

**Registration form**

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48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

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

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

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

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

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

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

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

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

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

**Technical Learning College TLC PO Box 3060, Chino Valley, AZ 86323  
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<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.*

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

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## Distribution Foreman Answer Key

Name \_\_\_\_\_

Phone \_\_\_\_\_

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

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Method of Course acceptance confirmation. Please fill this section

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

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

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| 212. A B C D | 235. A B C D | 258. A B C D | 281. A B C D |
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| 215. A B C D | 238. A B     | 261. A B C D | 284. A B C D |
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| 219. A B     | 242. A B C D | 265. A B C D | 288. A B C D |
| 220. A B     | 243. A B C D | 266. A B C D | 289. A B C D |
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**Please Sign that you understand and will abide with TLC's Rules.**

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**Signature**

**Please fax the answer key to TLC Western Campus  
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*Please e-mail or fax this survey along with your final exam*

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

Please rate the difficulty of your course.

Very Easy    0    1    2    3    4    5    Very Difficult

Please rate the difficulty of the testing process.

Very Easy    0    1    2    3    4    5    Very Difficult

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

Very Similar    0    1    2    3    4    5    Very Different

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

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Any other concerns or comments.

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## Distribution Foreman CEU Training Course Assignment

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

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

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

### Hyperlink to the Glossary and Appendix

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

## Water Distribution Section

### System Elements

1. In the distribution system, storage reservoirs are structures used to store water and \_\_\_\_\_ the supply or pressure.

- A. Increase water pressure
- B. Equalize
- C. Provide a reserve pressure for
- D. None of the above

2. Booster stations are used to \_\_\_\_\_ from storage tanks for low-pressure mains.

- A. Increase water pressure
- B. Equalize
- C. Provide a reserve pressure
- D. None of the above

### Butterfly Valve

3. Butterfly valves are rotary type of valves usually found on large transmission lines, and may also have an additional valve beside it known as a \_\_\_\_\_ to prevent water hammer.

- A. Regulator
- B. Bypass
- C. PRV
- D. None of the above

### Gate Valves

4. If the valve is wide open, the gate inside the valve is \_\_\_\_\_ into the valve bonnet.

- A. Fully drawn up
- B. Fully down
- C. Fully closed
- D. None of the above

5. There is little pressure drop or flow restriction through gate valves; however, gate valves are not suitable for?

- A. Pressure drops
- B. Isolation
- C. Throttling purposes
- D. None of the above

### Ball Valves

6. Ball valves should be either fully-on or fully-off, some ball valves also contain a swing check located within the ball to give the valve a check valve feature.

- A. True
- B. False

7. Corrosion increases the C-Factor and the carrying capacity in a pipe.  
A. True      B. False

### **Common Rotary Valves**

8. Globe valve is a rotary valve and is rare to find in most distribution systems, but is found at water treatment plants.  
A. True      B. False

### **Water Pressure**

9. 2.31 feet of water is equal to 1 psi, or 1 foot of water is equal to about a half a pound (.433 pounds to be exact).  
A. True      B. False
10. 20 psi is the minimum pressure required at any point in the water system, so that \_\_\_\_\_ is prevented.  
A. Cavitation      C. Backflow and infiltration  
B. Back pressure      D. None of the above
11. Which of the following is provided from the direct force of the water, or by the height of the water?  
A. Pressure      C. Maximum daily use  
B. System integrity      D. None of the above

### **Water Use or Demand**

12. Water system demand comes from many sources including residential, commercial, industrial and public consumers as well as waste and some?  
A. Pressure      C. Unavoidable loss  
B. System integrity      D. None of the above
13. The combination of storage reservoirs and distribution lines must be capable of meeting consumers' needs for pressure at all times.  
A. True      B. False
14. The quantity of water used in any community varies from 100 to 200 gallons per person per day.  
A. True      B. False
15. Which of the following is highly desired and represents a rather significant demand upon the system?  
A. Fire protection      C. Surge protection  
B. Cavitation protection      D. None of the above
16. A common design usage assumption is to plan for the usage of 100 to 150 gallons per person per day for average domestic use.  
A. True      B. False
17. The maximum daily use is approximately 3 to 5 times the average daily use.  
A. True      B. False
18. Which of the following is usually encountered during the summer months and can vary widely depending on irrigation practices?  
A. Maximum daily use      C. Unavoidable loss and waste  
B. Minimum daily use      D. None of the above

### Water Storage Introduction

19. Which of the following prevents contamination of water as it travels to the customer, finished water storage facilities are an important component of the protective distribution system?
- A. Cathodic protection
  - B. Corrosion protection
  - C. Barrier
  - D. None of the above

### Storage and Distribution

20. Proper construction is important in maintaining system integrity and the distribution system must also protect?
- A. Cathodic protection
  - B. Corrosion protection
  - C. Water quality
  - D. None of the above

### Water Storage Facilities

21. Water storage facilities and tanks vary in different types that are used in the water distribution systems, such as stand pipes, elevated tanks and reservoirs, hydropneumatic tanks and?
- A. Surge tanks
  - B. Water distribution systems
  - C. Storage reservoirs
  - D. None of the above

### Storage Reservoirs

22. The text recommends that \_\_\_\_\_ be located at a high enough elevation to allow the water to flow by gravity to the distribution system.
- A. Storage reservoirs
  - B. Levelers
  - C. Tree systems
  - D. None of the above

### Steel Reservoirs

23. Steel reservoirs or tanks generally have higher construction and installation costs than concrete, and require less maintenance.
- A. True
  - B. False

## Cross-Connection Section

### What is Backflow?

24. Backflow is the undesirable reversal of flow of nonpotable water or other substances through a \_\_\_\_\_ and into the piping of a public water system or consumer's potable water system.
- A. Backflow
  - B. Indirect connection
  - C. Cross-connection
  - D. None of the above
25. Which of the following can occur when there is a stoppage of water supply due to nearby firefighting, a break in a water main?
- A. Backsiphonage
  - B. Backpressure
  - C. Cross-connection
  - D. None of the above
26. Which of the following is a type of backflow caused by a downstream pressure that is greater than the upstream or supply pressure in a public water system or consumer's potable water system?
- A. Backflow
  - B. Backpressure
  - C. Indirect connection
  - D. None of the above
27. Which of the following can result from an increase in downstream pressure, a reduction in the potable water supply pressure, or a combination of both?
- A. Backflow
  - B. Backpressure
  - C. Backsiphonage
  - D. None of the above

