

**Registration form**

**WATER TREATMENT PROCESS CONTROL \$100.00  
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

**Start and Finish Dates:** \_\_\_\_\_

*You will have 90 days from this date in order to complete this course*

List number of hours worked on assignment must match State Requirement. \_\_\_\_\_

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*I have read and understood the disclaimer notice on page 2. Digitally sign XXX*

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**Class/Grade** \_\_\_\_\_

**Please circle/check which certification you are applying the course CEU's.**

Water Treatment \_\_\_ Water Distribution \_\_\_ Other \_\_\_\_\_

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<http://www.abctlc.com/downloads/PDF/CEU%20State%20Approvals.pdf>

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I affirm that I personally completed the entire text of the course. I also affirm that I completed the exam without assistance from any outside source. I understand that it is my responsibility to file or maintain my certificate of completion as required by the state or by the designation organization.

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## WT Process Control Answer Key

Name \_\_\_\_\_

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Did you check with your State agency to ensure this course is accepted for credit?

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***You can electronically complete this assignment in Adobe Acrobat DC.***

Please Circle, Bold, Underline or X, one answer per question. A **felt tipped pen** works best.

1. A B C D

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73. A B	93. A B C D	113. A B	133. A B
74. A B C D	94. A B C D	114. A B C D	134. A B
75. A B C D	95. A B C D	115. A B	135. A B
76. A B C D	96. A B C D	116. A B C D	136. A B
77. A B C D	97. A B C D	117. A B C D	137. A B
78. A B C D	98. A B C D	118. A B C D	138. A B
79. A B C D	99. A B C D	119. A B C D	139. A B
80. A B C D	100. A B C D	120. A B C D	140. A B C D
81. A B	101. A B C D	121. A B	141. A B C D
82. A B C D	102. A B C D	122. A B C D	142. A B
83. A B C D	103. A B	123. A B	143. A B C D
84. A B C D	104. A B	124. A B C D	144. A B
85. A B	105. A B	125. A B	145. A B
86. A B	106. A B	126. A B C D	146. A B C D
87. A B C D	107. A B	127. A B C D	147. A B C D
88. A B C D	108. A B	128. A B C D	148. A B C D
89. A B C D	109. A B	129. A B C D	149. A B C D
90. A B C D	110. A B	130. A B C D	150. A B C D
91. A B C D	111. A B	131. A B	
92. A B	112. A B	132. A B C D	

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**Signature**

***Please write down any questions you were not able to find the answers or that have errors.***

**Please e-mail or fax this survey along with your final exam**

**WATER TREATMENT PROCESS CONTROL CEU COURSE  
CUSTOMER SERVICE RESPONSE CARD**

NAME: \_\_\_\_\_

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**PLEASE COMPLETE THIS FORM BY CIRCLING THE NUMBER OF THE  
APPROPRIATE ANSWER IN THE AREA BELOW.**

Please rate the difficulty of your course.

Very Easy    0    1    2    3    4    5    Very Difficult

Please rate the difficulty of the testing process.

Very Easy    0    1    2    3    4    5    Very Difficult

Please rate the subject matter on the exam to your actual field or work.

Very Similar    0    1    2    3    4    5    Very Different

How did you hear about this Course? \_\_\_\_\_

What would you do to improve the Course?

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Any other concerns or comments.

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**Please fax the answer key to TLC Western Campus  
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*This course contains general EPA's SDWA federal rule requirements. Please be aware that each state implements water / sampling procedures / safety / environmental / SDWA regulations that may be more stringent than EPA's regulations. Check with your state environmental/health agency for more information. These rules change frequently and are often difficult to interpret and follow. Be careful to be in compliance with your regulatory agencies and do not follow this course for any compliance concerns.*

## Water Treatment Process Control CEU Training Course Assignment

The Water Treatment Process Control CEU course assignment is available in Word on the Internet for your convenience, please visit [www.abctlc.com](http://www.abctlc.com) and download the assignment and e-mail it back to TLC.

You will have 90 days from receipt of this manual to complete it in order to receive your Professional Development Hours (PDHs) or Continuing Education Unit (CEU). A score of 70 % or better is necessary to pass this course. If you should need any assistance, please email or fax all concerns and the completed ANSWER KEY to [info@tlch2o.com](mailto:info@tlch2o.com).

Select one answer per question. Please utilize the answer key. (s) on the answer will indicate either plural and singular tenses.

