Water Treatment Basics
Course Syllabus

Purpose
This course qualifies as specialized training for the CA and NV water treatment operator exams.

Topics

Basic Water Math
Unit Conversions
Working with Formulas
Understanding Percentages
Calculating Area
Calculating Volume
Weight Volume Relationships
Force-Pressure-Head
Velocity and Flow Rate
Pumps
The Metric System
Problem Solving

Math and Treatment Review
Flow Problems
Chemical Dose Problems
Source Water Review
Reservoirs Review
Reservoir Problems
Coagulation and Flocculation Review
Coagulation and Flocculation Problems
Sedimentation Review
Sedimentation Problems
Filtration Review
Filtration Problems
Disinfection Review
Disinfection Problems
Corrosion Control Review
Laboratory Problems
Regulations Review
Treatment Plant Chemicals
Management Principles Review
Microbiology
pH
Alkalinity
Turbidity
Chlorine
Total Hardness
Ca Hardness

CEUs (Contact Hours)
Upon completion of this course, you will receive a certificate for 3.6 CEUs (36 contact hours).

Completion Requirements
In order to receive IACET CEU credit for this course, you must complete the following:

- Complete each individual lesson module by watching the video lecture, completing the lesson handout, and passing the lesson quiz.

Once you have completed all of these elements, your course completion certificate will be automatically placed into your learning account for printing/downloading. It will remain in your learning account even after your course access has expired.

Learning Objectives

Unit Conversions

Upon completion of this lesson the student will be able to:

- Define what a unit is
- Define what an equivalent is
- Demonstrate how units and equivalents are used to solve math problems

Working with Formulas

Upon completion of this lesson the student will be able to:

- Define what a formula is
- Demonstrate how a formula is used
- Demonstrate how formulas are rearranged
- Demonstrate how to solve math problems using formulas

Understanding Percentages

Upon completion of this lesson the student will be able to:

- Demonstrate how to convert between fractions and percentages
- Demonstrate how to convert between decimals and percentages

Calculating Area

Upon completion of this lesson the student will be able to:

- Demonstrate how to solve for the area of a square
- Demonstrate how to solve for the area of a rectangle
- Demonstrate how to solve for the area of a circle
- Demonstrate how to solve for the area of a triangle

Calculating Volume

Upon completion of this lesson the student will be able to:

- Demonstrate how to solve for the volume of a cube
- Demonstrate how to solve for the volume of a cylinder
- Demonstrate how to solve for the volume of a cone
- Demonstrate how to solve for the volume of a sphere

Weight/Volume Relationships

Upon completion of this lesson the student will be able to:

- Recall how many pounds one gallon of water weighs
- Recall how many gallons are in one cubic foot
- Recall how many pounds one cubic foot of water weighs
- Recall how many liters are in one gallon
- Recall how many pounds are in one kilogram
- Discuss and demonstrate how these weight and volume relationships are used to solve math problems

Force-Pressure-Head

Upon completion of this lesson the student will be able to:

- Define force
- Define pressure
- Define water head
- Recall how many psi (pounds per square inch) is one foot of water head
- Discuss and demonstrate how to solve math problems involving force-pressure-head calculations

Velocity and Flow Rate

Upon completion of this lesson the student will be able to:

- Define velocity
- Demonstrate how velocity is calculated
- Define flow rate
- Demonstrate how flow rate is calculated

Pumps

Upon completion of this lesson the student will be able to:

- Define horsepower
- Define water horsepower
- Define break horsepower
- Define motor horsepower
- Discuss and demonstrate how to solve pump math problems involving horsepower

The Metric System

Upon completion of this lesson the student will be able to:

- Define what metric system units
- Demonstrate how to convert between weight and volume measurements in the metric system
- Demonstrate how to convert between metric units and standard units

Problem Solving

Upon completion of this lesson the student will be able to:

- Define the five steps to problem solving
- Determine if all five steps are needed to solve a specific problem
- Explain how the five steps work
- Apply the five step problem solving method to water math problems

Flow Problems

Upon completion of this lesson the student will be able to:

