

**Registration form**

**WATER MAINS \$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. \_\_\_\_\_

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

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

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

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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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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.

# Water Mains 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.

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**Signature**

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

**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**

**WATER MAINS CEU COURSE  
CUSTOMER SERVICE RESPONSE CARD**

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

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.

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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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## Water Mains CEU Training Course Assignment

The Water Mains 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    C. Provide a reserve pressure for  
B. Equalize    D. None of the above
2. Booster stations are used to \_\_\_\_\_ from storage tanks for low-pressure mains.  
A. Increase water pressure    C. Provide a reserve pressure  
B. Equalize    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    C. PRV  
B. Bypass    D. None of the above

### Water Distribution Valves

4. According to the text, at intersections of distribution mains, the number of valves required is normally one less than the number of?  
A. Ties    C. Depends on customers  
B. Radiating mains    D. None of the above
5. For large shutoff valves, it is necessary to surround the valve operator or entire valve within a vault or manhole to allow?  
A. Bluestakes    C. Repair or replacement  
B. Testing    D. None of the above

### Gate Valves

6. If the valve is wide open, the gate inside the valve is \_\_\_\_\_ into the valve bonnet.  
A. Fully drawn up    C. Fully closed  
B. Fully down    D. None of the above

7. There is little pressure drop or flow restriction through gate valves; however, gate valves are not suitable for?  
A. Pressure drops      C. Throttling purposes  
B. Isolation            D. None of the above

### Ball Valves

8. 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

### Valve Exercising

9. Valve exercising should be done once per year to locate inoperable valves due to freezing or build-up of rust or corrosion and to detect minimum flow restriction and to prevent valves from becoming frozen or damaged.  
A. True            B. False
10. A valve inspection should include drawing valve location maps to show distances to the valve from specific reference.  
A. True            B. False
11. Corrosion increases the C-Factor and the carrying capacity in a pipe.  
A. True            B. False

12. Over-pressurization of a valve is when a valve can \_\_\_\_\_ when high pressure enters the cavity and has no way to escape.  
A. Positive pressure differential            C. Lock in the closed position  
B. Lock in the open position                D. None of the above
13. Tuberculation corrosion inside a pipe or valve is caused by chemical changes produced by?  
A. Hard water                                  C. Electricity or electrolysis  
B. Chemical changes                         D. None of the above

### Common Rotary Valves

14. 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
15. Most Globes are compact OS & Y types, bolted bonnet, rising stems, with renewable seat rings.  
A. True            B. False

### Water Pressure

16. For ordinary domestic use, water pressure should be between 25 and 45 psi.  
A. True            B. False
17. 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
18. 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

19. Which of the following is provided from the direct force of the water, or by the height of the water?
- A. Pressure
  - B. System integrity
  - C. Maximum daily use
  - D. None of the above

### **Water Use or Demand**

20. Water system demand comes from many sources including residential, commercial, industrial and public consumers as well as waste and some?
- A. Pressure
  - B. System integrity
  - C. Unavoidable loss
  - D. None of the above
21. Which of the following is highly desired and represents a rather significant demand upon the system?
- A. Fire protection
  - B. Cavitation protection
  - C. Surge protection
  - D. None of the above
22. The combination of storage reservoirs and distribution lines must be capable of meeting consumers' needs for pressure at all times.
- A. True
  - B. False
23. The quantity of water used in any community varies from 100 to 200 gallons per person per day.
- A. True
  - B. False
24. 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
25. The maximum daily use is approximately 3 to 5 times the average daily use.
- A. True
  - B. False
26. Which of the following is usually encountered during the summer months and can vary widely depending on irrigation practices?
- A. Maximum daily use
  - B. Minimum daily use
  - C. Unavoidable loss and waste
  - D. None of the above

