



10
Modules

Certificate Program



WATER TREATMENT & TRANSMISSION TECHNOLOGY

START TODAY STUDY AT YOUR PACE ON YOUR SCHEDULE

Water Treatment & Transmission Technology Certificate

Earn your Water Treatment & Transmission Technology Certificate through American Water College in partnership with California State University, Fresno. This is a 100% online certificate program. Students complete the program by watching online lectures, reading assigned texts, and submitting assignments online.



Advance Your
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Demonstrate Your
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100% Online!

AMERICAN WATER COLLEGE

(661) 874-1655

AmericanWaterCollege.org

info@americanwatercollege.org

Water Treatment & Transmission Technology

The Water Treatment and Transmission Technology Certificate Program includes 10 modules. All modules are self-paced, online courses. Students will receive a certificate upon completing each module as well as an overall certificate after completing all five modules. The topics of the ten modules are outlined below.

Water Sources

(2.1 CEUs)

- Water Supply Hydrology
- Groundwater Sources
- Surface Water Sources
- Emergency and Alternative Water Sources
- Use and Conservation of Water
- Water Quality
- Water Source Protection

Introduction to Water Treatment

(4.3 CEUs)

- Water Treatment Processes
- Treatment of Water at the Source
- Preliminary Treatment
- Water Coagulation and Flocculation
- Sedimentation Basins and Clarifiers
- Filtration
- Disinfection
- Fluoridation

Advanced Water Treatment

(4.3 CEUs)

- Control of Corrosion and Scaling
- Iron and Manganese Control
- Lime Softening
- Ion Exchange
- Adsorption
- Aeration
- Membrane Processes
- Water Treatment Plant Residuals
- Treatment Plant Instrumentation and Control

Water Treatment Math

(3.6 CEUs)

- Powers and Scientific Notation
- Dimensional Analysis
- Rounding and Estimating
- Solving for the Unknown Value
- Ratios and Proportions
- Averages
- Percentages
- Linear Measurements
- Area Measurements
- Volume Measurements

Applied Chemistry

(2.9 CEUs)

- Operator Chemistry Made Easy
- The Structure of Matter
- The Classification of Matter
- Valence, Chemical Formulas, and Chemical Equations
- Solutions
- Acids, Bases, and Salts
- Chemistry of Treatment Processes
- Chemical Dosage Problems

Water Treatment & Transmission Technology

Water Transmission and Distribution I (4.8 CEUs)

- Introduction to Water Distribution Systems
- Pipe Systems and Piping
- Water Storage
- Pumping Stations and Pumps
- Hydraulics of Water Distribution Systems
- Valves
- Fire Hydrants
- Motors and Engines
- Instrumentation and Control

Water Transmission and Distribution II (4.9 CEUs)

- Water Meters
- Backflow Prevention and Cross-Connections Control
- Water Main Installation
- Backfilling, Main Testing, and Installation Safety
- System Operations
- Water Services
- Information Management
- System Security and Emergency Response
- Public Relations

Water Quality (4.1 CEUs)

- Public Water Supply Regulations
- Water Quality Monitoring
- Laboratory Equipment and Instruments
- Microbiological Contaminants
- Physical and Aggregate Properties of Water
- Inorganic Chemicals
- Organic Contaminants
- Radiological Contaminants
- Customer Complaint Investigations

Applied Hydraulics (2.0 CEUs)

- Density and Specific Gravity
- Pressure and Force
- Piezometric Surface and Hydraulic Grade Line
- Head
- Head Loss
- Pumping Problems
- Flow Rate Problems
- Thrust Control

Electricity for the Water Industry (1.4 CEUs)

- Electricity, Magnetism, and Electrical Measurements
- Electrical Quantities and Terms
- Functions and Ratings of Electrical Equipment

Water Sources

Course Overview

This course is designed to introduce students to the sources of water and the various threats to our water supply. Course material consists of reading assignments, video lectures, and lesson quizzes.

Course completion requires that the student successfully complete each component of each individual lesson. Students are not permitted to “challenge” the course quizzes to receive credit. Review questions and written assignments must be submitted either online or uploaded in a Word document for the professor’s review. Lesson quizzes have a minimum passing score of 70%.

Upon successful completion of the course requirements, students will receive a certificate of completion for the Water Sources course, which is applicable toward a Certificate in Water Treatment Technology from American Water College.

Required Texts

Textbook: *Water Sources*, Principles and Practices of Water Supply Operations series
Edition: Fourth Edition
Author: Paul Koch
ISBN: 1-58321-782-7

Educational Objectives

- To provide students with an overview of water use and conservation
- To provide students with a foundational knowledge of water sources
- To acquaint students with various source water threats
- To provide students with an overview of source water protection
- To provide students with an overview of water quality, water quality regulations and the public health concerns regarding water quality

Water Sources

Evaluation

Students will be graded on their performance on each lesson quiz, and their course participation. Unless each unit is completed, the student will not be permitted to advance to the next lesson, and the student will not be awarded credit for completion until all assignments, quizzes and lectures are completed. Please contact our office with any questions.

Support

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Email Inquiries: Info@americanwatercollege.org

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Water Sources

Lesson 1 – Water Supply Hydrology

Summary of This Lesson

Hydrology is the branch of science concerned with the properties of the earth's water, especially water movement in relation to land. This lesson explores the 12 processes in the hydrologic cycle, from evaporation and transpiration to snowmelt and subsurface flow.

In the context of water treatment, the study of hydrology is primarily concerned with factors that interrupt or affect the water supply and quality of water to be treated. This lesson explores a few of those adverse factors and their impact. Additionally, this lesson will introduce students to water volume and flow measurement terminology.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain and identify the different processes in the hydrologic cycle
- Identify and explain groundwater sources and groundwater movement
- Identify and explain surface water sources and the impact of the hydrologic cycle on surface water sources
- Identify and explain water volume and flow measurements

Assignments for This Lesson

- Read Chapter 1, “Water Supply Hydrology,” in *Water Sources*
- Watch the video lecture for Lesson 1
- Write a 1-page paper describing the hydrologic cycle. Include the major processes and what happens during each process. Upload to professor for review.
- Complete the quiz for Lesson 1

Water Sources

Lesson 2 – Groundwater Sources

Summary of This Lesson

Wells are the most common and efficient means of tapping a groundwater source. This lesson takes an in-depth look at the different types of wells, well drilling, well maintenance, well development and aquifer recharge. Additionally, students are introduced to the contamination factors associated with wells, and means of preventing groundwater contamination.

Finally, this lesson introduces springs and infiltration galleries as means of tapping a groundwater source.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify the different types of water wells
- Correctly identify and explain well terminology
- Identify the different types of wells
- Explain well construction procedures and methods
- Explain different methods of well development
- Identify and explain sanitary considerations in well construction and use
- Evaluate aquifer performance
- Explain well operation, maintenance and abandonment
- Define and explain springs and infiltration galleries

Assignments for This Lesson

- Read Chapter 2, “Groundwater Sources, in *Water Sources*
- Watch the video lecture for Lesson 2
- Write a 1-2 page paper describing the sequence of events required to drill and finish a new well. Include in your paper all of the major components of a well and their function. Upload to professor for review.
- Complete the quiz for Lesson 2

Water Sources

Lesson 3 – Surface Water Sources

Summary of This Lesson

Surface water can be largely defined as water that is not under the ground; for the purposes of this lesson, surface water will describe water that is open to the atmosphere and subject to surface runoff. As a part of the hydrologic cycle, surface water makes up a significant source of treatable drinking water.

This lesson will explore the different sources, types and factors that influence surface water supply, as well as some methods of protecting surface water sources.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify surface water sources
- Explain surface runoff, and identify factors that influence surface runoff
- Explain surface source considerations
- Identify different methods of water storage
- Identify and explain intake structures and their purposes
- Identify and explain surface-supply operating problems and contamination concerns

Assignments for This Lesson

- Read Chapter 3, “Surface Water Sources,” in *Water Sources*
- Watch the video lecture for Lesson 3
- Write a few paragraphs describing the types of intake structures. Include in your paper why there are different types of intake structures and the purpose they serve. Students are not required to submit this assignment.
- Complete the quiz for Lesson 3

Water Sources

Lesson 4 – Emergency and Alternative Water Sources

Summary of This Lesson

When the public water supply is interrupted or contaminated, there is more at stake than just the inconvenience for the customers. There are potential health risks inherent in an interrupted supply, from microbiological to chemical contamination to the more obvious sanitary concerns.

Each utility should develop an emergency response plan in the event of anything from a water main break to direct contamination. We will also look at alternative sources of water utilities can and should tap if or when an emergency arises.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify causes of source disruption
- Identify causes of source contamination
- List and evaluate long and short-term solutions for disruption or contamination
- Identify and list alternative water sources
- List emergency water supply options
- Evaluate and explain water reuse options

Assignments for This Lesson

- Read Chapter 4, “Emergency and Alternative Water Sources,” in *Water Sources*
- Watch the video lecture for Lesson 4
- Write a short paper describing the possible sources of source water contamination. Upload to professor for review.
- Complete the quiz for Lesson 4

Water Sources

Lesson 5 – Use and Conservation of Water

Summary of This Lesson

Water is our most valuable, most plentiful and most vital resource. The availability of safe drinking water is often taken for granted, until there is a shortage or an emergency situation as we discussed in the previous lesson. It is important for both utilities and customers to be aware of their water usage, and to be educated on various ways to conserve water.

This lesson will take an in-depth look at the different categories of water use, conservation issues and methods, and water rights issues that may affect a municipality's water use or conservation.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- List the three categories of water use
- Explain water use in each category
- Explain water conservation methods
- Explain water conservation benefits
- Explain water conservation problems
- Identify and explain water rights issues

Assignments for This Lesson

- Read Chapter 5, “Use and Conservation of Water,” in *Water Sources*
- Watch the video lecture for Lesson 5
- Write a short paper describing steps a water utility can take to encourage the efficient use of water. Upload to professor for review.
- Complete the quiz for Lesson 5

Water Sources

Lesson 6 – Water Quality

Summary of This Lesson

The public water supply must not only be reliable and continuous, the water must conform to state and federal standards for water quality. It is important for the public to have complete confidence in the quality of the water their utility supplies to their tap.

