

Operator Exam Prep

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Expected Range of Knowledge for Drinking Water Treatment Exam

Content Category	Number of questions by Exam Grade			
	T1	T2	T3	T4
Source Water	25	25	20	15
Water Treatment Processes	25	25	35	20
Operation / Maintenance	20	20	15	15
Laboratory Procedures	15	15	15	15
Regulations / Administrative Duties	15	15	15	35

Source Water

Clear Well Storage	Surface Water/Reservoirs	Wells/Groundwater
Raw Water Storage	Watershed Protection	

Water Treatment Processes

Coagulation	Corrosion Control	Flocculation
Sedimentation	Taste and Odor	Best Available Technology
Filtration	Iron and Manganese Removal	
Disinfection	Fluoridation	

Operation / Maintenance

Chemical Feeders	Water Meters	Electrical Generators
Pumps, Motors, and Gearboxes	Pressure Gauges	
Blowers and Compressors	Instrumentation	

Laboratory Procedures

Sampling	pH Analysis	Fluoride Analysis
General Lab Practices	Turbidity Analysis	Color Analysis
Disinfectant Analysis	Specific Conductance	Taste and Odor Analysis
Alkalinity Analysis	Hardness	Microbiological Analysis

Safety / Regulations / Administrative Duties

Controlling	Organizing	Safety
Directing	Planning	Secondary Contaminants
Implementing Regulations	Primary Contaminants	Total Coliform Rule
Lead and Copper Rule	Recordkeeping	
California Waterworks Standards		
Operator Certification Regulations		
Safe Drinking Water Act & Amendments		
Surface Water Treatment Rule and Amendments		

- Which of the following is removed at the raw water intake?
 - A. Dissolved Solids
 - B. Turbidity
 - C. Fish and debris
 - D. Hardness

- Which of the following is more likely to be found in groundwater?
 - A. Natural Organic Matter
 - B. Minerals
 - C. Coliform Bacteria
 - D. Cryptosporidium

- What is most commonly used to control algae growth in reservoirs?
 - A. Ferric chloride
 - B. Trihalomethane
 - C. Sodium hypochlorite
 - D. Copper Sulfate

- What are common filtration rates of gravity filtration?
 - A. 0.1 to 1.9 GPM/sq.ft.
 - B. 11 to 20GPM/sq.ft.
 - C. 2 to 10GPM/sq.ft.
 - D. 21 to 28GPM/sq.ft.

- Leakage within a centrifugal pump is intended for what purpose?
 - A. Cool moving parts
 - B. Relieve Pressure
 - C. Minimize vibration
 - D. Prevent cavitation

- Which of the following is the definition of a grab sample?
 - A. A sample that is not adequate for making periodic measurement
 - B. A sample that is taken to represent the flow
 - C. A composite sample
 - D. A single sample of water collected at a particular time and place which represents the composition of the water only at the time and place

- Adding sodium hypochlorite to water will have the following effect.
 - A. Create a slightly acidic solution
 - B. Increase pH
 - C. Decrease pH
 - D. No impact on pH

- What is the normal conventional treatment process train?
 - A. Coagulationn, flocculation, filtration
 - B. Rapid mix, coagulation, flocculation, filtration, disinfection
 - C. Flocculation and filtration
 - D. Rapid mix, filtration and disinfection

- Which of the following will react with chlorine to form Trihalomethane?
 - A. Hardness
 - B. Turbidity
 - C. Dissolved Solids
 - D. Natural Organic Matter

- What must be located near a hazardous chemical storage room?
 - A. MDA
 - B. SSD
 - C. SDS
 - D. TDH

- What is the best way to monitor filter performance?
 - A. Contact time
 - B. Hardness
 - C. Turbidity
 - D. Dissolved Solids

- What causes water to look cloudy?
 - A. Dissolved solids
 - B. Bicarbonates
 - C. Hardness
 - D. Suspended material

- Which sampling parameters must be taken in the field?
 - A. pH and temperature
 - B. Color
 - C. Hardness
 - D. Turbidity

- If the total coliform tests positive, then what must be done next?
 - A. Test for pH
 - B. Test for fecal coliform
 - C. Test for dissolved solids
 - D. Test for turbidity

- What is the definition of holding time for water samples?
 - A. The length of time a water sample is retained between taking the sample and discarding it
 - B. The length of time a water sample is exposed to the sun
 - C. The length of time a water sample is placed in the bottle before it is stored in a temperature-controlled room
 - D. The length of time a water sample is retained between taking the sample and laboratory analysis

- From a bacteriological standpoint, what is important for a well?
 - A. To protect it from contaminated runoff
 - B. Use a thicker steel casing
 - C. Drill shallow wells
 - D. Keep water table high

- Which is true about chlorine gas?
 - A. It is 4 times heavier than air.
 - B. It is 2.5 times lighter than air.
 - C. It is 2.5 times heavier than air.
 - D. It is 4 times lighter than air.

