

**Registration form**

**WATER & WASTEWATER SAMPLING \$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*

**Address** \_\_\_\_\_

**City** \_\_\_\_\_ **State** \_\_\_\_\_ **Zip** \_\_\_\_\_

**Email** \_\_\_\_\_ **Fax ( \_\_\_\_\_ )** \_\_\_\_\_

**Phone:**  
**Home ( \_\_\_\_\_ )** \_\_\_\_\_ **Work ( \_\_\_\_\_ )** \_\_\_\_\_

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

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

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

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

Wastewater Treatment \_\_\_\_\_ Pretreatment \_\_\_\_\_

**Technical Learning College TLC PO Box 3060, Chino Valley, AZ 86323  
Toll Free (866) 557-1746 Fax (928) 272-0747 [info@tlch2o.com](mailto:info@tlch2o.com)**

**If you've paid on the Internet, please write your Customer#** \_\_\_\_\_

**Please invoice me, my PO#** \_\_\_\_\_

***We will stop mailing the certificate of completion so we need either your fax number or e-mail address. We will e-mail the certificate to you, if no e-mail address; we will fax it to you.***

## **DISCLAIMER NOTICE**

I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I also understand that this type of study program deals with dangerous conditions and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable for any errors or omissions or advice contained in this CEU education training course or for any violation or injury or neglect or damage caused by this CEU education training or course material suggestion or error. I will call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded.

**State Approval Listing Link**, check to see if your State accepts or has pre-approved this course. Not all States are listed. Not all courses are listed. If the course is not accepted for CEU credit, we will give you the course free if you ask your State to accept it for credit.

## **State Approval Listing URL...**

<http://www.tlch2o.com/downloads/PDF/CEU%20State%20Approvals.pdf>

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

## **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.

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.

**Texas Students Only**  
**Acknowledgement of Notice of Potential Ineligibility for License**  
*You are required to sign and return to TLC or your credit will not be reported.*

Name: \_\_\_\_\_

Date of Birth: \_\_\_\_\_

Email Address: \_\_\_\_\_

By signing this form, I acknowledge that Technical Learning College notified me of the following:

- the potential ineligibility of an individual who has been convicted of an offense to be issued an occupational license by the Texas Commission on Environmental Quality (TCEQ) upon completion of the educational program;
- the current TCEQ Criminal Conviction Guidelines for Occupational Licensing, which describes the process by which the TCEQ's Executive Director determines whether a criminal conviction:
  - renders a prospective applicant an unsuitable candidate for an occupational license;
  - warrants the denial of a renewal application for an existing license; or
  - warrants revocation or suspension of a license previously granted.
- the right to request a criminal history evaluation from the TCEQ under Texas Occupations Code Section 53.102; and
- that the TCEQ may consider an individual to have been convicted of an offense for the purpose of denying, suspending or revoking a license under circumstances described in Title 30 Texas Administrative Code Section 30.33.

Enrollee Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Name of Training Provider/Organization: Technical Learning College

Contact Person: Melissa Durbin Role/Title: Dean



# For Texas TCEQ Wastewater Licensed Operators Important Information

## Wastewater/Collections Rule Changes (Texas Only)

### Rule Changes and Updates for Domestic Wastewater Systems

On Nov. 4, 2014, TCEQ commissioners adopted revisions to 30 Texas Administrative Code (TAC), Chapter 217, Design Criteria for Domestic Wastewater Systems, and “re-adopted” previously repealed rules in 30 TAC, Chapter 317, Design Criteria Prior to 2008.

#### ***Some of the changes to Chapter 217 include:***

- Adding new definitions and clarifying existing definitions;
- Adding design criteria and approval requirements for rehabilitation of existing infrastructure;
- Adding design criteria for new technologies, including cloth filters and air lift pumps;
- Making changes to reflect modern practices, standards and trends;
- Modifying rule language to improve readability and enforceability; and
- Modifying the design organic loadings and flows for a new wastewater treatment facility.