### Hyperlink to the Glossary and Appendix

<http://www.abctlc.com/downloads/PDF/WTGlossary.pdf>

### Water Quality Key Words

1. The "dissolved" fraction of which compound is an operational classification?
- A. Activated alumina                      C. Organic carbon  
B. Activated carbon                        D. None of the above

### Three Types of Public Water Systems

2. Provides water where people do not remain for long periods of time (for example: gas stations, campgrounds)
- A. TNCWS    C. NTNCWSs  
B. CWSs     D. None of the above
3. Approximately 52,000 systems serving the majority of the U.S. population
- A. TNCWS    C. NTNCWSs  
B. CWSs     D. None of the above
4. Provides water to the same people at least six months a year, but not all year (for example: schools, factories, churches, office buildings that have their own water system)
- A. TNCWS    C. NTNCWSs  
B. CWSs     D. None of the above

### Water Quality Section -Surface (Raw) Water Introduction

5. Operators need to appropriately treat surface water is never pure of \_\_\_\_\_, it. Most of the earth's water sources obtain their water supplies through precipitation.
- A. Excess nutrients                      C. Pollution  
B. Biological actions                    D. None of the above
6. Raw water generally contains varying amounts of dissolved minerals including calcium, magnesium, sodium, chlorides, sulfates and bicarbonates, depending on its source.
- A. True                      B. False

### Surface Water Properties

7. Water is accepted as the \_\_\_\_\_ because will dissolve most substances that comes in contact.
- A. Universal solvent                      C. Surface water  
B. Water quality                          D. None of the above
8. Depending on the region, some lakes and rivers receive \_\_\_\_\_ from sewer facilities or defective septic tanks.
- A. Excess nutrients                      C. Discharge  
B. Biological actions                    D. None of the above
9. Runoff could produce mud, leaves, decayed vegetation, and human and animal refuse. The discharge from industry could increase\_\_\_\_\_. Some lakes and reservoirs may experience seasonal turnover.
- A. Volatile organic compounds        C. Excess nutrients  
B. Water quality                          D. None of the above

### Managing Water Quality at the Source

10. Algae growth is supplied by the energy of the sun. As algae absorbs this energy, it converts carbon dioxide to oxygen. Algae and rooted aquatic plants are essential in the food chain of fish and birds. Algae growth is the result of photosynthesis.
- A. True                      B. False
11. The absence of dissolved oxygen in water is known as aerobic conditions.
- A. True                      B. False
12. Most treatment plant upsets are such as taste and odor, color, and filter clogging is due to algae. The type of algae determines the problem it will cause, for instance slime, corrosion, color, and toxicity.
- A. True                      B. False
13. Algae can be controlled in the water supply by using chemicals such as\_\_\_\_\_.
- A. pH and alkalinity                      C. Powdered activated carbon and chlorine  
B. Copper sulfate                          D. None of the above
14. Contingent upon federal regulations and the amount of copper found natural in water, operators have used \_\_\_\_\_ , powdered activated carbon and chlorine to control algae blooms.
- A. pH and alkalinity                      C. Potassium permanganate  
B. Metals, and non-metals              D. None of the above
15. The \_\_\_\_\_ of the water will govern how these chemicals will react.
- A. pH and alkalinity                      C. Powdered activated carbon and chlorine  
B. Metals, and non-metals              D. None of the above

### Physical Characteristics of Water

16. Physical characteristics are the elements found that are considered alkali, metals, and non-metals such as carbonates, fluoride,\_\_\_\_\_. The consumer relates it to scaling of faucets or staining.
- A. pH and alkalinity                      C. Powdered activated carbon and chlorine  
B. Sulfides or acids                        D. None of the above



17. pH is the negative logarithm of the hydrogen ion concentration,  $[H^+]$ , a measure of the degree to which a solution is \_\_\_\_\_ .

- A. Alkalinity
- B. Acidic or alkaline
- C. Hydrogen ion ( $H^+$ )
- D. None of the above

18. \_\_\_\_\_ is a substance that can give up a hydrogen ion ( $H^+$ ); a base is a substance that can accept  $H^+$ .

- A. Acid
- B. Base
- C. Acidic or alkaline
- D. None of the above

### Alkalinity

19. Alkalinity of water is its acid-neutralizing capacity. It is the sum of all the titratable bases. The measured value may vary significantly with the end-point pH used.

- A. True
- B. False

20. \_\_\_\_\_ with an overabundance of alkaline earth metal concentrations is significant in determining the suitability of water for irrigation.

