

**Registration form**

**DISTRIBUTION PRIMER 2 \$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. \_\_\_\_\_

**Name** \_\_\_\_\_ **Signature** \_\_\_\_\_

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

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

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

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*You can obtain a printed version of the course manual from TLC for an additional \$129.95 plus shipping charges.*

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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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## Distribution 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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*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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3. A B C D

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

***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*

**DISTRIBUTION PRIMER 2 CEU COURSE  
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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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**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 regulatory agencies and do not follow this course for any compliance concerns.*

## Distribution Primer 2 CEU Training Course Assignment

The Distribution Primer 2 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>

## Bacteriological Monitoring Section

### Organisms Descriptors and Meanings

1. Organo means...  
A. Rock      C. Light  
B. Organic    D. None of the above
2. Auto means...  
A. Without air      C. Self (Inorganic carbon)  
B. With air          D. None of the above
3. Facultative means...  
A. Without air      C. Self (Inorganic carbon)  
B. With air or without air    D. None of the above
4. Photo means...  
A. Feed or nourish      C. Light  
B. Other (Organic carbon)    D. None of the above
5. Troph means...  
A. Feed or nourish      C. Light  
B. Other (Organic carbon)    D. None of the above
6. Litho means...  
A. Rock      C. Light  
B. Organic    D. None of the above
7. Aerobic means...  
A. Without air      C. Self (Inorganic carbon)  
B. With air          D. None of the above
8. Chemo means...  
A. Rock      C. Chemical  
B. Organic    D. None of the above

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

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

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

11. 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                      C. Inorganic contaminants  
B. Pesticides and herbicides                      D. All of the above

12. 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      C. Inorganic contaminants  
B. Pesticides and herbicides                      D. Microbial contaminants

13. 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                      C. Inorganic contaminants  
B. Pesticides and herbicides                      D. Microbial contaminants

14. Which of the following may come from a variety of sources such as agriculture, urban stormwater run-off, and residential uses?  
A. Radioactive contaminants                      C. Inorganic contaminants  
B. Pesticides and herbicides                      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                      C. Inorganic contaminants  
B. Pesticides and herbicides                      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. 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

23. 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

24. Each total coliform-positive (TC+) routine sample must be tested for the presence of heterotrophic bacteria.

- A. True      B. False

25. 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

### **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 bacteria 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 are Gram-negative, non-spore-forming, facultatively anaerobic, non-motile bacteria.

- A. Fecal coliform bacteria    C. Shigellae  
B. Cryptosporidium          D. None of the above

29. 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

30. 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

31. 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

32. 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

33. 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

34. Which of the following can cause bacillary dysentery?

- A. Fecal coliform bacteria
- C. Shigella
- 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
- C. Total coliform analysis
- B. Coliform
- 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) primary types of samples are:

44. A PWS has a second Level 1 Assessment within a rolling 12-month period.

- A. Trigger: Level 1 Assessment      C. All of the above  
B. Trigger: Level 2 Assessment      D. None of the above

45. A PWS on state-approved annual monitoring has a Level 1 Assessment trigger in 2 consecutive years.

- A. Trigger: Level 1 Assessment      C. All of the above  
B. Trigger: Level 2 Assessment      D. None of the above

46. 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      C. Routine  
B. Special      D. None of the above

47. A PWS fails to take every required repeat sample after any single TC+ sample

- A. Trigger: Level 1 Assessment      C. All of the above  
B. Trigger: Level 2 Assessment      D. None of the above

48. A PWS incurs an E. coli MCL violation.

- A. Trigger: Level 1 Assessment      C. All of the above  
B. Trigger: Level 2 Assessment      D. None of the above

49. 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      C. All of the above  
B. Trigger: Level 2 Assessment      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      C. All of the above  
B. Trigger: Level 2 Assessment      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. 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

55. 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

### **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      C. Corrective measures  
B. Repeat sampling immediately      D. None of the above

### **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 requires public water systems that are vulnerable to microbial contamination to identify and fix problems.

- A. True      B. False

65. The water provider shall collect repeat samples (at least 3) for each TC+ positive routine sample.

- A. True      B. False

66. 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

67. 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

68. The RTCR requires public water systems (PWSs) to meet a legal limit for E. coli, as demonstrated by required monitoring.

- A. True      B. False

69. The RTCR suggests the frequency and timing of required microbial testing based on, public water type and source water type.

- A. True      B. False

70. 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

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

71. 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
- B. Reduced monitoring
- C. Microbial contamination
- D. Repeat water samples

72. 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)
- B. PN
- C. MCL violation
- D. TC+ routine or repeat sample

73. For PWSs on quarterly or annual routine sampling, collect additional routine samples (at least 3) in the month after a \_\_\_\_\_.

