH is less than 8.3 .
   c. the sample hardness is less than 20 mg/L.
   d. the sample is anaerobic.

2. Turbidity is measured using:

   a. a spectrophotometer.
   b. matched nessler tubes.
   c. a nephelometer.
   d. 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

   a. 290 mg/L
   b. 1240 mg/L
   c. 975 mg/L
   d. 413 mg/L

4. An example of a base is:

   a. ammonium hydroxide.
   b. ammonium chloride.
   c. sodium sulfate
   d. sodium hypochlorite

Grade II Laboratory Analyst

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

   a. read as they are.
   b. thrown out, as they are obviously contaminated.
   c. diluted to less than 5 mg/L.
   d. diluted to less than 40 mg/L.

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

   a. at pH 3.5 to 4.5 for free chlorine.
   b. at pH 6.5 to 7.5 for combined chlorine.
   c. using 0.01 N or 0.025 N sodium thiosulfate.
   d. 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):

   a. 1 mL
   b. 3 mL
   c. 5 mL
   d. 10 mL

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

   a. nitrite.
   b. activated sludge which has a high oxygen utilization rate.
   c. ferrous iron.
   d. 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?

   a. There is no impact as BOD measures only carbonaceous demand.
   b. The BOD will be lower because the nitrate in the sample will inhibit bacteria.
   c. The BOD will be higher due to the initial presence of ammonia and nitrifying bacteria.
   d. 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 $CaCO_3$ 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 tytose 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_{50} value.
   d. an EC_{50} value.

Sample Test Question Answer Key

Grade I	Grade III
1. a	1. c
2. c	2. a
3. a	3. a
4. a	4. b
Grade II	**Grade IV**
1. d	1. b
2. d	2. d
3. d	3. a
4. 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
General Reference
CWEA , (2001), *Laboratory Analyst Study Guides*, Grades 1-4 Oakland, CA. 510-382-7800. www.cwea.org
Hach Company, (1989), *Hach Water Analysis Book www.hach.com*
Water Environment Federation, (1985), *Simplified Laboratory Procedures For Wastewater Examination*, Alexandria, VA 1-800-666-0206. www.wef.org
Eaton, Andrew, *et al.* (Eds.), (1995) *Standard Methods for the Examination of Water and Wastewater*, 19th ed., Water Environment Federation. Alexandria, VA. 1-800-666-0206 www.wef.org
Aquatic Toxicology
Rand and Petrocelli, (1985), *Fundamentals Of Aquatic Toxicology: Methods and Applications*, Hemisphere Publishing. www.amazon.com or other online booksellers
U.S. Environmental Protection Agency, (1991), *Methods For Measuring The Acute Toxicity Of Effluents And Receiving Waters To Freshwater And Marine Organisms*, EPA/600/4-90/027. www.epa.gov
General Chemistry
Skoog & West, (1980) *Analytical Chemistry*, 3rd ed., Saunders College Publishing. www.directtextbook.com and other online booksellers
Shugar and Ballinger, (1990), *Chemical Technicians Ready Handbook*, 3rd ed., McGraw-Hill. www.mcgraw-hill.com
U.S. Environmental Protection Agency, (YEAR), *Identification Of Organic Compounds in Industrial Effluents*, EPA-600/4-79-016. Cincinnati. www.epa.gov
U.S. Environmental Protection Agency, (YEAR), *Methods For Chemical Analysis of Water and Wastes*, EPA-600/4-79-016. Cincinnati.
Skoog, (1985), *Principles of Instrumentation Analysis,* 3rd ed., Saunders College Publishing. www. directtextbook.com and other online booksellers
Snoeyink and Jenkins, (1980), Water *Chemistry,* Wiley. ISBN: 0471051969 www.amazon.com and other online booksellers
Laboratory Safety
Furr, (1989), *CRC Handbook of Laboratory Safety*, www.crcpress.com
Prudent Practices for Handling Hazardous Chemical in Laboratories, (1995) National Academy Press. www.nap.edu
Supervisor's Guide to Safety and Health Programs, (1992) Water Environment Federation. Alexandria, VA. 800-666-0206. www.wef.org
Management
Michigan State University*, (YEAR), Supervisory Management in the Wastewater Field*, Self-study course, 1-800-356-5705. www.vu.msu.edu
Mathematics
Price, Joanne Kirkpatrick (1991), *Applied Mathematics for Wastewater Plant Operators*, CRC Press www.crcpress.com 1-800-272-7737 ISBN: 0877628092
Sokal and Rohf, (1973), *Introduction to Biostatistics*, W.H. Freeman and Company.
Microbiology/Bacteriology
U.S. Environmental Protection Agency, (YEAR), *Microbiological Methods for Monitoring the Environment*, EPA/600/4-90/027. Cincinnati. www.epa.gov
Wastewater Biology: The Microlife, (1990) Water Environment Federation. Alexandria, VA. 800-666-0206. www.wef.org

Reference
Quality Assurance/Quality C
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.
Eaton, Andrew, *et al.* (Eds.), (1995) *Standard Methods for the Examination of Water and Wastewater*, 19th 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.
Regulations
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, *Water Environment Federation. Alexandria*, VA. 800-666-0206. www.wef.org
Environmental Laboratory Accreditation Program (ELAP) Legislation Documents, AB3739, AB2160, AB 45.
DOHS/ELAP, (1993), *ELAP Quick Reference Guide*, Los Angeles. 213-620-3564.
Sample Collection and Preparation
Keith, (1988), *Principles of Environmental Sampling*, ACS.
Wastewater sampling for Process and Quality Control (MOP OM-1), (1980) Water Environment Federation. Alexandria, VA. 800-666-0206.
Water and Wastewater Operations
White, van Nostrand, Reinhold, (1992), *Handbook of Chlorination and Alternative Disinfectants*, Water Environment Federation. Alexandria, VA. 800-666-0206.
Operation of Municipal Wastewater Treatment Plants (MOP 11), (1991) Water Environment Federation. Alexandria, VA. 800-666-0206.

For information about obtaining these publications call the phone number or visit the website listed in the reference. If no phone number or web address 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

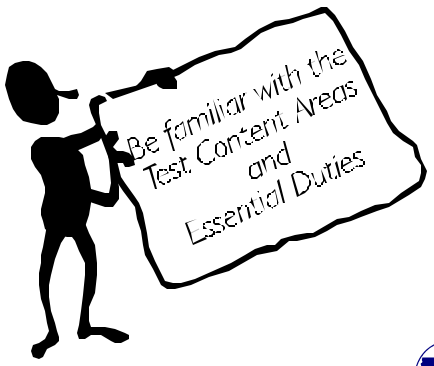
This section addresses a few possible methods for preparing for the certification test. Since you are most familiar with your own abilities you are responsible for determining the best method for preparing for your certification test. Following the suggestions in this section does not guarantee you will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

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: Yes.

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, 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 once?
Answer: Yes, but you can only take up to two at a time. 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 who have paid their fees about one month after the application deadline. 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. 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.*

Test Application Dates and Deadlines	
Application Deadline	Test date
April 30, 2006	July 22, 2006
October 31, 2006	January 27, 2007

Other CWEA Certificate Programs

- Biosolids Land Application Management
- Collection System Maintenance
- Environmental Compliance Inspector
- Plant Maintenance
- Industrial Waste Treatment Plant Operator

For more information about these programs call CWEA at 510-382-7800, or visit our web site at http://www.cwea.org

California Water Environment Association
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Oakland, CA 94621-1935

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