

IDEM Wastewater Operator Examination Study Guide Industrial Class B, Class C and Class D Exams

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As you prepare for the Industrial Class B, Class C and Class D exams, you will need to focus your study on Books 2, 4, 5, 10 and 14 as listed on the IDEM Wastewater Operator Certification Exam Book List web page. These references have been used in developing the examination questions which you will be required to answer.

Books 2, 4 and 5 are manuals prepared by and available through California State University, Sacramento College of Engineering and Computer Science, Office of Water Programs (Referred to hereafter as the Sacramento manuals), which can be purchased at: [Wastewater Courses \(csus.edu\)](http://www.csus.edu/water_courses)

Book 10 is IDEM's Wastewater Operator Certification Manual found at: https://www.in.gov/idem/cleanwater/files/wastewater_cert_booklist_10_manual.pdf

Book 14 is EPA's Introduction to the National Pretreatment Program, which is available online at: https://www3.epa.gov/npdes/pubs/pretreatment_program_intro_2011.pdf

This document is designed to guide you to the subject matter that you will need to be familiar with in order to pass the test. While this covers a wide range of material, you should keep in mind that the exam consists of only 100 multiple choice questions, you do not need to study every chapter of the Sacramento manuals, and since you have been working at a wastewater treatment plant for some time, much of this will already be familiar to you. You can do this! The breakdown of the distribution of the questions is described below.

Categories of test questions which will be covered based on the three Sacramento manuals and the percentage of the examination questions comprised from each area are listed below:

	Class B	Class C	Class D
Activated Sludge	3-5%	3-5%	5%
Advanced Treatment	3-5%	3-5%	3-5%
Clarifiers	3-5%	4-5%	3-5%
Industrial Treatment	30%	25%	25%
Laboratory	10%	10%	10%
Maintenance	5%	5%	5%
Preliminary treatment	5%	5%	5%
Safety	5%	5%	5%
Solids Handling	7-10%	10%	10-12%

(These percentages are approximate)

Chapters to be studied from the Sacramento manuals:

Book 2: Operation of Wastewater Treatment Plants – Volume II, 7th Edition

Chapter 16 Laboratory Procedures and Chemistry

Chapter 18 Analysis and Presentation of Data (C and D only)

Chapter 19 Records and Report Writing (C and D only)

Book 4: Industrial Waste Treatment – Volume I, 3rd Edition

Chapter 1 The Industrial Plant Operator

Chapter 2 Industrial Wastewaters

Chapter 3 Regulatory Requirements

Chapter 4 Preventing and Minimizing Wastes at the Source

Chapter 5 Industrial Waste Monitoring

Chapter 6 Flow Measurement

Chapter 7 Preliminary Treatment

Chapter 8 Physical-Chemical Treatment Processes

Chapter 9 Filtration

Chapter 10 Physical Treatment Processes

Chapter 11 Treatment of Metal Wastestreams

Chapter 13 Safety (C and D only)

Book 5: Industrial Waste Treatment – Volume II, 3rd Edition

Chapter 3 Activated Sludge Process Control

Chapter 4 Sequencing Batch Reactors (Class C only)

Chapter 5 Enhanced Biological Growth (Class B only)

Chapter 6 Anaerobic Treatment (Class D only)

Chapter 7 Residual Solids Management

Chapter 8 Maintenance (Class B only)

Mathematics: 10 – 15 %

Mathematics problems given on the examination will have a corresponding formula listed on the Formula Sheet furnished with the exam on your test day. It is recommended that you look over the formula sheets and work the problems in the Appendices in Volumes 1 and 2 of the Sacramento manuals. Solving these problems involves plugging the numbers given in the problem into the correct formula and calculating the answer.

There are a few basic rules that apply to solving formulas:

1. Work from left to right
2. Do all of the multiplication and division above the line (in the numerator) and below the line (in the denominator); then do the addition and subtraction above and below the line.
3. Perform the division (divide the numerator by the denominator).
4. Parentheses () are used in formulas to identify separate parts of a problem. Work the arithmetic within the parentheses before working outside the parentheses. Use the same order stated in rules 1, 2, and 3 above when working inside of parentheses.