28. Which of the following can have two forms-backpressure and backsiphonage?  
 A. Backflow                      C. Cross-connection  
 B. Backpressure                D. None of the above
29. The basic mechanism for preventing backflow is a mechanical \_\_\_\_\_, which provides a physical barrier to backflow.  
 A. Air gap                              C. Backflow  
 B. Backflow preventer            D. None of the above
30. The principal types of mechanical backflow preventer are the reduced-pressure principle assembly, the \_\_\_\_\_, and the double check valve assembly.  
 A. Vacuum breaker    C. Backflow check  
 B. Air gaper                      D. None of the above
31. Which of the following is a means or mechanism to prevent backflow?  
 A. Check device or method            C. Backflow check valve  
 B. Backflow preventer                D. None of the above
32. According to the text, basic means of preventing backflow is a(n) \_\_\_\_\_, which either eliminates a cross-connection or provides a barrier to backflow.  
 A. Vacuum breaker    C. Backflow check  
 B. Air gap                      D. None of the above
33. Which of the following is any temporary or permanent connection between a public water system or consumer's potable water system and any source or system containing nonpotable water or other substances?  
 A. Indirect connection            C. Cross-connection  
 B. Jumper                              D. None of the above
34. Which of the following is a type of backflow caused by a negative pressure (i.e., a vacuum or partial vacuum) in a public water system or consumer's potable water system?  
 A. Backsiphonage                      C. Cross-connection  
 B. Backpressure                      D. None of the above
35. Which of the following can occur whenever the amount of water being used exceeds the amount of water being supplied, such as during water line flushing, firefighting, or breaks in water mains?  
 A. Backsiphonage                      C. Cross-connection  
 B. Backpressure                      D. None of the above

**Types of Backflow Prevention Methods and Assemblies**

36. Which of the following must either be physically disconnected or have an approved backflow prevention device installed to protect the public water system?  
 A. Indirect connection            C. Cross-connection  
 B. Jumper                              D. None of the above
37. The type of device selected for a particular backflow installation depends on several factors.  
 A. True                      B. False
38. When the \_\_\_\_\_ is restricted, such as the case of an air gap located near a wall, the air gap separation must be increased.  
 A. Air break                              C. Airflow  
 B. Barrier to backflow                D. None of the above

39. An air gap is a physical disconnection between the free flowing discharge end of a potable water pipeline and the top of a(n)?  
 A. Open receiving vessel      C. Barrier to backflow  
 B. Air break                      D. None of the above
40. Which of the following must be at least two times the diameter of the supply pipe and not less than one inch?  
 A. Open receiving vessel      C. Air gap  
 B. Air break                      D. None of the above
41. An air break is a physical separation between the free flowing discharge end of a potable water supply pipeline, and the overflow rim of an open or non pressure receiving vessel.  
 A. True                      B. False
42. According to the text, air gap separations must be vertically orientated a distance of at least twice the inside diameter of the supply, but never less than?  
 A. 1 inch                      C. 12 inches  
 B. 2 inches                      D. None of the above
43. An obstruction around or near an \_\_\_\_\_ may restrict the flow of air into the outlet pipe and nullify the effectiveness of the air gap to prevent backsiphonage.  
 A. Open receiving vessel      C. Air gap  
 B. Air break                      D. None of the above
44. An air gap is acceptable for \_\_\_\_\_ and is theoretically the most effective protection.  
 A. High hazard installations      C. Low pollutional hazards  
 B. High pollutional concerns      D. None of the above

### **Vacuum Breakers**

45. Which of the following devices can have two primary types: atmospheric and pressure.  
 A. Vacuum breaker(s)                      C. Hazard application(s)  
 B. Atmospheric vacuum breakers                      D. None of the above
46. Both vacuum breakers devices primary purpose is to protect the water system from cross connections due to submerged inlets, such as irrigation systems and tank applications.  
 A. True                      B. False
47. Both vacuum breakers devices open the pipeline to atmosphere in the event of backsiphonage only.  
 A. True                      B. False
48. Both vacuum breakers devices are approved for backpressure conditions.  
 A. True                      B. False
49. Both vacuum breakers devices are only suitable for?  
 A. High hazard installations                      C. Low hazard conditions  
 B. High pollutional concerns                      D. None of the above
50. Which of the following may not be installed downstream of atmospheric vacuum breakers but are allowed on pressure vacuum breakers?  
 A. Valve assembly      C. Air inlet valve  
 B. Shut offs                      D. None of the above

51. The Atmospheric vacuum breaker allows air to enter the water line when the line pressure is reduced to a gauge pressure of zero or below.  
A. True      B. False
52. To prevent the air inlet from sticking open, the device must not be installed on the pressure side of a shutoff valve, or wherever it may be under constant pressure more than 2 hours during a 12-hour period.  
A. True      B. False
53. Atmospheric vacuum breakers Uses: Irrigation systems, commercial dishwasher and laundry equipment, chemical tanks and laboratory sinks.  
A. True      B. False
54. Pressure Vacuum Breaker Assembly (PVB) consists of a weighted check valve, an independently operating relief valve, two resilient seated shutoff valves, and two properly located resilient seated test cocks.  
A. True      B. False
55. The double check valve should be installed in a(n) \_\_\_\_\_ and protected from freezing.  
A. Confined space      C. Above the ground  
B. Accessible location      D. None of the above
56. During normal operation, the pressure between the two check valves, referred to as the air inlet zone, is maintained at a higher pressure than the supply pressure.  
A. True      B. False
57. If either reduced pressure backflow assembly check valve leaks, the differential pressure relief valve maintains a differential pressure of at least two (2) psi between the supply pressure and the zone between the two check valves by discharging water to atmosphere.  
A. True      B. False
58. According to the text, the reduced pressure backflow assembly or RP is designed to prevent backflow caused by backpressure and backsiphonage from low to high health hazards.  
A. True      B. False
59. According to the text, the RP needs to be installed 12 inches above the ground for testing purposes only.  
A. True      B. False
60. The reduced pressure backflow assembly can be used for high hazard situations under backpressure only. Under normal conditions, the second check valve should never close.  
A. True      B. False
61. According to the text, if the second check valve fails or becomes fouled and backflow into the reduced pressure zone occurs, the relief port vents the backflow to atmosphere.  
A. True      B. False
62. According to the text, the reduced pressure zone port opens anytime pressure in the zone comes within 2 psi of the supply pressure.  
A. True      B. False