This lesson looks at the four different characteristics of water quality, the public health concerns and importance of water quality, and the major public drinking water regulations.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- List and explain the four categories of water quality characteristics
- Identify and explain the factors that influence source water quality
- Explain the public health significance of water quality
- List the major public water supply regulations

Assignments for This Lesson

- Read Chapter 6, “Water Quality,” in *Water Sources*
- Watch the video lecture for Lesson 6
- Write a short paper describing the four broad categories of water quality characteristics and how they differ from each other. Give examples from each category. Upload to professor for review.
- Complete the quiz for Lesson 6

Water Sources

Lesson 7 – Water Source Protection

Summary of This Lesson

There are myriad ways to protect a public drinking water supply, starting with protection at the source. There are natural threats and human threats; both groundwater and surface water sources are vulnerable to contamination.

This lesson will cover the different types of pollution, their effect, and different means of protecting groundwater and surface water sources from future pollution.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the fundamental principles of source water protection
- Explain methods and evaluation of surface water protection
- Explain methods and evaluation of groundwater protection

Assignments for This Lesson

- Read Chapter 7, “Water Source Protection,” in *Water Sources*
- Watch the video lecture for Lesson 7
- Write a short paper discussing how the recreational use of lakes that are sources of drinking water can be accomplished. Upload to professor for review.
- Complete the quiz for Lesson 7

Introduction to Water Treatment

Course Overview

This course is designed to provide a foundational look at Water Treatment processes and methods. Course material consists of reading assignments, video lectures, review questions, study problems and lesson quizzes.

Course completion requires that the student successfully complete each component of each individual lesson. Review questions and written assignments must be submitted either online or uploaded in a Word document for the professor's review. Lesson quizzes have a minimum passing score of 70%.

Upon successful completion of the course requirements, students will receive a certificate of completion for 4.3 CEUs (43 contact hours) for the *Introduction to Water Treatment* course, which is applicable toward a Certificate in Water Treatment Technology from American Water College.

Required Texts

Textbook: *Water Treatment*, Principles and Practices of Water Supply Operations series

Edition: Fourth Edition

Author: Nicholas G. Pizzi

ISBN: 1-58321-777-0

Workbook: *Water Treatment Student Workbook*, Principles and Practices of Water Supply Operations series

Edition: Fourth Edition

ISBN: 1-58321-794-0

Educational Objectives

- To provide students with an overview of water treatment processes
- To provide students with a foundational knowledge of treatment processes at different stages of water treatment
- To acquaint students with the different components of a water treatment plant and their function

Introduction to Water Treatment

Evaluation

Students will be graded on their performance on each lesson quiz, and their course participation. Unless each unit is completed, the student will not be permitted to advance to the next lesson, and the student will not be awarded credit for completion until all assignments, quizzes and lectures are completed. Please contact our office with any questions.

Support

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Introduction to Water Treatment

Lesson 1 – Water Treatment Processes

Summary of This Lesson

Most water sources, whether groundwater or surface water, contain contaminants of some kind. The water treatment process is designed to remove those contaminants, providing safe and palatable drinking water. This lesson will look at reasons for treatment, selecting methods of treatment, and water source considerations.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain why the public water supply must generally be treated
- Identify and explain the advantages and disadvantages of groundwater as a source for the public drinking water
- Identify and explain the advantages and disadvantages of surface water as a source for the public drinking water
- Identify the factors influencing the type of treatment that must be used by a public water system
- Identify potential problems in treatment byproduct disposal
- Identify the different types of point-of-use treatment units and explain their use

Assignments for This Lesson

- Read Chapter 1, “Water Treatment Processes,” in *Water Treatment*
- Watch the video lecture for Lesson 1
- Answer Review Questions 1-6 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 1

Introduction to Water Treatment

Lesson 2 – Treatment of Water at the Source

Summary of This Lesson

While most water treatment occurs at a treatment plant, there are some situations where it is economically prudent, or practical, or even necessary, to treat water before it enters the treatment plant. This lesson will look at different reasons for treating water at the source, various source water threats, and different methods of source treatment.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify the problems that can be caused by algae growth in a water source
- Identify the problems that can be caused by aquatic plants in a reservoir
- Explain the methods of controlling the growth of algae
- Explain why stratification occurs in reservoirs, and how it can be prevented

Assignments for This Lesson

- Read Chapter 2, "Treatment of Water at the Source," in *Water Treatment*
- Watch the video lecture for Lesson 2
- Answer Review Questions 1-8 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for lesson 2

Introduction to Water Treatment

Lesson 3 – Preliminary Treatment

Summary of This Lesson

Preliminary treatment, or Pretreatment, is used when the water source contains large debris (rocks, logs, branches, aquatic plants, leaves, etc.) or sand, gravel and gritty substances. Failing to remove debris and grit may cause equipment damage or failure, clog pumps, and complicate the normal treatment process. Preliminary treatment is also used to remove massive amounts of sediment before entering the treatment plant, to alleviate the burden on the treatment plant's settling or sedimentation basins. Preliminary treatment can also reduce the amount of chemicals used in the treatment process. This lesson will focus primarily on screening, presedimentation and microstraining as methods for preliminary treatment.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify and explain the function and types of screens used on raw-water intakes
- Explain why presedimentation of surface water is often necessary
- Explain how presedimentation sand-and-grit removal devices work
- Explain what microstrainers are used for and how they separate

Assignments for This Lesson

- Read Chapter 3, "Preliminary Treatment," in *Water Treatment*
- Watch the video lecture for Lesson 3
- Answer Review Questions 1-7 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #3 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 3

Introduction to Water Treatment

Lesson 4 – Water Coagulation and Flocculation

Summary of This Lesson

Coagulation and Flocculation are the first two steps in conventional water treatment designed to remove turbidity and nonsettling solids from water. Nonsettling solids can be biological organisms, viruses, protozoans, color-causing particles and inorganic solids; not only are the visible nonsettling solids aesthetically unacceptable, but the bacteria and organic matter can cause serious illness if not removed from the water.

This lesson will examine coagulation, the process of adding and rapid-mixing chemical coagulant agents into raw water, and flocculation, the process of slow-mixing chemicals into water to assist in particle buildup. After coagulation and flocculation, the floc is settled out in sedimentation basins, and then filtered to remove any remaining suspended matter, which we'll cover in the following two lessons.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain why coagulation and flocculation are necessary in treating most surface water
- Explain the purpose of coagulation and flocculation in the treatment process
- Explain how coagulants work, and the difference between coagulants and coagulant aids
- Identify the different types of equipment used to feed coagulant chemicals
- Explain the basic design principles of rapid-mix facilities
- Understand the regulations that have an impact on the design or operation of the coagulation and flocculation process
- Identify and explain the advantages or disadvantages of various chemicals for coagulation and flocculation, and how they should be selected
- Explain how to properly monitor the coagulation and flocculation process for optimal results
- List and explain safety precautions related to handling chemicals
- Explain how and why proper records of the coagulation and flocculation process should be kept

Introduction to Water Treatment

Assignments for This Lesson

- Read Chapter 4, “Water Coagulation and Flocculation,” in *Water Treatment*
- Read Appendix A, “Specifications and Approval of Treatment Chemicals and System Components,” in *Water Treatment*
- Watch the video lecture for Lesson 4
- Answer Review Questions 1-21 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #4 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 4

Introduction to Water Treatment

Lesson 5 – Sedimentation Basins and Clarifiers

Summary of This Lesson

In the conventional water treatment process, sedimentation (also known as “clarification”) is between flocculation and filtration. Water flows slowly through the sedimentation basin or clarifier, allowing sand, grit, pollutants, floc and other solids to settle out of the water, thus lessening the load on the filters. This lesson will cover types of sedimentation basins, the principles of settling and optimal settling conditions, and collecting sludge for removal.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify the different types of sedimentation basins
- Identify and explain the different zones and parts of sedimentation basins
- Explain the principles of tube and plate settlers
- Explain the methods of sludge removal
- Identify typical problems encountered in operating sedimentation basins
- List the methods for disposing of sedimentation basin sludge

Assignments for This Lesson

- Read Chapter 5, “Sedimentation Basins and Clarifiers,” in *Water Treatment*
- Watch the video lecture for Lesson 5
- Answer Review Questions 1-11 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Student is **not** required to submit report for this lesson.
- Complete the quiz for Lesson 5

Introduction to Water Treatment

Lesson 6 – Filtration

Summary of This Lesson

After coagulation, flocculation and sedimentation (or clarification), the water is filtered. Filtration is most important in surface water treatment, as groundwater is naturally filtered in most cases. Surface water runoff and contamination pose the more serious threat, which filtration is designed to combat.

This lesson will cover filtration methods and principles, filter media and filtration monitoring for optimal performance and government regulatory compliance.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify the types of commonly used filtration facilities
- Explain the principle of gravity filter operation
- Explain the differences between pressure filters and gravity filters
- Identify the types of media used in filters
- Identify the types of underdrain systems used in filters
- Identify the types of commonly used filter controls
- Explain the purpose of backwashing filters and how backwashing is performed
- Identify the methods of monitoring filter operation
- Identify the principle regulations governing filtration operations
- Identify common filter operating problems
- List the types of records that must be kept on filter operation

Assignments for This Lesson

- Read Chapter 6, “Filtration,” in *Water Treatment*
- Watch the video lecture for Lesson 6
- Answer Review Questions 1-18 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problems #1-3 in the *Water Treatment Student Workbook*. Student is **not** required to submit reports for this lesson.
- Complete the quiz for Lesson 6

Introduction to Water Treatment

Lesson 7 – Disinfection

Summary of This Lesson

Disinfection is the addition of chemicals to destroy or inactivate disease-causing organisms in water. Viruses, bacteria, fungi or protozoa can cause symptoms ranging from mild illness to death. Disinfection is not sterilization, but disinfection does remove or inactivate organisms to acceptable levels.

