

Registration form

**WATER TREATMENT PRIMER 2 \$100.00
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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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Please circle/check which certification you are applying the course CEU's.

Water Treatment ___ Water Distribution ___ Other _____

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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 Primer 2 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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Please Circle, Bold, Underline or X, one answer per question. A felt tipped pen works best.

- | | | | |
|-------------|-------------|-------------|-------------|
| 1. A B C D | 18. A B | 35. A B C D | 52. A B |
| 2. A B C D | 19. A B | 36. A B C D | 53. A B |
| 3. A B C D | 20. A B | 37. A B C D | 54. A B |
| 4. A B C D | 21. A B | 38. A B C D | 55. A B |
| 5. A B C D | 22. A B | 39. A B C D | 56. A B |
| 6. A B C D | 23. A B | 40. A B | 57. A B C D |
| 7. A B C D | 24. A B | 41. A B | 58. A B |
| 8. A B C D | 25. A B | 42. A B | 59. A B C D |
| 9. A B C D | 26. A B C D | 43. A B | 60. A B |
| 10. A B C D | 27. A B C D | 44. A B C D | 61. A B C D |
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| 15. A B C D | 32. A B C D | 49. A B C D | 66. A B C D |
| 16. A B | 33. A B C D | 50. A B C D | 67. A B C D |
| 17. A B | 34. A B C D | 51. A B | 68. A B C D |

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

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**WATER TREATMENT PRIMER 2 CEU COURSE
CUSTOMER SERVICE RESPONSE CARD**

NAME: _____

E-MAIL _____ PHONE _____

***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?

Any other concerns or comments.

**Please fax the answer key to TLC Western Campus
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Rush Grading Service

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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 permit and State and do not follow this course for proper compliance.

Water Treatment Primer 2 CEU Training Course Assignment

The Water Treatment Primer 2 CEU course assignment is available in Word on the Internet for your convenience, please visit 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.

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>

Organisms Descriptors and Meanings

1. Photo means...

- A. Feed or nourish
- B. Other (Organic carbon)
- C. Light
- D. None of the above

2. Troph means...

- A. Feed or nourish
- B. Other (Organic carbon)
- C. Light
- D. None of the above

3. Litho means...

- A. Rock
- B. Organic
- C. Light
- D. None of the above

4. Organo means...

- A. Rock
- B. Organic
- C. Light
- D. None of the above

5. Auto means...

- A. Without air
- B. With air
- C. Self (Inorganic carbon)
- D. None of the above

6. Facultative means...

- A. Without air
- B. With air or without air
- C. Self (Inorganic carbon)
- D. None of the above

7. Aerobic means...

- A. Without air
- B. With air
- C. Self (Inorganic carbon)
- D. None of the above

8. Chemo means...

- A. Rock
- B. Organic
- C. Chemical
- D. None of the above

9. Hetero means...
- A. Feed or nourish
 - B. Other (Organic carbon)
 - C. Light
 - D. None of the above

10. Anaerobic means...
- A. Without air
 - B. With air
 - C. Self (Inorganic carbon)
 - D. None of the above

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

11. 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

12. Which of the following may come from a variety of sources such as agriculture, urban stormwater run-off, and residential uses?

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

13. Which of the following, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife?

- A. Microbial contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. All of the above

14. 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

15. 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

16. 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

17. 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

18. 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

19. 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

20. 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 siting plan subject to state review and revision.
A. True B. False
21. For PWSs collecting more than one sample per month, collect total coliform samples at regular intervals throughout the month, except that ground water systems serving 4,900 or fewer people may collect all required samples on a single day if the samples are taken from different sites.
A. True B. False
22. Each total coliform-positive (TC+) routine sample must be tested for the presence of heterotrophic bacteria.
A. True B. False
23. If any TC+ sample is also E. coli-positive (EC+), then the EC+ sample result must be reported to the state by the end of the month that the PWS is notified.
A. True B. False
24. 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
25. 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

26. 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 C. Giardia lamblia
B. Cryptosporidium D. None of the above
27. 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
28. 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

29. 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
30. Which of the following can cause bacillary dysentery?
 A. Fecal coliform bacteria C. *Shigella*
 B. *Cryptosporidium* D. None of the above
31. 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
32. 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
33. 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
34. 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

35. 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
36. Indicators in common use today for routine monitoring of drinking water include total coliforms, fecal coliforms, and?
 A. *Cryptosporidium* C. *Escherichia coli* (*E. coli*)
 B. Protozoa D. None of the above
37. According to the text, the routine microbiological analysis of your water is for?
 A. Contamination C. Coliform bacteria
 B. Colloids D. None of the above