- A. Alkalinity
- B. Acid
- C. Hydrogen ion ( $H^+$ )
- D. None of the above

21. Alkalinity measurements are used in the interpretation and control of water and wastewater treatment processes

- A. True
- B. False

### Turbidity Introduction

22. One physical feature of water is turbidity, is a measurement of the cloudiness of water caused by \_\_\_\_\_ .

- A. Suspended particles
- B. Variations
- C. Temperature fluctuation
- D. None of the above

23. High levels of turbidity may inhibit with proper water treatment and monitoring. If high quality raw water is low in turbidity, there will be a reduction in water treatment costs. Turbidity is unwanted because it causes health hazards.

- A. True
- B. False

24. The turbidity in natural surface waters is composed of a large number of sizes of particles. The sizes of particles can be changing constantly, depending on precipitation and \_\_\_\_\_ factors.

- A. MCL
- B. Manmade
- C. Temperature
- D. None of the above

25. When heavy rains transpire, runoff into streams, rivers, and reservoirs occurs, causing turbidity levels to increase. In most cases, the particle sizes are relatively large and settle relatively quickly in both the water treatment plant and the source of supply. However, in some instances, fine, colloidal material may be present in the supply, which may cause some difficulty in the coagulation process.

- A. True
- B. False

26. Low \_\_\_\_\_ waters can be very difficult to coagulate due to the difficulty in inducing collision between the colloids.

- A. Turbidity
- B. Colloids
- C. Total Dissolved Solids (TDS)
- D. None of the above

27. \_\_\_\_\_ may be existing in a water supply due to pollution, and these colloids can be difficult to remove in the coagulation process. In this situation, higher coagulant dosages are generally required.

- A. Turbidity
- B. Organic colloids
- C. Total Dissolved Solids (TDS)
- D. None of the above

### **Turbidity MCL**

28. An MCL for turbidity established by the EPA because \_\_\_\_\_ interferes with disinfection. This characteristic of water changes the most rapidly after a heavy rainfall.

- A. Conductivity
- B. Turbidity
- C. Temperature
- D. None of the above

29. The temperature variation of a sample, a scratched or unclean sample tube in the nephelometer and selecting an incorrect wavelength of a light path may be conditions caused by an inaccurate \_\_\_\_\_ measurement.

- A. Conductivity
- B. Turbidity
- C. Temperature
- D. None of the above

### **Dissolved Oxygen**

30. The level of dissolved oxygen in natural waters is often a direct indication of quality, since aquatic plants produce oxygen, while microorganisms generally consume it as they feed on \_\_\_\_\_.

- A. Pollutants
- B. Organic matter
- C. E. coli bacteria
- D. None of the above

31. At low temperatures, the \_\_\_\_\_ is increased, so that in winter, concentrations as high as 20 ppm may be found in natural waters; during summer, saturation levels can be as low as 4 or 5 ppm.

- A. Dissolved oxygen
- B. Thermal stratification
- C. Solubility of oxygen
- D. None of the above

32. \_\_\_\_\_ is essential for the support of fish and other aquatic life and aids in the natural decomposition of organic matter.

- A. Dissolved oxygen
- B. Thermal stratification
- C. Solubility of oxygen
- D. None of the above

33. Thermal stratification is possible as water becomes less dense when heated, meaning water weighs less per unit volume. Therefore, warmer water will be lighter and colder water will be heavier. Due to this, there will always be a level of “self-induced” \_\_\_\_\_ in a water storage.

- A. Saturation level(s)
- B. Thermal stratification
- C. Permanent hardness
- D. None of the above

### **Secondary Standard**

34. TDS is most often measured in parts per million (ppm) or milligrams per liter of water (mg/L). The normal TDS level ranges from \_\_\_\_\_

- A. 50 ppm to 1,000 ppm
- B. 5 ppm to 10 ppm
- C. 50 ppm to 100 ppm
- D. None of the above

35. The Environmental Protection Agency (EPA), which is responsible for drinking water regulations in the United States, has identified TDS as a secondary standard, meaning that it is a voluntary guideline. While the United States set legal standards for many harmful substances, TDS, along with other contaminants that cause aesthetic, cosmetic, and technical effects, has only a guideline.

- A. True      B. False

### **Langelier Saturation Index**

36. The Langelier saturation level approaches the concept of saturation using pH as a main variable. The LSI can be interpreted as the pH change required to bring water to \_\_\_\_\_.

- A. Saturation level(s)      C. Equilibrium  
B. Stratification      D. None of the above

### **More on the Stage 2 DBP Rule**

37. Which of the following rules focuses on public health protection by limiting exposure to DBPs, specifically total trihalomethanes and five haloacetic acids, which can form in water through disinfectants used to control microbial pathogens?