## Groundwater Treatment/Production System Section

### Groundwater and Wells

63. When toxic substances are spilled or dumped near a well, these can leach into \_\_\_\_\_ and contaminate the groundwater drawn from that well.
- A. Karst
  - B. Aquifer
  - C. Soil moisture
  - D. None of the above
64. Which of the following flows slowly through water-bearing formations at different rates?
- A. Groundwater
  - B. Drinking water
  - C. Soil moisture
  - D. None of the above
65. The level below which all the spaces in the ground are filled with water is called the?
- A. Unconfined aquifer(s)
  - B. Water table
  - C. Well(s)
  - D. None of the above
66. The area above the water table lies the?
- A. Unsaturated zone
  - B. Karst
  - C. Saturated zone
  - D. None of the above
67. The water in the saturated zone is called?
- A. Unconfined aquifer(s)
  - B. Groundwater
  - C. Water table
  - D. None of the above
68. Which of the following terms are cracks, joints, or fractures in solid rock, through which groundwater moves?
- A. Fractured aquifer(s)
  - B. Karst
  - C. Soil moisture
  - D. None of the above
69. Limestone is often located in?
- A. Unconfined aquifer(s)
  - B. Soil moisture
  - C. Fractured aquifer(s)
  - D. None of the above
70. Which of the following may move in different directions below the ground than the water flowing on the surface?
- A. Water table
  - B. Groundwater
  - C. Soil moisture
  - D. None of the above
71. Unconfined aquifers are those that are bounded by the water table. Some aquifers lie beneath layers of impermeable materials.
- A. True
  - B. False
72. A well inside an aquifer is an artesian well.
- A. True
  - B. False
73. Which of the following is the level to which the water in an artesian aquifer will rise?
- A. Aquifer
  - B. Piezometric surface
  - C. Water table
  - D. None of the above

74. Sandstone may become so highly cemented or recrystallized that all of the original space is filled, in this case, the rock is no longer a porous medium and is known as?
- A. Unconfined aquifer(s)
  - B. Porous media
  - C. Fractured aquifer(s)
  - D. None of the above

### **Cone of Depression**

75. During pumping, the water level in the well falls below the water table in the?
- A. Water table
  - B. Surrounding aquifer
  - C. Unconfined aquifer
  - D. None of the above
76. The movement of water from \_\_\_\_\_ into a well results in the formation of a cone of depression.
- A. Confined aquifer
  - B. An aquifer
  - C. Water table
  - D. None of the above
77. Which of the following describes a three-dimensional inverted cone surrounding the well that represents the volume of water removed as a result of pumping?
- A. Water table
  - B. Groundwater
  - C. Cone of depression
  - D. None of the above

### **Where Is Groundwater Stored?**

78. Areas where ground water exists in sufficient quantities to supply wells or springs are called aquifers, that literally means?
- A. Water table
  - B. Water bearer
  - C. Cone of depression
  - D. None of the above
79. Which of the following stores water in the spaces between particles of sand, gravel, soil, and rock as well as cracks, pores, and channels in relatively solid rocks?
- A. Water table
  - B. Aquifer(s)
  - C. Unconfined aquifer
  - D. None of the above
80. Which of the following is regulated largely by its porosity, or the relative amount of open space present to hold water?
- A. Water table
  - B. Groundwater
  - C. An aquifer's storage capacity
  - D. None of the above
81. If the aquifer is sandwiched between layers of comparatively impermeable materials, it is called?
- A. Confined aquifer
  - B. Unconfined aquifer
  - C. Water table
  - D. None of the above
82. Which of the following are frequently found at greater depths than unconfined aquifers?
- A. Confined aquifer(s)
  - B. Unconfined aquifer(s)
  - C. Water table
  - D. None of the above

### **Does Groundwater Move?**

83. Groundwater can move sideways as well as up or down. This movement is in response to gravity, differences in elevation, and?
- A. Permeable zones
  - B. Differences in pressure
  - C. Saturated zone
  - D. None of the above



84. Groundwater can move even more quickly in karst aquifers, which are areas in \_\_\_\_\_ and similar rocks where fractures or cracks have been widened by the action of the ground water to form sinkholes, tunnels, or even caves?  
A. Karst aquifer(s)      C. Water soluble limestone  
B. Saturated zone      D. None of the above

### Groundwater Quality

85. The layers of soil and particles of sand, gravel, crushed rocks, and larger rocks were thought to act as filters, trapping contaminants before they could reach the ground water.  
A. True      B. False

86. It is known that some contaminants can pass through all of these filtering layers into \_\_\_\_\_ to contaminate ground water.  
A. Permeable zones      C. Saturated zone  
B. Unsaturated zone      D. None of the above

### How Does Ground Water Become Contaminated?

87. Groundwater contamination can begin on the surface of the ground, in the ground above the water table, or in the ground below the?  
A. Water table      C. Permeable zones  
B. Ground water      D. None of the above

88. If the contaminant is introduced straight into the area below \_\_\_\_\_, the primary process that can affect the impact of the contaminant is dilution by the surrounding ground water.  
A. Water table      C. Unsaturated zone  
B. Saturated zone      D. None of the above

### What Kinds of Substances Can Contaminate Groundwater, and Where Do They Come from?

89. Substances that can pollute \_\_\_\_\_ can be divided into two basic categories: substances that occur naturally and substances produced or introduced by man's activities.  
A. Synthetic organic chemical(s)      C. Permeable zones  
B. Groundwater      D. None of the above

90. A substantial number of today's groundwater contamination problems stem from man's activities and can be introduced into ground water from?  
A. Contaminant(s)      C. A variety of sources  
B. Saturated zone      D. None of the above

### Abandoned Wells

91. If which of the following if abandoned without being properly sealed, it can act as a direct channel for contaminants to reach ground water?  
A. A well      C. Supplies of clean ground water  
B. Alternative sources of water      D. None of the above

### What Can Be Done After Contamination Has Occurred?

92. Rehabilitate the \_\_\_\_\_ by either restraining or detoxifying the contaminants while they are still in the aquifer.  
A. Aquifer      C. Supplies of clean ground water  
B. Contamination      D. None of the above

### Nature of the Aquifer

93. An unconfined aquifer has the \_\_\_\_\_ as its upper surface; there are no significant low-permeability layers between the water table and the surface.