Bacteria Sampling

38. Water samples for _____ must always be collected in a sterile container.
 A. Amoebas C. Viruses
 B. Bacteria tests D. None of the above

Methods

39. The MMO-MUG test, a product marketed as _____, is the most common. The sample results will be reported by the laboratories as simply coliforms present or absent.
- A. Colilert
 - B. Coliform
 - C. Total coliform analysis
 - D. None of the above

Microbial Regulations

40. One of the key regulations developed and implemented by the United States Environmental Protection Agency (USEPA) to counter pathogens in drinking water is the Surface Water Treatment Rule.
- A. True
 - B. False
41. Among Surface Water Treatment Rule provisions, the rule requires that a public water system, using surface water (or ground water under the direct influence of surface water) as its source, have sufficient treatment to reduce the source water concentration of protozoa and coliform bacteria by at least 99.9% and 99.99%, respectively.
- A. True
 - B. False
42. The Surface Water Treatment Rule suggests treatment criteria to assure that these performance recommendations are met; they may include turbidity limits, disinfectant residual and disinfectant contact time conditions.
- A. True
 - B. False

Basic Types of Water Samples

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

The three (3) types of samples are:

44. 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
45. 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
46. 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
47. 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
48. 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

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

49. 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

50. 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

51. Noncommunity and nontransient noncommunity public water systems will sample at the same frequency as a like sized community public water system if:

1. It has more than 1,000 daily population and has ground water as a source, or
2. It serves 25 or more daily population and utilizes surface water as a source or ground water under the direct influence of surface water as its source.

- A. True
- B. False

52. Noncommunity and nontransient, noncommunity water systems with less than 10,000 daily population and groundwater as a source will sample on an annual basis.

- A. True
- B. False

Maximum Contaminant Levels (MCLs)

53. State and federal laws establish standards for drinking water quality. Under normal circumstances when these standards are being met, the water is safe to drink with no threat to human health. These standards are known as maximum contaminant levels (MCL). When a particular contaminant exceeds its MCL a potential health threat may occur.

- A. True
- B. False

54. The MCLs are based on extensive research on toxicological properties of the contaminants, risk assessments and factors, short-term (acute) exposure, and long-term (chronic) exposure. You conduct the monitoring to make sure your water is in compliance with the MCL.

- A. True
- B. False

55. There are two types of MCL violations for coliform bacteria. The first is for total coliform; the second is an acute risk to health violation characterized by the confirmed presence of fecal coliform or E. coli.

- A. True
- B. False

Positive or Coliform Present Results

56. If you are notified of a positive coliform test result you need to contact either the Drinking Water Program or your local county health department within 72 hours, or by the next business day after the MCL compliance violation

- A. True
- B. False

57. With a positive total coliform sample, after you have contacted an agency for assistance, you will be instructed as to the proper repeat sampling procedures and possible corrective measures for solving the problem. It is very important to initiate the _____ as the corrective measures will be based on those results.

- A. Perform routine procedures
- B. Repeat sampling immediately
- C. Corrective measures
- D. None of the above

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

Heterotrophic Plate Count HPC

58. Heterotrophic Plate Count (HPC) --- formerly known as the Bac-T plate, is a procedure for estimating the number of live heterotrophic bacteria and measuring changes during water treatment and distribution in water or in swimming pools.

- A. True B. False

Heterotrophic Plate Count (Spread Plate Method)

59. Which of the following provides a technique to quantify the bacteriological activity of a sample?

- A. Colonies C. Heterotrophic Plate Count
B. Agar D. None of the above

Total Coliforms

60. This MCL is based on the presence of total coliforms, and compliance is on a daily or weekly basis, depending on your water system type and state rule.

- A. True B. False

61. For systems which collect fewer than _____ samples per month, no more than one sample per month may be positive. In other words, the second positive result (repeat or routine) in a month or quarter results in a MCL violation.

- A. 40 C. 200
B. 100 D. None of the above

The following are acute violations:

62. Which determines a violation of nitrate?

- A. Presence C. MCLG
B. MCL D. None of the above

Revised Total Coliform Rule (RTCR) Summary

63. EPA published the Revised Total Coliform Rule (RTCR) in the Federal Register (FR) on February 13, 2013 (78 FR 10269). It is the revision to the 1989 Total Coliform Rule (TCR).