This lesson examines the diseases and organisms that disinfection targets, the methods of disinfection (primarily chlorine or chlorine gas), regulations of disinfection by-products (DBPs), monitoring the disinfection process, and safety procedures for disinfection.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify the most commonly-occurring waterborne diseases in the US
- Explain the methods of disinfecting drinking water
- Explain chlorination principles
- Identify the common points of disinfection application
- Identify the equipment for handling and feeding chlorine gas
- Identify the equipment and facilities used for hypochlorination
- Identify the equipment used for other disinfection methods
- List state and federal regulations requiring the application of disinfectants to drinking water
- List state and federal regulations of disinfection by-products
- Explain the correct procedures for handling and connecting chlorine cylinders and containers
- Identify chlorine operation problems
- Explain chlorine control tests
- Identify and explain safety equipment and procedures for working with chlorine

Assignments for This Lesson

- Read Chapter 7, “Disinfection,” in *Water Treatment*
- Watch the video lecture for Lesson 7

Introduction to Water Treatment

- Answer Review Questions 1-33 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problems #1-2 in the *Water Treatment Student Workbook*. Submit your reports online.
- Complete the quiz for Lesson 7

Introduction to Water Treatment

Lesson 8 – Fluoridation

Summary of This Lesson

Fluoride can often be found in most drinking water sources, either as a naturally-occurring ion, or after being added at a treatment plant to provide this essential element for bone and tooth development. Fluoridation is the process of deliberately adding fluoride to the public water supply.

This lesson covers the process and reasons for fluoridation, the regulations affecting fluoridation, monitoring, tests and safety precautions.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- List the reasons for obtaining an optimum concentration of fluoride in drinking water
- Identify the long-term effects of excessive levels of fluoride in drinking water
- Identify the chemicals commonly used in fluoridating water
- Identify the equipment used for feeding fluoride to drinking water
- Identify the regulations requiring fluoridation of drinking water
- Explain how fluoride feed equipment is operated
- Identify and explain the operational control tests used when feeding fluoride
- Identify and explain safety precautions to observe in handling fluoride chemicals

Assignments for This Lesson

- Read Chapter 8, “Fluoridation,” in *Water Treatment*
- Watch the video lecture for Lesson 8
- Answer Review Questions 1-10 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #3 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 8

Advanced Water Treatment

Course Overview

This course is designed to provide an advanced overview of Water Treatment processes and methods. Course material consists of reading assignments, video lectures, review questions, study problems and lesson quizzes.

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Required Texts

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Author: Nicholas G. Pizzi
ISBN: 1-58321-777-0

Workbook: *Water Treatment Student Workbook, Principles and Practices of Water Supply Operations* series
Edition: Fourth Edition
ISBN: 1-58321-794-0

Educational Objectives

- To provide students with an overview of water treatment processes
- To provide students with an advanced understanding of treatment processes at different stages of water treatment
- To acquaint students with the different components of a water treatment plant and their function

Advanced Water Treatment

Evaluation

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Advanced Water Treatment

Lesson 1 – Control of Corrosion and Scaling

Summary of This Lesson

Some water systems find it necessary to take steps to control corrosion and scaling, not only to comply with federal or state regulations, but to extend the life of plumbing equipment, improve water quality and protect the public health. If the source water for a treatment plant causes corrosion or deposits scale on the system pipes and plumbing fixtures, there is a potential for lead or copper and other trace metals entering the public water supply.

This lesson will provide an overview of the reasons and methods of stabilizing water, controlling corrosion and scaling, and the chemicals involved in corrosion control.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the reasons for stabilizing water
- Explain the basic chemistry of corrosion and scale formation
- List state and federal regulations requiring corrosion control
- Identify and explain the methods for controlling corrosion
- Identify and explain the chemicals and equipment used for corrosion control
- Identify factors to be considered in selecting an appropriate stabilization process
- Explain the operation of a stabilization process
- Identify the common problems encountered in operating stabilization processes

Assignments for This Lesson

- Read Chapter 9, “Control of Corrosion and Scaling,” in *Water Treatment*
- Watch the video lecture for Lesson 1
- Answer Review Questions 1-16 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 1

Advanced Water Treatment

Lesson 2 – Iron and Manganese Control

Summary of This Lesson

Excessive iron or manganese can pose aesthetic, health or operational problems in a public water system. It is important not only to understand how iron and manganese can enter the water supply, but also to be familiar with the risks and treatment processes that remove iron and manganese from drinking water.

This lesson will provide an overview of the problems caused by excessive iron and manganese, the methods of removing iron and manganese, and the monitoring and regulations that govern iron and manganese control

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify the problems caused by excessive iron and manganese in water
- Explain the methods used for iron and manganese removal
- Identify and explain the equipment and facilities used for iron and manganese control
- List the regulations that apply to iron and manganese in drinking water
- Explain the monitoring and operation of iron and manganese removal processes

Assignments for This Lesson

- Read Chapter 10, “Iron and Manganese Control,” in *Water Treatment*
- Watch the video lecture for Lesson 2
- Answer Review Questions 1-9 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 2

Advanced Water Treatment

Lesson 3 – Lime Softening

Summary of This Lesson

The two most commonly-used water softening processes used in water treatment are lime softening, or the lime-soda ash process, and ion exchange. Ion exchange will be addressed in the next lesson, while this lesson focuses on the occurrence, chemistry and effects of hard water and how lime softening addresses water hardness.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify the characteristics and effects of hard and soft water
- List the minerals causing water hardness
- Identify the various types of water hardness
- Identify and explain the equipment used for lime-soda ash softening
- Identify regulations that may affect the softening process
- Explain how softening chemicals are stored and fed
- Explain how softening facilities are operated
- Identify and explain tests used for operational control of the softening process
- Identify and explain special safety precautions for handling softening chemicals

Assignments for This Lesson

- Read Chapter 11, “Lime Softening,” in *Water Treatment*
- Watch the video lecture for Lesson 3
- Answer Review Questions 1-15 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 3

Advanced Water Treatment

Lesson 4 – Ion Exchange

Summary of This Lesson

Ion exchange is the most common method for treatment plants to remove unwanted ions, some of which cause water hardness. This lesson will detail the ion exchange process and the developments made in this process. Additionally, we will look at the advantages and disadvantages of this process as a means of water treatment and softening.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify the chemicals that can be removed from water using ion exchange processes
- Identify and explain the advantages and disadvantages of ion exchange processes
- Explain the chemistry of ion exchange softening
- Identify and explain the facilities and equipment used for ion exchange softening
- Identify the problems encountered in disposing of wastes from the ion exchange process

Assignments for This Lesson

- Read Chapter 12, “Ion Exchange,” in *Water Treatment*
- Watch the video lecture for Lesson 4
- Answer Review Questions 1-9 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 4

Advanced Water Treatment

Lesson 5 – Adsorption

Summary of This Lesson

Adsorption is the adhesion of atoms, ions, or molecules from a gas, liquid, or dissolved solid on the surface of a solid. In water treatment, adsorption is used primarily to remove organic substances in water that can cause problems from taste and odor complaints to serious health problems. This lesson will provide an overview of the organic compounds that are objectionable and why, the regulations affecting adsorption and organic removal, the safety concerns when using carbon, and the operation and testing of adsorption processes.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the occurrence of organic chemicals of concern in groundwater and surface water
- Identify and explain the methods for removing organic chemicals of concern
- Explain the principles of adsorption
- Explain the methods of using powdered and granular activated carbon
- List federal and state regulations that may require the use of adsorption treatment
- Explain the operation and testing of adsorption processes
- Identify and explain special safety precautions that should be observed when using carbon

Assignments for This Lesson

- Read Chapter 13, “Adsorption,” in *Water Treatment*
- Watch the video lecture for Lesson 5
- Answer Review Questions 1-20 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 5

Advanced Water Treatment

Lesson 6 – Aeration

Summary of This Lesson

Natural aeration occurs when streams or rivers tumble over rocks and the water flow becomes turbulent. The turbulence brings air and water into contact, and the air dissolves into the water.

In water treatment, aeration is used to remove volatile organics from water, reduce the concentration of taste and odor-causing chemicals, to remove carbon dioxide and remove radon gas. When aeration is used, it's usually the first part of the treatment process. This lesson will look at the use and efficiency of aeration, and the problems associated with aeration as part of the treatment process.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain how aeration removes or modifies constituents in water
- Identify the troublesome constituents in water that are commonly removed by aeration
- Identify the types of aerators commonly used by public water systems
- Identify common problems associated with the operation of aeration equipment

Assignments for This Lesson

- Read Chapter 14, "Aeration," in *Water Treatment*
- Watch the video lecture for Lesson 6
- Answer Review Questions 1-9 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Student is **not** required to submit report for this lesson.
- Complete the quiz for Lesson 6

Advanced Water Treatment

Lesson 7 – Membrane Processes

Summary of This Lesson

Chemical dosing to remove contaminants can result in higher levels of DBPs in the water supply, which can cause problems of their own. Membrane processes are an alternative to utilizing disinfection solely in the treatment process. This lesson introduces membrane processes, and the advantages and disadvantages of using membrane as part of the treatment process.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify and explain the types of membrane processes
- Identify and explain the principles of microfiltration and nanofiltration/reverse osmosis
- Identify the types of equipment used
- Explain the operation of a membrane system

Assignments for This Lesson

- Read Chapter 15, “Membrane Processes,” in *Water Treatment*
- Watch the video lecture for Lesson 7
- Answer Review Questions 1-8 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 7

Advanced Water Treatment

Lesson 8 – Water Treatment Plant Residuals

Summary of This Lesson

It is important for water treatment plant residuals, such as sludge, to be handled and disposed of properly in order to ensure that operations continue smoothly and that the treatment plant stays in compliance with the state and federal regulations for water quality. It is crucial to develop a residuals-handling program and maintain adherence to the residuals-handling protocol.