- A. Stage 2 DBP rule      C. Long Term 2 Enhanced Surface Water Treatment Rule  
B. Stage 1 DBPR      D. None of the above

38. Safe Drinking Water Act (SDWA) has been highly effective in protecting public health and has evolved to respond to new and emerging threats to safe drinking water.

- A. True      B. False

### **What are Disinfection Byproducts (DBPs)?**

39. Which of the following form when disinfectants used to treat drinking water react with naturally occurring materials in the water?

- A. Chloramines      C. Disinfection byproducts (DBPs)  
B. Humic and fulvic acids      D. None of the above

### **Are THMs and HAAs the only disinfection byproducts?**

40. The presence of TTHM and HAA5 is representative of the occurrence of many other chlorination DBPs; thus, an increase of TTHM and HAA5 generally indicates an increase of DBPs from chlorination.

- A. True      B. False

### **All disinfectants form DBPs in one of two reactions:**

41. Chlorine and chlorine-based compounds (halogens) react with organics in water causing the hydrogen atom to substitute other atoms, resulting in halogenated by-products.

- A. True      B. False

### **Disinfection Byproduct Research and Regulations Summary**

42. \_\_\_\_\_ is unquestionably the most important step in the treatment of water for drinking water supplies.

- A. DBP(s)      C. Disinfection  
B. Turbidity (particle)      D. None of the above

43. The \_\_\_\_\_ should not be compromised because of concern over the potential long-term effects of disinfectants and DBPs.

- A. DBP(s)      C. Microbial quality of drinking water  
B. Turbidity (particle)      D. None of the above

44. The risk of illness and death resulting from exposure to pathogens in drinking water is very much greater than the risks from \_\_\_\_\_.
- A. Disinfectants and DBPs
  - B. Turbidity (particle)
  - C. Natural organic matter precursors
  - D. None of the above

### **Controlling Disinfection Byproducts**

45. Treatment techniques are available that provide water suppliers the opportunity to maximize potable water safety and quality while minimizing the risk of \_\_\_\_\_.
- A. DBP risks
  - B. Turbidity (particle)
  - C. Disinfectants and DBPs
  - D. None of the above

### **The EPA guidance discusses three processes to effectively remove natural organic matter prior to disinfection:**

#### **Coagulation and Clarification**

46. Most treatment plants optimize their coagulation process for \_\_\_\_\_ removal.
- A. Inorganic coagulants
  - B. Most contaminants
  - C. Turbidity (particle)
  - D. None of the above
47. Coagulation processes can also be optimized for natural organic matter removal with higher doses of \_\_\_\_\_ (such as alum or iron salts), and optimization of pH.
- A. THMs and HAAs
  - B. Inorganic coagulants
  - C. Natural organic matter
  - D. None of the above

#### **Absorption**

48. Activated carbon can be used to absorb \_\_\_\_\_ that react with disinfectants to form byproducts.
- A. Inorganic coagulants
  - B. Most contaminants
  - C. Soluble organics
  - D. None of the above

#### **Membrane Technology**

49. Other conventional methods of reducing DBP formation include changing the point of chlorination and using \_\_\_\_\_ for residual disinfection.
- A. Free residual disinfection
  - B. Chloramines
  - C. Total residual disinfection
  - D. None of the above
50. EPA predicted that most water systems will be able to achieve compliance with new DBP regulations through the use of one or more of these relatively low cost methods (EPA, 1998). Water system managers may also consider switching from chlorine to alternative disinfectants to reduce formation of \_\_\_\_\_.
- A. THMs and HAAs
  - B. Optimization of pH
  - C. Natural organic matter
  - D. None of the above

#### **Contaminants that may be present in sources of drinking water include:**

51. Which of the following like salts and metals, which can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming?
- A. Radioactive contaminants
  - B. Pesticides and herbicides
  - C. Inorganic contaminants
  - D. Microbial contaminants

(S) Means the answer can be plural or singular in nature

52. Which of the following can be synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can come from gas stations, urban stormwater run-off, and septic systems?

- A. Organic chemical contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. Microbial contaminants

53. Which of the following can be naturally occurring or be the result of oil and gas production and mining activities?

- A. Radioactive contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. Microbial contaminants

### **Background**

54. Coliform bacteria and chlorine residual are the only routine sampling and monitoring requirements for small ground water systems with chlorination. The coliform bacteriological sampling is governed by the Coliform Reduction amendment of the SDWA.

- A. True
- B. False

### **TCR**

55. The TCR recommends most of the Public Water Systems (PWS) to monitor their distribution system for bacteria according to the written sample sitting plan for that system.