- Recall the conversion factor between MGD (million gallons per day) and gpm (gallons per minute)
- Demonstrate how to calculate problems using the MGD to gpm conversion factors
- Recall the conversion factor between MGD and CFS (Cubic Feet Per Second)
- Demonstrate how to calculate problems using the MGD to CFS conversion factors

Chemical Dose Problems

Upon completion of this lesson the student will be able to:

- Describe what units are used in Polymer and Alum Dosing
- Describe what units are used in chemical feed pump calibrations and settings
- Explain the jar testing process
- Demonstrate how to calculate jar testing problems
- Explain chemical feed system calibrations
- Demonstrate how to calculate chemical feed calibration problems
- Demonstrate how to calculate feed pump settings in percent stroke
- Demonstrate how to calculate chlorinator settings

Reservoir Problems

Upon completion of this lesson the student will be able to:

- Describe what units are used in calculating the storage volume of a reservoir
- Demonstrate how to calculate reservoir storage volume problems
- Describe what units are used in calculating copper sulfate chemical dose problems
- Demonstrate how to calculate copper sulfate dosing problems

Coagulation and Flocculation Problems

Upon completion of this lesson the student will be able to:

- Demonstrate how to accurately calculate how many pounds of coagulant are used
- Demonstrate how to accurately calculate the proper dose of a coagulant
- Demonstrate how to accurately calculate the percent concentration of a stock solution
- Demonstrate how to accurately calculate percent of coagulant dilution

Sedimentation Problems

Upon completion of this lesson the student will be able to:

- Define what sedimentation basins do
- Demonstrate how to calculate detention time problems
- Recall what units are used in detention time
- Demonstrate how to calculate overflow rate problems (surface loading rate problems)
- Recall what units are used in overflow rate
- Demonstrate how to calculate flow velocity problems
- Recall what units are used in flow velocity
- Demonstrate how to calculate weir loading problems
- Recall what units are used in weir loading

Filtration Problems

Upon completion of this lesson the student will be able to:

- Define what a filter is and what it does
- Demonstrate how to solve filtration rate problems
- Demonstrate how to solve level drop rate problems
- Demonstrate how to solve filter flow rate problems
- Demonstrate how to solve unit filter run volume (UFRV) problems
- Demonstrate how to solve backwash flow problems
- Demonstrate how to solve flow to level increase conversion problems

- Demonstrate how to solve backwash water used problems
- Demonstrate how to solve backwash water to finished water percent problems

Disinfection Problems

Upon completion of this lesson the student will be able to:

- Define what units and formulas are used in disinfection problems
- Demonstrate how to solve chlorine dose problems
- Demonstrate how to solve chlorine demand problems
- Demonstrate how to solve chlorine usage problems
- Demonstrate how to solve hypo chlorinator flow rate problems
- Demonstrate how to solve hypochlorite solution strength problems
- Demonstrate how to solve hypochlorite dilution problems
- Demonstrate how to solve average pounds per day problems
- Demonstrate how to calculate chlorine supply in days

Laboratory Problems

Upon completion of this lesson the student will be able to:

- Define what units and formulas are used in laboratory problems
- Demonstrate how to solve temperature conversions between Fahrenheit to Celsius
- Demonstrate how to solve for the mean and median values of a data set
- Demonstrate how to solve removal efficiency

Source Water Review

Upon completion of this lesson the student will be able to:

- Define source water vocabulary
- Discuss proper water source evaluation
- Recall the different types of source water contaminants
- Explain the hydrologic cycle
- Distinguish the different types of public water systems
- Describe the main objectives of water treatment
- Formulate solutions to water quality problems

Reservoirs Review

Upon completion of this lesson the student will be able to:

- Define reservoir vocabulary
- Discuss stratification in reservoirs
- Relate problems with anaerobic conditions
- Discuss potential problems algae can cause
- Apply algae control techniques using copper sulfate

Coagulation and Flocculation Review

Upon completion of this lesson the student will be able to:

- Define coagulation and flocculation vocabulary words
- Discuss what is considered “Conventional Treatment”
- Express coagulation chemistry basics
- Discuss the purpose of flash mixers and define the different types of flash mixers