- A. Hydraulic head
- B. Water table
- C. Permeability area
- D. None of the above

94. According to the text, the top of the aquifer, can rise or fall depending on water use and amount of recharge to the aquifer and is called?

- A. Hydraulic head
- B. Water table
- C. Permeability zone
- D. None of the above

95. Which of the following terms has a low-permeability geologic formation as its upper boundary?

- A. Hydraulic head
- B. Water table
- C. A confined aquifer
- D. None of the above

### Hydraulic Head (h)

96. The hydraulic head is a measure of the water at a certain depth possesses because of its elevation and the pressure exerted through the weight of the water above it.

- A. True
- B. False

97. Which of the following has units of feet, and generally parallels to the elevation of water in the well?

- A. Hydraulic head
- B. Water table
- C. Permeability zone
- D. None of the above

### Permeability of the Aquifer (K)

98. Which of the following \_\_\_\_\_ or the permeability of the aquifer is a measure of how fast ground water can move through the aquifer?

- A. Hydraulic head
- B. Hydraulic conductivity
- C. Storage coefficient of the aquifer
- D. None of the above

99. Which of the following terms has units of distance/time, e.g., feet/day, although it does not represent an actual speed?

- A. Hydraulic head
- B. Hydraulic conductivity
- C. Storage coefficient of the aquifer
- D. None of the above

### In What Direction Is Groundwater Flowing?

100. The direction of groundwater flow is from higher to lower?

- A. Hydraulic head
- B. Hydraulic conductivity
- C. Storage coefficient of the aquifer
- D. None of the above

101. Which of the following can be measured by lowering a probe through the observation port of a number of wells, all within the same relative time period?

- A. Hydraulic head
- B. Hydraulic conductivity
- C. Storage coefficient of the aquifer
- D. None of the above

### What Is the Drawdown Associated with Pumping of a Well?

102. There is a relationship between the pumping rate of the well, the transmissivity of the aquifer, the distance between wells, \_\_\_\_\_, and the duration of the pumping event.

- A. Hydraulic head
- B. Hydraulic conductivity
- C. Storage coefficient of the aquifer
- D. None of the above

### Depth to First Water-Bearing Zone

103. Some report the depth at which water is first encountered in?  
A. The drill hole                      C. Recharge and discharge zone(s)  
B. Static water level (SWL)      D. None of the above

### Static Water Level

104. The driving force for ground water movement is the hydraulic head, and the \_\_\_\_\_ is a measure of that force.

- A. Hydrogeologic investigation(s)      C. Recharge and discharge zone(s)  
B. Static water level (SWL)              D. None of the above

105. Which of the following is a better gauge that a different aquifer has been encountered than the lithologic description?

- A. Water-bearing zone(s)                  C. Recharge and discharge zone(s)  
B. SWL                                          D. None of the above

106. Which of the following have important effects in groundwater protection and identifying the relation between area groundwater and local streams?

- A. Water-bearing zone(s)                  C. Recharge and discharge zone(s)  
B. SWL                                          D. None of the above

### Water-Bearing Zones

107. In some cases, the screened or perforated portions of cased wells provide a clue, but all too often, the screened interval is either significantly less than the actual static water level.

- A. True                      B. False

108. Arriving at accurate approximations of aquifer parameters or calculating ground water velocity requires us to know the thickness of the?

- A. Water-bearing zone(s)                  C. Recharge and discharge zone(s)  
B. SWL                                          D. None of the above

### How Wells Are Drilled

109. Drilling fluids are often used during drilling in order to keep the drill bit sharp while drilling is done.

- A. True                      B. False

110. Typical drilling fluids are combinations of acids and iron compounds.

- A. True                      B. False

### Basic Rotary Drilling Methods

111. Rotary drilling uses two methods that includes: direct and reverse mud rotary, direct air rotary, and?

- A. Advanced methods                      C. Drill through casing driver methods  
B. Typical drilling fluid(s)                  D. None of the above

### The Rotary Drill String

112. Rotary drilling methods use a drill string, which typically consists of a bit, collar, drill pipe and?

- A. The drill collar                          C. A kelly  
B. A Sub                                          D. None of the above

113. Which of the following is a section of heavy walled pipe that can be hexagonal, square, or rounded with grooves?

- A. The flighting
- B. The plug
- C. A kelly
- D. None of the above

114. Which of the following is several feet longer than the drill pipe being used and fits into the table drive much like the splines on a drive shaft fit into a transmission?

- A. The drill collar
- B. The Sub
- C. The kelly
- D. None of the above

115. Some rotary rigs use a top drive to turn \_\_\_\_\_ and are like a drill press.

- A. The drill collar
- B. Drag bit(s)
- C. The drill string
- D. None of the above

### **Direct Rotary Method**

116. The drilling fluid carries cuttings up the annular space between the drill pipe and formation and into mud pits or containment recirculating systems on the surface.

- A. True
- B. False

117. Which of the following pressurizes the borehole and helps to keep the hole open while removing cuttings?

- A. The drilling fluid
- B. The rig's mud pump
- C. The cutting's containment systems
- D. None of the above

118. Large drill rigs may utilize \_\_\_\_\_ that separate the cuttings from the drilling fluid before a pickup pump recirculates the drilling fluid back down the borehole, where the process is then repeated.

- A. The drilling fluid
- B. The rig's mud pump
- C. The cutting's containment systems
- D. None of the above

119. Mud pits may be dug into the ground adjacent to the rig in order to contain and settle out cuttings from this missing term before recirculating.

- A. The flighting
- B. The borehole
- C. The drilling fluid
- D. None of the above

### **Direct Mud Rotary Method**

120. Mud is circulated down the drill string and through the bit at the bottom of the borehole and the mud then carries the cuttings generated by the bit up to the surface and into the mud recirculating system.