### **SUBCHAPTER A: ADMINISTRATIVE REQUIREMENTS §§217.1 - 217.18**

Effective December 4, 2015 §217.1. Applicability. (a) Applicability. (1) This chapter applies to the design, operation, and maintenance of: (A) domestic wastewater treatment facilities that are constructed with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (B) treatment units that are altered, constructed, or re-rated with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (C) collection systems that are constructed with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (D) collection system units that are altered, constructed, or re-rated with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (E) existing domestic wastewater treatment facilities that do not have a current Texas Pollutant Discharge Elimination System permit or a Texas Land Application Permit and are required to have an active wastewater permit; (F) existing wastewater treatment facilities and collection systems that never received approval for plans and specifications from the executive director; and (G) collection system rehabilitation projects covered in §217.56(c) and §217.69 of this title (relating to Trenchless Pipe Installation; and Maintenance, Inspection, and Rehabilitation of the Collection System). (2) Domestic wastewater treatment facilities, treatment units, collection systems, and collection system units with plans and specifications approved by the executive director that were received on or after August 28, 2008 and before the effective date of this chapter must comply with the rules in this chapter, as they existed immediately before the effective date of the amendments to this chapter.

The rules in Texas Commission on Environmental Quality Page 2 Chapter 217 - Design Criteria for Domestic Wastewater Systems effect immediately before the effective date of the amendments to this chapter are continued in effect for that purpose. (3) This chapter does not apply to: (A) the design, installation, operation, or maintenance of domestic wastewater treatment facilities, treatment units, collection systems, or collection system units with plans and specifications that were approved by the executive director on or before August 27, 2008, which are governed by Chapter 317 of this title (relating to Design Criteria Prior to 2008) or design

criteria that preceded Chapter 317 of this title; and (B) systems regulated by Chapter 285 of this title (relating to On-Site Sewage Facilities); or collection systems or wastewater treatment facilities that collect, transport, treat, or dispose of wastewater that does not have the characteristics of domestic wastewater, although the wastewater may contain domestic wastewater.

(b) The executive director may grant variances from new requirements added by the amendments of this chapter to a person who proposes to construct, alter, or re-rate a collection system or wastewater treatment facility if the plans and specifications for the project are submitted within 180 days after the date the amendments to this chapter are effective, provided the plans and specifications comply with the rules in effect immediately prior to the amendment. Adopted November 4, 2015 Effective December 4, 2015

**The link to the rules is available on the TCEQ website at <https://www.tceq.texas.gov/rules/indxpdf.html>**

***For Texas Students Only....***

Please sign and date this notice

Printed Name

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Signature

Date

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# WT & WWT Sampling Answer Key

Name \_\_\_\_\_

Phone \_\_\_\_\_

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

**No refunds.**

You are responsible 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 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

2. A B C D

3. A B C D

4. A B C D

5. A B C D

6. A B C D

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51. A B C D

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67. A B C D

68. A B C D

69. A B C D

70. A B C D

71. A B C D

72. A B C D

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

*I understand that I am 100 percent responsible to ensure that TLC receives the Assignment and Registration Key and that it is accepted for credit by my State or Providence. I understand that TLC has a zero tolerance towards not following their rules, cheating or hostility towards staff or instructors. I need to complete the entire assignment for credit. There is no credit for partial assignment completion. My exam was proctored. I will contact TLC if I do not hear back from them within 2 days of assignment submission. I will forfeit my purchase costs and will not receive credit or a refund if I do not abide with TLC's rules.*

**Please Sign that you understand and will abide with TLC's Rules.**

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**Signature**

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



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

**WATER & WASTEWATER SAMPLING CEU COURSE  
CUSTOMER SERVICE RESPONSE CARD**

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

E-MAIL \_\_\_\_\_ PHONE \_\_\_\_\_

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

Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

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

Very Similar 0 1 2 3 4 5 Very Different

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

What would you do to improve the Course?

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Any other concerns or comments.