### **Water Storage Introduction**

27. 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**

28. 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

## **Cross-Connection Section**

### **What is Backflow?**

29. 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

30. 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                      C. Cross-connection  
B. Backpressure                        D. None of the above
31. 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                              C. Indirect connection  
B. Backpressure                        D. None of the above
32. 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                              C. Backsiphonage  
B. Backpressure                        D. None of the above
33. Which of the following can have two forms-backpressure and backsiphonage?
- A. Backflow                              C. Cross-connection  
B. Backpressure                        D. None of the above
34. 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
35. 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
36. 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
37. 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
38. 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
39. 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

40. 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
- B. Backpressure
- C. Cross-connection
- D. None of the above

### Types of Backflow Prevention Methods and Assemblies

41. 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
- B. Jumper
- C. Cross-connection
- D. None of the above

42. 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
- B. Barrier to backflow
- C. Airflow
- D. None of the above

43. 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
- B. Air break
- C. Barrier to backflow
- D. None of the above

44. 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
- B. Air break
- C. Air gap
- D. None of the above

45. 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
- B. 2 inches
- C. 12 inches
- D. None of the above

46. 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
- B. Air break
- C. Air gap
- D. None of the above

47. An air gap is acceptable for \_\_\_\_\_ and is theoretically the most effective protection.

- A. High hazard installations
- B. High polluttional concerns
- C. Low polluttional hazards
- D. None of the above

### Vacuum Breakers

48. Which of the following devices can have two primary types: atmospheric and pressure.

- A. Vacuum breaker(s)
- B. Atmospheric vacuum breakers
- C. Hazard application(s)
- D. None of the above

49. Which of the following contains a float check, a check seat, and an air inlet port?

- A. Double check
- B. Atmospheric vacuum breaker
- C. RP
- D. None of the above

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

## Groundwater Treatment/Production System Section

### Groundwater and Wells

50. 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
51. 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
52. 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
53. The area above the water table lies the?
- A. Unsaturated zone
  - B. Karst
  - C. Saturated zone
  - D. None of the above
54. The water in the saturated zone is called?
- A. Unconfined aquifer(s)
  - B. Groundwater
  - C. Water table
  - D. None of the above
55. 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
56. Limestone is often located in which of the following?
- A. Unconfined aquifer(s)
  - B. Soil moisture
  - C. Fractured aquifer(s)
  - D. None of the above
57. 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
58. 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
59. 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
60. Which of the following usually flows downhill along the slope of the water table?
- A. Groundwater
  - B. Water table
  - C. Soil moisture
  - D. None of the above

### **Cone of Depression**

61. During pumping, the water level in the well falls below the water table in the?  
A. Water table                      C. Unconfined aquifer  
B. Surrounding aquifer            D. None of the above
62. The movement of water from \_\_\_\_\_ into a well results in the formation of a cone of depression.  
A. Confined aquifer    C. Water table  
B. An aquifer            D. None of the above
63. 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            C. Cone of depression  
B. Groundwater          D. None of the above
64. Which of the following is the vertical drop in the height between the water level in the well prior to pumping and the water level in the well during pumping?  
A. Drawdown            C. Cone of depression  
B. Groundwater          D. None of the above
65. When a water well is installed in \_\_\_\_\_, water moves from the aquifer into the well through small holes or slits in the well casing or, in some types of wells, through the open bottom of the well?  
A. Confined aquifer            C. Water table  
B. An unconfined aquifer      D. None of the above

### **Where Is Ground Water Stored?**

66. Areas where ground water exists in sufficient quantities to supply wells or springs are called aquifers, that literally means?  
A. Water table            C. Cone of depression  
B. Water bearer            D. None of the above
67. 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            C. Unconfined aquifer  
B. Aquifer(s)              D. None of the above
68. Which of the following is regulated largely by its porosity, or the relative amount of open space present to hold water?  
A. Water table            C. An aquifer's storage capacity  
B. Groundwater            D. None of the above
69. If the aquifer is sandwiched between layers of comparatively impermeable materials, it is called?  
A. Confined aquifer            C. Water table  
B. Unconfined aquifer        D. None of the above
70. Which of the following are frequently found at greater depths than unconfined aquifers?  
A. Confined aquifer(s)        C. Water table  
B. Unconfined aquifer(s)      D. None of the above

### Does Groundwater Move?

71. 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

72. 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)
- B. Saturated zone
- C. Water soluble limestone
- D. None of the above

### Groundwater Quality

73. It is known that some contaminants can pass through all of these filtering layers into \_\_\_\_\_ to contaminate ground water.