- A. True B. False

64. The RTCR upholds the purpose of the 1989 TCR to protect public health by ensuring the duplicity of the drinking water distribution system and monitoring for the absence of microbial contamination.

- A. True B. False

65. The RTCR establishes criteria for systems to qualify for and stay on for special increased monitoring, which could reduce water system problems for better system operation.

- A. True B. False

66. The water provider shall develop and follow a sample-siting plan that designates the PWS's collection schedule. This includes location of _____.

- A. Routine and repeat water samples C. Microbial contamination
B. Reduced monitoring D. Repeat water samples

67. The water provider shall collect _____ on a regular basis (monthly, quarterly, annually). Have samples tested for the presence of total coliforms by a state certified laboratory.

- A. Routine water samples C. Microbial contamination
B. Reduced monitoring D. Repeat water samples

68. PN is required for violations incurred. Within required timeframes, the PWS must use the required health effects language and notify the public if they did not comply with certain requirements of the RTCR. The type of _____ depends on the severity of the violation.
 A. CCR(s) C. MCL violation
 B. PN D. TC+ routine or repeat sample
69. The RTCR requires public water systems that are vulnerable to microbial contamination to identify and fix problems.
 A. True B. False
70. The water provider shall collect repeat samples (at least 3) for each TC+ positive routine sample.
 A. True B. False
71. For PWSs on quarterly or annual routine sampling, collect additional routine samples (at least 3) in the month after a _____.
 A. CCR(s) C. Total coliform positive samples
 B. PN D. TC+ routine or repeat sample
72. PWSs incur violations if they do not comply with the requirements of the RTCR. The violation types are essentially the same as under the TCR with few changes. The biggest change is no acute or monthly MCL violation for _____ only.
 A. CCR(s) C. Total coliform positive samples
 B. PN D. TC+ routine or repeat sample
73. Community water systems (CWSs) must use specific language in their CCRs when they must conduct an assessment or if they incur _____.
 A. CCR(s) C. An E. coli MCL violation
 B. PN D. TC+ routine or repeat sample
74. The water provider shall analyze all _____ that are total coliform positive (TC+) for E. coli.
 A. Routine or repeat water samples C. Microbial contamination
 B. Reduced monitoring D. Repeat water samples
75. The RTCR requires public water systems (PWSs) to meet a legal limit for E. coli, as demonstrated by required monitoring.
 A. True B. False
76. The RTCR suggests the frequency and timing of required microbial testing based on, public water type and source water type.
 A. True B. False

Disinfection Key

77. The RTCR requires 99.99% or 4 log inactivation of _____.
 A. Enteric viruses C. Giardia lamblia cysts
 B. Crypto D. None of the above
78. The RTCR requires 99% or 2 log inactivation of _____.
 A. Enteric viruses C. Giardia lamblia cysts
 B. Crypto D. None of the above

79. The RTCR requires 99.9% or 3 log inactivation of _____.

- A. Enteric viruses
- B. Crypto
- C. Giardia lamblia cysts
- D. None of the above

80. The RTCR requires the chlorine residual leaving the plant must be = or _____ mg/L and measurable throughout the system.

- A. > 0.2
- B. 2.0
- C. 0.2
- D. None of the above

Waterborne Pathogen Section - Introduction Pathogen Section

81. Most pathogens are generally associated with diseases that _____ and affect people in a relatively short amount of time, generally a few days to two weeks.

- A. Cause intestinal illness
- B. Are mild in nature
- C. Will cause fatalities
- D. None of the above

How Diseases are Transmitted.

82. Waterborne pathogens are primarily spread by the?

- A. Fecal-oral or feces-to-mouth route
- B. Dermal to fecal route
- C. Oral to fecal route
- D. None of the above

Protozoan Caused Diseases

83. Which of the following bugs is larger than bacteria and viruses but still microscopic; they invade and inhabit the gastrointestinal tract?

- A. Hepatitis A
- B. E.coli
- C. Protozoan pathogens
- D. None of the above

84. Some of the parasites enter the environment in a dormant form, with a protective cell wall, called a?

- A. Lamblia
- B. Shell
- C. Cyst
- D. None of the above

Giardia lamblia

85. Which of the following bugs has been responsible for more community-wide outbreaks of disease in the U.S. than any other, and drug treatment are not 100% effective?

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Giardiasis
- D. None of the above

86. All of these diseases, with the exception of _____, have one symptom in common: diarrhea. They also have the same mode of transmission, fecal-oral, whether through person-to-person or animal-to-person contact.