Web site for the Formula Sheet:

https://www.in.gov/idem/cleanwater/files/wastewater_cert_study_guide_formula_sheet.pdf

Pretreatment: Exams B = 3-5%, C = 5%, D = 5%

Questions concerning the regulatory pretreatment program are derived from Book 14, EPA's Introduction to the National Pretreatment Program and Book 4, Industrial Waste Treatment, Volume I, Chapter 3 Regulatory Requirements

Rules/Statutes/Completing reports 20%

The remainder of the examination questions will cover Rules and permit requirements located in Chapter III, Section One, of the Wastewater Certification Manual (Book 10) and questions related to completion of the Discharge Monitoring Report (DMR) and the Monthly Report of Operation (MRO). A worksheet and necessary additional documents are incorporated into the Certification Manual as Appendices A, B, C, and D.

Subject Matter Topics

The following is subject matter that an operator should be familiar with. You should be able to answer questions on the points presented below. Of course, not all of this will appear on any given test, but some of it will appear on all tests.

Subject matter from Book 4:

Discuss safety equipment and supplies needed.

Discuss MSDS (now SDS).

Describe the atmospheric hazards of confined spaces.

Define confined space.

What toxic gases may be encountered in the wastewater field?

Can hydrogen sulfide gas be always detected by smell? If not, what is the reason?

Describe flammable/explosive gas.

Discuss the hazard of an oxygen deficient atmosphere.

What precautions are needed in entering a confined space?

What hazardous materials may be encountered during inspection and sampling?

What corrosive materials may be encountered at wastewater treatment plants?

Discuss the infection agents which can be found in a wastewater treatment plant.

Describe the types of physical hazards encountered during sampling and inspection.

Describe safety regulations and OSHA.

Describe U.S. EPA's general pretreatment regulations relative to a delegation of federal authority.

What is regulated under the general pretreatment regulations?

What are the categorical pretreatment standards?

What is TTO and how should it be sampled?

What is the general pretreatment regulation?

Discuss emergency planning.

Discuss the identification of spilled matter.

Discuss the control of spilled matter in sewer.

Describe POTW process changes during an emergency spill.

Discuss the initial response procedures during an emergency spill.

What steps must be taken in reporting a spill?

Discuss water use and treatment by industrial in general.

Describe the character of wastewater and types of wastewater treatment used by different industries.

List and discuss types of wastewater treatment plant hazards.

Discuss safety procedures that an operator should observe when working in various areas and on various types of equipment in a wastewater treatment plant.

Describe collection system hazards.

Discuss laboratory safety.

Describe lockout/tagout procedures in detail.

Discuss the development and implementation of a safety training program.

Create a legislative timeline of significant water/wastewater legislation and discuss the significance, purpose, implementation, etc. of each piece of legislation.

What are the types of Categorical Standards?

Discuss TTO (Total Toxic Organics).

How can Categorical Standards be modified?

Discuss the scope of local ordinances.

Discuss enforcement and penalties for non-compliance with environmental laws.

Discuss pollution prevention.

What are the effects of industrial wastestreams?

Describe specific types of treatment and problems associated with different manufacturing processes.

Describe the basic concepts of flow measurement.
Discuss open channel flow measurement.
Discuss closed pipe flow measurement.
How are flowmeters calibrated?
What types of flows should be measured? Discuss.
How does coagulation/flocculation work?
Describe jar testing.
What chemicals are used to improve settling?
Describe the types of equipment used in physical-chemical treatment processes.
What are typical operation, start-up, and maintenance procedures for physical-chemical treatment processes.
Explain how to flow proportion composite samples.
Discuss the operation and maintenance of gravity filters in detail.
Discuss inert-media pressure filters.
Discuss continuous backwash, upflow, and deep-bed silica sand media filters.
Discuss the types, operation and maintenance of cross flow membrane filtration in detail.
Discuss the air stripping of volatile organics.
Describe the troubleshooting and maintenance of an air stripping system.
Describe the activated carbon adsorption process.
Discuss activated carbon regeneration.
Describe the troubleshooting and maintenance of an air stripping system.
Compare and contrast types of metal wastestreams.
Describe several methods used to dewater sludges.
Describe several sludge drying methods.