- A. Permeable zones
- B. Unsaturated zone
- C. Saturated zone
- D. None of the above

### How Does Ground Water Become Contaminated?

74. 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
- B. Ground water
- C. Permeable zones
- D. None of the above

75. 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
- B. Saturated zone
- C. Unsaturated zone
- D. None of the above

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

76. 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)
- B. Groundwater
- C. Permeable zones
- D. None of the above

77. 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)
- B. Saturated zone
- C. A variety of sources
- D. None of the above

### Abandoned Wells

78. If which of the following is abandoned without being properly sealed, it can act as a direct channel for contaminants to reach ground water?

- A. A well
- B. Alternative sources of water
- C. Supplies of clean ground water
- D. None of the above

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

79. Rehabilitate the \_\_\_\_\_ by either restraining or detoxifying the contaminants while they are still in the aquifer.

- A. Aquifer
- B. Contamination
- C. Supplies of clean ground water
- D. None of the above



## Water Well Reports and Hydrogeology

### Nature of the Aquifer

80. 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

81. 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

82. 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)

83. 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)

84. 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

85. 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?

86. 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

87. 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?

88. 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

89. Some report the depth at which water is first encountered in?

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

### Static Water Level

90. 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

### Pump and Motor Section

#### Common Hydraulic Terms

91. Which of the following definitions is the engineering science pertaining to liquid pressure and flow?
- A. Hydraulics      C. Hydrokinetics  
B. Hydrology      D. None of the above
92. Which of the following definitions is the pressure exported by the atmosphere at any specific location?
- A. Pressure, Atmospheric      C. Pressure, Gauge  
B. Pressure, Static              D. None of the above
93. Which of the following definitions is pressure above zero absolute, i.e. the sum of atmospheric and gauge pressure?
- A. Pressure, Atmospheric      C. Pressure, Gauge  
B. Pressure, Static              D. None of the above
94. Which of the following definitions is the force per unit area, usually expressed in pounds per square inch?
- A. Pressure, Absolute          C. Pressure, Gauge  
B. Pressure                      D. None of the above
95. Which of the following definitions is the pressure differential above or below ambient atmospheric pressure?
- A. Pressure, Absolute          C. Pressure, Gauge  
B. Pressure                      D. None of the above
96. 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      C. Head  
B. Head, Static      D. None of the above
97. 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      C. Head  
B. Head, Static      D. None of the above
98. Which of the following definitions is the pressure in a fluid at rest?
- A. Head, Friction      C. Head  
B. Pressure, Static      D. None of the above
99. Which of the following definitions is the height of a column or body of fluid above a given point?
- A. Head, Friction      C. Head  
B. Head, Static      D. None of the above

100. Sea level pressure is approximately 2.31 pounds per square inch absolute, 1 bar = .433psi.  
A. True      B. False

### General Pumping Fundamentals

101. Here are the important points to consider about suction piping when the liquid being pumped is below the level of the pump: Sometimes suction lift is also referred to as 'positive suction head'.  
A. True      B. False

102. The suction side of pipe should be one diameter smaller than the pump inlet.  
A. True      B. False

103. The required eccentric reducer should be turned so that the top is flat and the bottom tapered.  
A. True      B. False

### Pumps

104. 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

105. Diaphragm pumps are force pumps in which the oscillating diaphragm takes the place of the piston.  
A. True      B. False

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

107. More complicated pumps have valves check valves that open to allow \_\_\_\_\_, and close automatically to prevent reverse flow.  
A. Pistons                      C. Passage in one direction  
B. Diaphragms                  D. None of the above