- A. True
- B. False

### **Air Rotary Method**

121. Air rotary methods utilize compressed water and derived rock cuttings as the drilling fluid.

- A. True
- B. False

122. Which of the following is kept in a pressured condition while drilling, in order to maintain the circulation of drilling fluid to the surface?

- A. The flighting
- B. The borehole
- C. The drilling fluid
- D. None of the above

123. Which of the following is added while drilling with air in order to maintain sufficient hole pressurization so that cuttings may be lifted to the surface efficiently while maintaining hole stability.

A. Chemical stabilizer                      C. Biodegradable foam or surfactant (soap)  
B. Mud                                              D. None of the above

124. According to the text, the air rotary method is particularly suitable to soft dirt drilling with a down hole air hammer.

A. True                      B. False

125. The air hammer makes use of compressed air to drive a piston up and down which makes \_\_\_\_\_ move up and down while the drill string rotates.

A. The air rotary method                      C. The hammer bit  
B. A roller button bit                      D. None of the above

126. Which of the following's action produces great rock breaking force and is very valuable for drilling through solid rock or consolidated formations?

A. The mud rotary method                      C. The combined rotating and hammering  
B. Drilling                                              D. None of the above

### Selecting an Appropriate Well Site

127. Before a well can be drilled a permit is normally required. The permit helps to ensure that an appropriate location of the well is selected which reduces the possibility of contamination.

A. True                      B. False

128. The ideal well location has good drainage and is higher than?

A. The quality of drinking water                      C. The surrounding ground surface  
B. The possibility of contamination                      D. None of the above

129. Which of the following should be at a lower elevation than the well, and the distances to those contamination sources must be in accordance with the State or Local Water Well Construction Codes?

A. Surface drainage(s)                                              C. All possible sources of contamination  
B. Preliminary aquifer parameters                                              D. None of the above

### Common Well Construction Specifications

130. Which of the following should always be located and constructed in such a manner that they yield safe water at all times and under all conditions?

A. Water wells                      C. A pumping test  
B. The aquifer                      D. None of the above

### Choice of Casing

131. According to the text, stainless steel casing and screen may be required for one situation, while PVC or low carbon steel may be acceptable in another.

A. True                      B. False

132. As with casing, the choice of well screen is as important as its placement, the size of the openings in the casing are dependent on the grain size of the filter or?

A. The anticipated flow rate                                              C. Gravel pack  
B. The well                                              D. None of the above

### Selecting an Optimum Pumping Rate

133. Specific capacities for each of the pumping steps are compared. The highest Sc observed is normally associated with?
- A. The anticipated flow rate
  - B. The well
  - C. The optimum pumping rate
  - D. None of the above

### Pump and Motor Section

#### Common Hydraulic Terms

134. Which of the following definitions is pressure above zero absolute, i.e. the sum of atmospheric and gauge pressure?
- A. Pressure, Atmospheric
  - B. Pressure, Static
  - C. Pressure, Gauge
  - D. None of the above
135. Which of the following definitions is the force per unit area, usually expressed in pounds per square inch?
- A. Pressure, Absolute
  - B. Pressure
  - C. Pressure, Gauge
  - D. None of the above
136. Which of the following definitions is the pressure differential above or below ambient atmospheric pressure?
- A. Pressure, Absolute
  - B. Pressure
  - C. Pressure, Gauge
  - D. None of the above
137. Which of the following definitions is height of a column or body of fluid above a given point expressed in linear units?
- A. Head, Friction
  - B. Head, Static
  - C. Head
  - D. None of the above
138. Which of the following definitions is required to overcome the friction at the interior surface of a conductor and between fluid particles in motion?
- A. Head, Friction
  - B. Head, Static
  - C. Head
  - D. None of the above
139. Which of the following definitions is the pressure in a fluid at rest?
- A. Head, Friction
  - B. Pressure, Static
  - C. Head
  - D. None of the above

#### General Pumping Fundamentals

140. According to the text, suction lift is when the level of water to be pumped is below the?
- A. Impeller
  - B. Suction
  - C. Centerline of the pump
  - D. None of the above
141. The suction side of pipe should be one diameter smaller than the pump inlet.
- A. True
  - B. False
142. The required eccentric reducer should be turned so that the top is flat and the bottom tapered.
- A. True
  - B. False

#### Pumps

143. Pumps are excellent examples of?
- A. Hydrostatics
  - B. Quasi-static devices
  - C. Multi-stage pumps
  - D. None of the above

144. Positive displacement pumps have a piston (or equivalent) moving in a closely-fitting cylinder and forces are exerted on the fluid by motion of the piston.

- A. True      B. False

### **Pump Categories**

145. The key to understanding a pump's operation is that a pump is to move water and generate the \_\_\_\_\_ we call pressure.

- A. Delivery force      C. Diaphragm pressure  
B. Impeller force      D. None of the above

### **Basic Water Pump**

146. The centrifugal pumps work by spinning water around in a circle inside a?

- A. Vortex      C. Cylindrical pump housing  
B. Cylinder      D. None of the above

147. According to the text, without an inward force, an object will travel in a straight line and will not complete the?

- A. Circle      C. Center  
B. Distance      D. None of the above

148. In a centrifugal pump, the inward force is provided by high-pressure water near the outer edge of the?

- A. Pump housing      C. Base  
B. Impeller blade(s)      D. None of the above

149. In the operation of the pump, the water at the edge of the \_\_\_\_\_ inward on the water between the impeller blades and makes it possible for that water to travel in a circle.

- A. Inward force      C. Center of the impeller  
B. Pump pushes      D. None of the above

### **Types of Water Pumps**

150. The water production well industry almost exclusively uses Turbine pumps, which are a type of centrifugal pump.

- A. True      B. False

151. The most common type of water pumps used for municipal and domestic water supplies are?

- A. Axial flow      C. Rotary pumps  
B. Variable displacement pumps      D. None of the above

152. Which of the following will produce at different rates relative to the amount of pressure or lift the pump is working against?

