

*Registration form*

**Water Treatment Primer 3 Training Course \$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*

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

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**Home (\_\_\_\_)** \_\_\_\_\_ **Work (\_\_\_\_)** \_\_\_\_\_

**Operator ID #** \_\_\_\_\_ **Exp. Date** \_\_\_\_\_

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

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

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

***Your certificate will be mailed to you in about two weeks.***

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Toll Free (866) 557-1746 Fax (928) 272-0747 [info@tlch2o.com](mailto:info@tlch2o.com)**

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## **DISCLAIMER NOTICE**

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**Professional Engineers**; Most states will accept our courses for credit but we do not officially list the States or Agencies. Please check your State for approval.

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*You can obtain a printed version from TLC for an additional \$69.95 plus shipping charges.*

## **AFFIDAVIT OF EXAM COMPLETION**

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.

## **Grading Information**

In order to maintain the integrity of our courses we do not distribute test scores, percentages or questions missed. Our exams are based upon pass/fail criteria with the benchmark for successful completion set at 70%. Once you pass the exam, your record will reflect a successful completion and a certificate will be issued to you.

For security purposes, please fax or e-mail a copy of your driver's license and always call us to confirm we've received your assignment and to confirm your identity.

Thank you...

All downloads are electronically tracked and monitored for security purposes.

# Water Treatment Primer 3 Answer Key

Name \_\_\_\_\_ Phone# \_\_\_\_\_  
*You can also type your own answer key*

***You are solely responsible in ensuring this course is accepted for credit by your State. Did you check with your State agency to ensure this course is accepted for credit?***

***Method of Course acceptance confirmation. Please fill this section***

Website \_\_\_ Telephone Call \_\_\_ Email \_\_\_ Spoke to \_\_\_\_\_

Did you receive the approval number, if applicable? \_\_\_\_\_

What is the course approval number, if applicable? \_\_\_\_\_

***You are responsible to ensure that TLC receives the Assignment and Registration Key. Please call us to ensure that we received it.***

***Please circle, underline, bold or X only one correct answer***

- |                 |                 |                 |
|-----------------|-----------------|-----------------|
| 1. A B C D E F  | 12. A B C D E F | 23. A B C D E F |
| 2. A B C D E F  | 13. A B C D E F | 24. A B C D E F |
| 3. A B C D E F  | 14. A B C D E F | 25. A B C D E F |
| 4. A B C D E F  | 15. A B C D E F | 26. A B C D E F |
| 5. A B C D E F  | 16. A B C D E F | 27. A B C D E F |
| 6. A B C D E F  | 17. A B C D E F | 28. A B C D E F |
| 7. A B C D E F  | 18. A B C D E F | 29. A B C D E F |
| 8. A B C D E F  | 19. A B C D E F | 30. A B C D E F |
| 9. A B C D E F  | 20. A B C D E F | 31. A B C D E F |
| 10. A B C D E F | 21. A B C D E F | 32. A B C D E F |
| 11. A B C D E F | 22. A B C D E F | 33. A B C D E F |

34. A B C D E F      56. A B C D E F      78. A B C D E F  
35. A B C D E F      57. A B C D E F      79. A B C D E F  
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37. A B C D E F      59. A B C D E F      81. A B C D E F  
38. A B C D E F      60. A B C D E F      82. A B C D E F  
39. A B C D E F      61. A B C D E F      83. A B C D E F  
40. A B C D E F      62. A B C D E F      84. A B C D E F  
41. A B C D E F      63. A B C D E F      85. A B C D E F  
42. A B C D E F      64. A B C D E F      86. A B C D E F  
43. A B C D E F      65. A B C D E F      87. A B C D E F  
44. A B C D E F      66. A B C D E F      88. A B C D E F  
45. A B C D E F      67. A B C D E F      89. A B C D E F  
46. A B C D E F      68. A B C D E F      90. A B C D E F  
47. A B C D E F      69. A B C D E F      91. A B C D E F  
48. A B C D E F      70. A B C D E F      92. A B C D E F  
49. A B C D E F      71. A B C D E F      93. A B C D E F  
50. A B C D E F      72. A B C D E F      94. A B C D E F  
51. A B C D E F      73. A B C D E F      95. A B C D E F  
52. A B C D E F      74. A B C D E F      96. A B C D E F  
53. A B C D E F      75. A B C D E F      97. A B C D E F  
54. A B C D E F      76. A B C D E F      98. A B C D E F  
55. A B C D E F      77. A B C D E F      99. A B C D E F

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| 100. A B C D E F | 117. A B C D E F | 134. A B C D E F |
| 101. A B C D E F | 118. A B C D E F | 135. A B C D E F |
| 102. A B C D E F | 119. A B C D E F | 136. A B C D E F |
| 103. A B C D E F | 120. A B C D E F | 137. A B C D E F |
| 104. A B C D E F | 121. A B C D E F | 138. A B C D E F |
| 105. A B C D E F | 122. A B C D E F | 139. A B C D E F |
| 106. A B C D E F | 123. A B C D E F | 140. A B C D E F |
| 107. A B C D E F | 124. A B C D E F | 141. A B C D E F |
| 108. A B C D E F | 125. A B C D E F | 142. A B C D E F |
| 109. A B C D E F | 126. A B C D E F | 143. A B C D E F |
| 110. A B C D E F | 127. A B C D E F | 144. A B C D E F |
| 111. A B C D E F | 128. A B C D E F | 145. A B C D E F |
| 112. A B C D E F | 129. A B C D E F | 146. A B C D E F |
| 113. A B C D E F | 130. A B C D E F | 147. A B C D E F |
| 114. A B C D E F | 131. A B C D E F | 148. A B C D E F |
| 115. A B C D E F | 132. A B C D E F | 149. A B C D E F |
| 116. A B C D E F | 133. A B C D E F | 150. A B C D E F |

**Please fax the answer key to  
TLC Western Campus Fax (928) 272-0747.**

**Always call us after faxing the paperwork to ensure that we've  
received it.**

**Rush Grading Service**

If you need this assignment graded and the results mailed to you within a 48-hour period, prepare to pay an additional rush service handling fee of \$50.00. This fee may not cover postage costs. If you need this service, simply write RUSH on the top of your Registration Form. We will place you in the front of the grading and processing line.

**Grading Information**

In order to maintain the integrity of our courses we do not distribute test scores, percentages or questions missed. Our exams are based upon pass/fail criteria with the benchmark for successful completion set at 70%. Once you pass the exam, your record will reflect a successful completion and a certificate will be issued to you.

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

## WATER TREATMENT PRIMER 3 CEU TRAINING COURSE

### CUSTOMER SERVICE RESPONSE CARD

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

1. Please rate the difficulty of your course.  
Very Easy      0      1      2      3      4      5      Very Difficult

2. Please rate the difficulty of the testing process.  
Very Easy      0      1      2      3      4      5      Very Difficult

3. Please rate the subject matter on the exam to your actual field or work.  
Very Similar      0      1      2      3      4      5      Very Different

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

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Any other concerns or comments.