This lesson discusses the purpose of residual dewatering and disposal and the means to accomplish both, and how the residual-handling applies as part of the overall water treatment process.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the importance of residuals handling, dewatering, and disposal to the overall operation of a water treatment plant
- Explain how and why residuals are dewatered
- Explain methods of calculating sludge quantities
- Explain how sludges are removed from water treatment basins
- Explain how solids separation processes are applied to water treatment plant sludges

Assignments for This Lesson

- Read Chapter 16, “Water Treatment Plant Residuals,” in *Water Treatment*
- Watch the video lecture for Lesson 8
- Answer Review Questions 1-15 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problems #1-2 in the *Water Treatment Student Workbook*. Submit your reports online.
- Complete the quiz for Lesson 8

Advanced Water Treatment

Lesson 9 – Treatment Plant Instrumentation and Control

Summary of This Lesson

It is important to be familiar with the different instrumentation and controls that are a part of a water treatment plant. These instruments and controls not only monitor flow, control processes with greater precision and improve the safety of the workplace, but they also track data and monitor the condition of equipment, which reduces the workload on operators. This lesson explores the different types of instruments and their purpose in the water treatment process.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the purpose and principal methods used for measuring flow
- Identify and explain the methods of measuring pressure and level
- Explain the principles of equipment automation
- Identify and explain the potential of computers for providing records and operational control in water treatment systems

Assignments for This Lesson

- Read Chapter 17, “Treatment Plant Instrumentation and Control,” in *Water Treatment*
- Watch the video lecture for Lesson 9
- Answer Review Questions 1-3 in the *Water Treatment Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Treatment Student Workbook*. Student is **not** required to submit report for this lesson

Water Treatment Math

Course Overview

This course is designed to acquaint students with the math, formulas and calculations used in water treatment, storage and distribution. Course material consists of reading assignments, video lectures, review questions, study problems and lesson quizzes.

Course completion requires that the student successfully complete each component of each individual lesson. Review questions and written assignments must be submitted either online or uploaded in a Word document for the professor's review. Lesson quizzes have a minimum passing score of 70%.

Upon successful completion of the course requirements, students will receive a certificate of completion for 3.6 CEUs (36 contact hours) for the Water Treatment Math course, which is applicable toward a Certificate in Water Treatment Technology from American Water College.

Required Texts

Textbook: *Basic Science Concepts and Applications, Principles and Practices of Water Supply Operations* series

Edition: Fourth Edition

Author: Nicholas G. Pizzi

ISBN: 1-58321-778-9

Workbook: *Basic Science Concepts and Applications Student Workbook, Principles and Practices of Water Supply Operations* series

Edition: Fourth Edition

ISBN: 1-58321-799-1

Educational Objectives

- To provide a foundational understanding of powers and scientific notation
- To demonstrate dimensional analysis
- To provide students with an understanding of rounding, estimating, and solving for an unknown value
- To demonstrate ratios, proportions, averages and percentages
- To provide students with an understand of linear measurements
- To provide a foundational understanding of area and volume measurement calculations
- To demonstrate conversions

Water Treatment Math

- To demonstrate graphs and tables and their uses in water treatment
- To provide students with a foundational understanding of calculating per capita water use, domestic water use, and industrial water use
- To demonstrate calculating average daily flow, surface overflow and weir overflow rates
- To provide a foundational understanding of filter loading and filter backwash rates
- To demonstrate mudball calculation
- To demonstrate detention time calculations
- To demonstrate well problem calculations

Evaluation

Students will be graded on their performance on each lesson quiz, and their course participation. Unless each unit is completed, the student will not be permitted to advance to the next lesson, and the student will not be awarded credit for completion until all assignments, quizzes and lectures are completed. Please contact our office with any questions.

Support

Students can contact our student support staff with any course-related, content-related or technology-related inquiries. Our office hours are Monday-Thursday, 9 to 5 PT, and Friday 9-12 PT.

Contact Info:

Phone Number: (661) 874-1655

Email Inquiries: Info@americanwatercollege.org

Additionally, students are encouraged to contact their professor directly with any questions or comments.

Water Treatment Math

Lesson 1 – Powers and Scientific Notation

Summary of This Lesson

In this lesson we will be covering two common methods of expressing numbers; powers and scientific notation.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to convert numbers and units from exponential form to whole numbers or expanded form
- How to change numbers and units from the expanded form into the exponential form
- How to take numbers out of positive and negative scientific notation
- How to put numbers in scientific notation

Assignments for This Lesson

- Read Mathematics Chapter 1, "Powers and Scientific Notation," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 1
- Answer the Review Questions for this lesson in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 1

Water Treatment Math

Lesson 2 – Dimensional Analysis

Summary of This Lesson

Dimensional Analysis is a tool to determine whether you have setup a problem correctly. Dimensional analysis does not use any numbers, it only uses the units to check the math problem.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to express a horizontal fraction as a vertical fraction
- How to divide a fraction
- How to divide out or cancel terms in the numerator and denominator of a fraction

Assignments for This Lesson

- Read Mathematics Chapter 2, "Dimensional Analysis," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 2
- Answer the Review Questions for chapter 2 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 2

Water Treatment Math

Lesson 3 – Rounding and Estimating

Summary of This Lesson

Estimating will help you have a ballpark idea of what your end answer should be. It gets you close to the final answer quickly. To estimate you will also be rounding. Rounding is done by replacing the final digits of a number with zeros.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to round a complex number to a place value in the decimal system
- How to estimate the approximate value of a calculation

Assignments for This Lesson

- Read Mathematics Chapter 3, "Rounding and Estimating," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 3
- Answer the Review Questions for chapter 3 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 3

Water Treatment Math

Lesson 4 – Solving for the Unknown Value

Summary of This Lesson

Often, you will be given a formula and all but one piece of information. Using the formula, you can solve for that last bit of information. At times though, you will have to change the formula using addition, subtraction, multiplication, and division.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to solve for the unknown value in formulas using multiplication and division
- How to solve for the unknown value in formulas using addition and subtraction

Assignments for This Lesson

- Read Mathematics Chapter 4, "Solving for the Unknown Value," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 4
- Answer the Review Questions for chapter 4 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 4

Water Treatment Math

Lesson 5 – Ratios and Proportions

Summary of This Lesson

Ratios are a common expression of how two numbers relate to each other. When ratios are proportionate, it means the numbers have been scaled up equally. We will cover what ratios and proportions are as well as how to calculate and use them.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How ratios and proportions are used
- The applications of ratios and proportions in water system calculations
- How to perform ratio and proportion calculations

Assignments for This Lesson

- Read Mathematics Chapter 5, "Ratios and Proportions," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 5
- Answer the Review Questions for chapter 5 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 5

Water Treatment Math

Lesson 6 – Averages

Summary of This Lesson

An average is simply taking a larger amount of data and finding one number to represent it. We will cover, how to calculate averages and what their used for.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to calculate averages of groups of numbers
- Common applications of averaging in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 6, "Averages," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 6
- Answer the Review Questions for chapter 6 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 6

Water Treatment Math

Lesson 7 – Percent

Summary of This Lesson

Percent is an expression per 100. Percentages are the way you can take any number, whether higher or lower than 100, and express it as a part of the whole. They can be converted to decimal numbers and fractions. Most percentages are used in formulas as decimals instead of percentages.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to perform percent calculations
- Common uses of percent calculations in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 7, "Powers and Scientific Notation," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 7
- Answer the Review Questions for chapter 7 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 7

Water Treatment Math

Lesson 8 – Linear Measurements

Summary of This Lesson

Linear measurements are a measure of distance. It is expressed as a straight line even if it comes from curved or angular objects. For example, a circumference is a linear measurement around a circle. When you write the circumference, you write it as a line in feet or yards or meters.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of performing linear measurements of angular and circular objects
- Common applications of linear measurements in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 8, "Linear Measurements," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 8
- Answer the Review Questions for chapter 8 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 8

Water Treatment Math

Lesson 9 – Area Measurements

Summary of This Lesson

Area measurements are measures of object surfaces. Commonly you will see square feet and square inches, but there are many other area measures you can use; such as, square yards, square meters, square centimeters and so on. Acre is also a unit of area. In this lesson though, we will be focusing on the three most commonly used area calculations of square, circle, and triangle.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to calculate area measurements of rectangles, triangles, and circles
- Common applications of area measurements in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 9, "Area Measurements," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 9
- Answer the Review Questions for chapter 9 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 9

Water Treatment Math

Lesson 10 – Volume Measurements

Summary of This Lesson

In lesson 8 we covered linear measurement. In lesson 9 we covered area measurements. Now we will add a 3rd dimension to cover volume measurements. Volume is the amount of space an object occupies. It will always be expressed as a cube, even for volumes with square or jagged edges.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to calculate volume measurements of shapes such as boxes, cylinders, cones, and shapes
- Common applications of volume measurements in water systems

Assignments for This Lesson

- Read Mathematics Chapter 10, "Volume Measurements," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 10
- Answer the Review Questions for chapter 10 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 10

Water Treatment Math

Lesson 11 – Conversions

Summary of This Lesson

Converting between units is the process of starting with one unit and ending up with another unit. All formulas are boiled down to converting between a unit (or group of units) and ending with another unit. To convert units, you will find equivalents and either multiply them or divide by them. In this lesson we will show you how to make sure you have the right units and how to know when to multiply or divide.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- What a unit is
- What an equivalent is
- How are units and equivalents used to solve math problems
- Methods for converting units
- Common unit conversions required in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 11, "Conversions," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 11
- Answer the Review Questions for chapter 11 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 11

Water Treatment Math

Lesson 12 – Graphs and Tables

Summary of This Lesson

Graphs and tables are simply a visual expression of data. In this lesson we will only cover the creation of simple graphs and tables and the method interpreting and using them.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to read and interpret graphs and tables
- The purpose of various graphs and tables used in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 12, "Graphs and Tables," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 12
- Answer the Review Questions for chapter 12 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 12

Water Treatment Math

Lesson 13 – Per Capita Water Use

Summary of This Lesson

Per capita water use is the measure of water use per person served. One way to express per capita use is gallons per capita per day (gpcd). We will cover calculating and using per capita water use in this lesson.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to calculate per capita water use
- The importance and uses of per capita water use data in water system operations.

