Alaska Water Treatment
Exam Preparation Grade 2
Course Syllabus

Purpose

This course will prepare you to pass your second level water treatment operator exam. There are 34 individual lesson modules included in this course.

Topics

Basic Water Math

Unit Conversions
Working with Formulas
Understanding Percentages
Calculating Area
Calculating Volume
Weight Volume Relationships
Force-Pressure-Head
Pumps
The Metric System
Problem Solving

Math and Treatment Review

Flow Problems
Chemical Dose Problems
Source Water Review
Reservoir Problems
Coagulation and Flocculation Review
Coagulation and Flocculation Problems
Sedimentation Review
Sedimentation Problems
Filtration Review
Filtration Problems
Disinfection Review
Disinfection Problems
Pumps and Motors
Electricity
Corrosion Control Review
Fluoridation Review
Iron and manganese Control
Lime Softening
Regulations Review
Membrane Technology Review
Aeration Review
Adsorption Review
Laboratory Review
Laboratory Problems
Treatment Plant Chemicals Review

CEUs (Contact Hours)

Upon completion of this course, you will receive a certificate for 2.6 CEUs (26 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

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

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 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

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 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

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 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

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 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

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

Pumps and Motors Review

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

- Define pumps and motors vocabulary
- Describe the construction and operation of velocity type pumps
- Describe the functions of the main components of a centrifugal pump
- Describe the theory of operation and common uses of positive displacement pumps
- Describe the differences between the various types of single and three-phase motors

Electricity

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

- Define electricity vocabulary
- Recall various types of electricity
- Recall key methods of measurement used in the water industry

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

Fluoridation

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

- Define fluoridation vocabulary
- Recall fluoride chemicals
- Recall the regulations related to fluoridation
- Describe good fluoride process operation practices
- Describe the tests associated with fluoridation
- Recall key safety info associated with fluoridation

Iron and Manganese Control

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

- Define iron and manganese control vocabulary
- Describe the problems caused by excessive iron and manganese
- Describe the methods used for iron and manganese removal
- Describe the equipment used for iron and manganese removal
- Recall the regulations that apply to iron and manganese in drinking water
- Describe monitoring and operations of iron and manganese removal processes

Lime Softening

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

- Describe the effects of hard and soft water
- Describe the minerals causing water hardness
- Recall the various types of water hardness
- Recall the regulations that may affect the softening process
- Describe how softening chemical are properly stored and fed
- Describe how softening facilities are operated
- Recall tests used for operational control of the softening process

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)

Membrane Technology

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

- Describe the types of membrane processes
- Recall the principles of microfiltration, nanofiltration, and reverse osmosis
- Describe the equipment used

- Describe the operations of a membrane system

Aeration Review

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

- Define aeration vocabulary
- 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

Adsorption Review

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

- Define adsorption vocabulary
- 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
- Explain the operation and testing of adsorption processes

Laboratory Review

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

- Define laboratory vocabulary
- Explain the importance of sampling
- Recall types of samples
- Explain general sample collection guidelines
- Recall regulations that apply to laboratory certifications and procedures
- Describe proper record keeping and sample labeling
- Describe proper sample handling (preservation, storage, and transportation)

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

Treatment Plant Chemicals Review

Upon completion of this lesson the student will have an understanding of water treatment chemicals, their formulas, and form/concentration for:

- Coagulation
- Disinfection
- Taste/odor
- Algae control
- Softening
- Common lab chemicals

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
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