- A. True
- B. False

56. The sample sitting plan identifies sampling frequency and locations throughout the distribution system that are selected to be representative of conditions in the entire system.

- A. True
- B. False

57. Coliform contamination may occur anywhere in the system, possibly due to problems such as; high pressure conditions, line fluctuations, or wells, and therefore routine monitoring is required.

- A. True
- B. False

### **Routine Sampling Requirements**

58. Total coliform samples must be collected by PWSs at sites that are representative of water quality throughout the distribution system according to a written sample sitting plan subject to state review and revision.

- A. True
- B. False

59. If any routine sample is TC+, repeat samples are required. – PWSs on quarterly or annual monitoring must take a minimum of one additional routine samples (known as additional routine monitoring) the quarter following a TC+ routine or repeat sample.

- A. True
- B. False

60. Reduced monitoring is general available for PWSs using only surface water and serving 1,000 or fewer persons that meet certain additional PWS criteria.

- A. True
- B. False

### **Dangerous Waterborne Microbes**

61. Which of the following is a parasite that enters lakes and rivers through sewage and animal waste. It causes cryptosporidiosis, a mild gastrointestinal disease. The disease can be severe or fatal for people with severely weakened immune systems.

- A. Coliform Bacteria
- B. Cryptosporidium
- C. Giardia lamblia
- D. None of the above

62. Which of the following are not necessarily agents of disease may indicate the presence of disease-carrying organisms?  
 A. Fecal coliform bacteria C. *Shigella dysenteriae*  
 B. *Cryptosporidium* D. None of the above
63. Which of the following is a parasite that enters lakes and rivers through sewage and animal waste. It causes gastrointestinal illness (e.g. diarrhea, vomiting, and cramps)?  
 A. Coliform Bacteria C. Protozoa  
 B. *Cryptosporidium* D. None of the above
64. Which of the following is a species of the rod-shaped bacterial genus *Shigella*?  
 A. Fecal coliform bacteria C. *Shigella dysenteriae*  
 B. *Cryptosporidium* D. None of the above
65. Which of the following can cause bacillary dysentery?  
 A. Fecal coliform bacteria C. *Shigella*  
 B. *Cryptosporidium* D. None of the above
66. Which of the following are Gram-negative, non-spore-forming, facultatively anaerobic, non-motile bacteria.  
 A. Fecal coliform bacteria C. *Shigellae*  
 B. *Cryptosporidium* D. None of the above
67. Which of the following are microscopic organisms that live in the intestines of warm-blooded animals? They also live in the waste material, or feces, excreted from the intestinal tract. When fecal coliform bacteria are present in high numbers in a water sample, it means that the water has received fecal matter from one source or another.  
 A. Fecal coliform bacteria C. *Shigella dysenteriae*  
 B. *Cryptosporidium* D. None of the above
68. Which of the following are common in the environment and are generally not harmful? However, the presence of these bacteria in drinking water are usually a result of a problem with the treatment system or the pipes which distribute water, and indicates that the water may be contaminated with germs that can cause disease.  
 A. Coliform Bacteria C. *Giardia lamblia*  
 B. *Cryptosporidium* D. None of the above
69. Which of the following are bacteria whose presence indicates that the water may be contaminated with human or animal wastes? Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms.  
 A. Fecal Coliform and *E. coli* C. *Shigella dysenteriae*  
 B. *Cryptosporidium* D. None of the above

### **Bacteriological Monitoring Introduction**

70. Which of the following are usually harmless, occur in high densities in their natural environment and are easily cultured in relatively simple bacteriological media?  
 A. Indicator bacteria C. Viruses  
 B. Amoebas D. None of the above

(S) Means the answer can be plural or singular in nature

71. Indicators in common use today for routine monitoring of drinking water include total coliforms, fecal coliforms, and?
- A. Cryptosporidium
  - B. Protozoa
  - C. Escherichia coli (E. coli)
  - D. None of the above

72. According to the text, the routine microbiological analysis of your water is for?
- A. Contamination
  - B. Colloids
  - C. Coliform bacteria
  - D. None of the above

### Basic Types of Water Samples

73. It is important to properly identify the type of sample you are collecting.
- A. True
  - B. False

### The three (3) types of samples are:

74. Samples collected following a coliform present routine sample. The number of repeat samples to be collected is based on the number of \_\_\_\_\_ samples you normally collect.
- A. Repeat
  - B. Special
  - C. Routine
  - D. None of the above

75. A PWS fails to take every required repeat sample after any single TC+ sample
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