- A. HIV infection
- B. Giardiasis
- C. Hepatitis A
- D. None of the above

Primary Waterborne Diseases Section

87. Humans are the reservoir for the Salmonella typhi pathogen, which causes diarrheal illness, and also known as?

- A. Campylobacter
- B. Shigella dysenteriae
- C. Typhoid fever
- D. None of the above

88. Shigella species, in the United States two-thirds of the shigellosis in the U.S. is caused by Shigella dysenteriae and the remaining one-third is caused by Shigella Campylobacter.
A. True B. False
89. Campylobacter, the basics. It's a bacterium. It causes diarrheal illness.
A. True B. False
90. Campylobacter is primarily associated with poultry, animals, and humans.
A. True B. False
91. Vibrio cholerae, the basics. It's a virus. It causes diarrheal illness, also known as cholera. It is typically associated with aquatic environments, shell stocks, and human. Vibrio cholerae has also been associated with ship ballast water.
A. True B. False
92. Legionnaire's disease, which causes a severe pneumonia, and the second, _____, which is a non-pneumonia illness; it's typically an influenza-like illness, and it's less severe.
A. Pontiac fever C. Typhoid fever
B. Yellow fever D. None of the above
93. Legionella, prevention. Legionella in water systems. Hot water in tanks should be maintained between _____ degrees Centigrade.
A. 81 to 100 C. 71 and 77
B. 110 to 210 D. None of the above
94. Which of the following is typically associated with soil and water?
A. Hepatitis A virus C. Pseudomonas
B. Legionella D. None of the above
95. Hepatitis A virus is resistant to combined chlorines, so it is important to have an adequate free chlorine residual. Fecal matter can shield Hepatitis A virus from chlorine.
A. True B. False
96. Humans are the reservoir for the Norovirus. Prevention strategies for this pathogen include?
A. Internal protection C. Containment protection
B. Source protection D. None of the above
97. Cryptosporidium is typically associated with animals and humans, and it can be acquired through consuming fecally contaminated food, contact with fecally contaminated soil and water.
A. True B. False
98. Cryptosporidium, prevention. Prevention strategies for this pathogen include source protection. A CT value of 50 is required when dealing with fecally accidents. CT equals a concentration, in parts per million, while time equals a contact time in minutes.
A. True B. False
99. Giardia prevention strategies for this pathogen include _____; filtration, coagulation, and halogenation of drinking water.
A. Internal protection C. Containment protection
B. Source protection D. None of the above

100. Schistosomatidae, the basics. It is a parasite. It is acquired through dermal contact, cercarial dermatitis. It is commonly known as?

- A. Swimmer's itch
- B. Beaver fever
- C. Hemorrhagic colitis
- D. None of the above

101. Schistosomatidae prevention strategies for this pathogen include placing boric acid on berms or interrupting the life cycle of the parasite by treating birds with a lead.

- A. True
- B. False

Waterborne Bacterial Diseases

102. Campylobacteriosis outbreaks have most often been associated with food, especially chicken and un-pasteurized milk, as well as un-chlorinated water. These organisms are also an important cause of "travelers' diarrhea." Medical treatment generally is not prescribed for campylobacteriosis because recovery is usually rapid.

- A. True
- B. False

103. Cholera, Legionellosis, salmonellosis, shigellosis, yersiniosis, are other bacterial diseases that can be transmitted through water. All bacteria in water are readily killed or inactivated with chlorine or other disinfectants.

- A. True
- B. False

104. Campylobacteriosis is the most common diarrheal illness caused by bacteria. Other symptoms include abdominal pain, malaise, fever, nausea and vomiting; and begin three to five days after exposure. The illness is frequently over within two to five days and usually lasts no more than 10 days.

- A. True
- B. False

Viruses

Coronavirus

105. It looks like the COVID-19 coronavirus is not able to live in water.

- A. True
- B. False

Chain of Custody Procedures

106. If both parties involved in the transfer must sign, date and note the time on the chain of custody record, this is known as?

- A. TC Plan
- B. Sample siting plan
- C. Samples transfer possession
- D. None of the above

107. The recipient will then attach the _____ showing the transfer dates and times to the custody sheets. If the samples are split and sent to more than one laboratory, prepare a separate chain of custody record for each sample.