- If chlorine residual is not detected after 3 mg/L of dosage is applied, then what might be occurring in the water?
 - A. Too much chlorine has been added
 - B. Sufficient chlorine dosage has been met
 - C. Breakpoint chlorination has been surpassed
 - D. Demand has not been met

- Which of the following is an indicator organism for pathogens?
 - A. Cryptosporidium
 - B. Cyst
 - C. Coliform
 - D. Giardia

- What would happen if there is an increase in turbidity, organics, and manganese in the water?
 - A. Decrease in chlorine demand
 - B. Increase in chlorine demand
 - C. Chlorine demand would be unaffected
 - D. Increase in filter run time

- Which of the following would increase alkalinity in water?
 - A. CaCO_3
 - B. Iron
 - C. Manganese
 - D. CO_2

- What is the definition of well draw down?
 - A. Distance to the nearest well
 - B. Lowering of water table due to drought
 - C. Distance between static and pumping water level
 - D. Depth of well

- What should be done with a water sample that cannot be analyzed in a timely manner?
 - A. Freeze it
 - B. Refrigerate it
 - C. Store at room temperature
 - D. Add ammonia

- Which of the following source water would most likely contain *Cryptosporidium* and *Giardia*?
 - A. Unconfined aquifer
 - B. Groundwater
 - C. Confined Aquifer
 - D. Stream

- What is the purpose of chlorine residual?
 - A. Provides a safeguard to inactivate additional microorganisms encountered after treatment
 - B. Chlorine used to oxidize iron and manganese
 - C. Chlorine added prior to reaching breakpoint chlorination
 - D. Chlorine added to oxidize nitrite

- Which is equivalent to 3 log removal?
 - A. 10^3
 - B. 99%
 - C. 99.9%
 - D. 33.3%

- How is turbidity measured?
 - A. mg/L
 - B. ppm
 - C. Nephelometric
 - D. Percentage

- Which chemical is used to dechlorinate water?
 - A. Sodium hydroxide
 - B. Sodium thiosulfate
 - C. Sodium hypochlorite
 - D. Sodium chloride

- What is the minimum chlorine residual required prior to introducing the effluent from a surface water treatment plant to the distribution system?
 - A. 0.2 ppm
 - B. 1 ppm
 - C. 1.5 ppm
 - D. 0.5 ppm

- What must you wear prior to being exposed to chlorine gas?
 - A. Zenon protector
 - B. Nanotech apparatus
 - C. SAS
 - D. Self-contained breathing apparatus (SCBA)

- Why isn't chlorine typically injected prior to filtration?
 - A. To minimize capital cost of the plant
 - B. Decreases oxidation
 - C. Increases THMs
 - D. Increases nitrification

- Which of the following is a disinfection by-product?
 - A. MTBE
 - B. Trichloroethylene
 - C. Trihalomethane
 - D. Tetrachlorethylene

- Which of the following is not affected by chlorine dose?
 - A. Hardness
 - B. Iron
 - C. Manganese
 - D. Natural organic matters

- How long should you run water before you grab a water sample?
 - A. 30 seconds
 - B. 5 minutes
 - C. 2 to 3 minutes
 - D. 3 sample bottles worth

- Which of the following is least likely to affect the effectiveness of chlorine?
 - A. pH
 - B. Temperature
 - C. Turbidity
 - D. Sodium

- When dealing with high pressure pipeline, which must you do?
 - A. Open and close valve quickly
 - B. Open valve quickly, but close slowly
 - C. Open and close valve slowly
 - D. Open valve slowly, buy close quickly

- Which of the following water source is more likely to have iron and manganese?
 - A. Lake
 - B. Groundwater
 - C. River
 - D. Stream

- What are colloidal particles?
 - A. Very small particles that do not dissolve and remain dispersed in a liquid for a long time due to their small size and electrical charge
 - B. Settleable solids
 - C. Large sized particles
 - D. Sand

- What is alkalinity?
 - A. The capacity of water to neutralize base
 - B. pH of 5
 - C. The capacity of water to neutralize acid
 - D. pH of 7

- What does MCL stand for?
 - A. Maximum Common Level
 - B. Maximum Constituent Level
 - C. Maximum Carcinogen Level
 - D. Maximum Contaminant Level

- What typically occurs at the beginning of a breakpoint chlorination curve?
 - A. Formation of chloramines
 - B. Chloramines partly destroyed
 - C. Free available residual formed
 - D. Chlorine destroyed by reducing compounds

- What is the drawback of pre-chlorination?
 - A. Formation of THMs
 - B. Taste and Odor
 - C. Scaling
 - D. Mudball Formation