- A. Pump's lifting capacity      C. Variable displacement pump  
B. Atmospheric pressure      D. None of the above

153. Impellers are rotated by the pump motor, which provides the \_\_\_\_\_ needed to overcome the pumping head.

- A. Pump's lifting capacity      C. Horsepower  
B. Atmospheric pressure      D. None of the above

154. The size and number of stages, horsepower of the motor and \_\_\_\_\_ are the key components relating to the pump's lifting capacity.

- A. Pumping head
- B. Atmospheric pressure
- C. Horsepower
- D. None of the above

155. Which of the following terms are variable displacement pumps that are by far used the most?

- A. Axial flow
- B. Centrifugal pumps
- C. Turbine pumps
- D. None of the above

## Safety Section

### Confined Space Entry Program- Purpose

156. The Confined Space Entry Program is provided to protect authorized employees that will enter confined spaces from safety or health hazards associated with confined spaces.

- A. True
- B. False

### Inherent Hazards

157. \_\_\_\_\_ are associated with specific types of equipment and the interactions among them. These hazards can be electrical, thermal, chemical, mechanical, etc.

- A. Inherent hazards
- B. Hazardous atmospheres
- C. Recognized serious safety or health hazards
- D. None of the above

### Induced Hazards

158. \_\_\_\_\_ result from a multitude of incorrect decisions and actions that occur during the actual construction process.

- A. Induced hazards
- B. Below-grade locations
- C. Build-up of explosive gases
- D. None of the above

### Typical Examples of Confined Workspaces

159. Confined workspaces in construction contain \_\_\_\_\_.

- A. Purging agents
- B. Below-grade location
- C. Both inherent and induced hazards
- D. None of the above

### Oxygen-Deficient Atmosphere

160. The ever-present possibility of \_\_\_\_\_ is one of the major problems confronting construction workers while working in vaults.

- A. A common confined space
- B. Vaults
- C. An oxygen-deficient atmosphere
- D. None of the above

### Asphyxiating Atmospheres

161. The composition of \_\_\_\_\_ is approximately 20.9% oxygen, 78.1% nitrogen, and 1% argon with small amounts of various other gases.

- A. Chemical reactions
- B. Normal atmosphere
- C. Irritant gases
- D. None of the above

### Oxygen Deprivation

162. Oxygen deprivation is a form of \_\_\_\_\_.

- A. Oxygen deprivation
- B. Asphyxiation
- C. Combustion
- D. None of the above

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



### Excavation and Trenching Section

163. According to the text, the \_\_\_\_\_ was revised because excavating is the most dangerous of all construction operations.

- A. Competent rule
- B. OSHA excavation standard
- C. Emergency rule
- D. None of the above

### Competent Person

164. Competent person means one who is capable of identifying existing hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees. The \_\_\_\_\_ has authorization to take prompt corrective measures to eliminate identified hazards.

- A. Competent person
- B. Contractor
- C. Watchman
- D. None of the above

### Competent Person Duties

165. The competent person performs daily inspections of the protective equipment, \_\_\_\_\_, safety equipment, and adjacent areas.

- A. Work progress
- B. Construction Crew
- C. Trench conditions
- D. None of the above

166. The competent person shall make \_\_\_\_\_ prior to the start of work and as needed throughout the shift.

- A. Personnel assignments
- B. Training available
- C. Inspections
- D. None of the above

167. The competent person shall make \_\_\_\_\_ after every rainstorm or other hazard occurrence.

- A. Inspections
- B. Training available
- C. Protective equipment available
- D. None of the above

168. The competent person must have knowledge of \_\_\_\_\_, telephone or radio dispatch.

- A. Personnel assignments
- B. Work schedules
- C. Emergency contact methods
- D. None of the above

169. The competent person removes employees and \_\_\_\_\_ from hazardous conditions and makes all changes necessary to ensure their safety.

- A. Competent persons
- B. All other personnel
- C. Protective equipment
- D. None of the above

170. The competent person makes sure that all \_\_\_\_\_ have proper protective equipment, hard-hats, reflective vests, steel-toed boots, harnesses, eye protection, hearing protection and drinking water.

- A. Competent persons
- B. Contractors
- C. Employees
- D. None of the above

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

## Scope of Work

171. According to the text, during excavation work a competent person shall be on the job site at all times when personnel are working within or around the \_\_\_\_\_.
- A. Competent person                      C. Excavation  
B. Contractors                              D. None of the above
172. Prior to opening an excavation, the estimated locations of \_\_\_\_\_ that reasonably may be expected to be encountered during excavation work shall be determined.
- A. Unauthorized persons              C. Underground utility installations  
B. Employees                              D. None of the above
173. \_\_\_\_\_ shall be taken to protect employees against the hazards posed by water accumulation in the excavation.
- A. Additional care                      C. Ladders  
B. Adequate precautions              D. None of the above
174. In trench excavations that are four (4') feet or more in depth, a stairway, ladder, or ramp shall be used as a \_\_\_\_\_.
- A. Tool                                              C. Bridge  
B. Means of access or egress              D. None of the above
175. When excavations are made in vehicular traffic areas, \_\_\_\_\_ shall wear a warning vest made with reflective material or highly visibility material.
- A. Competent persons                      C. Rescue personnel  
B. Each employee                              D. None of the above
176. When the atmosphere contains less than 19.5 percent oxygen, the area must be continuously ventilated until the \_\_\_\_\_.
- A. Excavation is closed                      C. Oxygen levels are above 19.5 percent  
B. Employees enter the space              D. None of the above
177. Where a \_\_\_\_\_, the area shall be ventilated until the flammable gas concentration is below 20 percent of the LFL (lower flammable limit).
- A. Competent person requires monitoring      C. Worker encounters fumes  
B. Gaseous condition exists                      D. None of the above
178. Whenever \_\_\_\_\_ exist or could reasonably exist, the air must be monitored continuously to assure that workers are protected.
- A. Traffic conditions                              C. Oxygen deficiency or gaseous conditions  
B. Excavations                                      D. None of the above
179. Where the stability of adjoining buildings, walls or other structures are \_\_\_\_\_, shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.
- A. Not a concern                                      C. Endangered by excavation operations  
B. Not mentioned in the specifications              D. None of the above
180. In situations where sidewalks, pavement and appurtenant structures may be undermined, a support system such as shoring must be provided to protect \_\_\_\_\_ from the possible collapse of such structures.
- A. Unauthorized persons                      C. Vehicles  
B. Employees                                      D. None of the above

### Personnel Protective Systems

181. According to the text, employees in \_\_\_\_\_ shall be protected from cave-ins by an adequate protective system, which shall be inspected by a competent person.