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

## Water and Wastewater Sampling CEU Training Course Assignment

The Water and Wastewater Sampling 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>

### Three Types of Public Water Systems

1. Provides water to the same population year-round for example: homes, apartment buildings.

- A. TNCWS    C. NTNCWSs
- B. CWSs     D. None of the above

2. Provides water to the same people at least six months a year, but not all year for example: schools, factories, churches, office buildings that have their own water system.

- A. TNCWS    C. NTNCWSs
- B. CWSs     D. None of the above

3. Approximately 18,000 water systems

- A. TNCWS    C. NTNCWSs
- B. CWSs     D. None of the above

4. Approximately 85,000 systems

- A. TNCWS    C. NTNCWSs
- B. CWSs     D. None of the above

5. Provides water where people do not remain for long periods of time for example: gas stations, campgrounds.

- A. TNCWS    C. NTNCWSs
- B. CWSs     D. None of the above

6. Approximately 52,000 systems serving the majority of the U.S. population

- A. TNCWS    C. NTNCWSs
- B. CWSs     D. None of the above

### Water Quality Section

#### Surface (Raw) Water Introduction

7. Operators need to appropriately treat surface water is never pure of \_\_\_\_\_, it. Most of the earth's water sources obtain their water supplies through precipitation.

- A. Excess nutrients                      C. Pollution
- B. Biological actions                    D. None of the above

### Surface Water Properties

8. Runoff could produce mud, leaves, decayed vegetation, and human and animal refuse. The discharge from industry could increase\_\_\_\_\_. Some lakes and reservoirs may experience seasonal turnover.

- A. Volatile organic compounds
- B. Water quality
- C. Excess nutrients
- D. None of the above

### Managing Water Quality at the Source

9. Contingent upon the region, source water may have several restrictions of use as part of a Water Shed Management Plan. In some areas, it may be restricted from recreational use, discharge or runoff from agriculture, or\_\_\_\_\_.

- A. Excess nutrients
- B. Biological actions
- C. Industrial and wastewater discharge
- D. None of the above

### Physical Characteristics of Water

10. Physical characteristics are the elements found that are considered alkali, metals, and non-metals such as carbonates, fluoride,\_\_\_\_\_. The consumer relates it to scaling of faucets or staining.

- A. pH and alkalinity
- B. Sulfides or acids
- C. Powdered activated carbon and chlorine
- D. None of the above

11. Total Dissolved Solids (TDS) is not a primary pollutant; it is a gauge of appealing water characteristics such as hardness and an indication of an assortment of chemical contaminants that might be present, such as?

- A. Turbidity
- B. Colloids
- C. Arsenic
- D. None of the above

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

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

### Alkalinity

13. Alkalinity is a measure of \_\_\_\_\_and can be interpreted in terms of specific substances only when the chemical composition of the sample is known.

- A. Hydrogen ion ( $H^+$ )
- B. Alkaline earth metal
- C. An aggregate property of water
- D. None of the above

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

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

### Turbidity Introduction

15. One physical feature of water is turbidity. A measure of the cloudiness of water caused by\_\_\_\_\_. The cloudy appearance of water caused by the presence of tiny particles.

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

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

16. \_\_\_\_\_ may be existing in a water supply due to pollution, and these colloids can be difficult to remove in the coagulation process. In this situation, higher coagulant dosages are generally required.
- A. Turbidity
  - B. Organic colloids
  - C. Total Dissolved Solids (TDS)
  - D. None of the above

### **Turbidity MCL**

17. An MCL for turbidity established by the EPA because \_\_\_\_\_ interferes with disinfection. This characteristic of water changes the most rapidly after a heavy rainfall.
- A. Conductivity
  - B. Turbidity
  - C. Temperature
  - D. None of the above

### **Dissolved Oxygen**

18. The level of dissolved oxygen in natural waters is often a direct indication of quality, since aquatic plants produce oxygen, while microorganisms generally consume it as they feed on \_\_\_\_\_.
- A. Pollutants
  - B. Organic matter
  - C. E. coli bacteria
  - D. None of the above