76. A PWS incurs an E. coli MCL violation.
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

77. A PWS collecting at least 40 samples per month has greater than 5.0 percent of the routine/repeat samples in the same month that are TC+.
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

78. A PWS has a second Level 1 Assessment within a rolling 12-month period.
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

79. A PWS on state-approved annual monitoring has a Level 1 Assessment trigger in 2 consecutive years.
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

80. A PWS collecting fewer than 40 samples per month has 2 or more TC+ routine/ repeat samples in the same month.
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

### Viruses

#### Coronavirus

81. It looks like the COVID-19 coronavirus is not able to live in water.
- A. True
  - B. False

## Water Treatment Section - Preliminary Treatment Process

### Preliminary Treatment

82. Weeds, leaves, and trash, if not removed, these will cause problems to the treatment plant's pumps and equipment, the best way to protect the plant is?

- A. Screening
- B. Super settling
- C. Change source
- D. None of the above

### Pre-Sedimentation

83. Sand and grit will damage plant equipment and pipes, so it must be removed with either rectangular or round shaped basin are called?

- A. Filtration basin(s)
- B. Coagulation basin(s)
- C. Sedimentation basin(s)
- D. None of the above

### Flights and Chains

84. Flights and chains remove the scum from the \_\_\_\_\_ of the basin.

- A. Scum box
- B. Surface
- C. Armature
- D. None of the above

### Circular Clarifiers

85. As suspended particles accumulate in a Filter bed, the pressure drop through the filter increases.

- A. True
- B. False

86. According to the text, when the pressure difference between filter inlet and outlet increases by 5 - 10 psi from the beginning of the cycle, the filter should be reconditioned. Operating beyond this pressure drop increases the chance of fouling - called " Mud-balling " - within the filter.

- A. True
- B. False

87. Which of the following processes uses alum and cationic polymer to neutralize the charge of colloidal particles?

- A. Filtration
- B. Reconditioning
- C. Flocculation
- D. None of the above

88. Which of the following compounds combines with alkalinity in the raw water to form a white precipitate that neutralizes suspended particles' electrical charge?

- A. Activated sodium
- B. PAC
- C. Alum
- D. None of the above

89. Which of the following systems uses a 30 to 50 mg/L alum dosage to form a large floc that requires extensive retention time to permit settling?

- A. Conventional technology
- B. Chemical pretreatment
- C. Slow Sand Filtration
- D. None of the above

90. Which of the following processes lasts about 5 to 10 minutes?

- A. Filter-to-Waste
- B. Reconditioning cycle
- C. Fast rinse
- D. None of the above

91. Which of the following terms is often used to enhance filter performance?

- A. Conventional technology
- B. Chemical pretreatment
- C. Fast rinse
- D. None of the above



92. Feeding chemicals such as alum, ferric chloride, or a cationic polymer neutralizes the particle charges, allowing the particles to cling to one another and be trapped by the filter media.  
A. True      B. False
93. Which of the following terms may increase filtered water clarity, measured in NTU, by 90% compared with filtration alone?  
A. Chemical pretreatment      C. Fast rinse  
B. Reconditioning cycle      D. None of the above
94. Water treatment systems use settling tanks unit to allow for \_\_\_\_\_.  
A. Gravity      C. Settling time  
B. Particle(s)      D. Sedimentation and settling
95. The main aim of tube settlers is to minimize the \_\_\_\_\_ that a small floc particle must settle before agglomerating into larger particles.  
A. Gravity      C. Settling time  
B. Vertical distance      D. Solids

### Conventional Water Treatment Process Introduction

96. \_\_\_\_\_ along with pre-chlorination for removal of dissolved iron when present with small amounts relative of manganese  
A. Disinfection      C. Pre-treatment  
B. Coagulation      D. Aeration
97. \_\_\_\_\_ for algae control and arresting biological growth  
A. Sodium hydroxide      C. Pre-treatment  
B. UV      D. Ferric Chloride
98. Coagulant aids, also known as polyelectrolytes – to improve \_\_\_\_\_ and for more robust floc formation  
A. Disinfection      C. Pre-treatment  
B. Coagulation      D. Aeration along with pre-chlorination
99. \_\_\_\_\_ for settling and the removal of suspended solids trapped in the floc  
A. Disinfection      C. Pre-treatment  
B. Coagulation      D. Sedimentation
100. \_\_\_\_\_ to remove particles from water either by passage through a sand bed that can be washed and reused or by passage through a purpose- designed filter that is washable.  
A. Disinfection      C. Pre-treatment  
B. Coagulation      D. Filtration
101. \_\_\_\_\_ for killing bacteria viruses and other pathogens.  
A. Disinfection      C. Pre-treatment  
B. Coagulation      D. Aeration along with pre-chlorination
102. \_\_\_\_\_ or slow-sand filtration  
A. Disinfection      C. Pre-treatment  
B. Coagulation      D. Coagulation or flocculation

(S) Means the answer can be plural or singular in nature

### **Treatment Design and Plant Operation**

103. SCADA (Supervisory Control and Data Acquisition) automation of water treatment is common in the US. Source water quality through the seasons, scale, and environmental impact can dictate capital costs and operating costs. End use of the treated water dictates the necessary quality monitoring technologies.