108. According to the text, the force pump has \_\_\_\_\_ in the cylinder, one for supply and the other for delivery.  
A. Two check valves              C. Rotors  
B. Diaphragms                      D. None of the above

109. In a positive displacement pump, supply valve opens when the cylinder \_\_\_\_\_, the delivery valve when the cylinder volume decreases.  
A. Volume increases              C. Air space increases  
B. Volume decreases              D. None of the above

### Pump Categories

110. 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

111. With a centrifugal pump the pressure is not referred to in pounds per square inch but rather as the equivalent in elevation, called?  
A. Inward force                  C. Delivery force  
B. Head                              D. None of the above

112. According to the text, pumps may be classified based on the application they serve.  
A. True      B. False

### Basic Water Pump

113. As the water slows down and its kinetic energy decreases, that water's pressure potential energy increases.

- A. True      B. False

114. As the water spins, the pressure near the outer edge of the pump housing becomes much lower than near the center of the impeller.

- A. True      B. False

115. The impeller blades cause the water to move faster and faster.

- A. True      B. False

116. The impellers may be of either a semi-open or closed type.

- A. True      B. False

117. 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

118. 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

119. 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

120. 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

121. 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

122. 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

123. 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

124. 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                      C. Horsepower  
B. Atmospheric pressure          D. None of the above
125. Which of the following terms are variable displacement pumps that are by far used the most?
- A. Axial flow                              C. Turbine pumps  
B. Centrifugal pumps                  D. None of the above
126. According to the text, the turbine pump utilizes impellers enclosed in single or multiple bowls or stages to?
- A. Pump head                              C. Horsepower  
B. Lift water                                D. None of the above
127. Vertical turbine pumps are commonly used in groundwater wells. These pumps are driven by a shaft rotated by a motor on the surface.
- A. True                                      B. False
128. The rotating shaft in a line shaft turbine is actually housed within the column pipe that delivers the water to the surface.
- A. True                                      B. False
129. The size of the \_\_\_\_\_ are selected based on the desired pumping rate and lift requirements.
- A. Impeller(s)                              C. Column, impeller, and bowls  
B. Lantern ring                              D. None of the above
130. According to the text, column pipe sections can be threaded or coupled together while the drive shaft is coupled and suspended within the column by?
- A. Column pipe                              C. Lantern ring  
B. Spider bearings                        D. None of the above
131. Which of the following terms, provide both a seal at the column pipe joints and keep the shaft aligned within the column?
- A. Column pipe                              C. Lantern ring  
B. Spider bearings                        D. None of the above
132. Oil and water lubricated systems will have a strainer attached to the \_\_\_\_\_ to prevent sediment from entering the pump.
- A. Intake                                      C. Inboard  
B. Diaphragm                                D. None of the above
133. Time delays or ratchet assemblies are often installed on these motors to either prevent the motor from turning on before \_\_\_\_\_ stops or simply not allow it to reverse at all.
- A. Reverse rotation                        C. Time delay or ratchet assembly  
B. Keyway and nut                         D. None of the above

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

## Safety Section

### Confined Space Entry Program-Purpose

134. 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

### Scope

135. According to the text, you are required to recognize \_\_\_\_\_ associated with confined spaces.

- A. Internal configurations      C. The dangers and hazards  
B. Permit-Required Confined Spaces      D. None of the above

### Definitions

#### Confined space:

136. A confined space is large enough or so configured that an employee can \_\_\_\_\_.

- A. Have sufficient oxygen      C. Recognize serious safety or health hazards  
B. Bodily enter and perform work      D. None of the above

137. A confined space has limited or restricted means for \_\_\_\_\_.

- A. An internal configuration      C. Hazardous atmosphere  
B. Entry or exit      D. None of the above

138. A confined space is not designed for \_\_\_\_\_.

- A. An internal configuration      C. Continuous employee occupancy  
B. Hazardous atmospheres      D. None of the above

139. A permit required confined space (permit space) contains or has a potential to contain a \_\_\_\_\_.

- A. Recognized internal configuration      C. Entry or exit  
B. Hazardous atmosphere      D. None of the above

140. A permit required confined space (permit space) contains a material that has \_\_\_\_\_.

- A. Authorized entrants      C. The potential for engulfing an entrant  
B. Hazardous atmospheres      D. None of the above

141. A permit required confined space (permit space) has an internal configuration such that \_\_\_\_\_ could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.