### **Secondary Standard**

19. TDS is most often measured in parts per million (ppm) or milligrams per liter of water (mg/L). The normal TDS level ranges from \_\_\_\_\_.
- A. 50 ppm to 1,000 ppm
  - B. 5 ppm to 10 ppm
  - C. 50 ppm to 100 ppm
  - D. None of the above

### **Langelier Saturation Index**

20. The Langelier Saturation index (LSI) is an evenness scale derived from the theoretical concept of saturation and provides an indicator of the degree of saturation of water with respect to calcium carbonate. It can be shown that the Langelier saturation index (LSI) approximates the base 10 logarithm of the \_\_\_\_\_ saturation level.
- A. Magnesium carbonate
  - B. Calcium carbonate
  - C. Calcite
  - D. None of the above

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

21. Which of the following rules focuses on public health protection by limiting exposure to DBPs, specifically total trihalomethanes and five haloacetic acids, which can form in water through disinfectants used to control microbial pathogens?
- A. Stage 2 DBP rule
  - B. Stage 1 DBPR
  - C. Long Term 2 Enhanced Surface Water Treatment Rule
  - D. None of the above

22. The Stage 1 Disinfectants and Disinfection Byproducts Rule and \_\_\_\_\_, promulgated in December 1998.
- A. Stage 1 DBPR
  - B. Stage 2 DBPR
  - C. Interim Enhanced Surface Water Treatment Rule
  - D. None of the above

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

23. Which of the following form when disinfectants used to treat drinking water react with naturally occurring materials in the water?
- A. Chloramines
  - B. Humic and fulvic acids
  - C. Disinfection byproducts (DBPs)
  - D. None of the above

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

24. Total trihalomethanes and haloacetic acids are widely occurring \_\_\_\_\_ formed during disinfection with chlorine and chloramine.
- A. Gases
  - B. Substances
  - C. Classes of DBPs
  - D. None of the above

### Disinfection Byproduct Research and Regulations Summary

25. \_\_\_\_\_ is unquestionably the most important step in the treatment of water for drinking water supplies.
- A. DBP(s)
  - B. Turbidity (particle)
  - C. Disinfection
  - D. None of the above
26. The risk of illness and death resulting from exposure to pathogens in drinking water is very much greater than the risks from \_\_\_\_\_.
- A. Disinfectants and DBPs
  - B. Turbidity (particle)
  - C. Natural organic matter precursors
  - D. None of the above

### Controlling Disinfection Byproducts

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

### Organisms Descriptors and Meanings

28. Photo means...
- A. Feed or nourish
  - B. Other (Organic carbon)
  - C. Light
  - D. None of the above
29. Troph means...
- A. Feed or nourish
  - B. Other (Organic carbon)
  - C. Light
  - D. None of the above
30. Litho means...
- A. Rock
  - B. Organic
  - C. Light
  - D. None of the above
31. Organo means...
- A. Rock
  - B. Organic
  - C. Light
  - D. None of the above
32. Auto means...
- A. Without air
  - B. With air
  - C. Self (Inorganic carbon)
  - D. None of the above
33. Aerobic means...
- A. Without air
  - B. With air
  - C. Self (Inorganic carbon)
  - D. None of the above
34. Chemo means...
- A. Rock
  - B. Organic
  - C. Chemical
  - D. None of the above

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

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

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

37. Which of the following like salts and metals, which can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming?

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

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

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

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

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

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

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

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

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

**TCR**

42. 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

43. 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

44. 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**

45. Total coliform samples must be collected by PWSs at sites which 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

46. 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

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

- A. True      B. False

48. 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

49. 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

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

- A. True      B. False

### **Dangerous Waterborne Microbes**

51. 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

52. Which of the following are not necessarily agents of disease may indicate the presence of disease-carrying organisms?