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## Water Treatment Primer 3 CEU Training Course Assignment

**The Assignment (Exam) is also available in Word on the Internet for your Convenience, please visit [www.ABCTL.com](http://www.ABCTL.com) and download the assignment and e-mail it back to TLC.**

You'll have 90 days from the start of this course to complete in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % is necessary to pass this course. We prefer if this exam is proctored. No intentional trick questions. If you should need any assistance, please email all concerns and the completed manual to [info@tlch2o.com](mailto:info@tlch2o.com).

We would prefer that you utilize the enclosed answer sheet in the front, but if you are unable to do so, type out your own answer key. Please include your name and address on your manual and make copy for yourself. You can e-mail or fax your Answer Key along with the Registration Form to TLC. **(S) Means answer may be plural or singular. Multiple Choice Section, One answer per question and please use the answer key.**

1. In the event of a significant intrusion of pathogens resulting, for example, from a broken water main, the level of the average "chlorine residual" will be insufficient to disinfect contaminated water. In such cases, it is the monitoring of the sudden drop in the \_\_\_\_\_ that provides the critical indication to water system operators that there is a source of contamination in the system.

- A. Elemental chlorine
- B. Disinfection
- C. Chlorine residual
- D. Chlorine disinfectant(s) (s) means plural or singular usage
- E. Chlorine-based process
- F. None of the above

### **The Benefits of Chlorine Potent Germicide**

2. Which of the following terms can reduce the level of many disease-causing microorganisms in drinking water to almost immeasurable levels.

- A. Elemental chlorine
- B. Disinfection methods
- C. Chlorine residual
- D. Chlorine disinfectant(s)
- E. Chlorine-based process
- F. None of the above

3. Chlorine is added to drinking water to destroy pathogenic organisms. It can be applied in several forms: elemental chlorine, sodium hypochlorite solution and?

- A. Disinfection agents
- B. Chlorine disinfectants
- C. Chlorine-based process
- D. Numerous alternative disinfection
- E. Dry calcium hypochlorite
- F. None of the above

4. One pound of \_\_\_\_\_ provides approximately as much free available chlorine as one gallon of sodium hypochlorite or approximately 1.5 pounds of calcium hypochlorite.

- A. Elemental chlorine
- B. Disinfection
- C. Chlorine residual
- D. Chlorine disinfectant(s) (s) means plural or singular usage
- E. Chlorine-based process
- F. None of the above

5. Which of the following terms can effectively disinfect drinking water, each has distinct advantages and limitations for particular applications.

- A. Any of these forms of chlorine
- B. Chlorine disinfectants
- C. Chlorine-based process
- D. Numerous alternative disinfection methods
- E. Dry calcium hypochlorite
- F. None of the above

6. Almost all water systems that disinfect their water use some type of chlorine-based process, either alone or?

- A. Disinfection
- B. Chlorine disinfectants
- C. Chlorine-based process
- D. Numerous alternative disinfection methods
- E. In combination with other disinfectants
- F. None of the above

### **Taste and Odor Control**

7. Which of the following terms reduce many disagreeable tastes and odors?

- A. Elemental chlorine
- B. Disinfection methods
- C. Chlorine residual
- D. Chlorine disinfectant(s)
- E. Chlorine-based process
- F. None of the above

### **Biological Growth Control**

8. Which of the following terms eliminate slime bacteria, molds and algae that commonly grow in water supply reservoirs, on the walls of water mains and in storage tanks?

- A. Disinfection
- B. Chlorine disinfectants
- C. Chlorine-based process
- D. Numerous alternative disinfection methods
- E. Dry calcium hypochlorite
- F. None of the above

### **Chemical Control**

9. Chlorine disinfectants destroy hydrogen sulfide and remove ammonia and other nitrogenous compounds that have unpleasant tastes and hinder?

- A. Elemental chlorine
- B. Disinfection
- C. Chlorine residual
- D. Chlorine disinfectant(s) (s) means plural or singular usage
- E. Chlorine-based process
- F. None of the above

### **Understanding Disinfection**

#### **Water Disinfection**

10. Which of the following terms is usually the final stage in the water treatment process in order to limit the effects of organic material, suspended solids and other contaminants?

- A. Disinfection
- B. Chlorine disinfectant
- C. Chlorine-based process
- D. Numerous alternative disinfection methods
- E. Dry calcium hypochlorite
- F. None of the above

11. Like the disinfection of wastewater, the primary methods used for the disinfection of water in very small (25-500 people) and small (501-3,300 people) treatment systems are ozone, ultraviolet irradiation (UV) and?

- A. Elemental chlorine
- B. Disinfection
- C. Chlorine residual
- D. Chlorine disinfectant(s) (s) means plural or singular usage
- E. Chlorine
- F. None of the above

12. There are numerous alternative disinfection processes that have been less widely used in small and very small water treatment systems, including \_\_\_\_\_, potassium permanganate, chloramines and peroxone (ozone/hydrogen peroxide).

- A. Disinfection
- B. Chlorine disinfectants
- C. Chlorine-based process
- D. Chlorine dioxide
- E. Dry calcium hypochlorite
- F. None of the above

13. Surface waters have been the focal point of \_\_\_\_\_ since their inception, as groundwaters (like wells) have been historically considered to be free of microbiological contamination. Current data indicates this to not be true.

- A. Elemental chlorine
- B. Disinfection
- C. Chlorine residual
- D. Chlorine disinfectant(s) (s) means plural or singular usage
- E. Chlorine-based process
- F. None of the above

### Chlorine Dioxide

14. Chlorine dioxide is a chemical compound with?

- A. The formula  $\text{ClO}_2$
- B. Hypochlorite(s)
- C. Available chlorine
- D. One of several oxides of chlorine
- E. A monohaloacetic acid
- F. None of the above

15. The molecule  $\text{ClO}_2$  electronic structure has long baffled chemists because?

- A. The same residuals
- B. A hydrogen atom
- C. The molecule  $\text{ClO}_2$
- D. None of the possible Lewis structures are very satisfactory
- E. The only liquid hypochlorite disinfectant
- F. None of the above

16. Which of the following terms is a highly endothermic compound that can decompose extremely violently when separated from diluting substances?

- A. Chlorine dioxide
- B. Hypochlorite(s)
- C. Available chlorine
- D. The oxide of chlorine
- E. A monohaloacetic acid
- F. None of the above

### Haloacetic Acids

17. Haloacetic acids are \_\_\_\_\_ in which a halogen atom takes the place of a hydrogen atom in acetic acid.

- A. The same residuals
- B. Carboxylic acids
- C. The molecule  $\text{ClO}_2$
- D. The electronegative halogens
- E. The only liquid hypochlorite disinfectant
- F. None of the above

18. Thus, in a monohaloacetic acid, a single halogen would replace?

- A. Chlorine dioxide
- B. Hypochlorite(s)
- C. Available chlorine
- D. A hydrogen atom
- E. A monohaloacetic acid
- F. None of the above

19. The inductive effect caused by the electronegative halogens often result in the higher acidity of these compounds by stabilizing?

- A. The same residuals
- B. A hydrogen atom
- C. The molecule  $\text{ClO}_2$
- D. The electronegative halogens
- E. The negative charge of the conjugate base
- F. None of the above

### Contaminants in Drinking Water

20. Haloacetic acids are a common undesirable by-product of drinking water chlorination. Exposure to such \_\_\_\_\_ in drinking water has been associated with a number of health outcomes by epidemiological studies, although the putative agent in such studies has not been identified.

