

This study guide is for wastewater treatment plant operators seeking certification at advanced skill and knowledge levels. The outlined topics indicate the general subjects which are the basis for examination questions. Operators should be knowledgeable in the subject matter outlined here. Reference materials and sample test questions can be found following the outline of topics.

I. WASTEWATER AND ITS CHARACTERISTICS

- A. Sources (municipal, industrial)
- B. Composition (water, solids, organic compounds, inorganic compounds, organisms)
- C. Production rates (individuals, municipalities, industries)
- D. Physical characteristics (color, odor, etc.)
- E. Units of measurement (gallons per day, population equivalent, etc.)

II. BIOLOGY

- A. Microorganisms
 - 1. Algae (green, blue-green, diatoms)
 - 2. Bacteria (anaerobic, aerobic, facultative, pathogenic, fecal coliform)
 - 3. Viruses
- B. Biological and biochemical processes (photosynthesis, aerobic and anaerobic digestion, etc.)
- C. Byproducts (oxygen, carbon dioxide, hydrogen sulfide, methane, nitrogen, water, etc.)
- D. Biochemical oxygen demand (BOD₅)

III. CHEMISTRY

- A. Nitrification (ammonia to nitrites and nitrates)
- B. Chlorination (chlorine demand, chloramines, breakpoint, disinfection, etc.)
- C. Sulfates and effect on odor
- D. Gases found at various stages (hydrogen sulfide, methane, etc.)
- E. Chemical oxygen demand

IV. SAMPLES AND TESTS

- A. Procedures
- B. Equipment (Imhoff cone, Gooch crucible, Nessler tubes)
- C. Techniques (grab as compared to composite, etc.)
- D. pH
- E. Fecal coliform bacteria per 100 ml.
- F. Suspended solids (total, mixed liquor volatile, etc.)
- G. Indicators (methylene blue, DPD, bromothymol blue, etc.)

V. TYPES OF TREATMENT

- A. Preliminary
- B. Primary
- C. Secondary
- D. Tertiary
- E. Chlorination
- F. Sludge

VI. CONSTRUCTION AND MAINTENANCE

- A. Buildings and grounds (cleanliness, protection from vandalism, etc.)
- B. Pumps, piping, valves, and other equipment (spare parts, lubrication, corrosion control, prevention of cross-connections and infiltration)

VII. TREATMENT (be able to identify steps in process, tests used to evaluate, process of treatment in each stage, samples required, flow rates, temperatures, pH, power needs, end products of different stages, loading ranges, detention times, oxygen concentrations, normal loading conditions, etc.)

- A. Grit chambers
- B. Clarifiers
- C. Aeration/preaeration and methods
- D. Trickling filters
- E. Sludge collection
- F. Activated sludge process
- G. Sand filters
- H. Stabilization ponds
- I. Chlorination
- J. Sludge treatment

VIII. SAFETY

- A. Construction safety
- B. Housekeeping techniques
- C. Proper laboratory techniques
- D. Handling hazardous materials (chlorine, acids)
- E. Poisonous and explosive gases (ventilation in confined spaces, no smoking in same)
- F. First aid

IX. NPDES PERMIT STIPULATIONS

- A. Discharge requirements (sampling and permission)
- B. Management requirements and responsibilities
- C. Self-monitoring reporting requirements
- D. Responsibility (lawsuits and fines)
- E. Submission of plans and specifications (required for new facilities, changes in

existing systems)

X. RECORDKEEPING

- A. Need for records (some required by state and federal law)
- B. Types of records (treatment, operation, maintenance, repair work)
- C. Operation and maintenance manuals

REFERENCES

1. “Manual of Instruction for Sewage Treatment Plant Operators,” New York State Department of Environmental Conservation
2. “Stabilization Ponds, Operations Manual,” Environmental Protection Agency
3. “Recommended Standards for Wastewater Facilities,” Great Lakes-Upper Mississippi River Board of State Health and Environmental Managers

TYPICAL SAMPLE QUESTIONS

Grade III Wastewater Treatment Plant Operators

1. Name the type of treatment that depends primarily upon biological aerobic organisms decomposing the organic solids to stable organic or inert solids.
 - a. Preliminary treatment
 - b. Primary treatment
 - c. Secondary treatment
 - d. Sludge treatment
 - e. Chlorination treatment

2. In trickling filters, the microorganisms used in treatment are:
 - a. Dispersed in the wastewater
 - b. Attached to a media
 - c. Mixed with the wastewater in concentrated dosages
 - d. Filtered from the wastewater and then added in high concentrations

3. Sludge should be pumped from the primary settling tank to the digester:
 - a. As rapidly as possible
 - b. Whenever gas bubbles and floating sludge begin to appear
 - c. Slowly and as frequently as needed
 - d. When the sludge blanket is within 2 inches of the overflow weir

4. The laboratory test which best measures the efficiency of a primary settling tank is the test for:
 - a. Suspended solids
 - b. BOD₅
 - c. Settleable solids
 - d. Volatile acid-alkalinity

5. PROBLEM

A single primary settling unit is 12 feet deep, 45 feet long, and 20 feet wide. This unit also has 80 feet of weir length. At a flow of 0.6 million gallons per day, what is the weir overflow rate and the detention time?

	<u>Weir Overflow Rate</u>	<u>Detention Time</u>
a.	800 gal./day/ft.	2.0 hours
b.	1000 gal./day/ft.	2.4 hours
c.	2500 gal./day/ft.	2.8 hours
d.	5000 gal./day/ft.	3.0 hours
e.	7500 gal./day/ft.	3.2 hours

ANSWERS: 1. c 2. b 3. c 4. a

5. PROBLEM ANSWER:

$$\frac{.6 \times 1,000,000 \text{ gal.}}{\text{day}} \times \frac{\text{total weir}}{80 \text{ ft.}} = 7500 \text{ gal./day/ft. weir overflow}$$

$$(12 \text{ ft.} \times 45 \text{ ft.} \times 20 \text{ ft.}) \times \frac{7.5 \text{ gal.}}{1 \text{ cu. ft.}} \times \frac{1 \text{ day}}{(.6 \times 1,000,000 \text{ gal.})} \times \frac{24 \text{ hr.}}{1 \text{ day}}$$

= e. 3.2 hours detention time