Subject matter from Book 5:

Discuss the various types of industrial treatment facilities (e.g. – dairy, petroleum, metal finishing, etc.) and key aspects of those treatment processes.
Compare and contrast the various fixed growth (or fixed film) processes such as trickling filter, biotower, etc.
Describe the function and maintenance of the primary equipment used in the various fixed growth processes.
Troubleshooting common problems associated with fixed film growth processes.
Discuss filter media in detail.
Compare and contrast the various aeration systems used in the activated sludge process.
RAS (Return Activated Sludge) – methods and process control in detail.
WAS (Waste Activated Sludge) – methods and process control in detail.

Discuss the following terms:

F/M (Food to Microorganism Ratio)

MCRT (Mean Cell Residence Time)

MLVSS (Mixed Liquor Volatile Suspended Solids)

OUR (Oxygen Uptake Rate)

Discuss activated sludge microbiology:

- Types of organisms

- What the organisms generally indicate in relation to sludge quality

- Troubleshooting the activated sludge process using microbiology

Discuss Sequencing Batch Reactors (SBRs):

- Start-up

- Process control

- Equipment

- Operation and maintenance

- Troubleshooting

Describe the following aspects of anaerobic treatment in detail:

- The anaerobic digestion process

- Compare and contrast types of anaerobic reactors and treatment systems

- Start-up and normal operating procedures

- Troubleshooting

- Laboratory tests and procedures

- Safety and maintenance

Compare and contrast the following types of sludge thickening in detail:

- Gravity thickening

- Dissolved air flotation

- Centrifuge

- Gravity belt filter

Discuss methods of sludge stabilization and conditioning.

Describe methods of sludge dewatering in detail.

Describe solids disposal options and government regulation.

What should a wastewater treatment plant maintenance program/safety plan include?

Study proper maintenance start-up procedures and troubleshooting guides for maintenance equipment.

Compare and contrast the various types of pumps, their preventative maintenance and troubleshooting.

Discuss electrical equipment safety and maintenance.

Discuss motor safety, maintenance, and troubleshooting.

Discuss flow meters:

Types

Sensor maintenance

Calibration

Troubleshooting

Describe chemical names and chemical formulas.

Describe laboratory equipment.

Discuss the term solutions.

What is the term titration?

Discuss the use of a spectrophotometer.

Discuss the corrosive chemicals found in laboratories.

Describe the toxic chemicals found in a laboratory.

Discuss proper laboratory techniques.

Discuss the importance of sampling.

Describe the types of samples collected at a wastewater treatment plant.

Describe the proper preservation of samples.

Describe the tests for settleable solids.

Describe the suspended solids test.

How do you determine volatile solids?

Discuss the measurement of the sludge volume index.

Discuss the measurement of D.O. in the aeration tanks.

Describe the alkalinity test procedure.

Describe the C.O.D. test procedure.

Describe the term buffer.

Describe the D.O. tests.

Describe the B.O.D. tests.

Describe pH tests.

Discuss the measurement of metals in wastewater.

What does the term "TKN" stand for? What does it measure?

Discuss the need for analyzing and presenting data.

Describe the causes of variation in laboratory test results.

Discuss the term sampling.

Describe the terms nanometer and gage reading.

Discuss the importance of records.

Discuss annual reports.

We at IDEM wish you success and hope to be seeing you out there working to protect Indiana's waters and the infrastructure investments in wastewater facilities.

Now, go pass that test!