- A. An entrant      C. An internal configuration  
B. Hazardous atmosphere      D. None of the above

142. A permit required confined space (permit space) contains any other recognized serious safety or \_\_\_\_\_.

- A. Engulfing an entrant      C. Health hazard  
B. Hazardous atmospheres      D. None of the above

### Unusual Conditions

#### Confined Space within a Confined Space

143. The \_\_\_\_\_ associated with the outer confined space and those of the inner confined space both require testing, monitoring, and control.

- A. Potential hazards      C. Manholes  
B. Access passages      D. None of the above

144. Often, only the outer space is evaluated for potential hazards. Workers are also faced with \_\_\_\_\_ when they enter the inner space.

- A. Poor lighting
- B. Excavations
- C. Potentially hazardous conditions
- D. None of the above

145. Workers entering a vessel inside an access pit should do so only after both spaces have been evaluated and \_\_\_\_\_.

- A. Purged
- B. Accessed
- C. Proper control measures established
- D. None of the above

### Hazards in One Space Entering another Space

146. According to the text, during an examination of \_\_\_\_\_, situations are often encountered which are not always easy to evaluate or control.

- A. Tanks
- B. Excavations
- C. Confined spaces in construction
- D. None of the above

147. A room that classifies as a confined space may be relatively safe for work. However, access passages from other areas outside or adjacent to the room could, at some point, allow the transfer of \_\_\_\_\_ into the "safe" room.

- A. Hazardous agents
- B. Equipment and tools
- C. Unauthorized workers
- D. None of the above

148. Welding fumes and other \_\_\_\_\_ generated in one room may easily travel through a pipe into another area, causing that area to change from a safe to an unsafe workplace.

- A. Toxic materials
- B. Construction debris
- C. Noise
- D. None of the above

149. In a situation where hazards in one space may enter another, a serious problem is that workers working in the "safe" area are not aware of the \_\_\_\_\_.

- A. Oxygen Level
- B. Access passages
- C. Hazards leaking into their area
- D. None of the above

### Permitted Confined Space Entry Program

150. According to the text, all trenches are \_\_\_\_\_.

- A. Too narrow for work
- B. Excavations
- C. Safe for short term work
- D. None of the above

151. According to the text, all excavations are \_\_\_\_\_.

- A. Permit-required
- B. Not trenches
- C. Access passages
- D. None of the above

### Permit Required Confined Space Entry General Rules

152. According to the text, only authorized and trained employees may enter a \_\_\_\_\_ or act as safety watchmen/attendants.

- A. Hazard
- B. Pipe
- C. Confined space
- D. None of the above

153. Employees are not permitted to smoke \_\_\_\_\_ or near the entrance/exit area.

- A. Near air and oxygen monitors
- B. During a side entry
- C. In a confined space
- D. None of the above

154. A watchmen or attendant must be present at all times during \_\_\_\_\_.
- A. Confined space entries                      C. Air monitoring  
B. Access passages                                D. None of the above
155. According to the text, no \_\_\_\_\_ will be made or work conducted below the level of any hanging material or material which could cause engulfment.
- A. Monitoring of entrant status                C. Identification of authorized entrants  
B. Bottom or side entry                         D. None of the above
156. \_\_\_\_\_ is required before workers are allowed to enter any permit-required confined space. Oxygen levels in the confined space must be between 19.5 and 23.5 percent.
- A. Air and oxygen monitoring                 C. Communication  
B. A supervisor                                    D. None of the above
157. Air and oxygen monitoring will check the levels of oxygen, explosive gasses, and carbon monoxide. Entry will not be permitted if explosive gas is detected above one-half the \_\_\_\_\_.
- A. Nitrogen level                                 C. Lower Explosive Limit (LEL)  
B. Argon level                                     D. None of the above
158. When covers are removed, all \_\_\_\_\_ will be protected by a barricade to prevent injuries to others.
- A. Air and oxygen monitoring                 C. Openings to confined spaces  
B. Side entries                                     D. None of the above