- A. Chlorine dioxide
- B. Hypochlorite(s)
- C. Available chlorine
- D. Disinfection by-products
- E. A monohaloacetic acid
- F. None of the above

21. Hypochlorites are calcium or sodium salts of hypochlorous acid and are supplied either dry or in liquid form. The same residuals are obtained as with \_\_\_\_\_, but the effect on the pH of the treated water is different.

- A. The same residuals
- B. A hydrogen atom
- C. The molecule ClO<sub>2</sub>
- D. Gas chlorine
- E. The only liquid hypochlorite disinfectant
- F. None of the above

22. Which of the following terms contain an excess of alkali and tend to raise the pH of the water?

- A. Chlorine dioxide
- B. Hypochlorite(s)
- C. Hypochlorite compounds
- D. As one of several oxides of chlorine
- E. A monohaloacetic acid
- F. None of the above

23. Which of the following terms is the only liquid hypochlorite disinfectant in current use?

- A. The same residuals
- B. A hydrogen atom
- C. The molecule ClO<sub>2</sub>
- D. Sodium hypochlorite
- E. The only liquid hypochlorite disinfectant
- F. None of the above

24. Which of the following terms, hypochlorite compounds have oxidizing powers equal to gas chlorine and can be employed for the same purposes in water treatment?

- A. All sodium-hypochlorite solutions
- B. Hypochlorite(s)
- C. Available chlorine
- D. Sodium hypochlorite
- E. Pound-for-pound of available chlorine
- F. None of the above

25. Which of the following terms requires a larger initial investment for feed equipment than what is needed for hypochlorite compounds?

- A. Bromate
- B. Trihalomethanes or (THM)
- C. Chlorite
- D. Gas chlorination
- E. Chlorine and other chemical disinfectants
- F. None of the above

26. Materials now in common use are \_\_\_\_\_ containing about 70 percent available chlorine and marketed under several trade names.

- A. All sodium-hypochlorite solution(s)
- B. Hypochlorite(s)
- C. Available chlorine
- D. Sodium hypochlorite
- E. High-test calcium hypochlorites
- F. None of the above

27. High-test calcium hypochlorites are \_\_\_\_\_ that give off a strong chlorine odor. Granular powdered or tablet forms are commercially available and all are readily soluble in water.

- A. The same residuals
- B. White corrosive solids
- C. The molecule ClO<sub>2</sub>
- D. The electronegative halogens
- E. The only liquid hypochlorite disinfectant
- F. None of the above

28. Sodium hypochlorite is sold only as a liquid and is normally referred to as?  
 A. Liquid bleach                                      D. Sodium hypochlorite  
 B. Hypochlorite(s)                                      E. A monohaloacetic acid  
 C. Available chlorine                                      F. None of the above
29. \_\_\_\_\_, though highly active, are relatively stable throughout production, packaging, distribution, and storage.  
 A. The same residuals                                      D. The electronegative halogens  
 B. A hydrogen atom                                      E. The only liquid hypochlorite disinfectant  
 C. High-test hypochlorites                                      F. None of the above
30. Storage at 86° F. for a year may reduce the \_\_\_\_\_ by about 10 percent. Storing at lower temperatures reduces the loss.  
 A. All sodium-hypochlorite solutions                                      D. Sodium hypochlorite  
 B. Hypochlorite(s)                                      E. A monohaloacetic acid  
 C. Available chlorine                                      F. None of the above
31. Which of the following terms are unstable to some degree and deteriorate more rapidly than the dry compounds?  
 A. The same residuals                                      D. All sodium-hypochlorite solutions  
 B. A hydrogen atom                                      E. The liquid hypochlorite disinfectants  
 C. Different disinfectants                                      F. None of the above

**Disinfection Byproducts**

32. Which of the following terms are formed when disinfectants used in water treatment plants react with bromide and/or natural organic matter present in the source water.  
 A. Bromate                                      D. Disinfection byproducts  
 B. Trihalomethanes or (THM)                                      E. Chlorine and other chemical disinfectants  
 C. Chlorite                                      F. None of the above
33. Which of the following terms produce different types or amounts of disinfection byproducts.  
 A. Bromate                                      D. Disinfection byproducts  
 B. Trihalomethanes or (THM)                                      E. Chlorine and other chemical disinfectants  
 C. Different disinfectants                                      F. None of the above
34. Disinfection byproducts for which regulations have been established have been identified in drinking water, including?  
 A. Bromate                                      D. Trihalomethanes, haloacetic acids, bromate, and chlorite  
 B. Trihalomethanes or (THM)                                      E. Chlorine and other chemical disinfectants  
 C. Chlorite                                      F. None of the above

**Trihalomethanes (THM)**

35. The trihalomethanes are \_\_\_\_\_, bromodichloromethane, dibromochloromethane, and bromoform.  
 A. Bromate                                      D. Disinfection byproducts  
 B. Chloroform                                      E. Chlorine and other chemical disinfectants  
 C. Chlorite                                      F. None of the above

36. Bromate is a chemical that is formed when \_\_\_\_\_ used to disinfect drinking water reacts with naturally occurring bromide found in source water.

- A. Bromate
- B. Trihalomethanes or (THM)
- C. Chlorite
- D. Ozone
- E. Chlorine and other chemical disinfectants
- F. None of the above

37. Chlorite is a byproduct formed when chlorine dioxide is used to disinfect water. EPA has published the Stage 1 Disinfectants/Disinfection Byproducts Rule to regulate \_\_\_\_\_ at a monthly average level of 1 part per million in drinking water.

- A. Bromate
- B. Trihalomethanes or (THM)
- C. Chlorite
- D. Disinfection byproducts
- E. Chlorine and other chemical disinfectants
- F. None of the above

38. Chloroform, typically the most prevalent \_\_\_\_\_ measured in chlorinated water, is probably the most thoroughly studied disinfection byproduct. Toxicological studies have shown that high levels of chloroform can cause cancer in laboratory animals.

- A. Bromate
- B. Trihalomethanes or (THM)
- C. Chlorite THM
- D. Disinfection byproducts
- E. Chlorine and other chemical disinfectants
- F. None of the above

### Understanding Disinfection Byproducts (DBPS)

39. Chlorine and other \_\_\_\_\_ have been widely used by public water systems to protect the public from microbial pathogens in drinking water.

- A. Bromate
- B. Trihalomethanes or (THM)
- C. Organic matter present
- D. Disinfection byproducts or DBPs
- E. Chemical disinfectants
- F. None of the above

40. DBPs are formed when certain disinfectants react with \_\_\_\_\_ (organic and inorganic materials) in source waters.

- A. DBP precursors
- B. Trihalomethanes or (THM)
- C. Organic matter present
- D. Disinfection byproducts or DBPs
- E. Chlorine and other chemical disinfectants
- F. None of the above

41. Which of the following terms in drinking water can vary significantly from one point in a distribution system to another, as many continue to form in the distribution system?