- A. CCR(s)
- B. PN
- C. Total coliform positive samples
- D. TC+ routine or repeat sample

74. 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)
- B. PN
- C. Total coliform positive samples
- D. TC+ routine or repeat sample

75. Community water systems (CWSs) must use specific language in their CCRs when they must conduct an assessment or if they incur \_\_\_\_\_.

- A. CCR(s)
- B. PN
- C. An E. coli MCL violation
- D. TC+ routine or repeat sample

76. The water provider shall analyze all \_\_\_\_\_ that are total coliform positive (TC+) for E. coli.

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

### Disinfection Key

77. The RTCR requires 99.99% or 4 log inactivation of \_\_\_\_\_.

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

78. The RTCR requires 99% or 2 log inactivation of \_\_\_\_\_.

- A. Enteric viruses
- B. Crypto
- C. Giardia lamblia cysts
- 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. Campylobacter is primarily associated with poultry, animals, and humans.
- A. True
  - B. False

88. 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

89. 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

90. 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

91. 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

92. Campylobacter, the basics. It's a bacterium. It causes diarrheal illness.  
A. True      B. False
93. 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
94. 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
95. 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
96. 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
97. Which of the following is typically associated with soil and water?  
A. Hepatitis A virus      C. Pseudomonas  
B. Legionella      D. None of the above
98. Humans are the reservoir for the Salmonella typhi pathogen, which causes diarrheal illness, and also known as?  
A. Campylobacter      C. Typhoid fever  
B. Shigella dysenteriae      D. None of the above
99. 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
100. 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
101. Schistosomatidae, the basics. It is a parasite. It is acquired through dermal contact, cercarial dermatitis. It is commonly known as?  
A. Swimmer's itch      C. Hemorrhagic colitis  
B. Beaver fever      D. None of the above

### **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

## Disinfection Section

### Chlorine's Appearance and Odor

104. Chlorine is a greenish-yellow gas it will condense to an amber liquid at approximately \_\_\_\_\_ F or at high pressures.

- A. -29.2 degrees      C. 29 degrees  
B. - 100 degrees      D. None of the above

105. Prolonged exposures to chlorine gas may result in?

- A. Moisture, steam, and water      C. Olfactory fatigue  
B. Odor thresholds      D. None of the above

### Chlorine Gas

#### Pathophysiology

106. As far as chlorine safety and respiratory protection, the intermediate \_\_\_\_\_ of chlorine accounts for its effect on the upper airway and the lower respiratory tract.

- A. Effects of Hydrochloric acid      C. Water solubility  
B. Vapor from Chlorine gas      D. None of the above

107. Respiratory exposure to \_\_\_\_\_ may be prolonged because its moderate water solubility may not cause upper airway symptoms for several minutes.

- A. Hydrochloric acid      C. Plasma exudation  
B. Chlorine gas      D. None of the above

108. The odor threshold for chlorine gas is approximately?

- A. 0.3-0.5 parts per million (ppm)      C. 3-5 parts per million (ppm)  
B. 3 parts per million (ppm)      D. None of the above

#### Mechanism of Activity

109. Chlorine gas feeds out of the cylinder through a gas regulator. The cylinders are on a scale that operators use to measure the amount used each day. The chains are used to prevent the tanks from falling over.

- A. True      B. False

#### Early Response to Chlorine Gas

110. If you mix ammonia with chlorine gas, this compound reacts to form\_\_\_\_\_.

- A. Chloramine gas      C. Sulfuric gas  
B. Chlorine gas      D. None of the above

#### Reactivity

111. Cylinders of chlorine may burst when exposed to elevated temperatures. When there is Chlorine in solution, this forms?

- A. Hydrogen sulfide      C. A corrosive material  
B. Oxomonosilane      D. None of the above

112. What is formed when chlorine is in contact with combustible substances (such as gasoline and petroleum products, hydrocarbons, turpentine, alcohols, acetylene, hydrogen, ammonia, and sulfur), reducing agents, and finely divided metals?

- A. Fires and explosions      C. Moisture, steam, and water  
B. Odor thresholds      D. None of the above

113. Contact between chlorine and arsenic, bismuth, boron, calcium, activated carbon, carbon disulfide, glycerol, hydrazine, iodine, methane, oxomonosilane, potassium, propylene, and silicon should be avoided.

- A. True      B. False

114. Chlorine reacts with hydrogen sulfide and water to form this substance?

- A. Hydrogen sulfide      C. Chlorinates  
B. Hydrochloric acid      D. None of the above

115. According to the text, chlorine is also incompatible with?

- A. Plastic      C. Moisture, steam, and water  
B. Palladium      D. None of the above

### Flammability

116. When there is a fire that involves Chlorine, the fire fight should be fought downwind from the minimum distance possible.