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

53. 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

54. 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

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



55. Which of the following can cause bacillary dysentery?

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

56. 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
- B. Cryptosporidium
- C. Shigella dysenteriae
- D. None of the above

### **Bacteriological Monitoring Introduction**

57. 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
- B. Amoebas
- C. Viruses
- D. None of the above

58. Indicators in common use today for routine monitoring of drinking water include total coliforms, fecal coliforms, and?

- A. Cryptosporidium
- B. Protozoa
- C. Escherichia coli (E. coli)
- D. None of the above

59. According to the text, the routine microbiological analysis of your water is for?

- A. Contamination
- B. Colloids
- C. Coliform bacteria
- D. None of the above

### **Bacteria Sampling**

60. Water samples for \_\_\_\_\_ must always be collected in a sterile container.

- A. Amoebas
- B. Bacteria tests
- C. Viruses
- D. None of the above

### **Methods**

61. The MMO-MUG test, a product marketed as \_\_\_\_\_, is the most common. The sample results will be reported by the laboratories as simply coliforms present or absent.

- A. Colilert
- B. Coliform
- C. Total coliform analysis
- D. None of the above

### **Microbial Regulations**

62. 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

63. 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

64. 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

65. It is important to properly identify the type of sample you are collecting.

- A. True                      B. False

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

66. 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

67. 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

68. 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

69. 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

70. 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

71. 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

72. 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

### Positive or Coliform Present Results

73. 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

74. 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**

75. 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)**

76. 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**

77. 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

78. 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:**

79. Which determines a violation of nitrate?

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

### **Revised Total Coliform Rule (RTCR) Summary**

80. 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

81. 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

82. 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

83. 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

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

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

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

**Disinfection Key**

94. The RTCR requires 99.99% or 4 log inactivation of \_\_\_\_\_ .  
 A. Enteric viruses C. Giardia lamblia cysts  
 B. Crypto D. None of the above
95. The RTCR requires 99% or 2 log inactivation of \_\_\_\_\_ .  
 A. Enteric viruses C. Giardia lamblia cysts  
 B. Crypto D. None of the above

96. The RTCR requires 99.9% or 3 log inactivation of \_\_\_\_\_.

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

97. 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**

98. 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

### **Protozoan Caused Diseases**

99. 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

100. 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**

101. 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

102. 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**

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

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

104. 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

105. *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

### **Waterborne Bacterial Diseases**

106. 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

### **Viruses**

#### **Coronavirus**

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

- A. True      B. False

### **Chain of Custody Procedures**

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

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

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

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

### **Factors in Chlorine Disinfection: Concentration and Contact Time**

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

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

111. As \_\_\_\_\_ are used, contact times may be reduced.

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

### **Water Laboratory Analysis Section**

#### **pH Testing Section**

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

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

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

- A. True      B. False

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

- A. True            B. False

115. Pure water has a pH very close to?

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

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

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

117. Mathematically, pH is the negative logarithm of the activity of the (solvated) hydronium ion, more often expressed as the measure of the?

- A. Electron concentration      C. Hydronium ion concentration  
B. Alkalinity concentration    D. None of the above

118. Which of the following terms for aqueous solutions can be done with a glass electrode and a pH meter, or using indicators?

- A. Primary sampling            C. Determining values  
B. Measurement of pH        D. None of the above

119. The pH scale is logarithmic and therefore pH is?

- A. An universal indicator      C. An excess of alkaline earth metal concentrations  
B. A dimensionless quantity    D. None of the above

120. Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater. It is one of the best measures of the sensitivity of the stream to acid inputs. There can be long-term changes in the \_\_\_\_\_ of rivers and streams in response to human disturbances.

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

121. pH is defined as the decimal logarithm of the reciprocal of the \_\_\_\_\_,  $a_{H^+}$ , in a solution.