- A. Shipping invoices
- B. Chain of custody release
- C. Sample siting plan
- D. None of the above

Factors in Chlorine Disinfection: Concentration and Contact Time

108. Based on the work of several researchers, CXT values [final free chlorine concentration (mg/L) multiplied by minimum contact time (minutes)], offer water operators guidance in computing an effective combination of chlorine concentration and _____ required to achieve disinfection of water at a given temperature.

- A. Chlorine concentration
- B. Chlorine contact time
- C. Higher strength chlorine solutions
- D. None of the above

109. The CXT formula demonstrates that if an operator chooses to decrease the chlorine concentration, the required _____ must be lengthened.

- A. Chlorine concentration
- B. Temperature
- C. Contact time
- D. None of the above

110. As _____ are used, contact times may be reduced.

- A. Chlorine concentration
- B. Temperature
- C. Higher strength chlorine solutions
- D. None of the above

Water Laboratory Analysis Section

pH Testing Section

111. When an atom loses _____ and thus has more protons than electrons, the atom is a positively-charged ion or cation.

- A. A proton
- B. Charge
- C. An electron
- D. None of the above

112. Measurement of pH for aqueous solutions can be done with a glass electrode and a pH meter, or using indicators like strip test paper.

- A. True
- B. False

113. In chemistry, pH is a measure of the acidity or basicity of an aqueous solution. Solutions with a pH greater than 7 are said to be acidic and solutions with a pH less than 7 are basic or alkaline.

- A. True
- B. False

114. Pure water has a pH very close to?

- A. 7
- B. 7.5
- C. 7.7
- D. None of the above

115. _____ are determined using a concentration cell with transference, by measuring the potential difference between a hydrogen electrode and a standard electrode such as the silver chloride electrode.

- A. Primary pH standard values
- B. Alkalinity
- C. pH measurement(s)
- D. None of the above

Alkalinity Sub-Section

Introduction

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

- A. Titratable bases
- B. pH and alkalinity
- C. Disinfection by-products
- D. None of the above

117. Alkalinity is a measure of an aggregate property of water and can be interpreted in terms of specific substances only when the chemical composition of the sample is known.

- A. True
- B. False

Alkalinity and pH Adjustment

118. Adjusting _____ is the most common corrosion control method because it is simple and inexpensive.

- A. End-point pH
- B. pH and alkalinity
- C. Disinfection by-products
- D. None of the above

119. Alkalinity is a measure of the concentration of hydrogen ions present in water; pH is a measure of water's ability to neutralize acids.

- A. True B. False

120. Generally, water pH less than _____ is associated with uniform corrosion, while pH between 6.5 and 8.0 can be associated with pitting corrosion.

- A. 9.0 C. 7.0
B. 6.5 D. None of the above

121. Some studies have suggested that systems using only pH to control corrosion should maintain a pH of at least _____ to reduce the availability of hydrogen ions as electron receptors.

- A. 9.0 C. 7.0
B. 6.5 D. None of the above

122. pH is not the only factor in the corrosion equation; _____ and alkalinity levels affect corrosion as well.

- A. Sodium bicarbonate C. Phosphates
B. Carbonate D. None of the above

123. Generally, an increase in pH and alkalinity can increase corrosion rates and remove the protective layer of scale on corrodible pipe material.

- A. True B. False

124. Chemicals commonly used for pH and alkalinity adjustment are _____, caustic soda (NaOH or sodium hydroxide), soda ash (Na₂CO₃ or sodium carbonate), and sodium bicarbonate (NaHCO₃, essentially baking soda).

- A. Sodium bicarbonate C. Hydrated lime
B. Sulfuric acid D. None of the above

125. Care must be taken, however, to maintain pH at a level that will control corrosion but not conflict with _____ for disinfection and control of disinfection by-products.

- A. End-point pH C. Optimum pH levels
B. pH and alkalinity D. None of the above

Corrosion Inhibitors

126. Inhibitors reduce corrosion by forming protective coatings on pipes. The most common corrosion inhibitors are _____, sodium silicates and mixtures of phosphates and silicates. These chemicals have proven successful in reducing corrosion in many water systems.

- A. Sodium bicarbonate C. Inorganic phosphates
B. Sulfuric acid D. None of the above

127. The phosphates used as corrosion inhibitors include polyphosphates, orthophosphates, glassy phosphates and bimetallic phosphates. In some cases, zinc is added in conjunction with orthophosphates or polyphosphates.