- A. The levels of DBPs
- B. Trihalomethanes or (THM)
- C. Organic matter present
- D. Disinfection byproducts or DBPs
- E. Chlorine and other chemical disinfectants
- F. None of the above

### Total Trihalomethanes

42. Which of the following terms are chemical compounds in which three of the four hydrogen atoms of methane (CH<sub>4</sub>) are replaced by halogen atoms.

- A. The levels of DBPs
- B. Trihalomethanes or (THM)
- C. Organic matter present
- D. Disinfection byproducts or DBPs
- E. Chlorine and other chemical disinfectants
- F. None of the above

43. Which of the following terms are also environmental pollutants, and many are considered carcinogenic?

- A. Bromate
- B. Trihalomethanes or (THM)
- C. Organic matter present
- D. Disinfection byproducts or DBPs
- E. Chlorine and other chemical disinfectants
- F. None of the above

44. Trihalomethanes with all the same halogen atoms are called?  
 A. Bromate D. Disinfection byproducts or DBPs  
 B. Haloforms E. Chlorine and other chemical disinfectants  
 C. Organic matter present F. None of the above
45. Trihalomethanes result from the reaction of chlorine and/or \_\_\_\_\_ with organic matter present in the water being treated.  
 A. Bromate D. Disinfection byproducts or DBPs  
 B. Bromine E. Chlorine and other chemical disinfectants  
 C. Bromoform F. None of the above
46. Which of the following terms produced have been associated through epidemiological studies with some adverse health effects?  
 A. Bromate D. Disinfection byproducts or DBPs  
 B. Trihalomethanes or (THMs) E. Chlorine and other chemical disinfectants  
 C. Organic matter present F. None of the above
47. Trihalomethanes are \_\_\_\_\_—the vast majority of which are not monitored—and it has not yet been clearly demonstrated which of these are the most plausible candidate for causation of these health effects.  
 A. Bromate D. Disinfection byproducts or DBPs  
 B. Trihalomethanes or (THM) E. Chlorine and other chemical disinfectants  
 C. Organic matter present F. None of the above
48. In the United States, the EPA limits the total concentration of the four chief constituents (chloroform, \_\_\_\_\_, bromodichloromethane, and dibromochloromethane), referred to as total trihalomethanes (TTHM), to 80 parts per billion in treated water.  
 A. Bromate D. Disinfection byproducts or DBPs  
 B. Bromine E. Chlorine and other chemical disinfectants  
 C. Bromoform F. None of the above

### THM Treatment

49. Precursors are \_\_\_\_\_ which reacts with chlorine to form THM's.  
 A. Organic material D. Disinfection byproducts or DBPs  
 B. Trihalomethanes or (THM) E. Precursors  
 C. Bromoform F. None of the above
50. One way to decrease \_\_\_\_\_ is to eliminate or reduce chlorination before the filters and to reduce precursors.  
 A. Organic material D. Disinfection byproducts or DBPs  
 B. Trihalomethanes or (THM'S) E. Precursors  
 C. Bromoform F. None of the above
51. Which of the following terms present before filtration, so we want to reduce or eliminate the time chlorine is in contact with this water?  
 A. Organic material D. Disinfection byproducts or DBPs  
 B. Trihalomethanes or (THM) E. There are more precursors  
 C. Bromoform F. None of the above

52. If some oxidation before \_\_\_\_\_ is required, an alternative disinfectant like potassium permanganate or peroxide could be considered.

- A. Reducing CT values
- B. Trihalomethanes or (THM) removal
- C. Enhanced coagulation
- D. Disinfection byproducts or DBPs reduction
- E. Filtration
- F. None of the above

53. The EPA has indicated that the best available technology for THM control at treatment plants is removal of precursors through?

- A. Reducing CT values
- B. Trihalomethanes or (THM) removal
- C. Enhanced coagulation
- D. Disinfection byproducts or DBPs reduction
- E. Filtration
- F. None of the above

54. Which of the following terms refers to the process of optimizing the filtration process to maximize removal of precursors?

- A. Reducing CT values
- B. Trihalomethanes or (THM) removal
- C. Enhanced coagulation
- D. Disinfection byproducts or DBPs reduction
- E. Filtration
- F. None of the above

### Chlorine Section- Chlorine (DDBP)

55. Today, most of our drinking water supplies are free of the micro-organisms — viruses, bacteria, and protozoa — that cause serious and life-threatening diseases, such as cholera and typhoid fever. This is largely due to the introduction of water treatment, particularly \_\_\_\_\_, at the turn of the century.

- A. Disinfection methods
- B. Chlorine disinfectant(s)
- C. Chlorination
- D. Numerous alternative disinfection methods
- E. Dry calcium hypochlorite
- F. None of the above

56. Living cells react with \_\_\_\_\_ and reduce its concentration while they die.

- A. All sodium-hypochlorite solution(s)
- B. Hypochlorite(s)
- C. Available chlorine
- D. Sodium hypochlorite
- E. Chlorine
- F. None of the above

57. Chlorine present as  $\text{Cl}$ ,  $\text{HOCl}$ , and  $\text{OCl}^-$  is called free available chlorine and that which is bound but still effective is combined chlorine. A particularly important group of compounds with?

- A. Disinfection methods
- B. Chlorine disinfectant(s)
- C. Chlorination
- D. Numerous alternative disinfection methods
- E. Dry calcium hypochlorite
- F. None of the above

58. One especially important feature of \_\_\_\_\_ is the ease of overdosing to create a residual concentration.

- A. All sodium-hypochlorite solution(s)
- B. Hypochlorite(s)
- C. Available chlorine
- D. Sodium hypochlorite
- E. Disinfection using chlorine
- F. None of the above

59. Which of the following terms provides some degree of protection right to the water faucet?

- A. With free available chlorine
- B. Free available chlorine
- C. Available chlorine
- D. This residual concentration of chlorine
- E. No chlorine residual
- F. None of the above



60. Which of the following terms, a typical residual is from 0.1 to 0.5 ppm?  
 A. With free available chlorine                      D. This residual concentration of chlorine  
 B. Free available chlorine                              E. No chlorine residual  
 C. Available chlorine                                      F. None of the above
61. Which of the following terms over the amount that reacts with the organic matter present?  
 A. Residual chlorine                      D. Sodium hypochlorite  
 B. Free available chlorine                      E. There will be no chlorine residual unless there is an excess  
 C. Available chlorine                      F. None of the above

**Chlorine by-products**

62. Chlorination by-products are the chemicals formed when \_\_\_\_\_ used to kill disease-causing micro-organisms reacts with naturally occurring organic matter in the water.  
 A. All sodium-hypochlorite solution(s)                      D. Sodium hypochlorite  
 B. Hypochlorite(s)    E. The chlorine  
 C. Available chlorine    F. None of the above

**The principal trihalomethanes are:**

63. Which of the following terms are generally lower in winter than in summer, because concentrations of natural organic matter are lower and less chlorine is required to disinfect at colder temperatures?  
 A. Organic material                      D. Disinfection byproducts or DBPs  
 B. THM concentrations                      E. Precursors  
 C. Bromoform                                      F. None of the above
64. High organic matter concentrations and \_\_\_\_\_ — is true when rivers or other surface waters are used as the source of the drinking water.  
 A. Organic material                      D. Disinfection byproducts or DBPs  
 B. High THM levels                      E. Precursors  
 C. Bromoform                                      F. None of the above

