

## Mathematics For Wastewater Operators

The understanding of the mathematics of wastewater treatment is an important tool for all wastewater system operators. This chapter covers most of the major categories of math calculations that are important to know for both certification and daily operations of wastewater systems. The examples range from basic problems like flows, velocities and detention times, that might appear on a Grade 1 or 2 exam, to more complex problems that could be found on a Grade 3 or 4 exam. The advanced levels will also have more problems related to wastewater treatment processes like F:M ratios and MCRT problems.

### FLOW

The amount of water moving through the system can be measured in one of three different units. They are gpm (gallons per minute), mgd (millions of gallons per day), and cfs (cubic feet per second). The conversions are listed below.

$$\begin{array}{ll} \text{mgd} \times 700 = \text{gpm} & \frac{\text{gpm}}{700} = \text{mgd} \\ \text{cfs} \times 449 = \text{gpm} & \frac{\text{gpm}}{449} = \text{cfs} \end{array}$$

Examples:

1. A system averages 2.0 mgd. How many gallons per minute is the daily average?

A. Convert mgd to gpm  
 $2.0 \text{ mgd} \times 700 = \mathbf{1400 \text{ gpm}}$

2. A pipeline has a carrying capacity of 3 cfs. What is the flow in gpm?

A. Convert cfs to gpm  
 $3 \text{ cfs} \times 449 = \mathbf{1347 \text{ gpm}}$

3. A lift station pumps 350 gpm. How many mgd will it pump?

A. Convert gpm to mgd  
 $\frac{350 \text{ gpm}}{700} = \mathbf{0.5 \text{ mgd}}$

### AREAS

In order to calculate volumes of circular tanks and velocities in pipes, the area of the circle must first be determined. There are two basic formulae used to calculate the area of a circle.

$$\begin{array}{ll} \text{Area} = 3.1416 \times r^2 & \text{Area} = d^2 \times 0.785 \\ r = \text{radius} & d = \text{diameter} \end{array}$$

Examples:

1. A sedimentation basin is 60 feet in diameter. What is the surface area of the tank?

A. Calculate the area  
 $3.1416 \times 30' \times 30' = \mathbf{2830 \text{ square feet}}$   
 $60' \times 60' \times 0.785 = \mathbf{2830 \text{ square feet}}$

# Wastewater Math Study Guide With Answers

**Rachel Sandford**



## **Wastewater Math Study Guide With Answers:**

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know and perform To ensure correlation to modern practice and design this volume provides illustrative problems for commonly used waterworks treatment operations found in today s treatment facilities Mathematics Manual for Water and Wastewater Treatment Plant Operators, Second Edition: Wastewater Treatment Operations Frank R. Spellman,2014-05-07 To properly operate a waterworks or wastewater treatment plant and to pass the examination for a waterworks wastewater operator s license it is necessary to know how to perform certain calculations All operators at all levels of licensure need a basic understanding of arithmetic and problem solving techniques to solve the problems they typically encounter in the workplace Hailed on its first publication as a masterly account written in an engaging highly readable user friendly style the Mathematics Manual for Water and Wastewater Treatment Plant Operators Second Edition has been expanded and divided into three specialized texts that contain hundreds of worked examples presented in a step by step format They are ideal for all levels of water treatment operators in training and practitioners studying for advanced licensure In addition they provide a handy desk reference and handheld guide for daily use in making operational math computations This third volume Wastewater Treatment Operations Math Concepts and Calculations covers computations commonly used in wastewater treatment with applied math problems specific to wastewater operations allowing operators of specific unit processes to focus on their area of specialty It explains calculations for flow velocity and pumping preliminary and primary treatments trickling filtration rotating biological contactors and chemical dosage It also addresses various aspects of biosolids in wastewater treatment ponds and water wastewater laboratory calculations The text presents math operations that progressively advance to higher more practical applications of mathematical calculations including math operations that operators at the highest level of licensure would be expected to know and perform To ensure correlation to modern practice and design this volume provides illustrative problems for commonly used wastewater treatment operations found in today s treatment facilities **Mathematics Manual for Water and Wastewater Treatment Plant Operators, Second Edition** Frank R. Spellman,2014-05-07 To properly operate a waterworks or wastewater treatment plant and to pass the examination for a waterworks wastewater operator s license it is necessary to know how to perform certain calculations All operators at all levels of licensure need a basic understanding of arithmetic and problem solving techniques to solve the problems they typically encounter in the workplace Hailed on its first publication as a masterly account written in an engaging highly readable user friendly style the Mathematics Manual for Water and Wastewater Treatment Plant Operators Second Edition has been expanded and divided into three specialized texts that contain hundreds of worked examples presented in a step by step format They are ideal for all levels of water treatment operators in training and practitioners studying for advanced licensure In addition they provide a handy desk reference and handheld guide for daily use in making operational math computations This first volume Basic Mathematics for Water and Wastewater Operators introduces and reviews fundamental concepts critical to qualified operators Presented at a basic level this volume reviews fractions and decimals rounding

numbers significant digits raising numbers to powers averages proportions conversion factors flow and detention time and the areas and volumes of different shapes It also explains how to keep track of units of measurement such as inches feet and gallons during the calculations After building a strong foundation based on theoretical math concepts the text moves on to applied math basic math concepts applied in solving practical problems for both water and wastewater operations The material is presented using clear explanations in manageable portions to make learning quick and easy and illustrative real world problems are provided that correlate to modern practice and design *Mathematics Manual for Water and Wastewater Treatment Plant Operators* Frank R. Spellman, 2023-07-31 To properly operate a waterworks or wastewater treatment plant and to pass the examination for a waterworks wastewater operator's license it is necessary to know how to perform certain calculations All operators at all levels of licensure need a basic understanding of arithmetic and problem solving techniques to solve the problems they typically encounter in the workplace Hailed on its first publication as a masterly account written in an engaging highly readable user friendly style the fully updated *Mathematics Manual for Water and Wastewater Treatment Plant Operators Basic Mathematics for Water and Wastewater Operators* introduces and reviews fundamental concepts critical to qualified operators It builds a strong foundation based on theoretical math concepts which it then applies to solving practical problems for both water and wastewater operations Features Provides a strong foundation based on theoretical math concepts which it then applies to solving practical problems for both water and wastewater operations Updated throughout and with several new practical problems added Provides illustrative examples for commonly used waterworks and wastewater treatment operations covering unit process operations found in today's treatment facilities

**Resources in Education**, 1984 **Wastewater Operator Examinations**, 1992 *Wastewater Treatment Plant Operations Made Easy* Frank R. Spellman, Joanne Drinan, 2003 This book gives plant operators and students of wastewater a simple and math based introduction to all major unit processes in the modern wastewater treatment plant The work is designed for operators and managers to run plants and to advance their careers by passing state licensure exams

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