- A. True B. False

128. Glassy phosphates, such as sodium hexametaphosphate, effectively reduce iron corrosion at dosages of _____ mg/l.

- A. 100 to 200
- B. 20 to 40
- C. 1 to 2
- D. None of the above

129. Glassy phosphate has an appearance of table salt.

- A. True
- B. False

130. Sodium silicates are particularly effective for systems with high water velocities, low hardness, low alkalinity and a pH of less than _____.

- A. 9.0
- B. 8.4
- C. 7.0
- D. None of the above

Turbidity Testing Sub-Section

These are QA/QC questions that ensure that you've read the questions. These questions may seem to be repeats, but are necessary for your comprehension and evaluation.

131. Turbidity is measured to evaluate the performance of _____.

- A. Water treatment plant(s)
- B. An aesthetic point
- C. Colloidal to coarse dispersions
- D. None of the above

132. Turbidity is caused by wide variety of suspended matter that range in size from colloidal to coarse dispersions, depending upon the _____, and ranges from pure inorganic substances to those that are highly organic in nature.

- A. Water treatment plant(s)
- B. An aesthetic point
- C. Degree of turbulence
- D. None of the above

133. Turbid waters are undesirable from _____ of view in drinking water supplies.

- A. Water treatment plant(s)
- B. An aesthetic point
- C. Colloidal to coarse dispersions
- D. None of the above

Surface Water (SW) System Compliance

134. Sample the _____ at the clear well

- A. Individual filter effluent
- B. 95% of samples
- C. Combined filter turbidity
- D. None of the above

135. 0.34 NTU in _____, never to exceed 1.0 NTU spike

- A. Individual filter effluent
- B. 95% of samples
- C. Combined filter turbidity
- D. None of the above

136. Sample turbidity at each _____

- A. Individual filter effluent
- B. 95% of samples
- C. Combined filter turbidity
- D. None of the above

Disinfection Key

137. 99.9% or 3 log inactivation of _____

- A. Crypto
- B. Enteric viruses
- C. Giardia lamblia cysts
- D. None of the above

138. 99.99% or 4 log inactivation of _____

- A. Crypto
- B. Enteric viruses
- C. Giardia lamblia cysts
- D. None of the above

139. 99% or 2 log inactivation of _____
A. Crypto C. Giardia lamblia cysts
B. Enteric viruses D. None of the above

140. The chlorine residual leaving the plant must be = or _____ mg/L and measurable throughout the system.
A. > 0.2 C. < 0.2
B. ≤ 0.2 D. None of the above

Turbidity Key

141. Turbidity is normally measured in mg/L and its size is measured in multimeters.
A. True B. False

142. Turbidity can be particles in the water consisting of finely divided solids, larger than bacteria, visible by the naked eye; ranging in size from 10 to 150mm.
A. True B. False

Cloudy Water

143. In order to have gravity affect these particles, we must somehow make them larger, somehow have them come together (agglomerate); in other words, somehow make them “stick” together, thereby increasing their size and mass.
A. True B. False

Force due to van der Waals forces

144. Van der Waals forces are strong forces based on a polar characteristic induced by neighboring molecules. When two or more polar molecules, such as He, Ar, H₂, are in close proximity, the nucleus of each atom will magnetically attract electrons in the counter atom resulting, at least momentarily, in an asymmetrical arrangement of the nucleus.
A. True B. False

How to Treat Turbidity

145. By supercharging the water supply momentarily with a positive charge, we can upset the charge effect of the particle enough to reduce the Zeta potential (repulsive force), thereby allowing van der Waals forces (attractive forces) to take over.
A. True B. False

146. By introducing aluminum (Al₃⁺) into the water in the form of Alum (Al₂(SO₄)₃•nH₂O) we can accomplish the supercharging of the water. This is the coagulation part of the coagulation/flocculation process; flocculation follows coagulation.
A. True B. False

147. During the flocculation process the particles join to form flocs; the larger the flocs, the faster they will settle within a clarifier. Other chemical coagulants used are Ferric Chloride and Ferrous Sulfate.
A. True B. False

148. Ferrous Sulfate works well through a range of pH values, _____.
A. 5.0 - 7.5 C. 4.5 to 9.5
B. 4.5 D. None of the above

149. Alum works best in the pH range of natural waters, _____.

- A. 5.0 - 7.5
- B. 4.5
- C. 4.5 to 9.5
- D. None of the above

150. Ferric Chloride works best at lower pH values, down to pH _____.

- A. 5.0 - 7.5
- B. 4.5
- C. 4.5 to 9.5
- D. None of the above