**Health Effects**

65. Laboratory animals exposed to \_\_\_\_\_ have shown increased incidences of cancer.  
 A. Organic material                                      D. Disinfection byproducts or DBPs  
 B. Trihalomethanes or (THM)                      E. Very high levels of THMs  
 C. Bromoform    F. None of the above

**Bacteria Section- Shigella dysenteriae**

66. Which of the following terms can cause shigellosis?  
 A. Shigella    D. Shigella dysenteriae  
 B. Salmonella    E. Disease-carrying organisms  
 C. Fecal coliform bacteria                      F. None of the above
67. Which of the following terms are Gram-negative, non-spore-forming, facultatively anaerobic, non-motile bacteria?  
 A. Shigellae    D. Shigella dysenteriae  
 B. Salmonella    E. Disease-carrying organisms  
 C. Fecal coliform bacteria                      F. None of the above

68. *S. dysenteriae*, spread by contaminated water and food, causes the most severe dysentery because of its potent and deadly Shiga toxin, but other species may also be?

- A. Shigellae
- B. Salmonella
- C. Fecal coliform bacteria
- D. Dysentery agents
- E. Disease-carrying organisms
- F. None of the above

69. Which of the following terms is typically via ingestion; depending on age and condition of the host as few as ten bacterial cells can be enough to cause an infection.

- A. Shigellae
- B. Shigella infection
- C. Fecal coliform bacteria
- D. Shigella dysenteriae
- E. Disease-carrying organisms
- F. None of the above

70. Which of the following terms causes dysentery that result in the destruction of the epithelial cells of the intestinal mucosa in the cecum and rectum?

- A. Shigella
- B. Salmonella
- C. Fecal coliform bacteria
- D. Shigella dysenteriae
- E. Disease-carrying organisms
- F. None of the above

71. Some strains produce enterotoxin and \_\_\_\_\_, similar to the verotoxin of *E. coli* O157:H7.

- A. Shigellae
- B. Shiga toxin
- C. Fecal coliform bacteria
- D. Shigella dysenteriae
- E. Disease-carrying organisms
- F. None of the above

### Salmonella

72. Which of the following terms is a Gram-negative bacterium. It is found in many turtles and other reptiles?

- A. Shigellae
- B. Salmonella
- C. Fecal coliform bacteria
- D. Shigella dysenteriae
- E. Disease-carrying organisms
- F. None of the above

### Escherichia Coli Section Fecal Coliform Bacteria

73. Which of the following terms are microscopic organisms that live in the intestines of warm-blooded animals.

- A. New sources of bacteria
- B. Indicator(s)
- C. Pathogens
- D. Actual pathogens
- E. Fecal coliform bacteria
- F. None of the above

74. When fecal coliform bacteria are present in high numbers in a water sample, it means that the water has received \_\_\_\_\_ from one source or another.

- A. Enterococcus bacteria
- B. Fecal matter
- C. Fecal coliform bacteria
- D. Bacteria
- E. Disease-carrying organisms
- F. None of the above

75. Which of the following terms may indicate the presence of disease-carrying organisms, which live in the same environment as the fecal coliform bacteria?

- A. New sources of bacteria
- B. Indicator(s)
- C. Pathogens
- D. Actual pathogens
- E. Fecal coliform bacteria
- F. None of the above

### Reasons for Natural Variation

76. Unlike the other conventional water quality parameters, \_\_\_\_\_ are living organisms.

- A. Enterococcus bacteria
- B. Indicators
- C. Fecal coliform bacteria
- D. Bacteria
- E. Disease-carrying organisms
- F. None of the above

77. Because bacterial concentrations are dependent on specific conditions for growth, and these conditions change quickly, \_\_\_\_\_ counts are not easy to predict.

- A. Enterococcus bacteria
- B. Indicators
- C. Fecal coliform bacteria
- D. Bacteria
- E. Disease-carrying organisms
- F. None of the above

### Expected Impact of Pollution

78. The primary sources of \_\_\_\_\_ to fresh water are wastewater treatment plant discharges, failing septic systems, and animal waste.

- A. Enterococcus bacteria
- B. Indicators
- C. Fecal coliform bacteria
- D. Bacteria
- E. Disease-carrying organisms
- F. None of the above

79. Which of the following terms do not necessarily decrease as a watershed develops from rural to urban. Instead, urbanization usually generates new sources of bacteria?

- A. New sources of bacteria
- B. Indicator(s)
- C. Pathogens
- D. Bacteria levels
- E. Fecal coliform bacteria
- F. None of the above

80. Farm animal manure and septic systems are replaced by domestic pets and leaking sanitary sewers. In fact, stormwater runoff in urbanized areas has been found to be?

- A. Enterococcus bacteria
- B. Indicators
- C. Fecal coliform bacteria
- D. Surprisingly high in fecal coliform bacteria concentrations
- E. Disease-carrying organisms
- F. None of the above

81. The presence of old, disintegrating storm and sanitary sewers, misplaced sewer pipes, and good breeding conditions are common explanations for?

- A. New sources of bacteria
- B. Indicator(s)
- C. The high levels measured
- D. Actual pathogens
- E. Fecal coliform bacteria
- F. None of the above

### Indicator Connection Varies

82. Which of the following terms are the "indicator" organisms generally measured to assess microbiological quality of water?

- A. Enterococcus bacteria
- B. Bacteria
- C. Fecal coliform bacteria
- D. General coliforms, E. Coli, and Enterococcus bacteria
- E. Disease-carrying organisms
- F. None of the above

83. Over the course of a professional lifetime pouring over indicator tests, in a context where all standards are based on \_\_\_\_\_, water workers tend to forget that the indicators are not the things we actually care about.

- A. New sources of bacteria
- B. Indicator(s)
- C. Pathogens
- D. Actual pathogens
- E. Fecal coliform bacteria
- F. None of the above

**What are these indicators?**

84. Which of the following terms indicate that the water has come in contact with plant or animal life?

- A. Enterococcus bacteria
- B. Indicators
- C. Fecal coliform bacteria
- D. Bacteria
- E. General coliforms
- F. None of the above

85. At very high levels they indicate there is what amounts to a lot of compost in the water, which could easily include?

- A. New sources of bacteria
- B. Indicator(s)
- C. Pathogens
- D. Actual pathogens
- E. Fecal coliform bacteria
- F. None of the above

86. Fecal coliforms, particularly \_\_\_\_\_, indicate that there are mammal or bird feces in the water.

- A. Pathogen(s)
- B. E. coli
- C. E. coli O157:H7
- D. Fecal contamination of water
- E. Organism
- F. None of the above

87. Enterococcus bacteria also indicate that there are feces from warm blooded animals in the water. Enterococcus are a type of?