### **Irritant (Corrosive) Atmospheres**

159. According to the text, irritant or corrosive atmospheres can be \_\_\_\_\_.
- A. Primary irritants                              C. Divided into primary and secondary groups  
B. Combustible gases                            D. None of the above
160. A primary irritant is one that may produce systemic toxic effects in addition to surface irritation.
- A. True                      B. False
161. Chlorine, ozone, hydrochloric acid, hydrofluoric acid, sulfuric acid, nitrogen dioxide, ammonia, and sulfur dioxide are examples of \_\_\_\_\_.
- A. Primary irritants                              C. Detector responses  
B. Combustible gases                            D. None of the above
162. \_\_\_\_\_ may produce systemic toxic effects in addition to surface irritation.
- A. A secondary irritant                            C. Corrosive atmospheres  
B. Evaluation of all serious hazards            D. None of the above
163. Benzene, carbon tetrachloride, ethyl chloride, trichloroethane, trichloroethylene, and chloropropene are examples of \_\_\_\_\_.
- A. Primary irritants                              C. Secondary irritants  
B. Combustible gases                            D. None of the above
164. \_\_\_\_\_ can be found in plastics plants, chemical plants, the petroleum industry, tanneries, refrigeration industries, paint manufacturing, and mining operations.
- A. Chemical reactions                            C. Irritant gases  
B. Normal atmosphere                            D. None of the above



165. According to the text, prolonged exposure at irritant or corrosive concentrations in a confined space may produce \_\_\_\_\_.

- A. Oxygen deprivation
- B. Oxygen by nitrogen
- C. Little or no evidence of irritation
- D. None of the above

### Excavation and Trenching Section

166. 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

167. OSHA also revised the \_\_\_\_\_ to clarify the requirements.

- A. Competent rule
- B. Existing standard
- C. Protective equipment standard
- D. None of the above

168. The performance criteria in the new standard provides employers with options when classifying soil and when selecting methods to protect the \_\_\_\_\_ from cave-ins.

- A. Competent person
- B. Employee
- C. Construction equipment
- D. None of the above

169. Although employers have options when meeting some of the requirements, \_\_\_\_\_ must realize that the employee must be protected at all times.

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

### Competent Person

170. 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

171. A \_\_\_\_\_ must have specific training in and be knowledgeable about soils analysis, the use of protective systems and the requirements of 29 CFR Part 1926.650-652 Subpart P.

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

172. Everyone is required to practice \_\_\_\_\_ one a year.

- A. Competent person training
- B. Rescue training exercises
- C. Emergency procedures
- D. None of the above

### Competent Person Duties

173. 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

174. 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

175. 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

176. 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

177. 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

### Scope of Work

178. 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
- B. Contractors
- C. Excavation
- D. None of the above

179. 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
- B. Employees
- C. Underground utility installations
- D. None of the above

180. \_\_\_\_\_ shall be taken to protect employees against the hazards posed by water accumulation in the excavation.

- A. Additional care
- B. Adequate precautions
- C. Ladders
- D. None of the above

181. In trench excavations that are four (4') feet or more in depth, a stairway, ladder, or ramp shall be used as a \_\_\_\_\_.

- A. Tool
- B. Means of access or egress
- C. Bridge
- D. None of the above

182. When excavations are made in vehicular traffic areas, \_\_\_\_\_ shall wear a warning vest made with reflective material or highly visibility material.