A. True                      B. False

### **Zeta Potential Introduction**

104. Zeta potential is a physical property exhibited by all solid-liquid and liquid-liquid colloidal systems. Surrounding the surface of all dispersed particles is a thick layer of ions that have the same charge of the particle's surface called the ATP layer.

A. True                      B. False

### **Solubility of Substances in Water**

105. Water is an excellent solvent for many compounds. Some dissolve in it as molecules while others, called electrolytes, dissociate and dissolve not as neutral molecules but as charged species called ions.

A. True                      B. False

### **Purpose of Coagulation**

106. Chemical Coagulation in the water/wastewater treatment is the process of bringing suspended matter in untreated water together for settling and for the preparation of the water for filtration.

A. True                      B. False

### **Turbidity Particles**

107. The ability of particles to remain suspended in water is a function of hydrogen ion activity.

A. True                      B. False

108. Turbidity particles can range in size from molecular to 50 microns (a tremendous range).

A. True                      B. False

109. Particles that are greater than one micron in diameter are considered silt, and settle out due to their relatively large size and density in a matter of days with the need to coagulation.

A. True                      B. False

### **Olation**

110. Olation involves the bridging of two or more of these large molecules to form even larger, positively charged ions. A typical molecule can contain eight aluminum ions, twenty hydroxide ions, and will have a +4 charge.

A. True                      B. False

### **Zeta Potential**

111. The Zeta Potential is reduced to zero in order for coagulation to occur, because the forces of attraction are predominant.

A. True                      B. False

### **Coagulants – Alum and Ferric Aluminum Sulfate (Alum)**

112. Aluminum Sulfate is also known as alum, filter alum, and alumina sulfate. Alum is the most widely used coagulant. Alum is available in dry form as a powder or in lump form. It can also be purchased and fed as a liquid.

A. True                      B. False

113. Alum has an exact formula due to the constant water molecules of hydration that may be attached to the aluminum sulfate molecule.

- A. True      B. False

114. When the pH level of the water is above 7.8 after the addition of the alum, the aluminum ions again become soluble, and the efficiency of coagulation is decreased. Under these conditions, aluminum ions again penetrate the filters, and \_\_\_\_\_ can occur in the clear well and in the distribution system in some cases.

- A. Post filtration alum coagulation      C. Byproducts of these reactions  
B. Olation reaction(s)      D. None of the above

### **Ferric Chloride (Ferric)**

115. Ferric chloride is becoming more extensively used as a coagulant due partially to the fact that the material can be purchased as a liquid.

- A. True      B. False

### **Factors Influencing Coagulation**

#### **Effects of pH**

116. The pH range in which a coagulation process occurs may be the single most important factor in \_\_\_\_\_ coagulation. The vast majority of coagulation problems are related to improper pH levels.

- A. Improper      C. Proper  
B. Optimum      D. None of the above

117. Whenever possible, coagulation should be conducted in \_\_\_\_\_. When this is not done, lower coagulation efficiency results, generally resulting in a waste of chemicals and a lowered water quality.

- A. The optimum pH zone      C. Collision between the colloids  
B. The coagulation process      D. None of the above

#### **Effects of Salts**

118. Since no natural waters are completely pure, each will have various levels of cations and anions such as calcium, sodium, magnesium, iron, manganese, sulfate, chloride, phosphate, and others. Some of these ions may affect the efficiency of \_\_\_\_\_.

- A. All chemical reactions      C. Collision between the colloids  
B. The coagulation process      D. None of the above

#### **Nature of Turbidity**

119. Generally, higher turbidity levels require higher coagulant dosages. However, seldom is the relationship between turbidity level and coagulant dosage linear. Usually, the additional coagulant required is \_\_\_\_\_ when turbidities are much higher than normal due to higher collision probabilities of the colloids during high turbidities.

- A. Improper      C. Relatively small  
B. Optimum      D. None of the above

#### **Water Temperature**

120. Cold water temperatures can cause two factors which add to the difficulty of the coagulation process. As water temperatures approach freezing, almost all chemical reactions occur more \_\_\_\_\_.