- A. Feces
- B. Actual pathogens
- C. Escherichia coli
- D. Escherichia coli O157:H7
- E. Fecal streptococci
- F. None of the above

88. They are another valuable indicator for determining the amount of?

- A. Fecal streptococci
- B. E. coli
- C. E. coli O157:H7
- D. Fecal contamination of water
- E. Organism
- F. None of the above

89. Which of the following terms are the biggest concern, because anything which infects one human could infect another?

- A. Human feces
- B. Actual pathogens
- C. Escherichia coli
- D. Escherichia coli O157:H7
- E. Fecal streptococci
- F. None of the above

90. Ingesting \_\_\_\_\_ via contaminated water supply is a classic means for infections to spread rapidly.

- A. Pathogen(s)
- B. E. coli
- C. E. coli O157:H7
- D. Fecal contamination of water
- E. Organism
- F. None of the above

91. Ingesting feces from someone who is not carrying any \_\_\_\_\_ may gross you out, but it can't infect you.

- A. Feces
- B. Actual pathogens
- C. Escherichia coli
- D. Pathogens
- E. Fecal streptococci
- F. None of the above

92. Infection rates are around 5% in the US, and approach 100% in areas with \_\_\_\_\_ and contaminated water supplies.

- A. Feces
- B. Actual pathogens
- C. Escherichia coli
- D. Poor hygiene
- E. Fecal streptococci
- F. None of the above

93. Whenever you are trying to form a mental map of reality based on water tests, you should include in the application of your water intuition an adjustment factor for your best guess of the ratio between indicators and?

- A. Feces
- B. Actual pathogens
- C. Escherichia coli
- D. Escherichia coli O157:H7
- E. Fecal streptococci
- F. None of the above

### **E. coli O157:H7**

94. E. coli O157:H7 (bacterium) found in \_\_\_\_\_. Symptoms vary with type caused gastroenteritis.

- A. Human feces
- B. Actual pathogens
- C. Escherichia coli
- D. Fecal contamination of water
- E. Fecal streptococci
- F. None of the above

95. Escherichia coli O157:H7 is an emerging cause of foodborne illness. An estimated 73,000 cases of infection and 61 deaths occur in the United States each year. Infection often leads to bloody diarrhea, and occasionally to kidney failure. Most illnesses have been associated with eating?

- A. Human feces
- B. Actual pathogens
- C. Escherichia coli
- D. Fecal contamination of water
- E. Fecal streptococci
- F. None of the above

96. Infection can also occur after \_\_\_\_\_ and after swimming in or drinking sewage-contaminated water.

- A. Drinking raw milk
- B. Actual pathogens
- C. Eating Escherichia coli
- D. Fecal contamination of water
- E. Eating fecal streptococci
- F. None of the above

97. Consumers can prevent \_\_\_\_\_ infection by thoroughly cooking ground beef, avoiding unpasteurized milk, and washing hands carefully. Because the organism lives in the intestines of healthy cattle, preventive measures on cattle farms and during meat processing are being investigated.

- A. Pathogen(s)
- B. E. coli
- C. E. coli O157:H7
- D. Fecal contamination of water
- E. Fecal streptococci
- F. None of the above

### **What is Escherichia coli O157:H7?**

98. E. coli O157:H7 is one of hundreds of strains of the bacterium?

- A. Feces
- B. Actual pathogens
- C. Escherichia coli
- D. Escherichia coli 007
- E. Fecal streptococci
- F. None of the above

99. Which of the following terms was first recognized as a cause of illness in 1982 during an outbreak of severe bloody diarrhea; the outbreak was traced to contaminated hamburgers. Since then, most infections have come from eating undercooked ground beef.

- A. Feces
- B. Actual pathogens
- C. Escherichia coli
- D. Escherichia coli O157:H7
- E. Fecal streptococci
- F. None of the above

100. The combination of letters and numbers in the name of the bacterium refers to the specific markers found on its surface and distinguishes it from other types of?

- A. Pathogen(s)
- B. E. coli
- C. E. coli O157:H7
- D. Fecal streptococci
- E. Organisms
- F. None of the above

101. Currently, there are four recognized classes of enterovirulent E. coli (collectively referred to as the EEC group) that cause gastroenteritis in humans. Among these is?

- A. A sample is positive for total coliform
- B. The enterohemorrhagic (EHEC) strain designated E. coli O157:H7
- C. That all bacterial contamination such as E. coli. is inactivated
- D. E. coli comes from human and animal wastes
- E. Causing human illness by several different mechanisms
- F. None of the above

102. E. coli is a normal inhabitant of the intestines of all animals, including humans. When aerobic culture methods are used, E. coli is?

- A. That cause gastroenteritis in humans
- B. The dominant species found in feces
- C. That cause severe damage to the lining of the intestine
- D. May end up in drinking water
- E. Can be treated using chlorine, ultra-violet light, or ozone
- F. None of the above

103. Normally E. coli serves a useful function in the body by suppressing the growth of harmful bacterial species and?

- A. By synthesizing appreciable amounts of vitamins
- B. Although it may be regulated by state or local authorities
- C. That all bacterial contamination such as E. coli. is inactivated
- D. E. coli comes from human and animal wastes
- E. Causing human illness by several different mechanisms
- F. None of the above

104. A minority of E. coli strains are capable of causing human illness by ?

- A. Causing gastroenteritis in humans
- B. Serving a useful function in the body
- C. Causing severe damage to the lining of the intestine
- D. Causing human illness by several different mechanisms
- E. Chlorine, ultra-violet light, or ozone
- F. None of the above

105. E. coli serotype O157:H7 is a rare variety of E. coli \_\_\_\_\_, potent toxins that cause severe damage to the lining of the intestine. These toxins [verotoxin (VT), shiga-like toxin] are closely related or identical to the toxin produced by Shigella dysenteriae.

- A. A sample is positive for total coliform
- B. Although it may be regulated by state or local authorities
- C. That all bacterial contamination such as E. coli. is inactivated
- D. That produces large quantities of one or more related
- E. Causing human illness by several different mechanisms
- F. None of the above

**How does E. coli or other fecal coliforms get in the water?**

106. E. coli \_\_\_\_\_. During rainfalls, snow melts, or other types of precipitation, E. coli may be washed into creeks, rivers, streams, lakes, or groundwater.

- A. Comes from human and animal wastes
- B. Serves a useful function in the body
- C. Causing severe damage to the lining of the intestine
- D. May end up in drinking water
- E. Can be treated using chlorine, ultra-violet light, or ozone
- F. None of the above

107. When these waters are used as sources of drinking water and the water is not treated or inadequately treated, E. coli?

- A. A sample is positive for total coliform
- B. Serves a useful function in the body
- C. Is a tasty bacterial contamination
- D. Comes from human and animal wastes
- E. May end up in drinking water
- F. None of the above

**How is water treated to protect me from E. coli?**

108. The water can be treated using chlorine, ultra-violet light, or ozone, all of which act to kill or inactivate E. coli. Systems using surface water sources are required to disinfect to ensure that all bacterial contamination such as E. coli. is inactivated. Systems using ground water sources are not required to?

- A. Disinfect, although many of them do
- B. Serve disinfection
- C. Provide chlorination
- D. Inform the public of DBPs, although many of them do
- E. None of the above

**How does the U.S. Environmental Protection Agency regulate E. coli?**

109. According to EPA regulations, \_\_\_\_\_, and serves 25 people or more or has 15 or more service connections, is regulated as a public water system under the Safe Drinking Water Act.