- A. Excavations
- B. Vehicles
- C. Protective systems
- D. None of the above

182. The use of \_\_\_\_\_ is required for all excavations deeper than five (5') feet, except when excavation is within stable rock.

- A. Tables
- B. Tabulated data
- C. Protective systems
- D. None of the above

### Excavation Protection Systems

183. There are three basic protective systems for excavations and trenches. They are sloping and benching systems, \_\_\_\_\_, and shields.

- A. Shoring
- B. Ramps
- C. Attendants
- D. None of the above

184. Every employee in an excavation or trench shall be protected from \_\_\_\_\_ by an adequate protective system.

- A. Unauthorized persons
- B. Cave-ins
- C. Polluted air
- D. None of the above

### Sloping and Benching Systems

185. An option for sloping is to slope to the angle required by OSHA Construction Standards for Type C, which is the most \_\_\_\_\_.

- A. Unstable soil type
- B. Stable soil type
- C. Porous soil type
- D. None of the above

### Shoring Systems

186. \_\_\_\_\_ is another protective system that utilizes a framework of vertical members, horizontal members, and cross braces to support the sides of the excavation to prevent a cave-in.

- A. Shoring
- B. Tabulated data
- C. Lateral support
- D. None of the above

### Shield Systems (Trench Boxes)

187. Shielding is the third method of providing a safe workplace in excavations. Unlike sloping and shoring, \_\_\_\_\_ does not prevent a cave-in.

- A. Shielding
- B. Tabulated data
- C. Soil testing
- D. None of the above

188. Shields are designed to \_\_\_\_\_, thereby protecting the employees working inside the structure.

- A. Withstand the soil forces caused by a cave-in
- B. Keep water out of the excavation
- C. Bend but not break
- D. None of the above

189. Design and construction of \_\_\_\_\_ is not covered in the OSHA Standards.

- A. Sloping and benching systems
- B. Shielding
- C. Protective systems
- D. None of the above

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

### Safety Precautions for Shield Systems

190. There must not be any lateral movement of \_\_\_\_\_ when installed.
- A. Sloping and benching systems
  - B. Shields
  - C. Ladders
  - D. None of the above

### Excavation & Trenching Guidelines

191. All other employees working in and around the excavation must be trained to recognize the hazards associated with \_\_\_\_\_.
- A. OSHA Standards
  - B. Trenching and excavating
  - C. Personal protective equipment
  - D. None of the above

### Hazard Controls

192. All overhead hazards (surface encumbrances) must be removed or supported to \_\_\_\_\_.
- A. Meet OSHA Standards
  - B. Make trenching and excavating easier
  - C. Eliminate the hazard
  - D. None of the above

193. If \_\_\_\_\_ will be over 20 feet deep, it must be designed by a registered professional engineer.

- A. An excavation
- B. A means of access or egress
- C. Construction equipment
- D. None of the above

194. \_\_\_\_\_, such as sloping, shoring, or shielding, will be utilized to protect employees.

- A. Adequate protective systems
- B. Soil classifications
- C. Soil testing
- D. None of the above

195. Workers must be supplied with, and wear, any \_\_\_\_\_ deemed necessary to protect them while working in excavations.

- A. Uniforms
- B. Apparel
- C. Personal protective equipment
- D. None of the above

### Excavation Safety Plan

196. A written excavation safety plan is required. This plan is to be developed to the level necessary to ensure complete compliance with the \_\_\_\_\_ and state and local safety standards.

- A. Professional engineer's requirements
- B. OSHA Excavation Safety Standard
- C. Protective systems
- D. None of the above

### Soil Classification and Identification

197. The Simplified Soil Classification System defined by OSHA Standards consists of four categories: \_\_\_\_\_, Type A, Type B, and Type C.

- A. Stable rock
- B. Gravel
- C. Stiff clay
- D. None of the above

### Shielding

198. Shielding does not prevent cave-ins. Instead, it protects the workers in the event of a cave-in.
- A. True
  - B. False

199. When placed in an excavation, shields have sufficient structural strength to support the \_\_\_\_\_, thereby protecting the employees in the trench.

- A. Nearby structures
- B. Construction vehicles
- C. Force of a cave-in should one occur
- D. None of the above

## Water Quality Section

### Three Types of Public Water Systems

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

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

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

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

202. 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
- B. CWSs
- C. NTNCWSs
- D. None of the above

203. Approximately 18,000 water systems

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

### Managing Water Quality at the Source

204. 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

205. 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

206. 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

207. 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

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

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

## Objections to Hard Water Scale Formation

209. Hard water forms scale, usually \_\_\_\_\_, which causes a variety of problems. Left to dry on the surface of glassware and plumbing fixtures, including showers doors, faucets, and sink tops; hard water leaves unsightly white scale known as water spots.

- A. Magnesium carbonate
- B. Calcium carbonate
- C. Calcite
- D. None of the above

## Secondary Standard

210. 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

## More on the Stage 2 DBP Rule

211. 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

## What are Disinfection Byproducts (DBPs)?

212. 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

## Disinfection Byproduct Research and Regulations Summary

213. \_\_\_\_\_ 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

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

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

## Bacteriological Monitoring Section

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

215. 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

216. 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

217. 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

### **TCR**

218. 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

219. 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

220. 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**

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

- A. True
- B. False

222. 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

223. 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**

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

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

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

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

### **Bacteria Sampling**

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

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

### Basic Types of Water Samples

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

- A. True                      B. False

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

228. 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

229. 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

230. 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

### Positive or Coliform Present Results

231. 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

232. 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

### Revised Total Coliform Rule (RTCR) Summary

233. 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

234. 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

235. 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

236. The RTCR requires public water systems that are vulnerable to microbial contamination to identify and fix problems.

- A. True      B. False



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

- A. True      B. False

238. 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

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

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

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

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

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

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

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

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

### Giardia lamblia

243. 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      C. Giardiasis  
B. Cryptosporidiosis      D. None of the above

### Primary Waterborne Diseases Section

244. Campylobacter is primarily associated with poultry, animals, and humans.

- A. True      B. False

245. 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

246. Legionnaire's disease, which causes a severe pneumonia, and the second, \_\_\_\_\_, which is a non-pneumonia illness; it's typically an influenza-like illness, and it's less severe.