- Recall how a Streaming Current Meter operates
- Discuss the principles of enhanced coagulation
- Apply jar testing principles
- Relate what operator actions are taken during changing plant conditions

Sedimentation Review

Upon completion of this lesson the student will be able to:

- Define sedimentation vocabulary words
- Recall the size ranges for various particles
- Describe the different sedimentation zones
- Identify the different types of sedimentation basins
- Analyze the expected performance of the sedimentation process
- Relate what operator actions are taken during changing plant conditions

Filtration Review

Upon completion of this lesson the student will be able to:

- Define filtration vocabulary
- Recall the factors that affect the filtration process
- Describe the different filtering mechanisms
- Identify the different types of filters
- Describe how filter media is classified
- Relate the required removal for viruses and Giardia
- Discuss the instrumentation used to monitor filters

Disinfection Review

Upon completion of this lesson the student will be able to:

- Define disinfection vocabulary
- Recall the factors influencing disinfection
- Describe the agents of disinfection
- Identify the properties of chlorine gas
- Describe the relationship between pH and chlorine species
- Describe breakpoint chlorination
- Discuss the pros and cons of alternative disinfectants
- Relate chlorine safety principles

Corrosion Control Review

Upon completion of this lesson the student will be able to:

- Define corrosion control vocabulary
- Recall the factors affecting corrosion
- Describe the tools used to control corrosion
- Identify the LCR (Lead and Copper Rule) requirements

Regulations Review

Upon completion of this lesson the student will be able to:

- Define regulation vocabulary
- Describe and identify each of the following rules/regulations

- Safe Drinking Water Act (SDWA)
- Surface Water Treatment Rule (SWTR)
- Total Coliform Rule (TCR)
- Lead and Copper Rule (LCR)
- Stage 1 Disinfection by Product Rule (DBP)
- Interim Enhanced Surface Water Treatment Rule (IESWTR)
- Long Term 2 Surface Water Treatment Rule (LT2SWTR)
- Stage 2 Disinfection by Products Rule (DBP)

Treatment Plant Chemicals Review

Upon completion of this lesson the student will be able to:

- Identify coagulation chemical compounds
- Identify disinfection chemical compounds
- Identify taste and odor reducing compounds
- Identify algae control chemical compounds
- Identify softening chemical compounds
- Identify common laboratory chemical compounds
- Identify common elements by their symbols

Management Principles Review

Upon completion of this lesson the student will be able to:

- Define management vocabulary
- Describe management principles
- Describe safety program management

Microbiology

Upon completion of this lesson the student will be able to:

- Perform the Coliform Analysis
- Identify the chemicals used in the Coliform analysis
- Identify positive and negative test results
- Describe the different analysis methods

pH

Upon completion of this lesson the student will be able to:

- Perform a pH analysis
- Identify what equipment is used
- Describe the sampling and storage procedure
- Understand the pH scale

Alkalinity

Upon completion of this lesson the student will be able to:

- Perform an Alkalinity analysis
- Understand what Alkalinity is
- Identify what equipment is used for an analysis
- Describe the sampling and storage procedure

Turbidity

Upon completion of this lesson the student will be able to:

- Perform a Turbidity analysis
- Describe what Turbidity is
- Identify what equipment is used
- Describe the sampling and storage procedure

Chlorine

Upon completion of this lesson the student will be able to:

- Perform a Chlorine analysis
- Describe the different methods of analysis
- Identify what equipment is used
- Describe the sampling and storage procedure

Total Hardness

Upon completion of this lesson the student will be able to:

- Describe what hardness is
- Perform a Total Hardness analysis
- Identify what equipment is used
- Describe the sampling and storage procedure

Ca Hardness

Upon completion of this lesson the student will be able to:

- Describe the difference between Ca Hardness and Total Hardness
- Perform a Ca Hardness analysis
- Identify what equipment is used
- Describe the sampling and storage procedure

Support

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

Contact Info

Phone Number: (661) 874-1655
General Course Inquiries: Info@americanwatercollege.org