- The secondary MCL is set for what purpose?
 - A. Health
 - B. Bacteria and viruses
 - C. Carcinogens
 - D. Aesthetic

- What is used to lower pH in water?
 - A. CO_2
 - B. CaCO_3
 - C. NaOCl
 - D. Ammonia

- Why is Trihalomethane considered to be harmful?
 - A. Causes Blue Baby syndrome
 - B. Increases blood pressure
 - C. Elevates lead concentration in water
 - D. It is a carcinogen

- Which of the following describes turbidity?
 - A. Inorganic Salts
 - B. Calcium and magnesium
 - C. Soluble iron and manganese
 - D. Cloudiness or haziness of a fluid caused by suspended solids

- What is typically the cause of taste and odor problems in raw surface water?
 - A. Nitrate
 - B. Arsenic
 - C. Sand
 - D. Algae Growth

- What are the 4 zones of a clarifier?
 - A. Inlet, outlet, settling, baffle
 - B. Inlet, outlet, settling, collective
 - C. Inlet, outlet, settling, short circuiting
 - D. Inlet, outlet, settling, sludge

- What might occur after a filter has been backwashed?
 - A. Surface wash begins
 - B. Pressure Increases
 - C. Turbidity momentarily increases in the filter effluent
 - D. Headloss increases

- What is 4 log removal?
 - A. 99.99%
 - B. 44.44%
 - C. 4%
 - D. 10^4

- What is considered to be a base?
 - A. pH of 7
 - B. pH of 4 to 6
 - C. pH of 1 to 3
 - D. pH in the range of 8 to 14

- What organism is capable of causing disease?
 - A. Facultative
 - B. Heterotrophic
 - C. Pathogen
 - D. Anaerobic

- What is an example of combined chlorine?
 - A. Hypochlorous acid
 - B. Ocl
 - C. Hypochlorite
 - D. Monochloramine

- What is true about the Total Coliform Rule?
 - A. Specifies the log removal for bacteria and viruses
 - B. Establishes an MCL based on the presence and absence of total coliforms or E. Coli
 - C. Does not require use of a sampling plan
 - D. Requires sanitary survey for all systems

- Convert 5 cubic feet per second to MGD.
 - A. 4.1 MGD
 - B. 3.2 MGD
 - C. 6.2 MGD
 - D. 7.5 MGD

$$\frac{5 \text{ ft}^3}{\text{sec}} \times \frac{60 \text{ sec}}{\text{min}} \times \frac{60 \text{ min}}{\text{hr}} \times \frac{24 \text{ hr}}{\text{day}} = 432,000 \frac{\text{ft}^3}{\text{day}}$$

$$\frac{432,000 \text{ ft}^3}{\text{day}} \times \frac{7.48 \text{ gallons}}{\text{ft}^3} = \frac{3,231,360 \text{ gallons}}{\text{day}}$$

$$\frac{3,231,360 \text{ gallons}}{\text{day}} \times \frac{1 \text{ MG}}{1,000,000 \text{ gallons}} = \mathbf{3.2 \text{ MGD}}$$

- How long will it take water to pass through a rectangular basin at a flowrate of 1.3 MGD, if the basin is 80 feet long, 40 feet wide, and 10 feet deep?
 - A. 3.2 hours
 - B. 5.2 hours
 - C. 2.1 hours
 - D. 4.4 hours

$$\text{Detention time} = \frac{\text{Volume}}{\text{Flowrate}}$$

$$\text{Detention time} = \frac{80\text{ft} \times 40\text{ft} \times 10\text{ft}}{1.3 \text{ MGD}}$$

$$\text{Detention time} = \frac{32,000 \text{ ft}^3}{1.3 \text{ MGD}}$$

$$\text{Detention time} = \frac{32,000 \text{ ft}^3 \times 7.48 \text{ gal/ft}^3}{1.3 \text{ MGD}}$$

$$\text{Detention time} = \frac{239,360 \text{ gallons}}{1.3 \text{ MGD}}$$

$$\text{Detention time} = \frac{239,360 \text{ gallons}}{1.3 \text{ MGD}} \times \frac{1 \text{ MGD}}{1,000,000 \text{ gallons/day}} = 0.18 \text{ day}$$

$$\text{Detention time} = 0.18 \text{ day} \times \frac{24 \text{ hours}}{\text{day}} = \mathbf{4.4 \text{ hours}}$$

- A tank with a diameter of 60 feet and a height of 20 feet is located 40 feet above a pipeline. What must the pressure be in the pipeline to completely fill this tank? Assume that pipe friction and head loss are negligible.
 - A. 26 psi
 - B. 35 psi
 - C. 41 psi
 - D. 74 psi

$$20 \text{ ft} + 40 \text{ ft} = 60 \text{ ft}$$

$$60 \text{ ft} \times \frac{0.433 \text{ psi}}{\text{ft}} = \mathbf{26 \text{ psi}}$$