- A. Pontiac fever      C. Typhoid fever  
B. Yellow fever      D. None of the above

247. Legionella, prevention. Legionella in water systems. Hot water in tanks should be maintained between \_\_\_\_\_ degrees Centigrade.

- A. 81 to 100      C. 71 and 77  
B. 110 to 210      D. None of the above

248. Which of the following is typically associated with soil and water?

- A. Hepatitis A virus
- B. Legionella
- C. Pseudomonas
- D. None of the above

### **Waterborne Bacterial Diseases**

249. 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

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

- A. True
- B. False

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

- A. True
- B. False

### **Viruses**

#### **Coronavirus**

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

- A. True
- B. False

### **Chain of Custody Procedures**

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

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

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

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

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

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

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

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

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

257. As \_\_\_\_\_ are used, contact times may be reduced.
- A. Chlorine concentration
  - B. Temperature
  - C. Higher strength chlorine solutions
  - D. None of the above

## Disinfection Section

### Chlorine's Appearance and Odor

258. Chlorine is a greenish-yellow gas it will condense to an amber liquid at approximately \_\_\_\_\_ F or at high pressures.
- A. -29.2 degrees
  - B. - 100 degrees
  - C. 29 degrees
  - D. None of the above

259. Prolonged exposures to chlorine gas may result in?
- A. Moisture, steam, and water
  - B. Odor thresholds
  - C. Olfactory fatigue
  - D. None of the above

### Chlorine Gas

#### Pathophysiology

260. As far as chlorine safety and respiratory protection, the intermediate \_\_\_\_\_ of chlorine accounts for its effect on the upper airway and the lower respiratory tract.
- A. Effects of Hydrochloric acid
  - B. Vapor from Chlorine gas
  - C. Water solubility
  - D. None of the above

261. Respiratory exposure to \_\_\_\_\_ may be prolonged because its moderate water solubility may not cause upper airway symptoms for several minutes.
- A. Hydrochloric acid
  - B. Chlorine gas
  - C. Plasma exudation
  - D. None of the above

262. The odor threshold for chlorine gas is approximately?
- A. 0.3-0.5 parts per million (ppm)
  - B. 3 parts per million (ppm)
  - C. 3-5 parts per million (ppm)
  - D. None of the above

#### Mechanism of Activity

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

#### Early Response to Chlorine Gas

264. If you mix ammonia with chlorine gas, this compound reacts to form\_\_\_\_\_.
- A. Chloramine gas
  - B. Chlorine gas
  - C. Sulfuric gas
  - D. None of the above

#### Reactivity

265. Cylinders of chlorine may burst when exposed to elevated temperatures. When there is Chlorine in solution, this forms?
- A. Hydrogen sulfide
  - B. Oxomonosilane
  - C. A corrosive material
  - D. None of the above

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

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

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

- A. True
- B. False

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

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

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

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

### Flammability

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

- A. True
- B. False

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

- A. True
- B. False

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

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

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

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

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

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

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

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

276. Chlorination is more effective as?

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

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

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

278. Chlorination is less effective in?

- A. Clear water
- B. Cloudy (turbid) water
- C. Day time
- D. None of the above

279. By adding a little more chlorine to what is already sufficient, this action will generally result in \_\_\_\_\_ that can be measured easily.

- A. pH increases
- B. A free chlorine residual
- C. Required contact time
- D. None of the above

### Chlorination Chemistry

280. The hypochlorite ion is a much weaker disinfecting agent than Hypochlorous acid, about 100 times less effective.

- A. True
- B. False

281. According to the text, pH and temperature affect the ratio of hypochlorous acid to hypochlorite ions. As the temperature is decreased, the \_\_\_\_\_ increases.

- A. Reduction Ratio
- B. Ratio of hypochlorous acid
- C. "CT" disinfection concept
- D. None of the above

282. Under normal water conditions, hypochlorous acid will also chemically react and break down into the hypochlorite ion.

- A. True
- B. False

283. Although the ratio of \_\_\_\_\_ is greater at lower temperatures, pathogenic organisms are actually harder to kill.

- A. Hypochlorous acid
- B. The amount of chlorine
- C. Total chlorine
- D. None of the above

284. If all other things were equal, \_\_\_\_\_ and a lower pH are more conducive to chlorine disinfection.

- A. Lower pH
- B. Hypochlorous acid
- C. Higher water temperatures
- D. None of the above

285. All three forms of chlorine produce Sodium hypochlorite when added to water.

- A. True
- B. False

286. Hypochlorous acid is a strong acid but a weak disinfecting agent. The amount of hypochlorous acid depends on the pH and temperature of the water.

- A. True
- B. False

### Chlorine DDBP

287. These term means that chlorine is present as  $\text{Cl}$ ,  $\text{HOCl}$ , and  $\text{OCl}^-$  is called \_\_\_\_\_, and that which is bound but still effective is \_\_\_\_\_.

- A. Free available chlorine and Total
- B. Free and Residual
- C. Free available chlorine and Combined Chlorine
- D. None of the above

288. Chloramines are formed by reactions with?

- A. Acid and  $\text{Cl}_2$
- B. Ammonia and  $\text{Cl}_2$
- C. Folic Acid and  $\text{Cl}_2$
- D. None of the above

### Types of Residual

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

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

### Chlorine Exposure Limits

290. What is OSHA's PEL?

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

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

- A. True
- B. False

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

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

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

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

### Alternate Disinfectants - Chloramine

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

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

### Chlorine Dioxide

295. Which term provides good Giardia and virus protection but its use is limited by the restriction on the maximum residual of 0.5 mg/L  $\text{ClO}_2$ /chlorite/chlorate allowed in finished water?

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

296. If chlorine dioxide is being used as an oxidant, the preferred method of generation is to entrain or \_\_\_\_\_ into a packed reaction chamber with a 25% aqueous solution of sodium chlorite ( $\text{NaClO}_2$ ).

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

## Ozone

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

- A. True      B. False

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

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

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

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

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

- A. True      B. False