Assignments for This Lesson

- Read Mathematics Chapter 13, "Per Capita Water Use," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 13
- Answer the Review Questions for chapter 13 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 13

Water Treatment Math

Lesson 14 – Domestic Water Use Based on Household Fixtures

Summary of This Lesson

Domestic water use generally makes up the largest portion of water use from a system. Common household fixture flow rates can be used to estimate the domestic water use.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of estimating domestic water use based on household fixtures
- How household fixture unit information is used in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 14, "Domestic Water Use Based on Household Fixtures," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 14
- Answer the Review Questions for chapter 14 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 14

Water Treatment Math

Lesson 15 – Water Use per Unit of Industrial Product Produced

Summary of This Lesson

Industrial production is generally measured by the product produced. Examples given in your text book are 20,000 gallons per ton of green beans in a cannery and 43,000 gallons used per ton of paper. This information is used to calculate the expected water requirements by an industrial plant.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of calculating water use per unit of industrial product produced
- How data on water use per unit of industrial product produced are used in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 15, "Water Use per Unit of Industrial Product Produced," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 15
- Answer the Review Questions for chapter 15 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 15

Water Treatment Math

Lesson 16 – Average Daily Flow

Summary of This Lesson

Average daily flow is just the total flow of water divided by the total number of days. This is an average, not a projection or estimate. Your actual daily flow will be different. The average daily flow is the number used to represent the daily flow required by the community.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of calculating average daily flow for a water system
- How average daily flow data are used in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 16, "Average Daily Flow," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 16
- Answer the Review Questions for chapter 16 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 16

Water Treatment Math

Lesson 17 – Surface Overflow Rate

Summary of This Lesson

Surface overflow rate is important in producing the best quality effluent. If the surface overflow rate is too high, there will be increased turbulence that results in suspended particles carrying over and not settling out. Surface overflow rate is calculated using the *surface area* not the weir length.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of calculating surface overflow rate
- How surface overflow rate data are used in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 17, "Surface Overflow Rate," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 17
- Answer the Review Questions for chapter 17 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 17

Water Treatment Math

Lesson 18 – Weir Overflow Rate

Summary of This Lesson

Weir overflow rate is the measure of water flowing over the weir. The weir is the length the water has to flow out of a tank (whether round or straight).

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of calculating weir overflow rate
- How weir overflow rate data are used in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 18, "Weir Overflow Rate," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 18
- Answer the Review Questions for chapter 18 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 18

Water Treatment Math

Lesson 19 – Filter Loading Rate

Summary of This Lesson

Filter loading rate is measured – in theory – much like surface overflow rate. You are calculating the flow based on the area. Only in this case, we are looking for the filter capacity and determining when a filter needs to be backwashed. Filter loading rate is calculated by the minute and not the day like surface overflow rate.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of calculating filter loading rate
- How filter loading rate data are used in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 19, "Filter Loading Rate," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 19
- Answer the Review Questions for chapter 19 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 19

Water Treatment Math

Lesson 20 – Filter Backwash Rate

Summary of This Lesson

It's important to know the backwash rate used in a filter because an excessive backwash rate will cause operational problems as will a backwash that's too slow. It is measured in gpm/ft² or inches of water rise/minute. Typical backwash rates vary from 15 gpm/ft² to 22 gpm/ft².

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of calculating filter backwash rate
- How filter backwash rate data are used in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 20, "Filter Backwash Rate," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 20
- Answer the Review Questions for chapter 20 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 20

Water Treatment Math

Lesson 21 – Mudball Calculation

Summary of This Lesson

Monitoring and calculating mudball formation is important particularly with sand filters. Mudballs can cause operational problems and filter malfunctions. Mudballs are calculated as a percent in the sample taken.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of calculating percent volume of mudballs in a filter
- How mudball calculation information is used in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 21, "Mudball Calculation," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 21
- Answer the Review Questions for chapter 21 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 21

Water Treatment Math

Lesson 22 – Detention Time

Summary of This Lesson

Detention time is the theoretical time a particle of water is in a tank or chamber. It is used for flash mixing, coagulation-flocculation, and sedimentation. It can be expressed as seconds, minutes, hours, or days. Most often seconds, minutes, and hours are used.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of determining detention time in a basin
- How detention time is used in water system operations

Assignments for This Lesson

- Read Mathematics Chapter 22, "Detention Time," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 22
- Answer the Review Questions for chapter 22 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 22

Water Treatment Math

Lesson 23 – Well Problems

Summary of This Lesson

Well yield, drawdown, and specific capacity are the three primary well calculations. This information is used to select the appropriate equipment and make operational changes.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Methods of calculation well yield, drawdown, and specific capacity
- How well calculations are used in water well operation and maintenance

Assignments for This Lesson

- Read Mathematics Chapter 23, "Well Problems," in Basic Science Concepts and Applications
- Watch the video lecture for Lesson 23
- Answer the Review Questions for chapter 23 in the *Basic Science Concepts and Applications Student Workbook*.
- Complete the quiz for Lesson 23

Applied Chemistry

Course Overview

This course is designed to acquaint students with the chemistry principles involved in water treatment, storage and distribution, and the math that applies to chemistry principles. Course material consists of reading assignments, video lectures, review questions, study problems and lesson quizzes.

Course completion requires that the student successfully complete each component of each individual lesson. Review questions and written assignments must be submitted either online or uploaded in a Word document for the professor's review. Lesson quizzes have a minimum passing score of 70%.

Upon successful completion of the course requirements, students will receive a certificate of completion for the Applied Chemistry course, which is applicable toward a Certificate in Water Treatment Technology from American Water College.

Required Texts

Textbook: *Basic Science Concepts and Applications, Principles and Practices of Water Supply Operations* series

Edition: Fourth Edition

Author: Nicholas G. Pizzi

ISBN: 1-58321-778-9

Workbook: *Basic Science Concepts and Applications Student Workbook, Principles and Practices of Water Supply Operations* series

Edition: Fourth Edition

ISBN: 1-58321-799-1

Educational Objectives

- To provide students with an overview of the structure of matter
- To provide students with an overview of the classification of matter
- To acquaint students with chemical formulas and equations
- To provide students with an overview of solutions, calculating solutions and dilution calculations
 - To acquaint students with acids, bases and salts
 - To provide students with an overview of the chemistry of water treatment processes
 - To acquaint students with chemical dosage problems and calculations

Applied Chemistry

Evaluation

Students will be graded on their performance on each lesson quiz, and their course participation. Unless each unit is completed, the student will not be permitted to advance to the next lesson, and the student will not be awarded credit for completion until all assignments, quizzes and lectures are completed. Please contact our office with any questions.

Support

Students can contact our student support staff with any course-related, content-related or technology-related inquiries. Our office hours are Monday-Thursday, 9 to 5 PT, and Friday 9-12 PT.

Contact Info:

Phone Number: (661) 874-1655

Email Inquiries: Info@americanwatercollege.org

Additionally, students are encouraged to contact their professor directly with any questions or comments.

Water Transmission and Distribution I

Course Overview

This course is designed to provide a foundational understanding of Water Transmission and Distribution, system maintenance and inspection, and the safety of the public water supply. Course material consists of reading assignments, video lectures, review questions, study problems and lesson quizzes.

Course completion requires that the student successfully complete each component of each individual lesson. Review questions and written assignments must be submitted either online or uploaded in a Word document for the professor's review. Lesson quizzes have a minimum passing score of 70%.

Upon successful completion of the course requirements, students will receive a certificate of completion for 4.8 CEUs (48 contact hours) the *Water Transmission and Distribution I* course, which is applicable toward a Certificate in Water Transmission Technology from American Water College.

Required Texts

Textbook: *Water Transmission and Distribution*, Principles and Practices of Water Supply Operations series

Edition: Fourth Edition

Author: Larry W. Mays

ISBN: 1-58321-781-9

Workbook: *Water Transmission and Distribution Student Workbook*, Principles and Practices of Water Supply Operations series

Edition: Fourth Edition

ISBN: 1-58321-800-9

Educational Objectives

- To provide students with an overview of system design, operation and maintenance
- To provide students with a foundational knowledge of types of equipment used to transmit and distribute water
- To acquaint students with the principles of water storage and safety
- To provide students with a foundational knowledge of pumps, pumping stations, operation, safety, record keeping and maintenance
 - To acquaint students with valves and hydrants, their inspection, installation and maintenance

Water Transmission and Distribution I

- To provide a foundational overview of motors and engines used in water transmission and distribution
- To acquaint students with the instrumentation and control of a water distribution system

Evaluation

Students will be graded on their performance on each lesson quiz, and their course participation. Unless each unit is completed, the student will not be permitted to advance to the next lesson, and the student will not be awarded credit for completion until all assignments, quizzes and lectures are completed. Please contact our office with any questions.

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Students can contact our student support staff with any course-related, content-related or technology-related inquiries. Our office hours are Monday-Thursday, 9 to 5 PT, and Friday 9-12 PT.

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Phone Number: (661) 874-1655

Email Inquiries: Info@americanwatercollege.org

Additionally, students are encouraged to contact their professor directly with any questions or comments.