- A. A sample is positive for total coliform
- B. Although it may be regulated by state or local authorities
- C. That all bacterial contamination such as E. coli. is inactivated
- D. If you cause E. coli coming from an operator
- E. If you cause a human illness by several different mechanisms, like chlorination mutation
- F. None of the above

110. Which of the following terms as defined by EPA regulations, it is not regulated under the Safe Drinking Water Act, although it may be regulated by state or local authorities?

- A. A sample is positive for total coliform
- B. If a system is not a public water system
- C. That all bacterial contamination such as E. coli. is inactivated
- D. If you cause E. coli coming from an operator
- E. If you cause a human illness by several different mechanisms, like chlorination mutation
- F. None of the above

111. Under the Safe Drinking Water Act, the EPA requires public water systems to monitor for coliform bacteria. Systems analyze first for total coliform?

- A. A sample is positive for total coliform
- B. Although it may be regulated by state or local authorities
- C. That all bacterial contamination such as E. coli. is inactivated
- D. Because this test is faster to produce results
- E. Causing human illness by several different mechanisms
- F. None of the above

112. Which of the following terms, the same sample must be analyzed for either fecal coliform or E. coli. Both are indicators of contamination with animal waste or human sewage?

- A. That cause gastroenteritis in humans
- B. Serves a useful function in the body
- C. That cause severe damage to the lining of the intestine
- D. Any time that a sample is positive for total coliform
- E. If you cause a human illness by several different mechanisms, like chlorination mutation
- F. None of the above

113. Smaller systems must take at least five samples a month unless the state has conducted a sanitary survey – a survey in which a state inspector examines system components and ensures they will protect public health – \_\_\_\_\_.

- A. A sample is positive for total coliform
- B. Although it may be regulated by state or local authorities
- C. That all bacterial contamination such as E. coli. is inactivated
- D. At the system within the last five years
- E. Preventing human illness by several different mechanisms
- F. None of the above

114. Systems serving 25 to 1,000 people typically take one sample per month. Some states reduce this frequency to quarterly for ground water systems if a recent sanitary survey shows that the system is free of?

- A. Pathogen(s)
- B. E. coli
- C. E. coli O157:H7
- D. Fecal contamination of water
- E. Sanitary defects
- F. None of the above

115. Some types of systems can qualify for annual monitoring. Systems using surface water, rather than ground water, are required to take extra steps to protect against \_\_\_\_\_ because surface water sources are more vulnerable to such contamination.

- A. Pathogen(s)
- B. E. coli
- C. E. coli O157:H7
- D. Fecal contamination of water
- E. Bacterial contamination
- F. None of the above



**What can I do to protect myself from E. coli O157:H7 in drinking water?**

116. Approximately 89 percent of Americans are receiving water from?  
A. Treated seawater and may cause gastroenteritis in humans  
B. Although it may be regulated by state or local authorities, it is okay for non-potable use  
C. Removing all bacterial contamination such as E. coli. and all bacteria is inactivated  
D. The system where the operator is e.coli free, at least on paper  
E. Community water systems that meet all health-based standards  
F. None of the above

**Positive Tests**

117. If you draw water from a private well, you can contact your state health department to obtain information on how to have your well tested for \_\_\_\_\_, and E. coli contamination.

- A. Pathogen(s)      D. Fecal contamination of water  
B. E. coli            E. Total coliforms  
C. E. coli O157:H7   F. None of the above

118. If your well tests positive for \_\_\_\_\_, there are several steps that you should take: (1) begin boiling all water intended for consumption, (2) disinfect the well according to procedures recommended by your local health department, and (3) monitor your water quality to make certain that the problem does not recur.

- A. Pathogen(s)      D. Fecal contamination of water  
B. E. coli            E. Total coliforms  
C. E. coli O157:H7   F. None of the above

119. If \_\_\_\_\_ is a recurring problem, you should investigate the feasibility of drilling a new well or install a point-of-entry disinfection unit, which can use chlorine, ultraviolet light, or ozone.

- A. Pathogen(s)      D. Bacteria  
B. E. coli            E. The contamination  
C. E. coli O157:H7   F. None of the above

120. Which of the following terms in diarrheal stools of infected persons can be passed from one person to another if hygiene or hand washing habits are inadequate?

- A. Pathogen(s)      D. Bacteria  
B. E. coli            E. The contamination  
C. E. coli O157:H7   F. None of the above

121. Family members and playmates of these children are at high risk of becoming infected. Young children typically shed the organism in their feces for a week or two after their illness resolves. Older children rarely carry the?

- A. Pathogen(s)      D. Bacteria  
B. E. coli            E. Organism without symptoms  
C. E. coli O157:H7   F. None of the above

**Legionnaires' Disease Legionella Section**

122. The first discovery of bacteria from \_\_\_\_\_ came in 1976 when an outbreak of pneumonia at an American Legion convention led to 29 deaths.

- A. Legionella bacteria      D. Original American Legion outbreak  
B. Genus Legionella        E. Pneumonia, and Pontiac fever, a milder illness  
C. Organism                F. None of the above

123. \_\_\_\_\_, what would come to be known as Legionella pneumophila, was isolated and given its own genus.

- A. Legionella bacteria
- B. Genus Legionella
- C. Bacteria
- D. Original American Legion outbreak
- E. The causative agent
- F. None of the above

124. The organisms classified in this genus are \_\_\_\_\_ that are considered intracellular parasites.

- A. Legionella bacteria
- B. Genus Legionella
- C. Bacteria
- D. Original American Legion outbreak
- E. Gram-negative bacteria
- F. None of the above

**What have been the water sources for Legionnaires' disease?**

125. The major source is water distribution systems of large buildings, including hotels and hospitals. Cooling towers have long been thought to be a major source for \_\_\_\_\_, but new data suggest that this is an overemphasized mode of transmission.

- A. Legionella
- B. Genus Legionella
- C. Bacteria
- D. Original American Legion outbreak
- E. Pneumonia, and Pontiac fever, a milder illness
- F. None of the above

126. Air conditioners are not a source for \_\_\_\_\_. They were suspected to be the source in the original American Legion outbreak in a Philadelphia hotel.

- A. Legionella bacteria
- B. Genus Legionella
- C. Legionnaires' disease
- D. Original American Legion outbreak
- E. Pneumonia, and Pontiac fever, a milder illness
- F. None of the above

127. Which of the following terms is caused most commonly by the inhalation of small droplets of water or fine aerosol containing Legionella bacteria?

- A. Legionella bacteria
- B. Legionnaire's disease
- C. Bacteria
- D. Original American Legion outbreak
- E. Pneumonia, and Pontiac fever, a milder illness
- F. None of the above

128. Which of the following terms are naturally found in environmental water sources such as rivers, lakes and ponds and may colonize man-made water systems that include air conditioning systems, humidifiers, cooling tower waters, hot water systems, spas and pools.

- A. Legionella bacteria
- B. Legionnaire's disease
- C. Bacteria
- D. Original American Legion outbreak
- E. Pneumonia, and Pontiac fever, a milder illness
- F. None of the above

**How do people contract Legionella?**

129. The most popular theory is that the organism is aerosolized in water and people inhale the droplets containing?

- A. Legionella bacteria
- B. Legionella
- C. Bacteria
- D. Original American Legion outbreak
- E. Pneumonia, and Pontiac fever, a milder illness
- F. None of the above

130. "Aspiration" is the most common way that bacteria enter into the lungs to cause?