- A. True      B. False

117. Keep unnecessary people away; isolate the hazard area and deny entry. For a massive fire in a cargo area, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from the area and let the fire burn. Emergency personnel should stay out of low areas and ventilate closed spaces before entering.

- A. True      B. False

118. The effectiveness of chlorination depends on the \_\_\_\_\_ of the water, the concentration of the chlorine solution added, the time that chlorine is in contact with the organism, and water quality.

- A. Chlorine residual      C. Oxygen  
B. Chlorine demand      D. None of the above

119. Chlorine may not be available for disinfection because \_\_\_\_\_ in the water (like iron, manganese, hydrogen sulfide, and ammonia).

- A. pH increases      C. Required contact time  
B. Part of it combines with other chemicals      D. None of the above

120. The amount of chlorine required to achieve disinfection and that reacts with the other chemicals is the?

- A. Chlorine residual      C. Free chlorine residual  
B. Chlorine demand      D. None of the above

121. Which term is used when disinfection decreases, as the concentration of the chlorine increases?

- A. pH increases      C. Required contact time  
B. Chlorine level and water quality      D. None of the above

122. Chlorination is more effective as?

- A. Water temperature increases      C. Water cools down  
B. Chlorine demand      D. None of the above

123. Chlorination becomes more alkaline and is less effective as the?

- A. Water's pH increases      C. Required contact time is maximized  
B. Water quality increases      D. None of the above



### Types of Residual

135. Which of the following is all chlorine that is available for disinfection?

- A. Chlorine residual
- C. Total chlorine
- B. Chlorine demand
- D. None of the above

### Chlorine Exposure Limits

136. What is OSHA's PEL?

- A. 10 PPM
- C. 1,000 PPM
- B. 1 PPM
- D. None of the above

137. Chlorine's Physical and chemical properties: A yellowish green, nonflammable and liquefied gas with an unpleasant and irritating smell.

- A. True
- B. False

138. Liquid chlorine is about \_\_\_\_\_ times heavier than water

- A. 1.5
- C. 2.5
- B. 10
- D. None of the above

139. Gaseous chlorine is about \_\_\_\_\_ times heavier than air.

- A. 1.5
- C. 2.5
- B. 10
- D. None of the above

### Alternate Disinfectants - Chloramine

140. It is recommended that Chloramine be used in conjunction with a stronger disinfectant. It is best utilized as a?

- A. Chloramine
- C. Stable distribution system disinfectant
- B. T10 value disinfectant
- D. None of the above

141. In the production of \_\_\_\_\_, the ammonia residuals in the finished water, when fed in excess of stoichiometric amount needed, should be limited to inhibit growth of nitrifying bacteria.

- A. Dry sodium chlorite
- C. Ammonia residual(s)
- B. Chloramines
- D. None of the above

### Chlorine Dioxide

142. Which term provides good Giardia and virus protection but its use is limited by the restriction on the maximum residual of 0.5 mg/L ClO<sub>2</sub>/chlorite/chlorate allowed in finished water?

- A. Chlorinated byproducts
- C. Ammonia residual(s)
- B. Chlorine dioxide
- D. None of the above

143. If chlorine dioxide is being used as an oxidant, the preferred method of generation is to entrain or \_\_\_\_\_ into a packed reaction chamber with a 25% aqueous solution of sodium chlorite (NaClO<sub>2</sub>).

- A. Chloramine
- C. Chlorine dioxide
- B. Chlorine gas
- D. None of the above

144. Which chemical is explosive and can cause fires in feed equipment if leaking solutions or spills are allowed to dry out?

- A. Dry sodium chlorite
- C. Ammonia
- B. Chlorine dioxide
- D. None of the above

145. Chlorine dioxide may be used for either taste or odor control or as a?

- A. Chloramine
- B. Pre-disinfectant
- C. Gas
- D. None of the above

**Ozone**

146. Ozone is a very effective disinfectant for both Giardia and viruses

- A. True
- B. False

147. When determining Ozone CT (contact time) values must be determined for the ozone basin alone; an accurate \_\_\_\_\_ must be obtained for the contact chamber, and residual levels.

- A. Residual
- B. T10 value
- C. Contact time
- D. None of the above

148. Ozone does not provide a system residual and should be used as a primary disinfectant only in conjunction with?

- A. Dry sodium chlorite
- B. Chlorine dioxide
- C. Free and/or combined chlorine
- D. None of the above

149. Ozone does not produce chlorinated byproducts (such as trihalomethanes) but it may cause an increase in such byproduct formation if it is fed ahead of free chlorine; ozone may also produce its own oxygenated byproducts such as  $\text{Cl}_2 + \text{NH}_4$ .

- A. True
- B. False

150. Ozonation must include adequate ozone leak detection alarm systems, and an ozone off-gas destruction system.

- A. True
- B. False