Water Transmission and Distribution I

Lesson 1 – Introduction to Water Distribution Systems

Summary of This Lesson

Planning is the first step in the creation of a distribution system. Proper planning will reflect the consumption and fire demand of the community. In this lesson we will cover the various types of distribution systems based on the water sources from ground water to purchased surface water. We will also cover the components and purpose of the distribution system for the different water sources.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The purpose of drinking water distribution systems
- The types of public water systems categorized by water source
- The components of distribution systems

Assignments for This Lesson

- Read Chapter 1, "Introduction to Water Distribution Systems," in Water Transmission and Distribution
- Watch the video lecture for Lesson 1
- Answer Review Questions 1-10 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 1

Water Transmission and Distribution I

Lesson 2 – Pipe Systems and Piping

Summary of This Lesson

There are three basic distribution layouts; arterial-loop systems, grid systems, and tree systems. Each system type has advantages and disadvantages. Depending on the needs of the system, a different layout should be chosen. Once the layout is chosen, you must map the system and select your pipe materials. In this lesson, we will cover the considerations for selecting the layout as well as the pipe materials.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The common configurations used in distribution system design
- The principal considerations involved in sizing water mains
- Considerations that must be made when piping materials are selected
- The purpose of AWWA and ANSI/NSF standards
- The four general types of piping used in water systems
- The general characteristics of commonly used pipe materials
- The principal advantages and disadvantages of each type of pipe
- The types of joints and fittings used with each type of pipe

Assignments for This Lesson

- Read Chapter 2, "Pipe Systems and Piping" in Water Transmission and Distribution
- Read Appendix A, " Specifications and Approval of Treatment Chemicals and System Components" in Water Transmission and Distribution
- Watch the video lecture for Lesson 2
- Answer Review Questions 1-12 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1-2 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 2

Water Transmission and Distribution I

Lesson 3 – Water Storage

Summary of This Lesson

Distribution storage is an important part of meeting the consumer and fire demands of a public water system. In this lesson we will cover the purposes of water storage as well as the different storage structure options for different community needs.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The principal reasons for storing water in the distribution system
- The difference between operating storage and emergency storage requirements
- The common construction features and accessory devices for water storage tanks
- The key factors that must be considered to select the proper size and location for a water reservoir
- The important points in the operation and maintenance of water storage facilities

Assignments for This Lesson

- Read Chapter 3, "Water Storage" in Water Transmission and Distribution
- Watch the video lecture for Lesson 3
- Answer Review Questions 1-9 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #2 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 3

Water Transmission and Distribution I

Lesson 4 – Pumping Stations and Pumps

Summary of This Lesson

When pumps are used in a distribution system, they account for most of the energy consumed in the distribution system. The purposes and types of pumps varies by needs. We will cover the types of pumps and their uses as well as the maintenance for each types of pump.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The operating principles of common types of velocity and positive-displacement pumps
- The general operating procedures for centrifugal pumps and the reasons for these procedures
- The regular preventive maintenance procedures required for centrifugal pumps
- The purpose and function of the principle parts of a centrifugal pump

Assignments for This Lesson

- Read Chapter 4, "Pumping Stations and Pumps" in Water Transmission and Distribution
- Watch the video lecture for Lesson 4
- Answer Review Questions 1-14 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 4

Water Transmission and Distribution I

Lesson 5 – Hydraulics of Water Distribution Systems

Summary of This Lesson

This lesson covers specific areas of hydraulics related to the distribution system. These include pipe flows, water age and system performance, using a network analysis, and hydraulic transients.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How to calculate flow of water in a pipe
- How the variables in the Hazen-Williams formula are determined
- The components and interactions of system hydraulics
- The capabilities and use of network analysis

Assignments for This Lesson

- Read Chapter 5, "Hydraulics of Water Distribution Systems" in Water Transmission and Distribution
- Watch the video lecture for Lesson 5
- Answer Review Questions 1-10 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 5

Water Transmission and Distribution I

Lesson 6 – Valves

Summary of This Lesson

Every distribution system requires different types of valves. Even within one system you will have numerous valves for different purposes. This lesson will cover the different types of valves and the uses for each one. We will also cover the maintenance, inspections, and record keeping of the valves.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The conditions under which different types of valves are installed in the distribution system
- The common types of valves and components
- The purpose of a valve exercise program and how one should be conducted
- The recommended inspection checks and maintenance that should be performed on valves
- The various types of valve operators used in water systems
- Records that should be kept on distribution system valves

Assignments for This Lesson

- Read Chapter 6, "Valves" in Water Transmission and Distribution
- Watch the video lecture for Lesson 6
- Answer Review Questions 1-10 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1-4 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 6

Water Transmission and Distribution I

Lesson 7 – Fire Hydrants

Summary of This Lesson

Although fighting fires is the most important function of a fire hydrant, they do serve more purposes than just one. We will cover the different types of hydrants, the uses of hydrants, and the proper maintenance and testing of hydrants. We will also cover the safety precautions for testing and flushing a hydrant.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The various uses of hydrants in a distribution system
- The difference between the dry-barrel and wet-barrel hydrants
- The principal components of dry-barrel and wet-barrel hydrants
- Proper procedures for installing, operating, inspecting, and maintaining hydrants
- The proper way to perform a hydrant flow test
- The information that should be recorded when fire hydrants are installed, inspected, and repair
- Safety precaution to observe during flushing and testing

Assignments for This Lesson

- Read Chapter 7, "Fire Hydrants" in Water Transmission and Distribution
- Watch the video lecture for Lesson 7
- Answer Review Questions 1-14 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1-4 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 7

Water Transmission and Distribution I

Lesson 8 – Motors and Engines

Summary of This Lesson

Both electric motors and combustion engines are used in the distribution system. Each has a different purpose. Electric motors make up 95% of the pumps used in distribution systems, while combustion engines are used primarily for power backup and use in remote locations where electricity is not available.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The types of electric motors used to power water systems components
- The principal types of motor control equipment used
- Methods used to improve the efficiency of electrically driven pumps
- The principal parts that must be periodically maintained or repaired in electric motors and control equipment
- The principal types of combustion engines used to power water system equipment
- The important points in the operation and maintenance of engines

Assignments for This Lesson

- Read Chapter 8, "Motors and Engines" in Water Transmission and Distribution
- Watch the video lecture for Lesson 8
- Answer Review Questions 1-11 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 8

Water Transmission and Distribution I

Lesson 9 – Instrumentation and Control

Summary of This Lesson

SCADA allows an operator to monitor and control flowrates, pressures, water levels, and more that are part of the distribution network. In this lesson, we will look at the common sensors, telemetry, primary and secondary instrumentation. We will also cover the different degrees of automation ranging from manual to automatic.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The various types of primary and secondary instrumentation used in water system operation
- The method of operation of common sensors
- How a basic telemetry system works
- Ways in which manual, semiautomatic, and automatic control systems can be arranged to operate
- How supervisory control and data acquisition (SCADA) can be used in water system operation
- The general requirements for maintenance of instruments and control equipment

Assignments for This Lesson

- Read Chapter 9, "Instrumentation and Control" in Water Transmission and Distribution
- Watch the video lecture for Lesson 9
- Answer Review Questions 1-9 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #2 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 9

Water Transmission and Distribution II

Course Overview

This course is designed to provide an advanced understanding of Water Transmission and Distribution, system maintenance and inspection, and the safety of the public water supply. Course material consists of reading assignments, video lectures, review questions, study problems and lesson quizzes.

Course completion requires that the student successfully complete each component of each individual lesson. Review questions and written assignments must be submitted either online or uploaded in a Word document for the professor's review. Lesson quizzes have a minimum passing score of 70%.

Upon successful completion of the course requirements, students will receive a certificate of completion for 4.9 CEUs (49 contact hours) for the Water Transmission and Distribution II course, which is applicable toward a Certificate in Water Treatment Technology from American Water College.

Required Texts

Textbook: *Water Transmission and Distribution*, Principles and Practices of Water Supply Operations series

Edition: Fourth Edition

Author: Larry W. Mays

ISBN: 1-58321-781-9

Workbook: *Water Transmission and Distribution Student Workbook*, Principles and Practices of Water Supply Operations series

Edition: Fourth Edition

ISBN: 1-58321-800-9

Educational Objectives

- To acquaint students with water metering, meter testing, maintenance and repair, and meter reading
- To provide students with a foundational knowledge of backflow prevention and the reasons for cross-connection control
- To acquaint students with water mains, installation and safety
- To provide students with a foundational knowledge information management and record-keeping responsibilities
 - To acquaint students with threats to the public water supply, vulnerabilities in the public water supply, and emergency response plans

Water Transmission and Distribution II

- To provide a foundational understanding of public relations and the importance of an informed public

Evaluation

Students will be graded on their performance on each lesson quiz, and their course participation. Unless each unit is completed, the student will not be permitted to advance to the next lesson, and the student will not be awarded credit for completion until all assignments, quizzes and lectures are completed. Please contact our office with any questions.

Support

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Contact Info:

Phone Number: (661) 874-1655

Email Inquiries: Info@americanwatercollege.org

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Water Transmission and Distribution II

Lesson 1 – Water Meters

Summary Of This Lesson

There are many types of water meters ranging from positive-displacement to magnetic and sonic meters. Each meter has advantages for different situation including corrosive water, large flow volumes, small/occasional flow and more. We will be covering the types of meters and their uses as well as installation and maintenance in this lesson.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The importance of metering water entering the distribution system, as well as water used by customers
- The basic operating principles of meters commonly used in water systems
- Factors that influence the type and size of meter used for various purposes
- Conditions that influence where meters are located

Assignments For This Lesson

- Read Chapter 10, "Water Meters," in Water Transmission and Distribution
- Watch the video lecture for Lesson 1
- Answer Review Questions 1-10 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Complete the quiz for Lesson 1

Water Transmission and Distribution II

Lesson 2 – Backflow Prevention and Cross-Connection Control

Summary Of This Lesson

Cross-connections can lead to nonpotable water entering the distribution system. This can lead to serious consequences if not controlled. Backflow devices are designed to prevent this from happening. This lesson will give you a brief overview backflow prevention and cross-connection control. We will cover the backflow prevention devices and how to how cross-connections occur.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The public health hazards that are created by cross-connections
- The factors that allow backflow and backsiphonage to occur
- Types of installations or facilities that are likely to have cross-connections
- Appropriate backflow-prevention devices that should be used based on the degree of hazard involved

Assignments For This Lesson

- Read Chapter 11, "Backflow Prevention and Cross-Connection Control" in Water Transmission and Distribution
- Watch the video lecture for Lesson 2
- Answer Review Questions 1-10 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1-2 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 2

Water Transmission and Distribution II

Lesson 3 – Water Main Installation

Summary Of This Lesson

Water main installation is one of the most important parts of a distribution system. Improper installation can lead to unnecessary maintenance resulting in frequent loss of service and fire protection as well as higher operating cost. Different pipe materials will have different specific installation guidelines. In this lesson we will cover the general principles of preparation and safety that can be applied to any main installation.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How pipes and fittings should be handled and prepared for installation
- Methods of excavations for water main installation
- Safety precautions that should be observed during trenching and pipe installation, and methods of preventing trench wall failure
- Procedures to be followed while laying pipe
- Methods of making connections to existing mains
- The importance of blocking and anchoring mains against movement and common restraint methods that are used