- A. Improper      C. Slowly  
B. Higher      D. None of the above



### **Pre-Sedimentation**

130. Contingent on the quality of the source water, some plants have pre-sedimentation, which allows larger \_\_\_\_\_ in a reservoir or lake reducing solid removal loads.

- A. Equalization of the basin
- B. Particles time to settle
- C. Floc particles mix
- D. None of the above

### **Sedimentation**

131. Sedimentation is the process of destabilizing coagulated particles in water.

- A. True
- B. False

### **Water Filtration Key Terms**

#### **Declining Rate Filters**

132. Declining Rate Filters system often requires \_\_\_\_\_ to provide adequate media submergence.

- A. Head loss
- B. Uniform media
- C. Effluent control structure
- D. None of the above

### **Disinfection**

133. Chlorine kills or "inactivates" harmful microorganisms in water.

- A. True
- B. False

### **Jar Testing**

134. Jar testing traditionally has been done on an infrequent basis in most water treatment plants to control THMs.

- A. True
- B. False

### **pH**

135. According to the text, pH is an expression of a basic or acid condition of a liquid. The range is from 0-14, zero being the most acid and 14 being the most alkaline. A pH of 7 is considered to be neutral.

- A. True
- B. False

### **Caustic**

136. A strong chemical - NaOH is used in the treatment process to neutralize acidity, and to lower the pH value.

- A. True
- B. False

### **Polymer**

137. Polymer is a water treatment chemical that when combined with other types of coagulants, aids in binding small suspended particles to larger particles to help in the settling and filtering processes.

- A. True
- B. False

### **Post-Chlorine**

138. The operator should make sure that the chlorinated water holds a residual in the distribution system.

- A. True
- B. False

### **Pre-Chlorination**

139. Before the filtration process, chlorination helps control fish and vegetation.

- A. True
- B. False

### Short-Circuiting

140. Short-Circuiting is usually undesirable, since it may result in shorter contact, reaction, or settling times in comparison with the?

- A. Presumed detention times
- B. Sedimentation/clarification process
- C. Modification of the conventional process
- D. None of the above

### Adsorption Clarifiers

141. In the sedimentation/clarification process, turbidity is \_\_\_\_\_ of the coagulated and flocculated solids.

- A. Increased by adsorption
- B. Reduced by adsorption
- C. Decreased by adsorption
- D. None of the above

### Filtration Overview

142. Filtration is a water treatment process step used to remove turbidity, dissolved organics, odor, taste and color.

- A. True
- B. False

### Anthracite Coal or Activated Carbon

143. For a filter which of the following should be conducted on a routine basis, at least once per day?

- A. Filtration process performance
- B. Effluent control measurement
- C. Post-disinfection performance
- D. None of the above

### EPA Filter Backwash Rule- Introduction

144. The U.S. Environmental Protection Agency (EPA) has finalized the Long Term 1 Enhanced Surface Water Treatment Rule and Filter Backwash Rule (LT1FBR) to increase protection of finished drinking water supplies from contamination by Cryptosporidium and other microbial pathogens.

- A. True
- B. False

### LT1FBR Required

145. The LT1FBR provisions does not apply to public water systems using surface water or ground water under the direct influence of surface water systems.

- A. True
- B. False

### Disinfection Benchmarking

146. Public water systems will be required to develop a(n) \_\_\_\_\_ unless they perform applicability monitoring which demonstrates their disinfection byproduct levels are less than 80% of the maximum contaminant levels.

- A. Disinfection profile
- B. Direct filtration system
- C. Disinfection benchmark
- D. None of the above

### Filtration Process- Detailed

147. Removal of \_\_\_\_\_ plays an important role in the natural treatment of groundwater as it percolates through the soil.

- A. Suspended solids by filtration
- B. Serious problems in filter operation
- C. Coagulation and flocculation processes
- D. None of the above

148. According to the text, since surface water sources are subject to run-off and do not undergo natural filtration, it must be filtered to?

- A. Remove particles and impurities
- B. Filtration process can be compared to a sieve or microstrainer
- C. Suspended particles can easily pass
- D. None of the above

### **Types of Filters**

149. What is the term for the mass of growing material that collects on the surface of the filter?

- A. Schmutzdecke    C. Mud balls
- B. Zoological growth    D. None of the above

### **Rapid Sand Filters**

150. Rapid sand filters can accommodate filter rates 40 times more than?

- A. Fixed film    C. Mixed media
- B. Slow sand filters    D. None of the above