- A. Competent persons
- B. Each employee
- C. Rescue personnel
- D. None of the above

183. The air shall be tested in excavations where \_\_\_\_\_ exist, or could be reasonably expected to exist.

- A. Limited visibilities
- B. Employees
- C. Oxygen deficiency or gaseous conditions
- D. None of the above

184. When the atmosphere contains less than 19.5 percent oxygen, the area must be continuously ventilated until the \_\_\_\_\_.

- A. Excavation is closed
- B. Employees enter the space
- C. Oxygen levels are above 19.5 percent
- D. None of the above

185. 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
- B. Gaseous condition exists
- C. Worker encounters fumes
- D. None of the above

186. Whenever \_\_\_\_\_ exist or could reasonably exist, the air must be monitored continuously to assure that workers are protected.

- A. Traffic conditions
- B. Excavations
- C. Oxygen deficiency or gaseous conditions
- D. None of the above

187. 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
- B. Not mentioned in the specifications
- C. Endangered by excavation operations
- D. None of the above

188. 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
- B. Employees
- C. Vehicles
- D. None of the above

### **Personnel Protective Systems**

189. 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

190. 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

191. For trench excavations less than five (5') feet deep, the use of \_\_\_\_\_ may not be required unless there is evidence of a potential cave-in. The competent person shall make this determination.

- A. Ladders
- B. Protective systems
- C. Ramps
- D. None of the above

192. Requirements for sloping, benching or protective systems are found in \_\_\_\_\_.

- A. Safety Manuals
- B. Tabulated data
- C. CFR 1926.652 (OSHA Construction Standards)
- D. None of the above

193. Whenever support systems, \_\_\_\_\_, or other protective systems are being used, a written copy of the manufacturer's specifications, recommendations, and limitations sheet shall be available at the job site.

- A. Shield systems
- B. Tabulated data
- C. Ramps
- D. None of the above

### Excavation Protection Systems

194. 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

195. 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

196. 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

197. Another option for sloping is to first determine the soil type, then use the table provided in Appendix B of the standard to determine the \_\_\_\_\_.

- A. Maximum allowable angle
- B. Porosity
- C. Protective system to be used
- D. None of the above

198. Another option for sloping is to utilize \_\_\_\_\_ prepared by a registered professional engineer.

- A. Instructions
- B. Tabulated data
- C. Standards
- D. None of the above

199. According to the text, a registered professional engineer can design a \_\_\_\_\_ for a specific job.

- A. Table
- B. Sloping plan
- C. Protective system
- D. None of the above

200. \_\_\_\_\_ for excavations five (5) to twenty (20) feet in depth must be constructed in accordance with the instructions of a designated competent person.

- A. Sloping and benching systems
- B. Tabulated data
- C. Trench excavation limits
- D. None of the above

201. A registered professional engineer must design and stamp the sloping and benching systems for excavations \_\_\_\_\_.

- A. Greater than twenty (20) feet deep
- B. In traffic areas
- C. To be made by contractors
- D. None of the above

### Shoring Systems

202. \_\_\_\_\_ 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

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

### Shield Systems (Trench Boxes)

203. 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

204. 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

205. 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

### Excavation Safety Plan

206. 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

207. 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

208. Type A soils are \_\_\_\_\_ with an unconfined compressive strength of 1.5 tons per square foot (TSF) or greater.

- A. The least stable
- B. Cohesive soils
- C. Field tested
- D. None of the above

### Shielding

209. 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

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

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

### Managing Water Quality at the Source

211. 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

212. 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

### pH Testing Section

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

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

### More on the Stage 2 DBP Rule

214. 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

### Bacteriological Monitoring Section

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

215. 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

### Background

216. Coliform bacteria and chlorine residual are the only routine sampling and monitoring requirements for small ground water systems with chlorination. The coliform bacteriological sampling is governed by the Coliform Reduction amendment of the SDWA.

- A. True
- B. False

### TCR

217. 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

218. 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

219. 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**

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

- A. True      B. False

221. 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

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

- A. True      B. False

223. 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

224. 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

225. 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

### **Bacteriological Monitoring Introduction**

226. Which of the following are usually harmless, occur in high densities in their natural environment and are easily cultured in relatively simple bacteriological media?