- An 18" diameter pipe that is 1 mile long is filled with water at a rate of 500 gpm. How long will it take to fill this pipe?
 - A. 3.5 hours
 - B. 2.3 hours
 - C. 4.2 hours
 - D. 1.2 hours

$$\text{Fill time} = \frac{\left(0.785 \times \left(\frac{18}{12}\right)^2\right) \times (1 \text{ mile} \times \frac{5,280 \text{ ft}}{\text{mile}})}{500 \text{ gpm}} = \frac{9,325.8 \text{ ft}^3}{500 \text{ gpm}}$$

$$\text{Fill time} = \frac{9,325.8 \text{ ft}^3 \times 7.48 \text{ gallons/ft}^3}{500 \text{ gpm}} = 139.5 \text{ min}$$

$$\text{Fill time} = 139.5 \text{ min} \times \frac{1 \text{ hr}}{60 \text{ min}} = \mathbf{2.3 \text{ hrs}}$$

- If a tank with a diameter of 40 feet and a height of 20 feet is full at 8AM and is draining at a rate of 200 GPM, then what is the water level in the tank at 4PM?
 - A. 11.8 ft
 - B. 9.8 ft
 - C. 14.1 ft
 - D. 2.6 ft

8 am to 4 pm = 8 hours of flow

$$\text{Volume}_{\text{full tank}} = 0.785 \times D^2 \times \text{height} = 0.785 \times (40 \text{ ft})^2 \times 20 \text{ ft} = 25,120 \text{ ft}^3$$

$$\text{Volume}_{\text{full tank}} = 25,120 \text{ ft}^3 \times \frac{7.48 \text{ gallons}}{\text{ft}^3} = 187,897.6 \text{ gallons}$$

$$\text{Volume}_{\text{outflow}} = \frac{200 \text{ gallons}}{\text{min}} \times \frac{60 \text{ min}}{\text{hr}} \times 8 \text{ hrs} = 96,000 \text{ gallons}$$

$$\begin{aligned} \text{Volume}_{\text{remaining}} &= \text{Volume}_{\text{full tank}} - \text{Volume}_{\text{outflow}} = 187,897.6 \text{ gal} - 96,000 \text{ gal} \\ &= 91,897.6 \text{ gallons} \end{aligned}$$

$$\text{Volume}_{\text{remaining}} = 91,897.6 \text{ gallons} \times \frac{1 \text{ ft}^3}{7.48 \text{ gallons}} = 12,285.8 \text{ ft}^3$$

$$12,285.8 \text{ ft}^3 = 0.785 \times (40 \text{ ft})^2 \times H \text{ ft}$$

$$\mathbf{9.8 \text{ ft} = H}$$

- If the water meter reads 2,000 at 10AM and 3,000 24 hours later, what is the water usage, assuming each unit equals 1,000 gallons?
 - A. 800,000 gallons
 - B. 500,251 gallons
 - C. 325,125 gallons
 - D. 1,000,000 gallons

$$3,000 - 2,000 = 1,000 \text{ units}$$

$$1,000 \text{ units} \times 1,000 \text{ gallons/unit} = \mathbf{1,000,000 \text{ gallons}}$$

- If 35 pounds of 65% calcium hypochlorite tablet is placed inside a tank, then what is the concentration of the water if there is 1,400,000 gallons in the tank?
 - A. 4.9 mg/L
 - B. 1.9 mg/L
 - C. 3.1 mg/L
 - D. 2.4 mg/L

$$35 \text{ lbs} \times .65 = 22.75 \text{ lbs}$$

$$\text{Lbs} = \text{mg/L} \times \text{MG} \times 8.34 \text{ lbs/gallon}$$

$$22.75 \text{ lbs} = \text{mg/L} \times 1.4 \text{ MG} \times 8.34 \text{ lbs/gallon}$$

$$\text{mg/L} = \mathbf{1.9 \text{ mg/L}}$$

Answers

Slide Number	Answer	Slide Number	Answer
3	C	33	C
4	B	34	C
5	D	35	A
6	C	36	C
7	A	37	D
8	D	38	C
9	B	39	A
10	B	40	A
11	D	41	C
12	C	42	D
13	C	43	D
14	D	44	A
15	A	45	D
16	B	46	A
17	D	47	D
18	A	48	D
19	C	49	D
20	D	50	D
21	C	51	C
22	B	52	A
23	A	53	D
24	C	54	C
25	B	55	D
26	D	56	B
27	A	57	B
28	C	59	D
29	C	61	A
30	B	63	B
31	A	65	B
32	D	67	D
		69	B

Questions?