Assignments For This Lesson

- Read Chapter 12, "Water Main Installation" in Water Transmission and Distribution
- Watch the video lecture for Lesson 3
- Answer Review Questions 1-11 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 3

Water Transmission and Distribution II

Lesson 4 – Backfilling, Main Testing, and Installation Safety

Summary Of This Lesson

Once the water main has been installed, backfilling, testing for leaks, disinfection, and bacteriological testing must be done to ensure the pipe is ready for use. We will be covering the purpose and methods of backfilling and leak testing the water mains. Then we will cover the disinfection and flushing required before the water main goes online. Lastly, the area should be restored to the state it was before the construction took place, including structures and vegetation.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The proper methods of backfilling and compacting the backfill in an excavation
- The procedures in pressure and leak testing of new water mains
- The methods of flushing and disinfecting newly constructed or repaired water mains
- Restoration of structures and vegetation following construction
- Safety precautions that must be followed on a construction site to protect worker and the public

Assignments For This Lesson

- Read Chapter 13, " Backfilling, Main Testing, and Installation Safety " in Water Transmission and Distribution
- Watch the video lecture for Lesson 4
- Answer Review Questions 1-11 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 4

Water Transmission and Distribution II

Lesson 5 – System Operations

Summary Of This Lesson

There are two primary objectives of distribution system operations. First is to maintain water quality through the distribution starting from the point of entry and ending at the point of use. Second is to maintain pressure to meet peak demand and fire flow requirements. With these two objectives in mind, we will discuss operational practices and procedures to accomplish these tasks.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The importance and techniques for maintaining distribution system water quality
- The practices and procedures to ensure system reliability resulting in acceptable pressure at all times and providing adequate flow for all distribution system uses

Assignments For This Lesson

- Read Chapter 14, " System Operations" in Water Transmission and Distribution
- Watch the video lecture for Lesson 5
- Answer Review Questions 1-9 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Complete the quiz for Lesson 5

Water Transmission and Distribution II

Lesson 6 – Water Services

Summary Of This Lesson

Water is delivered from the main line to the customer through water service lines. These vary in size and length depending on the connection type and flow required. This lesson will look at the components of a service line, factors governing the size, pipe materials, operating the equipment used for a service tap and record keeping for a service installation.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- What is meant by a service connection
- The components that make up a typical residential connection
- The principal factors that govern the size of water service lines
- Factors that should be evaluated in the selection of pipe materials used for a service connection
- The different types and sizes of connections used to connect service lines
- The use of corporation stops and the different types available
- The method of operating the equipment used in making service taps
- The need for keeping good records of water service installations

Assignments For This Lesson

- Read Chapter 15, "Water Services" in *Water Transmission and Distribution*
- Watch the video lecture for Lesson 6
- Answer Review Questions 1-10 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 6

Water Transmission and Distribution II

Lesson 7 – Information Management

Summary Of This Lesson

We have gone over the importance of good record keeping, but now we will cover how to manage all the records and other information collected. We will cover typical groups of information, uses of computers, system maps and records for system equipment. All this is important not only for new employees to have access to, but also for the seasoned operators to make informed decisions.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- Typical uses of computers for water system information management
- The importance of maintaining system maps, drawing, and records
- Examples of maps, drawings, and records commonly used in distribution system operations, as well as their purposes
- Records that should be maintained for water distribution system equipment

Assignments For This Lesson

- Read Chapter 16, "Information Management" in Water Transmission and Distribution
- Watch the video lecture for Lesson 7
- Answer Review Questions 1-11 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 7

Water Transmission and Distribution II

Lesson 8 – System Security and Emergency Response

Summary Of This Lesson

Supplying clean reliable drinking water is something most people take for granted. They rarely stop to think about it until it's not there. Natural disasters like hurricanes, earthquakes, and draughts are just a couple of causes for water shortage or quality concerns. Terror attacks are another threat to be aware of. This lesson will cover the types of emergencies that effect water utilities in the supply or quality of the water and the ways that utilities are vulnerable.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- The types of emergencies that could effect water utilities
- The areas that could make a water utility vulnerable
- The importance of protecting computer systems at a water utility
- The components of a vulnerability assessment

Assignments For This Lesson

- Read Chapter 17, " System Security and Emergency Response" in Water Transmission and Distribution
- Watch the video lecture for Lesson 8
- Answer Review Questions 1-11 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 8

Water Transmission and Distribution II

Lesson 9 – Public Relations

Summary Of This Lesson

Distribution operators are the most important people when it comes to public relations. Operators have more direct contact with the customers and will either instill confidence or distrust in the quality of the water. Happy and confident customers will pay their bills promptly and without complaint. Unhappy customers will complain and resort to drinking bottled water. The media campaigns projects will only be undermined if the operators have poor attitudes toward customers.

Lesson Objectives

Upon completion of this lesson, students will gain an understanding of:

- How public relations enhance a water utility's image
- Specific personal behaviors that improve or detract from customer relations
- Why informed employees are necessary for good public relations
- How written guidelines can assist personnel in maintaining good relations with customers
- Types of formal public relations programs and how they benefit customer awareness and utility operations

Assignments For This Lesson

- Read Chapter 18, " Public Relations" in Water Transmission and Distribution
- Watch the video lecture for Lesson 9
- Answer Review Questions 1-9 in the *Water Transmission and Distribution Student Workbook*. Submit your answers online.
- Answer Study Problem #1-2 in the *Water Transmission and Distribution Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 9

Water Quality

Course Overview

This course is designed to provide an overview of water quality regulations, methods of compliance, instrumentation used to monitor and ensure water quality, and the analysis required to supply clean and safe drinking water to the public. Course material consists of reading assignments, video lectures, review questions, study problems and lesson quizzes.

Course completion requires that the student successfully complete each component of each individual lesson. Review questions and written assignments must be submitted either online or uploaded in a Word document for the professor's review. Lesson quizzes have a minimum passing score of 70%.

Upon successful completion of the course requirements, students will receive a certificate of completion for the Water Quality course, which is applicable toward a Certificate in Water Treatment Technology from American Water College.

Required Texts

Textbook: *Water Quality, Principles and Practices of Water Supply Operations* series

Edition: Fourth Edition

Author: Joseph A. Ritter

ISBN: 1-58321-780-0

Workbook: *Water Quality Student Workbook, Principles and Practices of Water Supply Operations* series

Edition: Fourth Edition

ISBN: 1-58321-798-3

Educational Objectives

- To provide an overview of state and federal water quality regulations
- To acquaint students with the instrumentation utilized in maintaining water quality
- To acquaint students with tests and methods of compliance
- To provide an overview of analysis and data monitoring
- To demonstrate the public's reliance on operators to provide clean and safe drinking water

Water Quality

Evaluation

Students will be graded on their performance on each lesson quiz, and their course participation. Unless each unit is completed, the student will not be permitted to advance to the next lesson, and the student will not be awarded credit for completion until all assignments, quizzes and lectures are completed. Please contact our office with any questions.

Support

Students can contact our student support staff with any course-related, content-related or technology-related inquiries. Our office hours are Monday-Thursday, 9 to 5 PT, and Friday 9-12 PT.

Contact Info:

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Email Inquiries: Info@americanwatercollege.org

Additionally, students are encouraged to contact their professor directly with any questions or comments.

Water Quality

Lesson 1 – Public Water Supply Regulations

Summary of This Lesson

There are both state and federal regulations that govern water quality standards and methods of treatment. The Safe Drinking Water Act is the most widespread and overarching regulation in effect today. This lesson takes a detailed look at the SDWA, other regulations, and the contaminants that are regulated, with their maximum allowable levels.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain why the Safe Drinking Water Act was passed by Congress
- Explain why amendments to the SDWA were passed
- Identify the classes of public water systems covered by the act
- Explain the principle requirements of the act
- Explain special regulation requirements that have been enacted by USEPA

Assignments for This Lesson

- Read Chapter 1, “Public Water Supply Regulations,” in *Water Quality*
- Watch the video lecture for Lesson 1
- Answer Review Questions 1-11 in the *Water Quality Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Quality Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 1

Water Quality

Lesson 2 – Water Quality Monitoring

Summary of This Lesson

All water systems must monitor their water quality to some extent; a surface water treatment plant may need more monitoring, while a groundwater system may require less. It is important to monitor water for contaminants and to ensure that the treatment process is both effective and economical.

This lesson covers sampling and monitoring, data and records, and sample preservation and transportation.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the importance of representative sampling
- Explain the way in which grab, and composite samples are collected, and under what circumstances each method is used
- Explain the selection of proper sample volumes
- Identify and explain methods of establishing representative sampling points
- Explain the importance and limitations of sample preservation
- Explain the importance of proper sample labeling and record keeping

Assignments for This Lesson

- Read Chapter 2, “Water Quality Monitoring,” in *Water Quality*
- Watch the video lecture for Lesson 2
- Answer Review Questions 1-11 in the *Water Quality Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Quality Student Workbook*. Keep the required sketch in your notes, and submit the remainder of your report online.
- Complete the quiz for Lesson 2

Water Quality

Lesson 3 – Water Laboratory Equipment and Instruments

Summary of This Lesson

In our last lesson, we covered the importance of monitoring water quality. In this lesson, we will cover the labware and instruments that allow operators to perform monitoring analyses. These analyses are important in identifying, correcting or preventing potential water quality issues, and all operators should understand the lab procedures for those reasons.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify general labware and laboratory equipment
- Identify analytical instruments commonly used in a laboratory
- Identify and explain basic labware and instruments necessary to conduct routine process control tests

Assignments for This Lesson

- Read Chapter 3, “Water Laboratory Equipment and Instruments,” in *Water Quality*
- Watch the video lecture for Lesson 3
- Answer Review Questions 1-12 in the *Water Quality Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Quality Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 3

Water Quality

Lesson 4 – Microbiological Contaminants

Summary of This Lesson

From bacteria and viruses to protozoa, water is prone to pathogenic (disease-causing) organisms. These microbiological pathogens can cause illness, or in some cases death. It's crucial to be aware of the different contaminants, their effect, and the method of treating or removing these contaminants.