- A. Hydrogen ion activity            C. Brønsted–Lowry acid–base theory  
B. Acid-base behavior            D. None of the above

122. Which of the following terms may be used to measure pH, by making use of the fact that their color changes with pH?

- A. Indicators                    C. A set of non-linear simultaneous equations  
B. Spectrophotometer        D. None of the above

123. Alkalinity is the name given to the quantitative capacity of an aqueous solution to neutralize an?

- A. Acid                            C. Bond formation  
B. Base                            D. None of the above

124. Which of the following terms of the color of a test solution with a standard color chart provides a means to measure pH accurate to the nearest whole number?  
A. Universal indicator            C. Visual comparison  
B. Colorwheel measurement    D. None of the above
125. The pH scale is traceable to a set of standard solutions whose pH is established by US EPA.  
A. True            B. False
126. The calculation of the pH of a solution containing acids and/or bases is an example of a chemical speciation calculation, that is, a mathematical procedure for calculating the concentrations of all chemical species that are present in the solution. The complexity of the procedure depends on the?  
A. Nature of the solution            C. Alkaline earth metal concentrations  
B. pH                                    D. None of the above
127. Under normal circumstances this means that the concentration of hydrogen ions in acidic solution can be taken to be equal to the concentration of the acid. The pH is then equal to minus the logarithm of?  
A. The concentration value    C. A set of non-linear simultaneous equations  
B. The pH                            D. None of the above
128. Alkalinity of water is its acid-neutralizing capacity. It is the sum of all the titratable bases. The measured value may vary significantly with the?  
A. End-point pH            C. pH measurement(s)  
B. Alkalinity                    D. None of the above
129. For strong acids and bases no calculations are necessary except in extreme situations. The pH of a solution containing a weak acid requires the solution of a quadratic equation. The pH of a solution containing a weak base may require the?  
A. Solution of a cubic equation            C. Excess of alkaline earth metal concentrations  
B. Non-linear simultaneous equations    D. None of the above
130. Alkalinity is a measure of this missing term and can be interpreted in terms of specific substances only when the chemical composition of the sample is known.  
A. Universal indicator            C. Excess of alkaline earth metal concentrations  
B. An aggregate property of water    D. None of the above
131. More precise measurements are possible if the color is measured spectrophotometrically, using a?  
A. Universal indicator            C. Set of non-linear simultaneous equations  
B. Colorimeter or spectrophotometer    D. None of the above
132. Because the alkalinity of many surface waters is primarily a function of carbonate, bicarbonate, and hydroxide content, it is taken as an indication of the concentration of these constituents.  
A. True            B. False
133. For strong acids and bases no calculations are necessary except in extreme situations. The pH of a solution containing a weak acid requires?  
A. The concentration value            C. Excess of alkaline concentrations  
B. The solution of a quadratic equation    D. None of the above



134. The calculation of the pH of a solution containing acids and/or bases is an example of a \_\_\_\_\_ calculation, that is, a mathematical procedure for calculating the concentrations of all chemical species that are present in the solution
- A. Chemical speciation      C. Visual comparison  
B. Spectrophotometer      D. None of the above
135. Since pH is a logarithmic scale, a difference of one pH unit is equivalent to \_\_\_\_\_ fold difference in hydrogen ion concentration
- A. 1    C. 10  
B..1    D. None of the above
136. Which of the following terms measurements is used in the interpretation and control of water and wastewater treatment processes?
- A. Acid      C. Hydrogen bond formation  
B. Alkalinity    D. None of the above
137. Which of the following terms are compounds that, for practical purposes, are completely dissociated in water?
- A. Strong acids and bases    C. Strong bases and weak acids  
B. Chemical ions in chains    D. None of the above
138. The pH of a solution containing a \_\_\_\_\_ may require the solution of a cubic equation.
- A. Strong acids and bases    C. Weak base  
B. Strong base      D. None of the above
139. Sodium hydroxide, NaOH, is an example of a?
- A. Weak base      C. Strong acid  
B. Strong base      D. None of the above

### **Alkalinity Sub-Section**

#### **Introduction**

140. Alkalinity is a measure of an aggregate property of water and can be interpreted in terms of specific substances only when the chemical composition of the sample is known.
- A. True      B. False