- A. Indicator bacteria      C. Viruses  
B. Amoebas      D. None of the above

### **Bacteria Sampling**

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

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

### **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 incurs an E. coli MCL violation.
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

231. A PWS collecting at least 40 samples per month has greater than 5.0 percent of the routine/repeat samples in the same month that are TC+.
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

232. A PWS has a second Level 1 Assessment within a rolling 12-month period.
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

233. A PWS on state-approved annual monitoring has a Level 1 Assessment trigger in 2 consecutive years.
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

234. A PWS collecting fewer than 40 samples per month has 2 or more TC+ routine/ repeat samples in the same month.
- A. Trigger: Level 1 Assessment
  - B. Trigger: Level 2 Assessment
  - C. All of the above
  - D. None of the above

235. Noncommunity and nontransient noncommunity public water systems will sample at the same frequency as a like sized community public water system if:
1. It has more than 1,000 daily population and has ground water as a source, or
  2. It serves 25 or more daily population and utilizes surface water as a source or ground water under the direct influence of surface water as its source.
- A. True
  - B. False

**Positive or Coliform Present Results**

236. 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

237. With a positive total coliform sample, after you have contacted an agency for assistance, you will be instructed as to the proper repeat sampling procedures and possible corrective measures for solving the problem. It is very important to initiate the \_\_\_\_\_ as the corrective measures will be based on those results.
- A. Perform routine procedures
  - B. Repeat sampling immediately
  - C. Corrective measures
  - D. None of the above

**Heterotrophic Plate Count HPC**

238. 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)**

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

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

### **Total Coliforms**

240. 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
- B. 100
- C. 200
- D. None of the above

### **The following are acute violations:**

241. Which determines a violation of nitrate?

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

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

242. 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

243. 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

244. 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

245. 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
- B. Reduced monitoring
- C. Microbial contamination
- D. Repeat water samples

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

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

247. PN is required for violations incurred. Within required timeframes, the PWS must use the required health effects language and notify the public if they did not comply with certain requirements of the RTCR. The type of \_\_\_\_\_ depends on the severity of the violation.

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

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

- A. True      B. False

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

- A. True      B. False

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

- A. True      B. False

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

- A. True      B. False

252. 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

253. 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

254. 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

255. 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

### Disinfection Key

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

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

## Disinfection Section

### Chlorine's Appearance and Odor

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

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

258. Prolonged exposures to chlorine gas may result in?

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

## Chlorine Gas

### Pathophysiology

259. 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

260. 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

261. 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

### Early Response to Chlorine Gas

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

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

### Reactivity

263. 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

264. 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

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

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

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

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

### Flammability

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

- A. True
- B. False

268. 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

269. 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

270. 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

271. 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

272. 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

273. Chlorination is more effective as?

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

274. 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

275. Chlorination is less effective in?

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

276. 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**

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

- A. True
- B. False

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

- A. True
- B. False

279. 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

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

- 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. 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

283. 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

### Chlorine DDBP

284. These term means that chlorine is present as Cl, HOCl, and OCl<sup>-</sup> 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

285. Chloramines are formed by reactions with?

- A. Acid and Cl<sub>2</sub>
- B. Ammonia and Cl<sub>2</sub>
- C. Folic Acid and Cl<sub>2</sub>
- D. None of the above

### Types of Residual

286. 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

287. What is OSHA's PEL?

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

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

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

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

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

### Alternate Disinfectants - Chloramine

290. 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

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

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

### Chlorine Dioxide

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

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

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

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

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

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

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

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

296. Total residual oxidants (including chlorine dioxide and chlorite, but excluding Chlorine dioxide) shall not exceed 0.50 mg/L during normal operation or 0.30 mg/L (including chlorine dioxide, chlorite and chlorate) during periods of extreme variations in the raw water supply.

- A. True
- B. False

### Ozone

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

- A. True
- B. False

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

- A. True
- B. False

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

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

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

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