This lesson covers the different types of microbiological contaminants, and the common methods of monitoring and removal.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the significance of pathogens in drinking water
- Explain why coliform bacteria are used as an indicator of pathogenic organisms
- Identify and explain the general procedures involved in the commonly used microbiological tests of drinking water
- Explain the important new concepts in the Total Coliform Rule

Assignments for This Lesson

- Read Chapter 4, “Microbiological Contaminants,” in *Water Quality*
- Watch the video lecture for Lesson 4
- Answer Review Questions 1-10 in the *Water Quality Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Quality Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 4

Water Quality

Lesson 5 – Physical and Aggregate Properties of Water

Summary of This Lesson

The physical makeup of water can affect the treatment process, making chemical or biological contaminants harder to treat. This lesson covers the physical properties of water and how to sample and test the physical characteristics of water.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the significance of the more common physical tests required for public water system operation
- Identify and explain the methods of sampling for physical tests of water
- Identify and explain the methods of performing physical tests of water

Assignments for This Lesson

- Read Chapter 5, “Physical and Aggregate Properties of Water,” in *Water Quality*
- Watch the video lecture for Lesson 5
- Answer Review Questions 1-10 in the *Water Quality Student Workbook*. Submit your answers online.
- Answer Study Problems #1-3 in the *Water Quality Student Workbook*. Submit your reports online.
- Complete the quiz for Lesson 5

Water Quality

Lesson 6 – Inorganic Chemicals

Summary of This Lesson

The USEPA regulates several inorganic compounds in water, including: antimony, asbestos, barium, beryllium, cadmium, chromium, copper, cyanide, fluoride, lead, mercury, nitrate, nitrite, selenium, thallium, arsenic, and others. In this lesson, we will explore the different inorganic contaminants, the significance of its presence in water, and the method of sampling or testing for these contaminants.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the significance of the more important inorganic chemicals of concern in drinking water treatment
- Identify and explain methods of sampling for inorganic chemicals
- Identify and explain methods of analysis for inorganic chemicals

Assignments for This Lesson

- Read Chapter 6, “Inorganic Chemicals,” in *Water Quality*
- Watch the video lecture for Lesson 6
- Answer Review Questions 1-10 in the *Water Quality Student Workbook*. Submit your answers online.
- Answer Study Problems #1-2 in the *Water Quality Student Workbook*. Submit your reports online.
- Complete the quiz for Lesson 6

Water Quality

Lesson 7 – Organic Contaminants

Summary of This Lesson

Organic contaminants most often occur in surface water sources as the result of plants or algae growth, and human activities. Organic compounds can also occur as a result of water treatment and transmission. These contaminants can cause treatment issues and serious health problems if not treated properly. This lesson will cover the sources and solutions for organic contaminants.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify the basic properties of organic chemicals
- Identify the principal sources of natural and synthetic organic substances in water
- Explain the adverse health effects of organic chemicals
- Explain the methods of measuring the concentration of organic chemicals in water
- Explain the methods of controlling organic chemicals in drinking water

Assignments for This Lesson

- Read Chapter 7, “Organic Contaminants,” in *Water Quality*.
- Watch the video lecture for Lesson 7
- Answer Review Questions 1-9 in the *Water Quality Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Quality Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 7

Water Quality

Lesson 8 – Radiological Contaminants

Summary of This Lesson

Our final lesson on contaminants for this course focuses on radiological contamination issues. Natural radioactivity can contaminate water, or it can be the result of industrial or medical sources. The health risks are widespread and potentially life-threatening. This lesson takes an in-depth look at the structure of radioactive particles, the health hazards, and the methods of treating water for radioactivity removal.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the basic theory of radioactive materials
- Identify the radioactive materials of principal concern in drinking water
- Explain the adverse health effects of radioactivity in drinking water
- Explain radionuclide monitoring requirements
- Explain methods of treating water for radioactivity removal

Assignments for This Lesson

- Read Chapter 8, “Radiological Contaminants,” in *Water Quality*
- Watch the video lecture for Lesson 8
- Answer Review Questions 1-10 in the *Water Quality Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Quality Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 8

Water Quality

Lesson 9 – Customer Complaint Investigations

Summary of This Lesson

It is important for any water treatment operator to respond to a customer's inquiries or complaints about their water quality. Not only is this an important step in building the public confidence in their water supply, responding to a customer complaint may be an early warning sign of a contaminant issue or water quality problem.

This lesson will explain the differences between taste-and-odor investigations, physical appearance investigations, a laundry and fixture staining investigation, and investigating an alleged illness as a result of poor water quality.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the general principles of conducting an investigation in response to a customer complaint on water quality
- Explain the general principles of conducting a taste-and-odor complaint investigation
- Explain the general principles of conducting a physical appearance complaint investigation
- Explain the general principles of conducting an investigation of staining on laundry and plumbing fixtures complaint
- Explain the general principles of conducting an alleged illness complaint investigation

Assignments for This Lesson

- Read Chapter 9, "Customer Complaint Investigations," in *Water Quality*
- Watch the video lecture for Lesson 9
- Answer Review Questions 1-10 in the *Water Quality Student Workbook*. Submit your answers online.
- Answer Study Problem #1 in the *Water Quality Student Workbook*. Submit your report online.
- Complete the quiz for Lesson 9

Applied Hydraulics

Course Overview

This course is designed to acquaint students with the hydraulics involved in water treatment, storage and distribution, and the math that applies to hydraulic principles. Course material consists of reading assignments, video lectures, review questions, study problems and lesson quizzes.

Course completion requires that the student successfully complete each component of each individual lesson. Review questions and written assignments must be submitted either online or uploaded in a Word document for the professor's review. Lesson quizzes have a minimum passing score of 70%.

Upon successful completion of the course requirements, students will receive a certificate of completion for the *Applied Hydraulics* course, which is applicable toward a Certificate in Water Treatment Technology from American Water College.

Required Texts

Textbook: *Basic Science Concepts and Applications, Principles and Practices of Water Supply Operations* series

Edition: Fourth Edition

Author: Nicholas G. Pizzi

ISBN: 1-58321-778-9

Workbook: *Basic Science Concepts and Applications Student Workbook, Principles and Practices of Water Supply Operations* series

Edition: Fourth Edition

ISBN: 1-58321-799-1

Educational Objectives

- To provide students with an overview of density and specific gravity and the mathematical concepts that apply
- To provide students with an overview of pressure and force, and the mathematical concepts that apply
- To acquaint students with the principles of piezometric surface and hydraulic grade lines
 - To acquaint students with head, head loss, and the mathematical applications that apply

Applied Hydraulics

- To acquaint students with pumps and calculating their efficiency
- To acquaint students with flow rate problems encountered in the water treatment and distribution process
- To acquaint students with thrust, thrust control, and the mathematical concepts that apply

Evaluation

Students will be graded on their performance on each lesson quiz, and their course participation. Unless each unit is completed, the student will not be permitted to advance to the next lesson, and the student will not be awarded credit for completion until all assignments, quizzes and lectures are completed. Please contact our office with any questions.

Support

Students can contact our student support staff with any course-related, content-related or technology-related inquiries. Our office hours are Monday-Thursday, 9 to 5 PT, and Friday 9-12 PT.

Contact Info:

Phone Number: (661) 874-1655

Email Inquiries: Info@americanwatercollege.org

Additionally, students are encouraged to contact their professor directly with any questions or comments.

Electricity for the Water Industry

Course Overview

This course is designed to acquaint students with the electric terms, measurements and equipment used in water treatment, storage and distribution. Course material consists of reading assignments, video lectures, review questions, study problems and lesson quizzes.

Course completion requires that the student successfully complete each component of each individual lesson. Review questions and written assignments must be submitted either online or uploaded in a Word document for the professor's review. Lesson quizzes have a minimum passing score of 70%.

Upon successful completion of the course requirements, students will receive a certificate of completion for the *Electricity for the Water Industry* course, which is applicable toward a Certificate in Water Treatment Technology from American Water College.

Required Texts

Textbook: *Basic Science Concepts and Applications, Principles and Practices of Water Supply Operations* series

Edition: Fourth Edition

Author: Nicholas G. Pizzi

ISBN: 1-58321-778-9

Workbook: *Basic Science Concepts and Applications Student Workbook, Principles and Practices of Water Supply Operations* series

Edition: Fourth Edition

ISBN: 1-58321-799-1

Educational Objectives

- To provide students with an overview of electricity, magnetism and electrical measurements used in the water industry
- To provide students with the proper electrical quantities and terms used in the water industry
- To demonstrate the functions and the applicable ratings of electrical equipment used in the water industry

Electricity for the Water Industry

Evaluation

Students will be graded on their performance on each lesson quiz, and their course participation. Unless each unit is completed, the student will not be permitted to advance to the next lesson, and the student will not be awarded credit for completion until all assignments, quizzes and lectures are completed. Please contact our office with any questions.

Support

Students can contact our student support staff with any course-related, content-related or technology-related inquiries. Our office hours are Monday-Thursday, 9 to 5 PT, and Friday 9-12 PT.

Contact Info:

Phone Number: (661) 874-1655

Email Inquiries: Info@americanwatercollege.org

Additionally, students are encouraged to contact their professor directly with any questions or comments.

Enrollment & Payment Options

Students have the option to enroll in one course at a time or in the complete Water Treatment and Transmission Technology Certificate Program. By enrolling in the complete program, students will receive a discounted enrollment fee.

Option 1 – Individual Course Enrollment

Water Sources	\$199.99
Introduction to Water Treatment	\$349.99
Advanced Water Treatment	\$349.99
Water Treatment Math	\$299.99
Applied Chemistry	\$249.99
Water Transmission & Distribution I	\$399.99
Water Transmission & Distribution II	\$399.99
Water Quality	\$349.99
Applied Hydraulics	\$179.99
Electricity for the Water Industry	\$119.99

Total Program Cost **\$2,899.90**

Option 2 – Complete Program Enrollment **\$2,495**

Option 3 – Split Payment **\$1,299 first installment**
\$1,299 second installment (after 6 mo.)

Option 4 – Monthly Payment **\$449 enrollment fee**
\$199/mo. For 11 months

Option 5 – PayPal Credit **0% financing on approved credit**
6 months to pay \$2,495