- A. Legionella bacteria
- B. Genus Legionella
- C. Legionnaire's disease
- D. Original American Legion outbreak
- E. Pneumonia
- F. None of the above

131. Which of the following terms means choking such that secretions in the mouth get past the choking reflexes and instead of going into the esophagus and stomach, mistakenly, enter the lung?

- A. Aspiration
- B. Common mode of transmission
- C. Resulting in expensive settlements
- D. Legionella testing of environmental samples
- E. Not part of a routine maintenance program
- F. None of the above

132. Which of the following terms - to prevent aspiration is defective in patients who smoke or have lung disease?

- A. Aspiration
- B. Common mode of transmission
- C. Resulting in expensive settlements
- D. The protective mechanisms
- E. Not part of a routine maintenance program
- F. None of the above

133. Which of the following terms - may multiply to high numbers in cooling towers, evaporative condensers, air washers, humidifiers, hot water heaters, spas, fountains, and plumbing fixtures?

- A. Legionella bacteria
- B. Legionella
- C. Bacteria
- D. Original American Legion outbreak
- E. Pneumonia, and Pontiac fever, a milder illness
- F. None of the above

134. Once high numbers of Legionella have been found, \_\_\_\_\_ for disinfecting water systems with chlorine and detergent is available. This procedure is not part of a routine maintenance program because equipment may become corroded.

- A. A relatively simple procedure
- B. Exercising 'reasonable care'
- C. Resulting in expensive settlements
- D. Legionella testing of environmental samples
- E. Not part of a routine maintenance program
- F. None of the above

135. Property owners have been sued for the spread of Legionella, resulting in expensive settlements. \_\_\_\_\_ with a battery of DFA monoclonal antibodies for several serogroups and species of Legionella morphologically intact bacteria provides a means for exercising 'reasonable care' to deter potential litigation.

- A. Regular monitoring
- B. Exercising 'reasonable care'
- C. Resulting in expensive settlements
- D. Legionella testing of environmental samples
- E. Not part of a routine maintenance program
- F. None of the above

136. Currently, there are no United States government regulations concerning permissible numbers of legionella in water systems and there are no federal or state certification programs for laboratories that perform?

- A. Aspiration
- B. Exercising 'reasonable care'
- C. Resulting in expensive settlements
- D. Legionella testing of environmental samples
- E. Not part of a routine maintenance program
- F. None of the above

### Viruses

137. Viruses are acellular microorganisms. They are made up of only genetic material and a protein coat. Viruses depend on the energy and metabolic machinery of?

- A. The host cell to reproduce
- B. Bacteria
- C. Fecal coliforms
- D. Organism
- E. Infectious diseases
- F. None of the above

138. Which of the following terms - consist of genetic material—either deoxyribonucleic acid or ribonucleic acid surrounded by a protective coating of protein, called a capsid, with or without an outer lipid envelope?

- A. Virus(es)
- B. Bacteria
- C. Fecal coliforms
- D. Organism
- E. Cells
- F. None of the above

139. Which of the following terms - are between 20 and 100 times smaller than bacteria and hence are too small to be seen by light microscopy.

- A. Virus(es)
- B. Bacteria
- C. Fecal coliforms
- D. Viruses are not considered free-living
- E. Although many infectious diseases
- F. None of the above

140. Which of the following terms - are not considered free-living, since they cannot reproduce outside of a living cell; they have evolved to transmit their genetic information?

- A. Virus(es)
- B. Bacteria
- C. Fecal coliforms
- D. Viruses are not considered free-living
- E. Although many infectious diseases
- F. None of the above

141. A few viruses stimulate cells to grow uncontrollably and produce cancers. Although many infectious diseases, such as the common cold, are caused by viruses, there are no cures for these?

- A. Virus(es)
- B. Illnesses
- C. Fecal coliforms
- D. Organisms
- E. Infectious diseases
- F. None of the above

### **Bacteriological Monitoring Review**

142. 26 \_\_\_\_\_ have been documented each year in the United States over the past 25 years.

- A. Pathogen outbreaks
- B. E. coli outbreaks
- C. Fecal coliforms outbreaks
- D. Waterborne-disease outbreaks
- E. Total coliforms outbreaks
- F. None of the above

143. Although significant improvements in drinking water and wastewater treatment have been achieved, \_\_\_\_\_ indicate that certain types and sources of waterborne pathogens are still a threat to human health in the United States.

- A. Pathogen outbreaks
- B. E. coli outbreaks
- C. Fecal coliforms outbreaks
- D. Waterborne-disease outbreaks
- E. Total coliforms outbreaks
- F. None of the above

144. In particular, waterborne disease outbreaks caused by Escherichia coli O157:H7 were reported more frequently in 1995-96 than in previous years, and during that same period, \_\_\_\_\_ caused large outbreaks associated with recreational water quality.

- A. Pathogen(s)
- B. E. coli
- C. Fecal coliforms
- D. Cryptosporidium and Giardia
- E. Total coliforms
- F. None of the above

145. Microbiological examination of water is used to determine the sanitary quality of water and the public health risk from?

- A. Pathogen(s)
- B. E. coli
- C. Outbreak(s)
- D. Escherichia coli O157.:H7
- E. Waterborne disease
- F. None of the above

146. Monitoring programs vary widely at the local level for recreational waters, and the result is the \_\_\_\_\_ across the United States

- A. Pathogen(s)
- B. E. coli
- C. Fecal coliforms
- D. Escherichia coli O157.:H7
- E. Total coliforms
- F. None of the above

147. Concepts about the relation between the occurrence and distribution of \_\_\_\_\_ and a range of environmental factors such as climate, hydrology, land use, and human and animal population densities need to be tested in areas that represent the national water-use patterns for public and domestic supply and for recreational uses.

- A. Pathogen(s)
- B. E. coli
- C. Outbreak(s)
- D. Escherichia coli O157.:H7
- E. Organisms
- F. None of the above

### **Understanding Bacteriological Monitoring**

#### **Understanding Bacteria Sampling**

148. Waterborne bacterial pathogens in the United States include species in the genera Salmonella, Shigella, Vibrio, Campylobacter, Yersinia, and pathogenic strains of?

- A. Infectious diseases
- B. E. coli
- C. Fecal coliforms
- D. Escherichia coli O157.:H7
- E. Total coliforms
- F. None of the above

149. Because bacterial pathogens generally appear intermittently in low concentrations in the environment and because methods of culturing are difficult, \_\_\_\_\_ are used to indicate the possible presence of pathogens.

- A. Pathogen(s)
- B. E. coli
- C. Total Coliform
- D. Fecal-indicator bacteria
- E. Bac-T tests
- F. None of the above

150. Which of the following terms - should be applicable in all types of water; unable to reproduce in ambient waters; be harmless to man and other animals; lend itself to easy, quantitative testing procedures?

- A. Pathogen(s)
- B. E. coli
- C. Total Coliform
- D. Fecal-indicator bacteria
- E. Bac-T tests
- F. None of the above

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